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*The application of blockchain technology in the agri-food sector.
A case for Geographical Indications.*

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Abstract (EN)

The research aims to understand the role that blockchain technology could play in the realm of Geographical Indications. More specifically, looking at the phenomenon from the perspective of GI producer groups, rather than from that of PDO and PGI individual producers and companies, an attempt is made to understand whether blockchain could contribute to the governance of Geographical Indications, answering to one main research question: can blockchain be proposed and presented as a valid tool in the hands of producer groups to uptake the different functions leading to the governance of GIs? The work builds on the acknowledgment that the agri-food sector is now characterised by an extensive digitalisation process that, while taking different forms and responding to various functions, involves blockchain and the broader category of distributed ledger technologies, as well, which indeed find fertile ground for implementation in agri-food supply chains. These statements also apply to the specific field of Geographical Indications, a well-established and solid system in the EU framework that, however, is currently undergoing profound changes, marking the need for adjustment and adaptation of the system. These changes are connected to the entry into force of the new European regulatory regime for GIs, introduced under Regulation (EU) No 2024/1143, but also to known issues and new challenges the GI system and its actors must address. In response to this need for adjustment and adaptation, Geographical Indications must also start thinking in terms of innovation, which, although not exclusively technological, surely involves digitalisation. For blockchain, this scenario paves the way for novel and original horizons of application, which extend to include the still uncharted concept of GI governance, entrusted to producer groups through the attribution of larger tasks and greater responsibilities towards their GIs.

Key words (EN)

blockchain; agri-food sector; Geographical Indications; GIs; governance; producer groups.

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Table of Contents

INTRODUCTION.....	4
CHAPTER I – Overview of the context. The role of blockchain technology in a digitalised agri-food sector.....	8
1. The agri-food sector through the lens of digitalisation.....	8
1.1. Exploring new trajectories: the agri-food sector between sustainability and digitalisation.....	11
1.2. Perspectives, applications, and challenges.....	21
2. Exploring the tools. What do we talk about when we talk about blockchain?	32
2.1. Delving into blockchain: features and models.....	37
2.2. Blockchain applications: a quick look at smart contracts.....	43
2.3. Reviewing the legislative background of blockchain.....	49
2.3.1. The European Strategy for Blockchain.....	50
2.3.2. The national framework.....	55
3. Implementing blockchain technology in the agri-food sector.....	58
3.1. An innovative tool for well-known challenges.....	59
3.2. Not all that glitters is gold: enduring limits.....	65
CHAPTER II – Approaching the field of interest. Geographical Indications between origin and quality, tradition and innovation.....	70
1. Framing Geographical Indications.....	70
1.1. The core components of the system: Quality.....	73
1.2. (follows) Origin.....	84
1.3. The multidimensional and multifunctional appearance of Geographical Indications.....	91
1.3.1. The pursuit of the market. Economic-related benefits of GIs.....	92

1.3.2. Traditional knowledge, cultural heritage, and biodiversity conservation. Non-market functions of GIs.....	95
2. The European Union framework for Geographical Indications.....	98
2.1. Prodomes: EU quality schemes and their thirty-year legislative evolution.....	101
2.2. New perspectives: protected designation of origin and protected geographical indication under Regulation (EU) No 2024/1143.....	111
2.2.1. Protection of PDO and PGI and <i>ex officio</i> protection.....	116
2.2.2. PDO and PGI as ingredients.....	119
2.2.3. Looking at the procedures: Registration, opposition, and amendments to product specifications.....	121
3. Between the known and the new. Challenges of Geographical Indications.....	126
3.1. Infringements.....	127
3.1.1. The broad scope of evocation through the lens of the Court of Justice of the European Union.....	129
3.1.2. Protecting Geographical Indications on the <i>World Wide Web</i>	136
3.2. The hard path to sustainability.....	141
CHAPTER III – Taking a step forward. Applying blockchain to the realm of Geographical Indications.....	148
1. Merging blockchain technology and Geographical Indications: an introduction.....	148
1.1. Overview of blockchain’s ancillary functions for Geographical Indications.....	151
2. Producer groups tasks and responsibilities under Reg. (EU) No 2024/1143. What room for blockchain?.....	156
2.1. Establishing a new Geographical Indication.....	163
2.2. Ensuring compliance with product specifications.....	167
2.3. Protecting and enforcing the Geographical Indication.....	171
2.4. Enhancing, promoting, and improving the Geographical Indication.....	178
2.4.1. Verifying and communicating the sustainability of Geographical	

Indications through blockchain.....	181
2.5. Blockchain for democratic accountability.....	185
3. Wrapping it up with some conclusive thoughts.....	186
3.1. The flip side of the coin.....	188
CHAPTER IV – Outcomes from the outside. Cases and questions for Italian producer groups.....	195
1. Introduction and methodological indications.....	195
2. Applying blockchain to the governance of Geographical Indications. Through the eyes of GI producer groups.....	201
2.1. Consorzio Arancia Rossa di Sicilia PGI.....	202
2.2. Consorzio Tutela del Pecorino Toscano PDO.....	207
2.3. Consorzio Cioccolato di Modica PGI.....	212
2.4. No result is a bad result.....	216
3. Applying blockchain to the governance of Geographical Indications. Through the eyes of Origin Italia.....	218
4. Final remarks.....	224
CONCLUSION.....	230
BIBLIOGRAPHY.....	239

INTRODUCTION

The present research is part of the PhD Program of National Interest funded by the Italian National Recovery and Resilience Plan (DIN PNRR) in ‘Blockchain and Distributed Ledger Technology’, Curriculum Law and Governance, coordinated by the University of Camerino.

The topic to be developed in the research, which took place at the University of Macerata, was therefore established from the outset and linked to the specific subject of the PhD Program, and it specifically revolved around the application of blockchain and distributed ledger technologies in the agri-food sector and for legal compliance.

Ever since the initial passages of the work of research, exploring blockchain implementation in the agri-food sector revealed the existence of an extensive and well-developed body of literature. As will be seen in detail throughout the work, the application of blockchain-based solutions has already been widely discussed by the relevant doctrine, particularly in relation to issues such as traceability, food safety, global supply chain management, and much more. Faced with such an ample body of literature that, in various ways, had dealt with and was dealing with these topics, the identification of an alternative key of observation emerged as a necessary step to contribute to the legal debate on blockchain adoption in the agri-food sector. And, within this context, the field of Geographical Indications progressively came into focus.

More precisely, the decision to delve into the realm of GIs was informed by two main elements. On the one hand, by the identification of blockchain’s potential for the protection of IP, and by the growing interest in understanding whether this could also apply to the *sui generis* intellectual property rights that Geographical Indications are. On the other hand, it was suggested by the advent of the reform of the European GIs system, which appeared as a treasure trove for further legal research.

Of course, it would be improper to state that blockchain implementation in quality agri-food production is something new, and the framing that is provided in the first sections of the work will reveal it. Additionally, an initial systematic review of experiences and case studies concerning blockchain adoption in the Italian agri-food sector was undertaken in the early stages of this research to get a first understanding of the extent and actual scope of the phenomenon that was being observed. This preliminary analysis showed that a significant

number of such initiatives involved Italian PDO and PGI products. However, a closer examination of the available literature made it rather clear that blockchain applications were predominantly considered from the viewpoint of companies and individual producers of Geographical Indications, and mostly as a marketing or communication tool to inform consumers about the characteristics and qualities of the GI products.

The existing approaches to legal research in the field appeared thus to leave room for more. Indeed, given the widely acknowledged potential of blockchain-based solutions and distributed ledger technologies, it seemed unlikely that, for Geographical Indications, no other perspectives to consider and no different applications to explore could be found.

Two developments proved particularly influential in defining the structure and orientation of the present work. By pure coincidence, they also overlapped with each other.

The first development was reached during the research stay at the Max Planck Institute for Innovation and Competition in Munich. This period was characterised by a sensitive acceleration in bibliographic research and sources analysis, involving both the many legal aspects intertwined with blockchain, and Geographical Indications, whose qualification and functioning as IPRs became the subject of closer examination.

The second development was represented by the publication of the new European Regulation on Geographical Indications in April 2024. The analysis of Regulation (EU) No 2024/1143, indeed, brings to light the strong emphasis placed by the European legislator on the idea of a comprehensive governance of Geographical Indications, and consequently on the values and opportunities that this idea entails for GIs. At the same time, however, it also leads to considering the implications that this broader governance has for GI producer groups and the effects on the tasks and functions attributed to them at the associative level, as well as the tools that producer groups can use to cope with such new responsibilities.

Taken together, these elements gradually converged, providing the basis for a more focused line of research.

The work therefore delves into blockchain application in the field of Geographical Indications, looking at the phenomenon *not* from the viewpoint of individual producers, but *rather* from the collective perspective of producer groups. The latter appears, in fact, as a community reflecting the typical patterns of a blockchain network, including the distribution and decentralisation of the decision-making power relating to the functioning of the system itself.

Moving from these premises in the described context, the work therefore primarily seeks to answer one main research question, that is, to understand whether blockchain technology could be implemented as a digital solution suitable for the governance of Geographical Indications and, consequently, whether it could be proposed and presented as a valid tool in the hands of GI producer groups to carry out the different functions, tasks and responsibilities entrusted to them under Reg. (EU) No 2024/1143. More specifically, all of this translates into an attempt to figure out whether blockchain-based solutions could be used for the various functions assigned to producer groups, for which of these functions it appears to be innovative and resolute of existing obstacles, and when, on the contrary, its implementation does not appear convincing or disruptive.

To better address the question, an empirical legal research was conducted. In the work, indeed, the normative investigation, that is typical and proper of legal research, is at some point matched with a different empirical method. From a scientific perspective, the work is essentially the outcome of legal research based on bibliographic research and the study of the relevant literature, as well as the analysis of the related legislation and case law. In this way, the work merges two main pillars: blockchain technology, on the one hand, whose functioning, main features, potentialities, and applications have been deepened, together with the leading legal issues arising from it; and Geographical Indications, on the other hand, putting together their core components, functions, the legal regime applicable to them at the European level, mainly in light of the new Regulation, and the critical profiles affecting this framework.

However, to achieve a more complete and comprehensive overview of blockchain implementation for the governance of Geographical Indications, gathering some feedback from the ‘outside’, i.e., from the same producer groups that are so pivotal in the work, appeared as equally necessary. And this is where the empirical research pops in, as interviews with some Italian protection consortia and with Origin Italia were conducted, to collect their viewpoints, insights, and opinions on the possibility of resorting to blockchain for the governance of Geographical Indications.

Each of these activities eventually resulted in the present PhD work. The thesis, which follows an outline from the general to the specific, is structured in four parts.

The first chapter offers a general overview of the context from which the research originates. To this end, it addresses the topics of technological innovation and digitalisation in agriculture and in the agri-food sector, considering European policies and stressing

perspectives, applications, and legal challenges. This introductory chapter also provides an analysis of the observed solution, i.e., blockchain technology, highlighting the technical elements that are most relevant for this work and further looking at its implementation in the agri-food sector.

The second chapter is entitled '*Approaching the field of interest*', and this is precisely its function. Here, an attempt is made to provide the main elements and the indications that are deemed essential to understand the field of interest, that is, that of Geographical Indications. To this end, the chapter illustrates the core components of Geographical Indications and their functions, the EU *sui generis* regime applicable to them under Reg. (EU) No 2024/1143, the key novelties introduced with the 2024 EU quality schemes reform, and the main hurdles and new challenges the GIs system faces.

The third chapter takes a step further and reflects the proper content of the research, as it delves into blockchain application in the realm of GIs. More precisely, it addresses the possibility of proposing blockchain technology as a tool in the hands of GI producer groups to manage the complex system of tasks and responsibilities that is imposed on them for the governance of their Geographical Indications. To this end, it sheds light on four different functions: establishing a new Geographical Indication; ensuring compliance with product specifications; protecting and enforcing the Geographical Indication; enhancing, promoting, and improving the Geographical Indication. In parallel, blockchain's contribution to democratic accountability within GI producer groups is also explored.

The fourth chapter is empirically driven. As anticipated, empirical research was undertaken to get feedback and insights on the legal reflections developed in the course of the work; thus, interviews with three Italian protection consortia and with Origin Italia were conducted. The outcomes of this empirical research are presented in chapter four, which also explains the methodology used for data collection and data analysis.

The closing part of the work is finally dedicated to drawing some conclusions, combining the legal reflection and the empirical outcomes developed from the interviews, to provide an answer to the main research question.

CHAPTER I

Overview of the context. The role of blockchain technology in a digitalised agri-food sector

SUMMARY: 1. The agri-food sector through the lens of digitalisation. - 1.1. Exploring new trajectories: the agri-food sector between sustainability and digitalisation. - 1.2. Perspectives, applications, and challenges. - 2. Exploring the tools. What do we talk about when we talk about blockchain? - 2.1. Delving into blockchain: features and models. - 2.2. Blockchain applications: a quick look at smart contracts. - 2.3. Reviewing the legislative background of blockchain. - 2.3.1. The European Strategy for Blockchain. - 2.3.2. The national framework. - 3. Implementing blockchain technology in the agri-food sector. - 3.1. An innovative tool for well-known challenges. - 3.2. Not all that glitters is gold: enduring limits.

1. The agri-food sector through the lens of digitalisation.

It is now plain for all that technology and digitalisation¹, together with the innovation and scientific progress linked to them, have nowadays disrupted multiple – perhaps all – aspects of individuals' lives: the way they communicate with others and relate to the outside world, how they inform themselves, how they think and act, how they perform their daily and working activities². The tools originally intended to assist people have become such an integral and

¹ A premise of conceptual nature is here necessary. In the following work, reference is always made to the term *digitalisation*, which, however, assumes a preliminary clarification of the meaning to be attributed to the concept, as well as of the distinction between those of digitisation, digitalisation, and digital transformation, apparently similar but different, though strictly interconnected one to the other. In this perspective, this work agrees with the reflection presented in G. BRUNORI, *Agriculture and rural areas facing the "twin transition": principles for a sustainable rural digitalisation*, in *Italian Review of Agricultural Economics*, 2022, 3, p. 5, who highlights how: *'To build strategies for sustainable digitalisation implies a good understanding of what digitalisation is. We start from the analytical distinction between digitisation, digitalisation, and digital transformation, and their relationship with innovation'*. The A. defines digitisation as *'...an innovation that turns an analogical process/product into a digital one'*, thus a purely technical process. Digitalisation, on the contrary, *'...qualifies the change that digitisation generates in a broader social (or, better, socio-technical) system'*. Finally, *'When digitalisation goes beyond the boundaries of local production processes and affects the way the economy and society are organized – the rules, distribution of power, knowledge and resource base – it is possible to talk about digital transformation'*. In the light of these reflections, and since the idea of digital transformation extends to a more general context and embraces different scopes (as also highlighted in S. ROLANDI, *Il ruolo attribuito alla digitalizzazione nella Strategia Farm to Fork dell'Unione Europea, tra riferimenti espliciti e nascosti. Quali interventi legislativi in quattro anni?*, in *Rivista di diritto agrario*, 2023, 4, I, p. 640, note 11), it was here preferred to adopt the term *digitalisation* to address the process of technological innovation in agriculture and the agri-food sector.

² Walking hand in hand with the spaces that technology has increasingly gained over the decades, the doctrine has also been investigating the theme, analysing and studying, from different perspectives and scientific sectors – from human sciences to philosophy, from social sciences and anthropology to medical sciences, including economics and law – the impacts that the constant and disruptive changes brought about by technological innovation and

indispensable part of their lives that it is now unthinkable to return to the way things were before.

Just as many aspects of human behaviour experience the constant influence of digitalisation, so do the sectors in which these activities are carried out, coming to terms with the novelties that technological innovation brings about. The agri-food sector has not been exempt from this evolution which, over a few decades, has gradually affected its features and functioning by providing new tools, innovative techniques, and improved methods, thus offering new opportunities for the players of the scenario. At the same time, however, unprecedented challenges and obstacles have arisen, including legal ones, which, in large part, originate from the convenience to govern the propulsive thrust of technology and its constant changes, and the effects they produce³, as well as to ensure, in each case, the best possible balance with other requests, like those related to sustainability⁴, in its threefold dimension of

digitalisation can produce. It is interesting to recall some contributions that, from different perspectives, reflect the role that technology and digitalisation play in society and in everyday life of individuals: A. FEENBERG, *Questioning Technology*, 1st ed., Londra, Routledge, 1999; B. WELLMAN, C. HAYTHORNTHWAITE, *The Internet in Everyday Life*, New York, Blackwell Pub, 2002; L. HADDON, *Information and Communication Technologies in Everyday Life: A Concise Introduction and Research Guide*, Oxford, Bloomsbury Publishing, 2010; M. CHAYKO, *Techno-social Life: The Internet, Digital Technology, and Social Connectedness*, in *Sociology Compass*, 2014, 8, pp. 976-991; P. BREY, *The strategic role of technology in a good society*, in *Technology in society*, 2018, 52, pp. 39-45; J. WOLFF, *How is Technology Changing the World, and How Should the World Change Technology*, in *Global Perspectives*, 2021, 2; R. VOLT, J. CROISSANT, *Society and Technological Change*, 9th ed., Long Grove, Waveland Press, Inc., 2024. For a recent legal analysis of the most pressing challenges posed by emerging technologies, including AI, quantum technologies, cybersecurity, and DLT, see R. BIEDA, A. BLECHOVÁ, E. F. LÓPEZ, R. POTENZANO (eds.) *Legal Challenges of Disruptive Technologies*, 1st ed., Baden, Nomos, 2025.

³ The possibility of governing technology through law and regulation will be addressed later on, in chapter I, par. 2.3. Here, it is sufficient to point out that the identification of a balance, as fragile and unstable as it is, between law and regulation, on the one hand, and technological innovation and digitalisation, on the other, represents a much-debated topic between legal scholars. In particular, the heart of the matter is whether and, if so, to what extent it is possible and convenient to regulate technology, i.e., to provide the law with the task of governing (*rectius*, controlling) technological innovation. Indeed, while this alternative would seem to avoid the risks associated with the limitless predominance of technology, doubts arise when considering whether (excessive) regulation does not hinder technological evolution and progress.

⁴ The debate around sustainability and sustainable development started as early as the 1970s when, during the first UN Conference on the Human Environment, held in Stockholm in 1972, its essential features were outlined, including the need not to exhaust natural resources and to maintain and improve the Earth's capacity to produce essential renewable resources, or again the call for States to adopt development approaches compatible with the need to protect and improve the environment. On these aspects see M. C. CICIRIELLO, *Dal principio del patrimonio comune al concetto di sviluppo sostenibile*, in *Diritto e giurisprudenza agraria e dell'ambiente*, 1996; S. MANSERVISI, *Nuovi profili del diritto ambientale dell'Unione europea. Tra evoluzione scientifica e sviluppo sostenibile*, Roma, Aracne, 2018. However, it was just in 1987 that a definition of 'sustainable development' was provided, in the Report of the World Commission on Environment and Development: Our Common Future (mostly known as the Brundtland Report), where we read that: 'Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs'. About the quoted definition, which even today constitutes the starting point of any discourse on sustainable development, eminent scholars highlight how it merges the essence of sustainable development with the importance of balancing the needs of present generations with the ones of future generations, even though it does not specify their nature. On this aspect, see S. BOLOGNINI, *Il consumatore nel mercato agro-alimentare*

environmental, economic and social sustainability⁵, that modern agri-food systems must unavoidably confront⁶.

Although apparently difficult to reconcile, settled in the achievement of different and sometimes dissonant goals, the trajectories of sustainability and technological innovation do

europeo fra scelte di acquisto consapevoli e scelte di acquisto sostenibili, in *Rivista di diritto agrario*, 2019, 4, I, p. 618. M. C. CICIRIELLO, *op. cit.*, p. 228, also underlines that this feature, while defining with a certain vagueness, makes the concept of sustainable development a dynamic one, capable of adapting its content over time. In this regard, it is also interesting to recall the reflection presented in B. LA PORTA, *Riflessioni per una definizione di «prodotto alimentare sostenibile»*, in *Rivista di diritto agrario*, 2021, 2, I, p. 283, who, while acknowledging the vagueness of the term and its principle, and criticizing its excessive use (‘*uso bulimico*’) in the last thirty years, points out how the concept of sustainable development plays a pivotal role with legislative norms, for both their interpretation and control of legitimacy. After this initial moment, sustainable development rapidly became the focus of most UN conferences on the environment, including the UN Conference on Environment and Development of 1992, held in Rio de Janeiro, whose established principles played a significant role in the progression of the debate on sustainability. See S. MANSERVISI, *Verso un uso sostenibile dell’energia, il miglioramento dell’efficienza energetica e la creazione di modelli di produzione di consumo sostenibili anche nel settore alimentare*, in *Rivista di diritto agrario*, 2017, 2, I, pp. 300-301.

⁵ Over time, the above-mentioned dynamic character of sustainable development has allowed the acquisition of meanings other than the environmental one. More precisely, it is the 2030 Agenda for Sustainable Development that has enshrined the idea of the threefold dimension of sustainability, which is at once environmental, economic, and social, and thus requires an assessment of different but interconnected spheres, all fundamental to human and planet well-being. In this sense, S. BOLOGNINI, *Il consumatore nel mercato agro-alimentare europeo fra scelte di acquisto consapevoli e scelte di acquisto sostenibili*, *op. cit.*, p. 620. See UNITED NATIONS GENERAL ASSEMBLY, *Transforming our world: the 2030 Agenda for Sustainable Development*, A/RES/70/1, 25.09.2015. The 2030 Agenda is a plan of action that shaped the collective commitment of UN States to achieve, by 2030, a series of common goals, formalized in 17 Sustainable Development Goals (SDGs) and a major program of action of 169 targets. The document thus formalizes the UN’s commonly shared strategies to achieve a better and more sustainable future for all, resulting from the awareness of a large number of challenges that are common to all governments in the global scenario, linked first and foremost to economic and social development, which is thus declined in terms of sustainability. For a reflection on the Agenda 2030 and its SDGs, see M. MONTINI, F. VOLPE, *Sustainable Development Goals: “molto rumore per nulla?”*, in *Rivista giuridica dell’ambiente*, 2015, 3, pp. 489-496; M. MONTINI, *L’interazione tra gli SDGs ed il principio dello sviluppo sostenibile per l’attuazione del diritto internazionale dell’ambiente*, in *www.federalismi.it*, 2019, 9, pp. 4-7. In this direction, it is also worth highlighting how scholars have reflected on the importance of considering further specifications of the affirmed features, as in the case of social food sustainability [see P. LATTANZI, A. ISIDORI, *Il complesso cammino delle agroenergie verso la sostenibilità. Quale ruolo per le comunità energetiche rinnovabili?*, in *Przegląd prawa rolnego (Agricultural Law Review)*, 2024, 2, pp. 83-98], as well as different meanings, as in the case of cultural sustainability. On this aspect, A. DI LAURO, *Le denominazioni d’origine protette e le indicazioni geografiche protette di fronte alla sfida dello sviluppo sostenibile*, in *Rivista di diritto agrario*, 2018, 3, I, pp. 381-410.

⁶ The literature that has addressed the topic of sustainability in the agri-food sector, and the importance of its sustainable development, is understandably quite vast. Consider, *ex multis*, L. PAOLONI, *L’uso sostenibile della terra*, in *Agricoltura, Istituzioni, Mercati*, 2011, 2, pp. 123-132; S. CARMIGNANI, *Agricoltura e pluridimensionalità dello sviluppo sostenibile*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2016, 1, pp. 1-3; A. JANNARELLI, *Il diritto agrario del nuovo millennio tra food security, food safety e sustainable agriculture*, in *Rivista di diritto agrario*, 2018, 4, I, pp. 548-556; E. CRISTIANI, *Modelli di agricoltura “sostenibile” con particolare attenzione al diritto vitivinicolo*, in *Przegląd prawa rolnego (Agricultural Law Review)*, 2018, 1, pp. 133-144; A. DI LAURO, *Le denominazioni di origine protette e le indicazioni geografiche protette: strumenti per lo sviluppo sostenibile dell’impresa agricola?*, in *Rivista di diritto agrario*, 2019, 2, I, pp. 239-257.; M. ALABRESE, *Politiche climatiche, politiche agricole e il bisogno di coordinamento*, in *Rivista di diritto agrario*, 2020, 1, I, pp. 618-648; L. PAOLONI, *La sostenibilità “etica” della filiera agroalimentare*, in *Rivista di diritto alimentare*, 2020, 4, pp. 5-20; E. CRISTIANI, *La sostenibilità ambientale delle filiere agro-alimentari*, in *Rivista di diritto agrario*, 2021, 1, I, pp. 54-68.; G. DE LUCA, *La Strategia “Dal produttore al consumatore” e la questione della sostenibilità economica del Green Deal per i produttori primari*, in *Rivista di diritto agrario*, 2022, 4, I, pp. 650-686.

not always run parallel to each other. On the contrary, sustainability and technological innovation can, under certain conditions, establish a relationship of reciprocal instrumentality and support⁷. Here, on the one hand, sustainability is not hindered by technological innovation, and its goals are also achieved through innovative tools, techniques, and strategies; on the other hand, technological innovation continuously finds new spaces, perspectives, and areas of interest to expand and progress⁸.

1.1. Exploring new trajectories: the agri-food sector between sustainability and digitalisation.

In 2015, with the signing of the Paris Agreement⁹ and the settlement of the 2030 Agenda for Sustainable Development¹⁰, the European Union formalized its commitment to join the fight against climate change and, in this way, also identified new paradigms to conceive and plan present agri-food systems¹¹. As a result, the policies and strategies identified at the European

⁷ See L. PAOLONI, *Sostenibilità e innovazione in agricoltura. Dilemma o opportunità?*, in *Diritto agroalimentare*, 2024, 3, p. 586, which underlines how technological innovation is proposed as an indispensable set of models for an agri-food sector that is called upon to face unpredictable, often uncontrollable, phenomena such as climate change, food waste, new energetic needs, and the process of depletion of natural resources. In this perspective, technological innovation becomes a real sustainability factor.

⁸ This aspect is also stressed in I. CANFORA, *Politica Agricola Comune e digitalizzazione del comparto agroalimentare*, in *Rivista di diritto alimentare*, 2023, Quaderno 1, p. 12, that, however, denies that the functional relationship between sustainability and digitalisation is bi-directional, as only the former makes use of the latter to achieve its goals: *'In questo quadro, la relazione tra sostenibilità e innovazione tecnologica va considerata in rapporto di funzionalità della digitalizzazione e dell'innovazione per il raggiungimento degli obiettivi di sostenibilità – senza che questo binomio appaia bidirezionale, poiché gli obiettivi di sostenibilità si avvalgono dell'innovazione'*.

⁹ The Paris Agreement is a legally binding international treaty on climate change whose overarching, long-term goal is to hold the increase in the global average temperature to well below 2° C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5° C above pre-industrial levels, as illustrated in the UN Climate Change official page on the Paris Agreement, available at the following link: <https://unfccc.int/process-and-meetings/the-paris-agreement> (last accessed 20.01.2025). The EU signed the Paris Agreement in 2016. See Council Decision (EU) 2016/1841 of 5 October 2016 on the conclusion, on behalf of the European Union, of the Paris Agreement adopted under the United Nations Framework Convention on Climate Change. On this topic see, *ex multis*, F. SCALIA, *L'Accordo di Parigi e i «paradossi» delle politiche dell'Europa su clima ed energia*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2016, 6, pp. 1-25; L. ARISTEI, *L'Accordo di Parigi: obiettivi e disciplina*, in *Rivista quadrimestrale di diritto dell'ambiente*, 2017, 3, pp. 73-96; M. MONTINI, *Riflessioni critiche sull'Accordo di Parigi sui cambiamenti climatici*, in *Rivista di diritto internazionale*, 2017, 3, pp. 719-755.

¹⁰ See *supra*, fn. 5.

¹¹ Indeed, many identified purposes have direct or indirect repercussions on agri-food systems, these being a clear and glaring example of how economic activities impact people's well-being and health, the environment and its natural resources, biodiversity, and climate resilience when exercised from the unilateral perspective of profit. This is the case with Goal 2 *'End hunger, achieve food security and improved nutrition and promote sustainable agriculture'*, Goal 12 *'Ensure sustainable consumption and production patterns'*, Goal 13 *'Take urgent action to combat climate change and its impacts'*, Goal 14 *'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'*, Goal 15 *'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'*, and others. For an analysis of the role and impacts of the Agenda 2030 and its Sustainable

level for the following years, and consequently adopted by Member States, reflected the full endorsement of the accepted responsibilities¹².

In particular, the commitments mentioned above were followed by the European Green Deal¹³, an extensive program¹⁴ presented as an integral part of the EU Commission's strategy to implement the UN's 2030 Agenda and proposed as '*...a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. It also aims to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts (...)*'¹⁵.

To this end – and to achieve the environmental, economic, and social sustainability goals as enshrined in the 2030 Agenda – the European Green Deal plans to proceed with both general and sectoral initiatives, the latter aimed at those economic sectors already identified by the EU climate policy as mostly critical for the effective transition to climate neutrality, including the agri-food sector¹⁶. Adopting a systemic approach, the Commission also aims to facilitate the

Development Goals on agriculture and agri-food systems, see *ex multis* S. MANSERVISI, *Le Convenzioni internazionali sul clima e il ruolo dell'agricoltura*, in *Agricoltura, Istituzioni, Mercati*, 2016, 2, pp. 22-51; S. CARMIGNANI, *SDGs e agricoltura. Una breve riflessione*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020, pp. 207-220; S. MANSERVISI, *Il ruolo emergente del diritto agroalimentare tra economia circolare e SDGs di Agenda 2030*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, *op. cit.*, pp. 843-875.

¹² See U. von der Leyen, Speech in the European Parliament Plenary Session, 27.11.2019, which outlines the policy directions followed by the EU Commission for the 2019-2024 legislative period. However, the re-election of President von der Leyen in July 2024 allows to draw a line of continuity with the political objectives that the Commission intends to pursue in the second term, as confirmed by the President herself in her speech at the European Parliament for the 2024-2029 legislative period. See U. von der Leyen, Speech in the European Parliament Plenary Session, 27.11.2024: '*So I want to be clear. We will stay the course of the new growth strategy and the goals we set for 2030 and 2050*'.

¹³ EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, *The European Green Deal*, Brussels, 11.12.2019, COM(2019) 640 final.

¹⁴ In this regard, some scholars have highlighted how the Green Deal's program might be too ambitious and emphasized that the outlined goals should not remain mere aspirations but rather be translated into concrete and detailed legislative measures. In this sense, E. CRISTIANI, *La sostenibilità ambientale delle filiere agro-alimentari*, *op. cit.*, p. 57.

¹⁵ EUROPEAN COMMISSION, *The European Green Deal*, p. 1.

¹⁶ EUROPEAN COMMISSION, *The European Green Deal*, p. 11: '*European food is famous for being safe, nutritious and of high quality. It should now also become the global standard for sustainability. Although the transition to more sustainable systems has started, feeding a fast-growing world population remains a challenge with current production patterns. Food production still results in air, water and soil pollution, contributes to the loss of biodiversity and climate change, and consumes excessive amounts of natural resources, while an important part of food is wasted. At the same time, low quality diets contribute to obesity and diseases such as cancer*'.

achievement of sustainable agri-food systems by identifying a series of key actions, established for each passage of supply chains¹⁷.

Based on what was anticipated by the European Green Deal, the further and precise implementation of the actions designed for the agri-food sector was entrusted to the Communication '*A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system*' (from now on, Farm to Fork Strategy, also known as F2F Strategy)¹⁸, presented by the EU Commission as being '*...at the heart of the Green Deal [and] also central to the Commission's agenda to achieve the United Nations' Sustainable Development Goals (SDGs)*'¹⁹.

Endorsing the links between healthy people, healthy societies, and a healthy planet, and thus willing to address the challenges of sustainable food systems, the Strategy presents three main goals, which can be traced to the three dimensions of sustainable development and recall the predominance of sustainability for agri-food productions: to ensure that the food chain has a neutral or positive environmental impact; to ensure food security, nutrition, and public health through the access to sufficient, nutritious, sustainable food; to preserve the affordability of food while generating fairer economic returns in supply chains, so that the most sustainable food also becomes the most affordable one²⁰.

It is thus clear that sustainability represents an unavoidable, albeit certainly complex, challenge against which the European legislator, as mentioned before, tried to prepare itself and adapt daily²¹. As for the agri-food sector, although from the outset the presented plan of action

¹⁷ On these aspects, see P. LATTANZI, *La transizione verso un sistema alimentare sostenibile nel Green Deal*, in P. BORGHI, I. CANFORA, A. DI LAURO, L. RUSSO (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024, pp. 29-30.

¹⁸ EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system*, Brussels, 20.5.2020, COM(2020) 381final. For a comprehensive overview see H. SCHEBESTA, J.J.L. CANDEL, *Game-changing potential of the EU's Farm to fork Strategy*, in *Nature food*, 2020, 1, pp. 586-588; H. SCHEBESTA, N. BERNAZ, C. MACCHI, *The European union Farm to fork strategy: sustainability and responsible business in the food supply chain*, in *European food and feed law review*, 2020, 15, pp. 420-427; F. VENTURI, *The Farm to Fork Strategy. A Comprehensive but Cautious Approach to "Multidimensional" Food Sustainability*, in *Rivista quadrimestrale di diritto dell'ambiente*, 2021, 1, pp. 70-93; P. LATTANZI, *La transizione verso un sistema alimentare sostenibile nel Green Deal*, op. cit., pp. 29-44.

¹⁹ EUROPEAN COMMISSION, *A Farm to Fork Strategy*, p. 2.

²⁰ EUROPEAN COMMISSION, *A Farm to Fork Strategy*, p. 4. See P. LATTANZI, *La transizione verso un sistema alimentare sostenibile nel Green Deal*, cit., pp. 31-32, to which reference is also made for an analysis of the Strategy's structure, its political and specific objectives, its quantitative targets, and legislative and non-legislative measures.

²¹ In this regard, it should be recalled that the Farm to Fork Strategy is only one of the many measures designed by the European legislator to deal with the emergencies connected to sustainability, in the broader context of the Green Deal. The latter, indeed, encompasses multiple strategies intended to operate in many sectors: climate, to become the first climate neutral continent by 2050; energy, to achieve a clean and efficient energy transition;

has shown inner weaknesses and important shortcomings, further burdened by the occurrence of difficult external events²², the Farm to Fork Strategy certainly sought to accelerate these ambitious goals, mainly through the adoption of a '*holistic approach to the food system*' that could overcome the fragmentation and inefficiencies of related policies²³.

environment and oceans, to protect biodiversity and ecosystems; agriculture, to ensure a healthy food system for people and the planet; transport, to provide an efficient, safe, and environmentally-friendly sector; industry, to establish an industrial strategy for a competitive, green, and digital Europe. The complex system of the European Green Deal, with its initiatives, highlights, and latest steps, is fully illustrated at the following link: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en (last accessed 22.01.2025)

²² See P. LATTANZI, *La transizione verso un sistema alimentare sostenibile nel Green Deal*, op. cit., p. 43-44. As to the former, reference is made to the difficulties connected to the need of avoiding trade-offs between its multiple objectives, as well as obstacles linked to a difficult horizontal (between the multiple directions signed by the EU Commission) and vertical coordination (between the European level and Member States); as to the latter, instead, the A. in particular recalls the crisis following the Russian invasion of Ukraine. Speaking of outer critical factors, it is also relevant to remember that the Farm to Fork Strategy, despite presented only a few months after the European Green Deal, found itself to operate in a deeply changed scenario due to the Covid-19 pandemic, which also had strong impacts on the European food system, underlining some of its weaknesses. On these aspects, see also H. SCHEBESTA, M. ALESSANDRINI, F. CAZZINI, C. MACCHI, S. ROLANDI, *Tour de table: Farm to Fork law update*, in *European Food and Feed Law Review*, 2022, 3, pp. 208-218.

²³ H. SCHEBESTA, *How to Save the Farm to Fork Strategy: A Two-Phased Approach*, in *European Food and Feed Law Review*, 2023, 4, p. 236.

In the vision developed by European institutions, however, any consideration that concerns achieving a sustainable European agri-food sector goes hand in hand with reflections on the contribution that technological innovation and digitalisation²⁴ could provide²⁵.

²⁴ Technological innovation and digitalisation, as well, are priorities of the European Commission led by President von der Leyen, addressed for the first time in the 2019-2024 legislative period and once again confirmed for the second mandate. In her first speech to the Parliament, President von der Leyen stressed the need for Europe to lead the transition to a healthy planet and a new digital world: this second aim is pursued by the program 'A Europe Fit for the Digital Age', designed to empower EU people with a new generation of technologies and to achieve the digital transition. The European digital strategy was thus presented with the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Shaping Europe's digital future*, Brussels, 19.2.2020, COM(2020) 67final, later followed by the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *2030 Digital Compass: the European way for the Digital Decade*, Brussels, 9.3.2021, COM(2021) 118final. Through time, it has involved a great number of initiatives and actions, intended to operate in different sectors, and among them: the Digital Service Act (Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market For Digital Services and amending Directive 2000/31/EC), developed to ensure a safe and accountable online environment; the Digital Markets Act (Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828), to guarantee fair and open digital markets; the European Chips Act (Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation (EU) 2021/694), to strengthen EU's competitiveness in semiconductor technologies; the European Data Act (Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828), to develop a European strategy on data; and much more. A complete overview of the described program, its initiatives, and the latest updates can be found at the following link: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en (last accessed 23.01.2025). On the European digital strategy, it is mostly important to emphasize that the commitments of digitalisation and technological progress are also conceived in relation and dialogue with those formalized in the European Green Deal, as the twin challenge of a green and digital transformation has to go hand in hand: in this perspective, the digital transition is also perceived as a tool to achieve the goals of sustainable development. On this point, see P. LATTANZI, *L'agricoltura di precisione: fisionomia, quadro strategico di riferimento e implicazioni giuridiche*, in *Rivista di diritto alimentare*, 2024, 2, p. 23. Whether digitalisation can be a valuable ally for the agri-food sector in its pursuit of sustainability is the leading question in the research proposed in S. BOLOGNINI, *Disciplinari di sostenibilità e digitalizzazione*, in *Rivista di diritto agrario*, 2024, 1, I, pp. 3-73.

²⁵ The literature that, in recent years, has investigated the digitalisation of the agri-food sector is quite large and confirms the interest in dealing with the topic, as well as the need to identify and address the main legal challenges and obstacles related to it, and to search for possible solutions. By way of example, but not limited to it, see P. LATTANZI, *L'agricoltura di fronte alla sfida della digitalizzazione: opportunità e rischi di una nuova rivoluzione*, in *Rivista di diritto agrario*, 2017, 4, I, pp. 555-598; P. LATTANZI, *L'agricoltura di precisione. Una sfida anche per il diritto*, in *Agriregionieuropa*, 2018, 53, pp. 1-5; A. TOMMASINI, *La "rivoluzione" tecnologica nell'agroalimentare: algoritmi e innovazione digitale tra rischi e opportunità*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, op. cit. pp. 771-792; S. ROLANDI, G. BRUNORI, M. BACCO, I. SCOTTI, *The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts*, in *Sustainability*, 2021, 13, pp. 1-16; M. ALABRESE, A. SABA, *Digitalising Agricultural and Food Systems: policy challenges and actions for the sustainable transition in the EU*, in *Perspectives on Federalism*, 2022, 3, pp. 34-47; A.A. V.V., *Rivista di diritto alimentare*, Quaderno n. 1, 2023; G. PISCIOTTA TOSINI (ed.), *La rilevanza della digitalizzazione per un mercato agroalimentare sostenibile*, Atti del Convegno, Palermo, Palermo University Press, 2023; M. FERRARI, *Fattori di produzione, innovazione e distribuzione di valore nella filiera agroalimentare*, Milano, Ledizioni, 2023; B. LA PORTA, *Contributo per una visione contemporanea dell'azienda agricola: tra sostenibilità e sfide del mondo digitale*, Torino, Giappichelli, 2023; S. ROLANDI, *Il ruolo attribuito alla digitalizzazione nella Strategia Farm to Fork dell'Unione Europea, tra riferimenti espliciti e nascosti. Quali interventi legislativi in quattro anni?*, op. cit., pp. 636-658; L. RUSSO, *Il diritto agrario fra innovazione e sostenibilità*, in *Rivista di diritto agrario*, 2023, 3, I, pp. 464-488; A. SABA, *The EU policy framework on the digital*

The European legislator expressly recognises that, in agriculture, digital technologies can enable a more efficient and targeted production, thereby increasing the sustainability, performance, and competitiveness of the sector. In this perspective, agriculture is identified as a key sector where digital solutions can help reduce, among others, greenhouse gas emissions and the use of pesticides²⁶.

In general, the research of functional synergy between sustainability and digitalisation recurses in the development of European policies, to the point that, in the latest years, it has enabled to take a decisive step towards the creation of innovative, integrated and interconnected agri-food systems²⁷, which are also the result of the implementation of innovative technologies such as the Internet of Things (IoT, but identified as the *Internet of Farming* for the agri-food sector²⁸), Big Data, Artificial Intelligence, blockchain and distributed ledger technologies²⁹, cloud computing, robotics, drones, and sensors, also combined³⁰.

Indeed, digitalisation plays a crucial role in the European policies for the agri-food sector, starting with the European Green Deal³¹, passing through the measures designed by the

transition of farming and food systems, in M. ALABRESE, A. SABA (eds.), *EU law on sustainable and climate resilient agriculture after the European Green Deal*, Pula, Rurinnova, 2023, pp. 77-89. For an overview of the profiles that, in general, intertwine the topic of innovation in the agri-food sector, see also R. SAIJA, *L'innovazione tra diritto dell'agricoltura e regole del cibo. Paradigmi consolidati e nuovi scenari*, Padova, Cedam, 2024.

²⁶ EUROPEAN COMMISSION, *2030 Digital Compass: the European way for the Digital Decade*, COM(2021) 118final, p. 9.

²⁷ B. LA PORTA, *Contributo per una visione contemporanea dell'azienda agricola: tra sostenibilità e sfide del mondo digitale*, op. cit., p. 52.

²⁸ W. D'AVANZO, *Smart Farming. La quarta rivoluzione industriale e la digitalizzazione del settore agricolo*, in *Diritto agroalimentare*, 2022, 2, pp. 279-299.

²⁹ See *infra*, chapter I, par. 3.

³⁰ To have an idea of the possibilities offered by the implementation of different technologies in agriculture and in the agri-food sector see, *ex multis*, S. WOLFERT, L. GE, C. VERDOUW, M. J. BOGAARDT, *Big data in smart farming – a review*, in *Agricultural Systems*, 2017, 153, pp. 69-80; F. BALDUCCI, D. IMPEDOVO, G. PIRLO, *Machine Learning Applications on Agricultural Datasets for Smart Farm Enhancement*, in *Machines*, 2018, 6, pp. 1-22; J. MIRANDA, P. PONCE, A. MOLINA, P. WRIGHT, *Sensing, smart and sustainable technologies for Agri-Food 4.0*, in *Computers in Industry*, 2019, 108, pp. 21-36; R. KODAN *et al.*, *Internet of things for food sector: Status quo and projected potential*, in *Food Reviews International*, 2020, 6, pp. 584-600; J. L. RUIZ-REAL *et al.*, *A look at the past, present and future research trends of artificial intelligence in agriculture*, in *Agronomy*, 2020, 10, pp. 1-16; A. REJEB *et al.*, *The Interplay between the Internet of Things and agriculture: A bibliometric analysis and research agenda*, in *Internet of Things*, 2022, 19, pp. 1-26. For an overview of the most recent advances in digital technologies applied to the agri-food sector, see L. CRICELLI, R. MAURIELLO, S. STRAZULLO, *Technological innovation in agri-food supply chains*, in *British Food Journal*, 2024, 5, pp. 1852-1869. For a comprehensive legal reflection on the topic, see S. SAPIENZA, *Big Data, Algorithms and Food Safety, A Legal and Ethical Approach to Data Ownership and Data Governance*, New York, Springer, 2022; L. LEONE, *Big data e intelligenza artificiale nell'agricoltura europea 4.0: una lettura etico-giuridica*, in *Diritto agroalimentare*, 2024, 3, pp. 505-550; I. L. VAL, *The EU AI Act and the Food System: How the European Union AI Act Applies to Agrifood*, in *European Journal of Risk Regulation*, 2025, 1, pp. 1-21. For some general reflections on these points, see also E. BATTELLI, *Innovazione tecnologica e gestione della filiera agroalimentare*, in *Diritto agroalimentare*, 2024, 3, 455-475.

³¹ EUROPEAN COMMISSION, *The European Green Deal*, p. 9: 'Digital technologies are a critical enabler for attaining the sustainability goals of the Green Deal in many different sectors', including the agri-food sector. Thus, the Commission agrees to explore measures to ensure that digital technologies (including artificial intelligence,

Farm to Fork Strategy, and lastly further confirmed by the provisions included in the CAP for the period 2023-2027³², which conceives the modernisation of agriculture as a fundamental scope, to be achieved also through sharing of knowledge, innovation, and digitalisation³³.

As a matter of fact, several passages of the Farm to Fork Strategy refer to digitalisation³⁴, which is perceived as strictly functional to achieving sustainability and thus requires human and financial investment³⁵. Before the challenges that agri-food operators must face, including that of combining sustainable production and consumption with the unsolved issue of food security, digitalisation clearly shows its potential³⁶. Indeed, an accurate reading of the Strategy highlights different functions that, either directly or indirectly, are attributed to digitalisation³⁷.

5G, and cloud computing) accelerate the impact of policies to deal with climate change and protect the environment.

³² The final set of regulation for the Common Agricultural Policy 2023-2027 was approved on 2 December 2021 and consists of the following regulations: Regulation (EU) No 2021/2015 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for Strategic Plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013; Regulation (EU) No 2021/2116 of the European Parliament and of the Council of 2 December 2021 on the financing, management and monitoring of the common agricultural policy and repealing Regulation (EU) No 1306/2013; Regulation (EU) No 2021/2117 of the European Parliament and of the Council of 2 December 2021 amending Regulations (EU) No 1308/2013 establishing a common organisation of the markets in agricultural products, (EU) No 1151/2012 on quality schemes for agricultural products and foodstuffs, (EU) No 251/2014 on the definition, description, presentation, labelling and the protection of geographical indications of aromatised wine products and (EU) No 228/2013 laying down specific measures for agriculture in the outermost regions of the Union. For a comprehensive overview on the new CAP 2023-2027, see A.A. V.V., *Rivista di diritto agrario*, 2020, 1, I; S. MASINI, V. RUBINO (eds.), *La sostenibilità in agricoltura e la riforma della PAC*, Bari, Cacucci Editore, 2021; L. COSTATO, *L'ennesima riforma della PAC: alla ricerca di modelli tuttora incerti, tra piani strategici, competenze concorrenti e mercato*, in *Rivista di diritto alimentare*, 2021, 3, pp. 1-2; F. SOTTE, *Riflessioni sulla futura politica agricola europea*, in *Agricalabriaeuropa*, 2021, 1; A.A. V.V., *Rivista di diritto agrario*, 2022, 2, I.

³³ Reg. (EU) 2021/2115, art. 6, par. 2: *'The objectives set out in paragraph 1 shall be complemented and interconnected with the cross-cutting objective of modernising agriculture and rural areas by fostering and sharing of knowledge, innovation and digitalisation in agriculture and rural areas and by encouraging their uptake by farmers, through improved access to research, innovation, knowledge exchange and training'*.

³⁴ For a comprehensive overview of the role of digitalisation in the Farm to Fork Strategy, see S. ROLANDI, *Il ruolo attribuito alla digitalizzazione nella Strategia Farm to Fork dell'Unione Europea, tra riferimenti espliciti e nascosti. Quali interventi legislativi in quattro anni?*, op. cit., pp. 637-658.

³⁵ EUROPEAN COMMISSION, *A Farm to Fork Strategy*, p. 5: *'All actors of the food chain must play their part in achieving the sustainability of food chain. Farmers, fishers and aquaculture producers need to transform their production methods more quickly, and make the best use of nature-based, technological, digital, and space-based solutions to deliver better climate and environmental results, increase climate resilience and reduce and optimise the use of inputs (e.g. pesticides, fertilisers). These solutions require human and financial investment, but also promise higher returns by creating added value and by reducing costs'*.

³⁶ EUROPEAN COMMISSION, *A Farm to Fork Strategy*, p. 4.

³⁷ S. ROLANDI, *Il ruolo attribuito alla digitalizzazione nella Strategia Farm to Fork dell'Unione Europea, tra riferimenti espliciti e nascosti. Quali interventi legislativi in quattro anni?*, op. cit., pp. 646-656, identifies and describes five of them, including the function of ensuring the sustainability of food production, where the use of digital tools is expressly identified as a possible means to make food production sustainable when it comes to practices such as the use of pesticides or carbon farming.

In addition to this, in section 3.1 ‘Research, innovation, technology and investments’, the EU Commission emphasizes the deep relationship between sustainability, on the one hand, and innovation and access to technologies³⁸, on the other, identifying Horizon 2020 and Horizon Europe as the two key programs to support and endorse research, innovation and technological development, respectively with a budget of around € 1 billion for Green Deal priorities and € 10 billion on R&I. Consequently, the Strategy envisages many areas of intervention for research and technological innovation including, among others, agro-ecological approaches in primary production, the reduction in the use of pesticides, fertilisers, and antimicrobials, seeds security and diversity to restore soil health and functions, and the availability and use of alternative proteins and feed materials such as plants, insect-based proteins, and meat substitutes³⁹.

The Farm to Fork Strategy also dwells on the importance attributed to the CAP to achieve the illustrated results, confirming the central role that should be appointed to the digitalisation process in this scenario. And the same approach is indeed to be found in the Common Agricultural Policy for the period 2023-2027 which, once again, bets on innovation and digitalisation to tackle the well-known instances of present agricultural and food systems⁴⁰, to identify strategies capable of combining traditional techniques and innovative processes and systems, further expressing the awareness that research, innovation, technological development and digitalisation are at the heart of the progress to meet the challenges of the agricultural and food sectors⁴¹.

A reading of the CAP documents shows that the digitalisation of agriculture is conceived as an integral part of the new governance, as it is aimed at guaranteeing the achievement of the sustainable development goals. At the same time, it highlights a further objective, that is, the simplification and modernisation of the Common Agricultural Policy itself, to be achieved via digital technologies. The latter are indeed expected to bring multiple benefits in terms of reduction of administrative burdens, simplification of controls, and performance evaluation, but also to (re)define the CAP as a policy increasingly driven by data⁴².

³⁸ EUROPEAN COMMISSION, *A Farm to Fork Strategy*, p. 15: ‘Research and innovation (R&I) are key drivers in accelerating the transition to sustainable, healthy and inclusive food systems from primary production to consumption. R&I can help develop and test solutions, overcome barriers and uncover new market opportunities’.

³⁹ *Ivi*.

⁴⁰ On the intersections between the Common Agricultural Policy and digitalisation, see the contributions included in AA. VV., *Rivista di diritto alimentare*, Quaderno n. 1, 2023.

⁴¹ N. LUCIFERO, *Imprese agricole e start-up tra innovazione e ricambio generazionale*, in M. MAURO (ed.) *Start-up e PMI innovative in agricoltura. Imprese agricole tra innovazione e sostenibilità*, Padova, Cedam, 2024, p. 25.

⁴² In this sense, P. LATTANZI, *L'agricoltura di precisione: fisionomia, quadro strategico di riferimento e implicazioni giuridiche*, op. cit., pp. 26 ss.

Right from its premises, Regulation (EU) 2021/2115 recognises the relevance of innovation and technological development for agricultural and food productions⁴³, as well as the need to take action to adapt the agricultural environment to the thrust of innovation⁴⁴, thus asking Member States to comply with the outlined trajectories⁴⁵.

Consequently, the Member States CAP strategic plans must indicate the elements that ensure the modernisation of the agricultural policy within the State⁴⁶, mostly highlighting two aspects: a) an overview of the actions that the Member State intends to define to achieve the cross-cutting objective of modernisation; b) the strategy for the development of digital technologies in agriculture and rural areas they intend to use⁴⁷.

⁴³ Reg. (EU) 2021/2115, recital 23: '*A smarter, modernised and more sustainable CAP needs to embrace research and innovation in order to serve the multi-functionality of Union agriculture, forestry and food systems, investing in technological development and digitalisation, as well as improving the uptake and effective deployment of technologies, digital technologies in particular, and the access to, and increased sharing of, impartial, sound, relevant and new knowledge*'.

⁴⁴ Reg. (EU) 2021/2115, recital 32: '*As many rural areas in the Union suffer from structural problems such as a lack of attractive employment opportunities, skill shortages, underinvestment in broadband and connectivity, digital and other infrastructures and essential services, as well as youth drain, it is fundamental to strengthen the socio-economic fabric in those areas, in line with the Cork 2.0 Declaration 'A Better Life in Rural Areas', in particular through job creation and generational renewal, by bringing the Commission's jobs and growth agenda to rural areas, by promoting social inclusion, support for young people, generational renewal and the development of 'smart villages' across the European countryside, and by contributing to mitigating depopulation*'.

⁴⁵ As carefully outlined by renowned doctrine, the regulations of the new CAP show a clear change in the approach to digitalisation and technological innovation, to which a pivotal role is also attributed in the perspective of strengthening the outer rural context, which must adjust to embrace the digital transition that is taking place and to take advantage of its opportunities. See I. CANFORA, *Politica Agricola Comune e digitalizzazione del comparto agroalimentare*, op. cit., p. 13, to whom refer for a detailed analysis of the measures adopted by the CAP 2023-2027 to adjust to the opportunities and challenges of digitalisation, as well as the tools available to operators, and the role of Member States.

⁴⁶ Reg. (EU) 2021/2115, art. 114 '*Modernisation: The section on the elements that ensure modernisation of the CAP referred to in Article 107(1), point (g), shall highlight the elements of the CAP Strategic Plan that support the modernisation of the agriculture and rural areas and the CAP, and shall contain in particular: (a) an overview of how the CAP Strategic Plan will contribute to the achievement of the cross-cutting objective set out in Article 6(2), in particular through: (i) a description of the organisational set-up of the AKIS; (ii) a description of how advisory services as referred to in Article 15, research and the national CAP network referred to in Article 126 will cooperate to provide advice, knowledge flows and innovation services and how the actions supported under interventions pursuant to Article 78 or other relevant interventions are integrated into the AKIS; (b) a description of the strategy for the development of digital technologies in agriculture and rural areas and for the use of those technologies to improve the effectiveness and efficiency of the CAP Strategic Plan interventions*'.

⁴⁷ At this point, it is interesting to dwell on the choices made by the Italian Strategic Plan to address the challenges related to digitalisation. The CAP Strategic Plan for Italy was approved by the EU Commission on 2 December 2022. See EUROPEAN COMMISSION, Commission Implementing Decision of 2.12.2022 approving the 2023-2027 CAP Strategic Plan of Italy for Union support financed by the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development, Brussels, 2.12.2022, C(2022) 8645final. The approved version is available at the following link: https://www.reterurale.it/downloads/PSP_Italia_15112022.pdf (last accessed 28.01.2025). In the national Strategic Plan, digitalisation is indicated in Chapter 2 '*Valutazione delle esigenze e strategia di intervento*' ('*Migliorare l'orientamento al mercato e aumentare la competitività dell'azienda agricola nel breve e nel lungo periodo, anche attraverso una maggiore attenzione alla ricerca, alla tecnologia e alla digitalizzazione*' – 2.1.SO2). In this scenario, digitalisation mostly responds to two identified needs: to increase the profitability and competitiveness of companies and operators; to strengthen the quality and accessibility of material and digital infrastructures, also by encouraging companies and operators to invest in new

The brief excursus of strategies and policies highlights the acquired awareness of European institutions – fully shared and assimilated by Member States, as shown by the reconstructed efforts of the Italian legislators – of the role that digitalisation and technological innovation can play in the construction of sustainable and efficient modern agri-food systems, as well as of the convenience to take advantage of the opportunities offered by this broad

technologies. This first, cross-cutting objective is then matched to different sectorial interventions including, for example, those for the wine, for fruit and vegetable, and for the beekeeping sectors. Furthermore, section 8 of the Italian Strategic Plan is entirely dedicated to the modernisation of the national agricultural sector, with a specific focus on two main aspects: the AKIS system and digitalisation. As to the former, the Strategic Plan aims to improve the overall organisational structure of the Italian agricultural knowledge and innovation system (see section 8.1, p. 4449). The latter, instead, is the subject of a specific Strategy for digitalisation, in line with art. 114, let. b, of Reg. (EU) 2021/2115 (see section 8.5, p. 4455). Moving from the results of the SWOT analysis – which, in particular, highlights critical aspects such as the lack of statistical innovations and surveys on already introduced ones, the disuse of digital tools due to high costs and lack of training, the unavailability of advisory services for SMEs, the difficulties in infrastructural development in suburban areas – the Strategy pursues three main objectives: 1) to reduce the digital divide; 2) to increase the use of data; 3) to develop digitalised business models. For each of them, specific lines of interventions are identified, followed by one or more actions to undertake. In general, it can be said that the Strategy for digitalisation focuses on the promotion of knowledge and information, on support for operators, and on the dissemination and distribution of digital tools for businesses. Finally, the Strategy also acknowledges the issue of the digital divide between urban and rural areas and thus proposes to improve levels of connectivity and digitalisation processes in the latter, as well as to pursue higher standards of digital literacy among rural areas through activities of training, counselling, and through the access to data. In conclusion, the short analysis of the road taken by the national Strategic Plan shows that the Italian legislator has warmly welcomed the dispositions of Reg. (EU) 2021/2115 on the modernisation of the agricultural sector, as the objectives of digitalisation and technological innovation, in particular, seem to permeate the very approach of the program for the implementation of the CAP measures. For an in-depth analysis, see also A. BONFIGLIO, *La digitalizzazione nel Piano Strategico Nazionale della PAC 2023-2027*, in *PianetaPSR*, 2023, 120, available at the link: <https://www.pianetapsr.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/2851> (last accessed: 28.01.2025). In this perspective, it is more than appropriate to recall that, even before the measures formalised in the Strategic Plan, the Italian legislator had already expressed its commitment to support digitalisation and technological innovation in the national agri-food sector. In this direction, significant forms of funding can be found in the Italian National Recovery and Resilience Plan (NRRP) *‘Italia Domani’*, presented in response to the crisis caused by the COVID-19 pandemic and approved by the EU Council in July 2021 (COUNCIL OF THE EUROPEAN UNION, Council Implementing Decision on the approval of the assessment of the recovery and resilience plan for Italy, Brussels, 6.7.2021), whose text is available at: <https://www.governo.it/sites/governo.it/files/PNRR.pdf> (last accessed 28.01.2025). Through its six measures – in particular, Missione 1 *‘Digitalizzazione, innovazione, competitività e cultura’* and Missione 2 *‘Rivoluzione verde e transizione ecologica’* – the Italian NRRP formalises its main objective for the agri-food sector: to contribute to its modernisation, also through digital transformation, to develop increasingly efficient and competitive processes while achieving higher levels of sustainability for companies and operators. To this end, the Plan envisages specific measures for the agri-food sector, as in the case of Missione 2, Componente 1.2 *‘Sviluppare una filiera agroalimentare sostenibile’*, with its three investments line respectively directed at logistics development, at the so-called *‘Parco Agrisolare’*, and at innovation and mechanisation in the agri-food sector. In addition to this, the NRRP envisages a series of transversal interventions that, although not directly designed for the agri-food sector, nevertheless involve it, such as the preliminary structural interventions to implement internet connections and their speed throughout the national territory. On these aspects, see F. COLI, A. MANZONI, *Green revolution e agri-food: la strategia del PNRR tra esigenze europee e nazionali*, in *Pandora Rivista*, 2021, 2, pp. 204-215; F. COLI, *L’Agricoltura sostenibile nel Pnrr e la sfida della complessità*, in *Euractive Italia*, 2022. This brief illustration shows how the focus on digitalisation and technological innovation is central in the Italian strategy for the agricultural sector, too, even though only the passage of time will prove the effectiveness and suitability of these measures to modernise the agri-food sector. For some further indications of the policies and instruments designed by the Italian legislator to support digitalisation in the agri-food sector, see B. LAPORTA, *Contributo per una visione contemporanea dell’azienda agricola: tra sostenibilità e sfide del mondo digitale*, op. cit., pp. 57-62.

panorama to achieve the pursued objectives. This awareness, however, cannot be accompanied only by good intentions; rather, it requires the concrete and tangible support of *ad hoc* funding policies, adequate to sustain operators and companies in the financial investments necessary to progress in the race towards the modernisation of the agri-food sector and to create a rural context that is capable of acknowledging and implementing these new possibilities, through the action of Member States.

1.2. Perspectives, applications, and challenges.

The policies and strategies designed by the European legislator to harmoniously develop the trajectories of sustainability and digitalisation in the agri-food sector have found a propulsive thrust and constant confirmation in the broad panorama of technological innovation, which, in different ways, has developed its areas of use with time⁴⁸.

This has not only been the effect of the progressive identification of new technologies, increasingly suitable and valuable for the analysed sector. Indeed, the gradual acceptance, by part of the involved actors, of the advantages that the use of digital solutions and technological tools can bring to agricultural activities has played a fundamental role, too: to increase productivity while optimising productive factors and reducing environmental impacts; to contain costs while increasing the incomes of operators and businesses⁴⁹. These advantages, moreover, go beyond the single context and engage the whole society, which is nowadays involved in facing epochal challenges such as climate change, the rapid growth of the global population, and scarcity and pollution of natural resources⁵⁰.

⁴⁸ A. SCUDERI, *La digital transformation nel sistema agroalimentare*, in G. GUZZARDI (ed.), *Persona e mercato nella società digitale*. Atti delle giornate di studi (Catania, 13 dicembre 2022 e 4 maggio 2023), Napoli, Editoriale Scientifica Italiana, 2024, pp. 11-18, which, indeed, speaks of a digital transformation for the agri-food sector that has already taken place and is fundamental to improve the competitiveness of the sector while facing environmental, social, and economic challenges. For a comprehensive overview of these topics, see also M. FERRARI, *Digitalizzazione e innovazione nell'attività delle imprese agricole*, in M. MAURO (ed.) *Start-up e PMI innovative in agricoltura*, op. cit.; ID., *Le imprese alimentari e la digitalizzazione*, in *Trattato di diritto alimentare Italiano e dell'Unione europea*, op. cit., pp. 277-287.

⁴⁹ In this sense, A. TOMMASINI, *La "rivoluzione" tecnologica nell'agroalimentare: algoritmi e innovazione digitale tra rischi e opportunità*, op. cit., p. 773, that, additionally, highlights how digitalisation is capable of providing an answer to the main challenges faced by the actors of the agri-food sector, including, on the one hand, the increase in the purchase of prices of technical means and, on the other hand, the significant decrease in the market value of agricultural products.

⁵⁰ See P. LATTANZI, *L'agricoltura di precisione: fisionomia, quadro strategico di riferimento e implicazioni giuridiche*, op. cit., p. 19.

These aspects appear clearly when analysing the widespread environment of precision agriculture which, even today, is probably the best-known and most evident proof of the technological change that the agri-food sector is experiencing, in its *fourth revolution*⁵¹, as it encompasses all the methodologies (including the implementation of Information and Communication Technologies, ICT, both in the decision-making and the application phases) aimed at making precise, accurate, and efficient agronomic interventions, which consider the state, features, and current needs, of the site where the interventions itself is planned⁵². Starting in the 1980s with the first implementation of the first GPS (global positioning system), mostly to improve the equipment used to apply specific quantities of fertilisers, seeds, or pesticides to each portion of the soil, through time the tools available to precision agriculture have significantly enhanced and include various types of app, drones, robots, automatic driving systems, sensors, hardware and software systems incorporated and not incorporated to agricultural equipment and machines, all of which are further enhanced by the synchronization with other technologies such as Big Data, the IoT, Artificial Intelligence, and so on⁵³. To the point that, today, precision agriculture also includes applications of *'prescriptive agriculture'*,

⁵¹ See D. C. ROSE, J. CHILVERS, *Agriculture 4.0: Broadening Responsible Innovation in an Era of Smart Farming*, in *Frontiers in Sustainable Food Systems*, 2018, 2, pp. 1-2: 'Each previous agricultural revolution was radical at the time – the first representing a transition from hunting and gathering to settled agriculture, the second relating to the British agricultural revolution in the 18th century, and the third relating to post-war productivity increases associated with mechanisation and the Green Revolution'. See also H. BARRETT, D. C. ROSE, *Perceptions of the fourth agricultural revolution: what's in, what's out, and what consequences are anticipated*, in *Sociologia Ruralis*, 2022, 62, pp. 162-189.

⁵² According to one of the earliest and best-known definitions of precision agriculture, it consists of a system that enables to 'do the right thing, in the right place, at the right time, and in the right way'. In these terms, F. J. PIERCE, P. NOWAK, *Aspects of Precision Agriculture*, in *Advances in Agronomy*, 1999, 67, p. 4. Moving from this and the definitions proposed in numerous scientific papers published on this topic over time, the International Society of Precision Agriculture (ISPA) today describes it as 'a management strategy that gathers, processes and analyses temporal, spatial and individual plant and animal data and combines it with other information to support management decisions according to estimated variability for improved resource use efficiency, productivity, quality, profitability and sustainability of agricultural production'. The definition is available on the International Society of Precision Agriculture website and at the following link: <https://www.ispag.org/about/definition> (last accessed 30.01.2025). It is not possible here to deepen precision agriculture; for a general overview of the topic, its perspectives and opportunities, and its risks and criticalities, please refer to the in-depth analysis offered in P. LATTANZI, *L'agricoltura di fronte alla sfida della digitalizzazione: opportunità e rischi di una nuova rivoluzione*, op. cit., pp. 555-598; ID., *L'agricoltura di precisione. Una sfida anche per il diritto*, in *Agriregionieuropa*, op. cit., pp. 1-5; ID., *L'agricoltura di precisione: fisionomia, quadro strategico di riferimento e implicazioni giuridiche*, op. cit., pp. 19-36.

⁵³ The literature on the tools available for precision agriculture is understandably quite vast. For a comprehensive overview see J. V. STAFFORD (ed.), *Precision Agriculture '23*, Wageningen, Wageningen Academic Publishers, 2023.

which make use of advanced data analysis techniques not simply to predict what will happen, but also recommend which actions to take to optimise the awaited result⁵⁴.

On closer inspection, however, further considerations on the role of digitalisation can be made when observing the daily exercise of agricultural activities. For example, web applications aimed at facilitating and supporting operators in arranging the necessary and requested documentation have been used for some time and have also been embracing technological development in recent years⁵⁵.

However, the wide range of technologies at the service of the agri-food sector arises in every stage of the production chain. Therefore, alongside the innovative tools that provide their usefulness especially in the field, such as the described techniques of precision agriculture, it is equally important to mention and consider the digital devices that, on the other hand, find application in the following steps of agri-food supply chains: from production and processing and storage, to transport and distribution, up to the final moment of purchase by consumers.

In this perspective, technological innovations find their meaning also when addressing the topic of traceability of agri-food supply chains⁵⁶, as the implementation of digital solutions

⁵⁴ On the topic of prescriptive agriculture, see N. RASMUSSEN, *From Precision Agriculture to Market Manipulation: A New Frontier in the Legal Community*, in *Minnesota Journal of Law Science & Technology*, 2016, pp. 489-516; S.L. FERRELL, *Legal Issues on the Farm Data Frontier, Part I: Managing First-Degree Relationships in Farm Data Transfers*, in *Drake Journal of Agricultural Law*, 2016, 21, pp. 13-57.

⁵⁵ An interesting example in this sense is provided by the so-called '*quaderno di campagna*', introduced in Italy with the D. Lgs. No 150 of 14 August 2012, which implemented Directive 2009/128/EC (Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides). Ever since its introduction, the '*quaderno di campagna*' has been used by operators to keep a record of any treatment used in the field (of phytosanitary products, fertilisers, etc.), the adopted methods, the quantities, the timing, and so on. It is, in other words, a register which provides an overall picture of the activities and treatments carried out in the field, so that correct information can be obtained. However, if in the past it could be held in any form (thus, also paper-based) and displayed in the event of controls from the competent authorities, from January 2025, the system has compulsorily become digital: data and information must be shared with the *Agenzia per le erogazioni in agricoltura* (AGEA) and stored in the digital dossier. It is clear that, while for operators the digitalisation of the '*quaderno di campagna*' does not entail any additional commitment if compared to the previous situation – as the burden of registration does not change, nor does its content – the novelty lies in the opening to a more secure digital system, which also makes controls faster and more reliable. Its implementation, however, will require technical support in managing applications and data.

⁵⁶ As well known, traceability in the agri-food sector is regulated by Regulation (EC) 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (also, General Food Law, GFL). According to the Regulation, the fundamental goal of food traceability is to remove unsafe food from the market, to ensure fair trading amongst operators, and the reliability of information offered to consumers. Thus, mandatory requirements for the traceability of foods, feeds, and ingredients, are established: in line with the principles of food traceability laid out by the Codex Alimentarius, the GFL embraces the '*one step back - one step forward*' approach, requesting FBOs to identify any person from whom they have been supplied with a food or raw material, and any person to whom their products have been supplied (excluding final consumers). In this sense, see L. SALVI, *Traceability and Hygiene Package*, in L. COSTATO, F. ALBISINNI (eds.) *European and Global Food Law*, Milano, Wolters Kluwer, 2016, p. 285: '*...traceability is conceived as a step-by-step process: information is not required to follow the entire production process and distribution chain through to*

makes it possible to quickly and reliably collect useful data, concerning each step of production chains, while lowering the possibilities of mistakes, mostly by avoiding human intervention that is susceptible to accidental mistakes and voluntary fraud⁵⁷. In this case, technology allows the recording of precise and trustworthy product and process information, which may concern the origin⁵⁸, or techniques and methods of production, as in the case of organic farming⁵⁹.

the market, but is rather confined to the specific stage of the production concerned'. On this approach, it has also been observed that: *'[T]he burden of reconstructing the whole food chain when an incident occurs is on the authorities and to that end traceability information has to be made available to those authorities on demand'*. See B. VAN DER MEULEN (ed.), *EU Food Law Handbook*, Wageningen, Wageningen Academic Publisher, 2014, p. 360. However, it is also important to underline a significant shortcoming in the described system: while the provision identifies its goals and aimed results, it does not specify how they should be achieved. The implementation of the system, eventually, is left to the discretion of FBOs. On these aspects, see also P. LATTANZI, S. MARIANI, *Blockchain and the food supply chain, the future of food traceability*, in A. CALIGIURI (ed.) *Legal technology transformation. A practical assessment*, Napoli, Editoriale Scientifica, 2020, p. 263.

⁵⁷ In this regard, it is interesting to recall the results of the Fitness Check on Regulation (EC) 178/2002, launched in 2014 and finally presented on 15 January 2018, as a policy evaluation aimed at assessing whether the framework for the GFL is 'fit for the purpose', also concerning the implementation of mandatory requirements for traceability. In particular, the assessment revealed that some aspects of the traceability system could be improved, as *'...it still occurs that the traceability chain is interrupted because of errors or incomplete documentation at a particular stage'*. See EUROPEAN COMMISSION, Commission Staff Working Document the Refit Evaluation of the General Food Law (Regulation (EC) No 178/2002), Brussels, 15.1.2018, SWD(2018) 38final, p. 54. The identified criticalities leave room for implementing digital solutions, capable of overcoming these obstacles by avoiding human mistakes or incompleteness. It is in this scenario, and for the mentioned purposes, that blockchain technology has found its main role. Indeed, blockchain is a distributed ledger technology that, when applied to the agri-food sector, allows real-time traceability of all supply chain stages, offering guarantees of transparency and immutability of information. These aspects will be analysed more carefully in the following passages of the work (see *infra*, chapter I, par. 3).

⁵⁸ It has been observed that, in commercial communication, origin has become a major element of interest and, perhaps, the true reason for trades. See S. MASINI, *Corso di diritto alimentare*, Milano, Giuffrè, 2011, p. 202. In general, and perhaps also for this reason, the literature that has addressed the complex topics of origin and its regulation is understandably quite vast. Consider, *ex multis*, F. ALBISINNI, *L'origine dei prodotti agro-alimentari e la qualità territoriale*, in *Rivista di diritto agrario*, 2000, 1, I, pp. 23-44; F. ALBISINNI, *Luoghi e regole del diritto alimentare: il territorio tra competizione e sicurezza*, in *Diritto e giurisprudenza agraria e dell'ambiente*, 2004, 4, pp. 201-212; F. ALBISINNI, *La comunicazione al consumatore di alimenti, le disposizioni nazionali e l'origine dei prodotti*, in *Rivista di diritto agrario*, 2012, 1, I, pp. 66-78; L. RUSSO, *Communication of the origin of food products: legal aspects*, in *Agricultural Law Review (Przegląd prawa rolnego)*, 2021, 29, pp. 405-422. The topic will be more carefully addressed in the following parts of the work (see, *infra*, chapter II, par. 1.2).

⁵⁹ The linkage between traceability and organic production has long been investigated by scholars, from a policy, legal, and socioeconomic perspective, with different objectives: to understand whether, and to what extent, traceability is important in the framework of organic production; which obstacles hinder its effective realisation; how important is it for producers to trace the organic nature of their production and how important is it, on the other hand, for consumers to access to this information. In this sense, see E. M. TAVERNIER, *An empirical analysis of producer perception of traceability in organic agriculture*, in *Renewable Agriculture and Food Systems*, 2004, 19, pp. 110-117; M. INGRASSIA, S. BACARELLA, P. COLUMBA, L. ALTAMORE, S. CHIRONI, *Traceability and Labelling of Food Products from the Consumer Perspective*, in *Chemical Engineering Transactions*, 2017, 58, pp. 865-870. More recently, the reflection on the subject has also involved searching for the contribution that innovative technologies can offer to the traceability of organic productions. See M. VAN HILTEN, G. ONGENA, P. RAVESTEIJN, *Blockchain for Organic Food Traceability: Case Studies on Drivers and Challenges*, in *Frontiers in Blockchain*, 2020, 3, pp. 1-13.

Or, again, this information may concern some features of the chain itself, as with short supply chains⁶⁰.

Of great interest are also the technological applications that allow agri-food operators to strengthen their connection with consumers, showing and promoting their companies⁶¹ and providing voluntary product information capable of steering their purchasing choice⁶².

⁶⁰ Short supply chains, as well, are enriched by the possibility of tracing back the steps of each product. This aspect is further confirmed by the recent Law No. 61 of 17 May 2022 '*Norme per la valorizzazione e la promozione dei prodotti agricoli e alimentari a chilometro zero e di quelli provenienti da filiera corta*', which intends to provide specific regulations on short supply chains. The law, among other things, plans to establish a 'short supply chain' and a '0 Km' logo, as well as the requirement for traceability and to provide correct information to consumers. On these points, see M. C. RIZZUTO, *Filiere corte tra sostenibilità e valorizzazione del territorio*, in *Rivista di diritto alimentare*, 2023, 1, pp. 66-86. In general, the regulation of short supply chains has been widely investigated in the literature. See, *ex multis*, F. ADORNATO, *Contratti e mercati di prossimità e di territorio dei prodotti agroalimentari*, in *Rivista di diritto alimentare*, 2013, 1, pp. 15-24; G. COCCO, *Filiera corta e farmers' markets*, in *Rivista giuridica dell'ambiente*, 2015, 2, pp. 167-208; I. CANFORA, *La valorizzazione dei prodotti agricoli regionali tra politiche territoriali e vincoli europei*, in *I diritti della terra e del mercato agroalimentare*. Liber Amicorum Alberto Germanò, II, Torino, Utet Giuridica, 2017, pp. 1357-1375; M. ALESSANDRINI, *Regulating Short Food Supply Chains in the EU*, New York, Springer, 2024.

⁶¹ In this scenario, it is possible to examine the applications employed to handle augmented reality, which can act as mechanisms to enrich sensorial perception through electronic and digital devices. See M. A. LEMLEY, E. VOLOKH, *Law, virtual reality and augmented reality*, in *University of Pennsylvania Law Review*, 2018, 166, pp. 1051-1138. The reference is, in particular, to the Metaverse, which shows its ability to decrease the distances between producers and consumers, offering new spaces for the remote sale of goods and access to services, mostly experiential ones. By flanking the physical space with its digital projection in the Metaverse, indeed, producers and companies open up to the new scenario of digital tourism, made up of interactive tours, virtual discovery of products and places, and intense marketing activities. All of this fosters a rapprochement between producers and consumers, with positive impacts on the perception of the company and its activity. In this perspective, the Metaverse is not just an evolved e-commerce platform, but rather a space where the consumer lands to benefit from a wide range of services and experiences. From a legal perspective, complete and effective protection of consumers must be ensured in the Metaverse, as well, by adopting different instruments based on the activities carried out in this digital space. For example, Regulation (EU) No 1169/2011 on the provision of food information to consumers applies if the digital space in the Metaverse is presented using labelling systems. Consumers exploring the Metaverse must be guaranteed the principles of truth, transparency, and fairness, enabling them to make choices that are not tainted by misleading representations of producers. On this topic, see B. LA PORTA, *Contributo per una visione contemporanea dell'azienda agricola: tra sostenibilità e sfide del mondo digitale*, *op. cit.*, p. 173 ss.

⁶² As is well known, business-to-consumer (B2C) communication plays a fundamental role as a channel to connect production and consumption models, making the consumer a potential and necessary actor in food supply chains. For a detailed study on this topic, see S. BOLOGNINI, *La disciplina della comunicazione business to consumer nel mercato agro-alimentare europeo*, Torino, Giappichelli, 2012. As it makes use of mandatory and voluntary information, distinctive signs, trademarks, and public and private certifications, it has been observed that B2C communication is a tool to allow consumers to make informed purchasing choices, but, at the same time, it can also act as a tool to guide their purchasing conduct. This aspect is emphasised in S. BOLOGNINI, *Il consumatore nel mercato agro-alimentare europeo fra scelte di acquisto consapevoli e scelte di acquisto sostenibili*, *op. cit.*, pp. 615-644, who, in particular, underlines the possibility of using B2C communication to steer consumers towards sustainable agri-food purchasing choices. In this panorama, the focus is mostly on information, as it allows for messages to be conveyed from producers to consumers, either because the former is obliged to do so (in the case of mandatory information) or because it can obtain specific advantages from it, drawing the consumers' attention to specific elements, features, and qualities of the product, that the producer considers pivotal (in the case of voluntary information). On the role of information in the agri-food sector, see *ex multis* A. DI LAURO, *Comunicazione pubblicitaria ed informazione nel settore agro-alimentare*, Milano, Giuffrè, 2005; A. GERMANÒ, M. P. RAGIONIERI, E. ROOK BASILE, *Diritto agroalimentare. Le regole del mercato degli alimenti e dell'informazione alimentare*, Torino, Giappichelli, 2014; S. MASINI, *Informazioni e scelte del consumatore*, in

Mention apart should be made for the new selling platforms⁶³.

At the same time, however, it should be remembered that the agri-food sector's digitalisation path is not devoid of criticalities, which come to light under different perspectives:

Trattato di diritto alimentare italiano e dell'Unione europea, op. cit., pp. 417-431.; ID., *Piattaforme online e motori di ricerca: sul rischio di accesso del consumatore digitale di alimenti*, in *Diritto agroalimentare*, 2023, 3; A. DI LAURO, *Informazioni e scelte*, in F. ALBISINNI, L. COSTATO (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea*, Padova, Cedam, 2023, pp. 1189-1201. For a detailed analysis of the European framework on voluntary information, see *ex multis* M. GIUFFRIDA, *Pratiche leali di informazione e informazioni volontarie*, in *Rivista di diritto agrario*, 2012, 1, I, pp. 79-93; V. PAGANIZZA, *Informazioni volontarie sugli alimenti*, in V. RUBINO (ed.), *Le informazioni sugli alimenti ai consumatori. Il Regolamento (UE) n. 1169/2011*, Roma, Aracne, 2015, pp. 219-230; P. BORGHI, *Le informazioni volontarie nella disciplina della etichettatura degli alimenti*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza, op. cit.*, pp. 93-118.

⁶³ The topic of distance selling is quite old and cannot be considered, as such, a novelty brought by the digital transformation of the agri-food sector. See L. VANDER VEER, *Real Food from Virtual Shops (A Case Study from the Netherlands)*, in *European Food and Feed Law Review*, 2012, 7, pp. 3-13, who, more than a decade ago, already pointed out how virtual markets were rapidly becoming popular in the agri-food sector. Nevertheless, there is no doubt that digitalisation has gradually manifested its effects in the field of distance selling of agri-food products, by developing new means of communication and digital technologies that have changed the possibilities of interaction between the involved actors. In the context of B2C communication, in particular, digitalisation has enlarged the online tools available for distance selling, employed by consumers to place orders, get information on products and services, express opinions, and compare experiences: from ordinary services like e-commerce (electronic commerce) and m-commerce (mobile commerce) to advanced means aimed at further facilitating the digital purchase of agri-food products. On these aspects, see S. BOLOGNINI, *La vendita a distanza dei prodotti alimentari fra innovazione del mercato agroalimentare e regime delle tutele*, in *Rivista di diritto agrario*, 2020, 4, I, pp. 395-442. The described expansion of digital agri-food markets entails the necessity to pay attention to new forms of threat in B2C communication, information to consumers, and, more in general, in their protection in distance selling; a necessity of which, however, the European legislator has partially been aware of. An example of this is provided by the introduction, in the already-mentioned Reg. (EU) 1169/2011 on the provision of food information to consumers, of a specific provision on distance selling. Art. 14, indeed, establishes that in the case of distance selling, mandatory food information must be made available before the purchase is concluded, to enable consumers to make informed choices. For a study on this provision, see M. HAGENMEYER, *Food Information Regulation, Commentary on Regulation (EU) No. 1169/2011 on the Provision of Food Information to Consumers*, Berlin, Lexxion, 2012, pp. 137 ss; I. CANFORA, *Informazioni a tutela della salute e conformazione del contenuto negoziale tra diritto europeo e diritti nazionali*, in *Rivista di diritto agrario*, 2014, 2, I, pp. 119-141. However, it has been observed that the evolution of the legal framework, especially from the point of view of consumers' protection in B2C communication, has perhaps not been capable of sufficiently balancing the experienced innovations in distance selling of agri-food products. This is because, on the one hand, the private means of protection prove to be scarcely available to consumers and, on the other hand, public sanctions are low-cost and, therefore, not dissuasive enough. See S. BOLOGNINI, *La vendita a distanza dei prodotti alimentari fra innovazione del mercato agroalimentare e regime delle tutele*, cit., p. 440. For an in-depth analysis of these topics, see also S. BOLOGNINI, *Contrattazione a distanza e tutela del consumatore*, Torino, Giappichelli, 2018. More recently, ID., *E-commerce e comunicazione*, in L. COSTATO, F. ALBISINNI (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea, op. cit.* For an overview of the phenomenon of food e-commerce, also from an economic perspective, see S. ROLANDI, *Food E-commerce as a New Tool for the Growth of the Economy. European Legal Framework for Information of Prepacked Food Sold Online*, in M. G. ALABRESE, M. BRUNORI, S. ROLANDI, A. SABA (eds.) *Agricultural Law. Current Issues from a Global Perspective*, New York, Springer, 2017, pp. 231-244. For an exhaustive examination of the legal issues and the various interests involved in the distance selling of agri-food products, see M. D'ADDEZIO, *Vendita a distanza e altre modalità di vendita diretta di prodotti agricoli e alimentari: molteplicità di questioni giuridiche e di interessi coinvolti*, in *Diritto agroalimentare*, 2020, 1, pp. 23-49. For the most recent comprehensive work delving into these topics, see S. ROLANDI, *Food E-commerce and the Law. A Legal Analysis of the Role of Food Information in Strengthening Trust in EU Business-to-Consumers Food E-Commerce*, Torino, Giappichelli, 2025.

from economic to social, from technological to ethical⁶⁴. Proceeding step-by-step, the main persistent obstacles to a straightforward and functional digitalisation of the sector can be traced back to four key areas: environmental, economic, social, and governance challenges⁶⁵.

Starting with the first domain, it is crucial to recall the significant environmental barrier associated with the adoption of innovative technologies, primarily due to the substantial energy requirements that these technologies necessitate. All digital tools, as is known, need energy to function; this demand becomes particularly significant with more pervasive tools and technologies, as in the case of advanced sensors and automated machines⁶⁶ or with the implementation of distributed ledger technologies⁶⁷. At the same time, the production and frequent replacement of digital devices require raw materials that inevitably lead to resource depletion, while electronic waste from obsolete equipment poses pollution risks if not disposed of properly. These impacts can partly offset the environmental benefits of digital technologies⁶⁸.

The second domain is the economic one, and several reflections originate from it. Indeed, one of the best-known obstacles to the digitalisation of the agri-food sector, acknowledged by most producers and SMEs, is connected to the shortage of capital to invest in improving their activities, specifically for technological progress. Adopting advanced tools, procedures, and models entails high costs that must be faced both in the initial stage, for their purchase and introduction, and continuously or cyclically for their management, updating, and upkeep. In this perspective, the large investment required acts as a great barrier, mostly when

⁶⁴ Back in 2017, the European Parliament Research Service (EPRS) developed and presented a study to identify the main legal, social, and ethical considerations surrounding precision agriculture and the issues that might have to be dealt with, because of the new technological trends, especially in the upcoming passages of the Common Agricultural Policy. The study acknowledges that embracing new technologies can at times be difficult for farmers and companies, mostly because of expensive machinery, the absence of infrastructure, and a lack of knowledge and specific know-how, identified as some of the main challenges that the agricultural and food sectors face when approaching digitalisation. The results of the study are accessible online via the following link: [https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU\(2017\)603207](https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU(2017)603207) (last accessed 6.02.2025). See M. KRITIKOS, *Precision Agriculture in Europe. Legal, Social, and Ethical Considerations*, European Parliament Research Service, Brussels, 2017.

⁶⁵ In this sense, the scheme provided in S. ROLANDI, G. BRUNORI, M. BACCO, I. SCOTTI, *The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts*, *op. cit.*, pp. 9 ss. can be agreed with. To illustrate the impacts of digitalisation in agriculture, including the negative ones, the A. identify these four *domains*, which appear more than suitable and agreeable to provide a clear, organic, and complete analysis of the main obstacles.

⁶⁶ For an overview, see R. SPARROW, M. HOWARD, *Robots in agriculture: Perspectives, impacts, ethics, and policy*, in *Precision Agriculture*, 2020, 22, pp. 818-833.

⁶⁷ *Infra*, chapter I, par. 2.

⁶⁸ See S. LANGE, J. POHL, T. SANTARIUS, *Digitalization and energy consumption. Does ICT reduce energy demand?*, in *Ecological Economics*, 2020, 176, pp. 1-18.

the incurred costs are not counterbalanced by a clear perception of the achievable benefits and results, which should uphold the economic viability of technological innovation⁶⁹.

This last observation partially relates to the third domain, as well. In the extended scenario of the social obstacles⁷⁰ hindering the digitalisation of the agri-food sector, the operators' scepticism and reluctance to open up to the opportunities offered by technological innovation find their place. Under this point of view, indeed, it must be recalled that the technological advancement of agri-food companies – which, for some years now, has been taking place mostly thanks to the new generations of producers – still runs the risk of major slowdowns due to the lack of awareness and confidence in the innovative tools⁷¹. This obstacle can only be overcome through a full understanding, by part of the actors involved, of the idea that the advantages of digitalisation will be wholly expressed soon: agri-food operators and companies must, therefore, be forward-looking and actively be part of this process of technological innovation to maintain their competitiveness in increasingly digitalised markets.

Concerning the social domain, significant obstacles are also to be found in the so-called *digital illiteracy*. The difficulties experienced by agri-food actors to approach the innovations offered by digitalisation, a consequence of the lack of specialised digital skills and very low know-how, lead to two different but coexisting scenarios: on the one hand, producers' reluctance to trust and make use of tools they do not know (and do not know how to use) significantly slows down the process of digitalisation; on the other hand, the risk is for producers (notoriously the weak part in contractual relations⁷²) to be subjected to another figure,

⁶⁹ See also A. TOMMASINI, *La "rivoluzione" tecnologica nell'agroalimentare: algoritmi e innovazione digitale tra rischi e opportunità*, op. cit., p. 790.

⁷⁰ For an overview of the social impacts of digitalisation in the agri-food sector, see L. KLERKX, E. JAKKU, P. LABARTHE, *A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda*, in *NJAS- Wageningen Journal of Life Science*, 2019, 90, pp. 1-16; C. EASTWOOD, L. KLERKX, M. AYRE, *Managing Socio-Ethical Challenges in the Development of Smart Farming: from a Fragmented to a Comprehensive Approach for Responsible Research and Innovation*, in *Journal of Agricultural and Environmental Ethics*, 2019, 32, pp. 741–768. A more general overview of the relation between digitalisation and people's well-being is provided in the Report OECD, *How's Life in the Digital Age? Opportunities and Risks of the Digital Transformation for People's Well-being*, Paris, OECD Publishing, 2019.

⁷¹ This aspect is accurately highlighted in W. D'AVANZO, *Blockchain e smart contracts per la gestione della filiera agroalimentare, Potenzialità, progetti e problemi dell'internet del valore*, in *Diritto agroalimentare*, 2021, 1, p. 114, who points out how the lack of awareness, on the one hand, and the lack of adequate technological knowledge, on the other, actually prevent a complete and widespread adoption of the innovative technologies available to the agri-food sector.

⁷² Extensively on this topic, A. JANNARELLI, *I rapporti contrattuali nella filiera agro-alimentare*, in A. GERMANÒ, E. ROOK BASILE (eds.) *I contratti agrari (collana Trattato nei contratti)*, Torino, Utet Giuridica, 2015, pp. 275-384.

the digital service provider⁷³. In the extreme, this could also result in the gradual loss of autonomy for agri-food operators and companies.

In this perspective, a relevant obstacle is represented by the lack of infrastructure, as well. Despite the (European and national) expressions of commitment and the provisions of substantial public investments towards technological innovation, the infrastructure available on the national territory is still not capable of managing the functionality of more or less advanced digital tools and of guaranteeing stable, efficient, and secure IT connections throughout the territory. On the contrary, the lack of adequate infrastructure is mostly experienced in rural areas, setting the so-called *digital divide*, which represents a major barrier to the implementation of technological solutions⁷⁴. Indeed, as much as the other environmental, economic, and social obstacles might be overcome, the absence of an adequate infrastructural system for connection at the national level will always hold the digitalisation of the sector back.

The barriers thus illustrated suggest the idea that the advantages of digitalisation could be grasped only by specific types of players in the field, those possessing high knowledge and specific skills, good social relations, and generous economic resources, with further asymmetries and exclusion in the agri-food sector⁷⁵.

In this jagged landscape, the criticalities relating to the domain of governance⁷⁶ find their place, as well: they include, among others, the issues connected to security, which should be mentioned and analysed mostly from the perspective of data protection. As well known,

⁷³ L. PAOLONI, *Sostenibilità e innovazione in agricoltura. Dilemma o opportunità?*, op. cit., pp. 587-588, which recalls that today technological innovation is still excessively based on top-down approaches; with these applications, the digital transition of the sector risks depriving agri-food operators of their meaning and role, further subjecting them to the rules established by the big players of the digital sector. Additionally, as underlined in S. ROLANDI, G. BRUNORI, M. BACCO, I. SCOTTI, *The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts*, op. cit., p. 11, this condition could become particularly inconvenient whenever a digital procedure is implemented to obtain public certifications or public payments and incentives.

⁷⁴ L. YE, H. YANG, *From digital divide to social inclusion: A tale of mobile platform empowerment in rural areas*, in *Sustainability*, 2020, 12, pp. 1-16.

⁷⁵ In this sense, it is extremely important to consider the legal research addressing the effects that digitalisation could have on contracts in the agri-food sector. See L. RUSSO, *Le nuove sfide della digitalizzazione nei contratti della filiera agroalimentare*, in *Rivista di diritto alimentare*, 2025, 3, pp. 7-17, which observes that digital transition entails 'new contracts' for agri-food businesses, with the risks of economic and negotiating power asymmetries between the parties, and yet this sector has not been adequately taken into account by either EU or national legislators, since EU legislation currently offers minimal protection to the professional counterparts of large digital operators. In the same perspective, ID., *La contrattazione digitale nella filiera agroalimentare: verso la scomparsa dell'umano?*, in A. DI LAURO, L. LEONE, G. STRAMBI (eds.), *Normatività contemporanea. Norme sensoriali e norme sperimentali nel settore alimentare*, Pisa, Edizioni ETS, 2025, pp. 265-273.

⁷⁶ S. ROLANDI, G. BRUNORI, M. BACCO, I. SCOTTI, *The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts*, op. cit., p. 10: 'An emerging relevant domain affected by digitalization is the "governance one", which refers to the mechanisms and the processes through which people can articulate and mediate their interests and needs while exercising their rights and obligations'.

indeed, the advent and diffusion of innovative digital technologies in the agri-food sector have entailed that any action carried out by producers and companies can be turned into data⁷⁷, and it is precisely the collection and analysis of these data (especially large amounts of them, i.e., Big Data⁷⁸) that allows digitalisation to move forwards, generating new ideas, solutions, processes, methods, predicting future events with greater accuracy, and giving rise to the so-called *data-driven innovation* in agriculture⁷⁹.

Despite the absolute importance attributed to data for the technological improvement of the whole sector, one of the main concerns for agri-food operators seems to relate precisely to data ownership, an issue concerning not only the protection of data – which includes both security (e.g., against cyber-attacks) and confidentiality of shared information – but also and above all its control and economic exploitation. From a legal perspective, these questions lead to considering the issue of data regulation and data economy, and, looking closely at the agri-

⁷⁷ This process takes the name of *datafication* and it has been carefully studied and analysed by the literature for several years now. See, *ex multis*, M. LYCETT, 'Datafication': *Making sense of (big) data in a complex world*, in *European Journal of Information Systems*, 2013, 4, pp. 381-386; K. J. STRANDBOURG, *Monitoring, Datafication, and Consent: Legal Approaches to Privacy in the Big Data Context*, in J. LANE, V. STODDEN, S. BENDER, H. NISSENBAUM (eds.), *Privacy, big data, and the public good: Frameworks for engagement*, Cambridge, Cambridge University Press, 2014, pp. 5-43.

⁷⁸ One of the best-known definitions of Big Data is provided in the Gartner Glossary, available at the following link: <https://www.gartner.com/en/information-technology/glossary/big-data> (last accessed 6.02.2025), which defines them as '...high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation'. The definition emphasises the fact that, over the last decade, the volume (i.e., the quantity of data), the variety (i.e., the multiplicity of types), the velocity (i.e., the rapidity of data production, sharing, and analysis), the veracity (i.e., the accuracy and detail), and the value (economic value) of produced data have increased exponentially. On the five v's of Big Data, see A. DE MAURO, M. GRECO, M. GRIMALDI, *A formal definition of Big Data based on its essential features*, in *Library Review*, 2016, 3, pp. 122-135. Thus, what makes data *big* is not just the impressive capacities in data production and collection, but mostly the power of analysis, further enhanced by the synergy of other technologies, such as the Internet of Things.

⁷⁹ A first and general definition of data-driven innovation is provided in SOFTWARE INFORMATION INDUSTRY ASSOCIATION (SIIA), *Data-Driven Innovation – A Guide for Policymakers: Understanding and Enabling the Economic and Social Value of Data*, SIIA White Paper, Washington DC, 2013, p. 8: 'consumer and business users alike have access to myriad internet-connected devices that can generate data inputs and reap the benefits of innovative data outputs virtually any time, anywhere. This reality is changing user behaviour and expectations, and therefore business models'. Successively, EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Towards a thriving data-driven economy*, Brussels, 2.7.2014, COM(2014) 442final, p. 5: 'The term 'data-driven innovation' (DDI) refers to the capacity of businesses and public sector bodies to make use of information from improved data analytics to develop improved services and goods that facilitate everyday life of individuals and of organisations, including SMEs'. Therefore, data-driven innovation can improve resources' efficiency and productivity, economic competitiveness, and social welfare through its ability to impact any sector of the economy, including the agri-food sector. In this sense, see OECD, *Data-Driven Innovation: Big Data for Growth and Well-Being*, Paris, OECD Publishing, 2016; OECD, *Farm Management Practices to Foster Green Growth*, Paris, OECD Publishing, 2017. In the agri-food sector, indeed, the idea that 'data is the new oil' is widely shared, meaning that data constitutes an essential and unavoidable element in the digital transformation that is taking place. In this sense, see also COPA-COGECA, *Principi essenziali per la raccolta, l'utilizzo e lo scambio dei dati agricoli*, 2016, accessible at the association website, 'publications' page: <https://copa-cogeca.eu/> (last accessed 6.02.2025).

food sector, to wonder whether it is possible to identify *rights* connected to the data generated by innovative equipment and digitalised models⁸⁰.

In conclusion, the outlined overview allows to highlight that digitalisation has conquered greater and greater spaces in agri-food activities, and continues to do so with a disconcerting speed. To the point that today it is no longer possible to conceive agriculture and the agri-food sector without the contribution of digital technologies, and an accurate legal reflection cannot but take into consideration the impacts, opportunities, and obstacles brought by digitalisation. However, the legal responses to the critical profiles that arise from such processes – and perhaps even the political ones – are not yet exhaustive under many circumstances⁸¹.

Therefore, the legal debate on the (positive and negative) effects of the digitalisation of the sector is far from being over, between *old* problems that are still unsolved, and *new* issues that surface with the establishment of increasingly innovative and disruptive technologies.

⁸⁰ For an in-depth analysis of these topics, see. P. LATTANZI, *L'agricoltura di fronte alla sfida della digitalizzazione: opportunità e rischi di una nuova rivoluzione*, op. cit. For a general reflection on the legal nature of data in the agri-food sector, see P. GUARDA, *Riflessioni in merito alla natura giuridica dei dati nell'agricoltura di precisione: un'interpretazione teleologicamente orientata*, in *Rivista di diritto alimentare*, 2023, Quaderno n. 1, pp. 20-35. A detailed study on the mentioned aspects is also provided in M. FERRARI, *Fattori di produzione, innovazione e distribuzione di valore nella filiera agroalimentare*, op. cit., who, while offering an overview of the opportunities and criticalities arising from the growing spaces of technology and digital innovation in agriculture, mostly focuses on the role of data. Starting from the assumption that precision agriculture represents, for the agri-food sector, the most significant manifestation of data economy (see pp. 155 ss.: *'L'agricoltura di precisione rappresenta per la filiera agroalimentare la manifestazione probabilmente più significativa di quel fenomeno più ampio che va sotto il nome di data economy'*), the A. highlights and dwells on the need to identify suitable tools to protect data and information resulting from the exercise of agricultural and food activities, which cannot adequately be identified in the ordinary means of protection of intellectual property (patents, copyrights, and trade secrets). So far the protection of agricultural data is thus mainly (*exclusively?*) carried out at the contractual level which, however, is still a slippery slope for the operators of the agri-food sector, notoriously the weak party in contractual relations. To the point that farmers risk not to obtain, from the digitalisation processes currently under way, the promised advantages in terms of value increase, and instead end up subjected to players with bigger bargaining power. On this point, see J. SOARES, *The New Frontier: How Sharing of Big Data in Agriculture Interferes with the Protection of Farmers' Ownership Rights over their Data*, in *S.J Agricultural Law Review*, 2016, 26, pp. 283-289. As a reaction to these dynamics, in the last years self-regulation initiatives took place, both in and outside Europe, to establish the content of those contracts by providing principles based on farmers' protection: though just partially, these initiatives tried to respond to farmers' hesitations and fears on the ownership of their data. In this scenario, above all, see COPA-COGECA, *EU Code of conduct on agricultural data sharing by contractual agreement*, 2020, a non-binding code that sheds greater light on contractual relations and provides general principles for the use and sharing of agricultural data within agri-food chains. One of the cornerstones of the mentioned code of conduct is that the control over data is recognised to the subject which generates it, the farmer, thus any action involving data (collection, use, sharing, portability, etc.) only takes place after consent has been provided. Nevertheless, it has also been observed that, in the absence of specific regulatory schemes, codes of conduct represent shelters, albeit weak ones: in any case, indeed, they rely on a contractual basis in which farmers risk inequalities. See M. FERRARI, *Fattori di produzione, innovazione e distribuzione di valore nella filiera agroalimentare*, op. cit., pp. 283 ss.

⁸¹ F. ALBISINNI, *Agricoltura e digitalizzazione: l'impresa agricola nel tempo presente*, in *Rivista di diritto alimentare*, 2023, Quaderno n. 1, p. 92.

2. Exploring the tools. What do we talk about when we talk about blockchain?

In the *fourth industrial revolution* – which was already introduced in the previous paragraphs, despite specifically referencing the agri-food sector – blockchain technology stands out.

Over the past decades, indeed, the technology has shown its suitability and applicability to various sectors, qualifying as a disruptive technology⁸² and requesting further investigation into the effects of its overwhelming diffusion. It has therefore also drawn the attention of both academics and practitioners, businesses and institutions all over the world.

These premises pave the way for a more detailed investigation of blockchain technology, its functioning, and its features. To deal with this topic, indeed, a preliminary understanding of the instrument being investigated is inevitable, and it requires taking into account some strictly *technical* aspects.

Despite the recent and renewed success, blockchain technology has a rather long history⁸³. Indeed, the first appearance of the idea behind the technology dates back to the 1990s, when the cryptographers S. Haber and W. S. Stornetta came up with the idea of a time-linked chain of blocks, built using one-way hash functions, as a possible solution to authenticate digital

⁸² The term disruptive technology, and the concept lying behind it, has nowadays achieved a substantial expansion, mainly as a result of the great evolution that has taken place over the last decade and which has brought technologies to a higher level in people's lives. Precisely because of this fast and never-ending diffusion, it is not easy to identify and provide a single definition of disruptive technologies, which, however, can be considered as pooled by '*...the potential to disrupt the status quo, alter the way people live and work, rearrange value pools, and lead to entirely new products and services*'. (MCKINSEY GLOBAL INSTITUTE, *Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy*, Washington DC, 2013, p. 1). As to the role of blockchain technology within this framework, even though some have observed that '*...there are cases that blockchain is argued to be a disruptive innovation, while there are others where blockchain is considered as a sustaining one*' [N. FELOUTZIS, G. LEKAKOS, *Is Blockchain a Disruptive Innovation? A Systematic Literature Review*, in D. H. DE LA IGLESIA, J. F. DE PAZ SANTANA, A. J. LOPEZ RIVERO (eds.), *New Trends in Disruptive Technologies, Tech Ethics and Artificial Intelligence*, New York, Springer, 2023, p. 184], it cannot be ignored that technology has made its way into a wide variety of (economic) sectors, actively contributing to all of them. In this sense, looking at the phenomenon through the lens of the definition provided before, the *disruptive* character of blockchain cannot be denied. Many contributors have described blockchain's potentially disruptive nature in different areas. On this topic see, *ex multis*, J. FRIZZO-BARKER *et al*, *Blockchain as a disruptive technology for business: a systematic review*, in *International Journal of Information Management*, 2020, 51, pp. 1-14; E.S. ROSS, *Nobody Puts Blockchain in a Corner: the Disruptive Role of Blockchain Technology in the Financial Services Industry and Current Regulatory Issues*, in *Catholic University Journal of Law and Technology*, 2017, 25, 2, pp. 353-386; Z. BEZOVSKI *et al.*, *The Impacts and the Potential Disruption of the Blockchain Technology on Marketing*, in *Journal of Economics*, 2021, 6, 1, pp. 13-23; B. MARCHI *et al.*, *The disruptive potential of blockchain technologies in the energy sector*, in *ECEEE Summery Study Proceedings*, 2019, pp. 899-906.

⁸³ For an interesting overview of the passages that form part of the history of blockchain technology and its development, see A. PERNA, *Le origini della blockchain*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019, pp. 3-18.

documents, thus preventing any form of external alteration or modification and ensuring their integrity and reliability⁸⁴.

This early idea laid the foundations for what, a few decades later, would be the real springboard of blockchain technology: that is, the presentation of Bitcoin with Satoshi Nakamoto's White Paper⁸⁵. Taking one step forward from the foundations laid by S. Haber and W. S. Stornetta's article, the idea of the person (*or group?*) hidden behind the pseudonym of Satoshi Nakamoto was to create a new, fully traceable and secure means of transferring value, a peer-to-peer system for the *trustless* transfer of currencies⁸⁶. The new system, indeed, had the main purpose of allowing financial transactions directly from one user to another, without any need to rely on an external intermediary, third to the transaction itself: mostly, that meant without the need to resort to financial institutions⁸⁷.

Already in the following years, some of the effects ignited by the Bitcoin White Paper started to appear, showing the potential reach of the technology far beyond the mere

⁸⁴ S. HABER, W. S. STORNETTA, *How to time-stamp a digital document*, in *Journal of Cryptology*, 1991, 3, 2, pp. 99-111. The work moved from the acknowledgment of the shortcomings connected to resorting to an external certification entity for the mentioned purposes, including those related to privacy and trust. Therefore, they introduced the use of cryptography, digital signatures, and chains of blocks to implement the time-stamping of digital documents. Acknowledging the ease with which digital records could be altered without anyone noticing, the technology was first conceived and built as a tool to timestamp digital documents, i.e. to mark the data itself with a certain and verifiable date and time, thus conferring them with legal validity and making it possible to trace back to the exact moment of creation or last amendment of a digital document.

⁸⁵ SATOSHI NAKAMOTO, *Bitcoin: A Peer-to-Peer Electronic Cash System*, 2008, pp.1-9. This work certainly has the merit of having brought blockchain technology into the spotlight, leading it to the progressive, significant diffusion on a global scale that is nowadays still taking place.

⁸⁶ Satoshi Nakamoto's idea was intended as an innovative solution in the context of the global financial crisis of 2008, a response to the collective loss of trust in traditional economies and financial systems. In this general climate of mistrust and scepticism, Bitcoin promised to provide autonomy and independence from central authorities. Indeed, the project finds its ideological roots in the reflections of the Cypherpunk movement, concerned with studying the effects of the digital revolution on civil society already at the end of the 20th century. The connections between blockchain technology and the philosophy behind the Cypherpunk movement are well analysed by W. MAGNUSON, *Blockchain Democracy: Technology, Law and the Rule of the Crowd*, Cambridge, Cambridge University Press, 2020, pp. 18 ss. Confirming this, The Crypto Anarchist Manifesto, published in 1988 by one of the founders of the movement, outlines the idea of a digital technology that would one day allow people to communicate and interact with each other – both personally and economically – through the use of cryptographic protocols, granting total anonymity. See T. C. MAY, *The Crypto Anarchist Manifesto*, 1988, available online at the link: <https://groups.csail.mit.edu/mac/classes/6.805/articles/crypto/cypherpunks/may-crypto-manifesto.html> (last accessed 5.12.2024).

⁸⁷ The purpose, as expressed in the White Paper, is indeed to establish '*...an electronic payment system based on cryptographic proof instead of trust, allowing any willing parties to transact directly with each other without the need for a trusted third party*'. SATOSHI NAKAMOTO, *Bitcoin: A Peer-to-Peer Electronic Cash System*, op. cit., p. 1. An interesting reflection on this point is offered by A. RAINONE, *La disciplina della blockchain e le sue implicazioni pratico-applicative: il caso del diritto d'autore*, Master Degree Thesis, Università degli Studi di Torino, 2020-2021, p. 31, underlying that blockchain reality, today, largely differs from what was originally conceived. Indeed, the technology can no longer be conceived as an instrument of subversion, an alternative to ordinary financial systems; on the contrary, it is integrating and becoming a part of their layouts.

cryptocurrency⁸⁸. It is only in recent times, however, that blockchain technology has found its greatest diffusion, gaining a prominent position in many areas⁸⁹. The reasons behind this recent explosion are probably to be found in the structure of the technology that, merging with its peculiar features and specific dynamics, contributes to making its functioning quite different (*innovative*, indeed) than that of other technological tools that might be used for similar functions.

Therefore, aware of the inaccuracies of an academic education that is *anything but technical*, an explanation of what blockchain is and how it works will be attempted now⁹⁰.

Blockchain technology is a decentralised and distributed digital ledger of information, allocated over several computers of the same network, belonging to the family of distributed ledger technologies⁹¹. It is a digital database, shared within a network composed of many users, technically named nodes⁹², all possessing a copy of the unique version of the shared register, which is automatically updated every time the system changes.

⁸⁸ A clear example of this is offered by Ethereum, a platform designed to enable the implementation of blockchain-based solutions and applications of different types. See V. BUTERIN, *Ethereum White Paper. A next-generation smart contract and decentralized application platform*, 2014. However, Ethereum shows its peculiarities and clear differences if compared with Bitcoin: indeed, the former was specifically designed to provide a platform to program new solutions and, above all, to develop and implement smart contracts using a specific programming language, Solidity.

⁸⁹ R.J. COLOMBO, *Bitcoin: Hype or Harbinger?*, in *Journal of International Business and Law*, 2016, 16, 1, p. 2, where the A. recognizes that 'Although the future of Bitcoin per se remains hotly contested, virtually all concede that the technology unleashed by Bitcoin is here to stay – at least for the foreseeable future. Indeed, a growing number of companies have made significant investments in the technology at the core of Bitcoin, known as blockchain'.

⁹⁰ The content of this paragraph is mainly the outcome of what I learned during the Seminar '*Blockchain: concetti fondamentali e applicazioni*' organised by the University of Macerata and held by Prof. Paolo Semani, which I was lucky to attend during the first months of my PhD. For a more complete and precise analysis, consider B. SINGHAL, G. DHAMEJA, P.S. PANDA, *How Blockchain Works*, in *Beginning Blockchain. A Beginner's Guide to Building Blockchain Solutions*, New York, Apress, 2018.

⁹¹ A clarification here is needed. Very often the terms '*Distributed Ledger Technologies*' and '*Blockchain*' are still mistaken, or used as synonyms. In reality, no complete correspondence can be identified between the two concepts, which describe different technologies, even though tightly bound one with the other because, as mentioned above, blockchain technology constitutes a type of DLT. However, the two technologies do share many fundamental aspects. On this point, see A. GASCHI, V. PORTALE, *La definizione di blockchain e distributed ledger*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche, op. cit.*, pp. 19-31. In general, the term distributed ledger technologies is nowadays used with a broad scope of application to describe and identify a multi-party digital system that operates without the need for a central operator or authority. The relevant literature has provided several definitions of what a distributed ledger technology system is, to the point that a universal, genuine, and coherent definition of the term is still missing. Sometimes, these explanations are way too specific and technical, which makes them inaccessible to general audiences; other times, on the contrary, they tend to be too simplistic and excessively broad. A comprehensive analysis of DLT is provided, *ex multis*, by M. RAUCHS *et al.*, *Distributed Ledger Technology Systems: A Conceptual Framework*, Cambridge, Cambridge Centre for Alternative Finance, 2018.

⁹² Precisely, a node is a computer that is part of the network and manages one of the copies of the unique version of the blockchain ledger. The identities hiding behind the single nodes are not easily detectable. Indeed, these identities are encrypted, and the nodes participate in the system by using two different keys: a private key, which

The functioning of the technology is based on some pillars: decentralisation, immutability, transparency, consensus, safety, and programmability⁹³. These pillars are, in a nutshell, what make blockchain what it is, distinguishing it from any other digital database and thus justifying, in some circumstances, its use⁹⁴. Blockchain allows all the nodes belonging to the network to directly communicate with each other, conveying each change to the ledger and validating it autonomously and independently from the intervention of an external third party.

Understanding how these dynamics are possible or even how they work opens up some technical considerations: indeed, blockchain uses algorithms and cryptographic techniques to record and synchronize data concerning different transactions into blocks, permanently and immutably stored inside the chain. These blocks are chronologically connected to each other through hashes, thus creating a chain of blocks⁹⁵.

In general, whenever a transaction is implemented between two participants of the blockchain network (let's say, an exchange of money flowing from node A to node B), the new block representing it is disclosed to the other components of the network (e.g., node C, node D, node E, etc.), which are then called upon to approve – that means, to validate – the transaction itself. Indeed, only after the new block, thus the information and data contained in it, has been

can be imagined as a sort of 'password' to access the network, and a public key, the 'e-mail address', that is used to perform transactions and to operate within the network.

⁹³ The main features of blockchain technology will be addressed in detail in the following paragraph. See *infra*, chapter I, par. 2.1.

⁹⁴ As it will appear in the course of the research, blockchain is not a panacea for any issue. On the contrary, there are cases or circumstances in which the implementation of the technology might not be the most appropriate option, as the burdens associated with it are not outweighed by the benefits.

⁹⁵ A comprehensive analysis is provided by D. CARBONI, *Le tecnologie alla base della blockchain*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche, op. cit.*, pp. 33-50. The hash function is a fundamental technical element for blockchain. It is a mechanism that turns input elements and information into output data: this output is called 'hash value'. A hash value in a blockchain is an alphanumeric string that exclusively identifies a specific, unique block, as said before, and is the result of the content of the block itself; it thus provides a digital fingerprint on that block that is timestamped and not reversible. Through hashes, blocks are connected one to the other. Indeed, hashes are included in the header of each block, and the hash identifying one block replicates part of the hash of the previous block, and so on for the whole chain, allowing for the establishment of the *block-chain*. In this way, the hash discloses its dual function: firstly, and as said, through hashes blocks are sequentially linked on the other; secondly, any attempt to alter the content of a block (that is, the data stored inside it and relating to a specific transaction) would immediately be detected, as the hash would be affected by the manipulation and all the hashes of the subsequent blocks would no longer coincide. Therefore, hash values come up as essential elements to ensure the immutability of the blockchain register, as even the slightest change in the data included in one block would have the effect of altering the correspondence between the hashes of two (or more) subsequent blocks, making the whole chain deeply affected by it. The waste of economic, computational, and time resources that would be necessary to restore the system makes it highly inconvenient to attack the registered blocks, making the blockchain potentially immutable. On these aspects, see also L. RICCI, *La tecnologia delle blockchain: concetti di base*, in E. NAVARRETTA, L. RICCI, A. VALLINI (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di blockchain*, Torino, Giappichelli, Vol. I, 2021, pp. 15 ss.

validated by all nodes belonging to the blockchain, meaning that the participants have acknowledged the legitimacy of the transactions therein included, it is added to the chain. In this way, the transaction is permanently recorded in the blockchain.

As blockchains are decentralised systems, validating a new block and its transactions is attributed to the nodes⁹⁶. The validation process is made possible through a shared consensus mechanism, which, in simple words, is the tool used by the nodes to keep consistency on the blockchain, achieving the distributed agreement on the state of the ledger, thus contributing to keeping the decentralised network secure and ensuring the reliability of data⁹⁷.

The consensus mechanism through which the validation of a new block is performed differs from case to case, and the decision on the most suitable one is strictly affected by the features of the platform itself⁹⁸. With such a functioning, anyway, blockchain establishes a peer-

⁹⁶ The computational process that the nodes undertake to synchronise transactions and validate new blocks takes the name of 'mining' and is usually counterbalanced by a reward, in the form of cryptocurrencies, aimed at inciting nodes to take part to mining, as well as at 'compensating' them for the large amounts of computational energy invested in the operation. On the technical aspects of blockchain mining, see F.A. GALATOLO, *Blockchain: come funziona davvero?*, in E. NAVARRETTA, L. RICCI, A. VALLINI (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di blockchain*, op. cit., pp. 26 ss; J. BONNEAU, A. MILLER, J. CLARK, A. NARAYANAN, J. A. KROLL, E. W. FELTEN, *SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies*, in *IEEE Symposium on Security and Privacy*, 2015, pp. 104-121. As blockchain networks are usually composed of large amounts of nodes, it is very unlikely that single nodes alone succeed in mining a new block in a reasonable time to fulfil the scope. To cope with this point of failure *mining pools*, in which several nodes join together in a single 'centre', started to develop: in this case, the objective is pursued in the interest (and in the name) of the whole pool and, at the same time, the expected reward is shared and distributed between all the nodes making up the pool, regardless of who achieved the result. On this phenomenon, see M. ROSENFELD, *Analyses of Bitcoin Pooled Mining Reward Systems*, in *Arxiv*, 2011, pp. 1-46. As much as mining pools might seem functional for blockchain working, some implications come to the surface. In particular, some scholars highlight how mining pools represent a particularly controversial element within the framework of blockchain structure and functioning because, to some extent, they risk manipulating and falsifying the decentralisation of the system, with potentially negative effects on the stability of the platform, too. See J. BONNEAU, A. MILLER, J. CLARK, A. NARAYANAN, J. A. KROLL, E. W. FELTEN, op. cit., p. 110-111.

⁹⁷ L. RICCI, *La tecnologia delle blockchain: concetti di base*, op. cit., p. 17.

⁹⁸ For a comprehensive overlook see L.M. BACH, B. MIHALJEVIC, M. ZAGAR, *Comparative analysis of blockchain consensus algorithms*, 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), IEEE, 2018, pp. 1545-1550. Indeed, as it will shortly be highlighted (*infra*, chapter I, par. 2.1), blockchain platforms can be developed based on different starting models which, above all, differ significantly in their internal organisation. This profile also affects the identification of the most suitable type of consensus mechanism, according to the following logic: the higher the degree of trust established within the blockchain and among its nodes, the less complicated the mechanism can be. Vice versa, if the blockchain system as such does not allow for the establishment of a degree of trust among its participants, then this result must be achieved through the consensus mechanism which, as a consequence of this, will therefore be more articulated. Among the best-known models, it is worth mentioning the *Proof-of-Work* (PoW), where the nodes compete against each other to be the first to calculate the hash of the new block and be rewarded with the payment of an amount of cryptocurrency. However, the *Proof-of-Work* system entails significant shortcomings, including the huge amounts of computational energy invested by all competing nodes while rushing to solve the puzzle, the majority of which gets wasted when all of them – except for the winner – lose the game. In this sense, see E. SCHUSTER, *Cloud Crypto Land*, in *LSE Law, Society and Economy Working Papers*, 2019, 17, p. 7, who, talking about shared consensus mechanisms in blockchain systems, uses the expression 'wasteful by design'. Mainly in response to such a significant issue, the *Proof-of-Stake* (PoS) model was designed, where the validator is rather selected among the

to-peer network in which all the nodes possess a copy of the unique version of the distributed ledger and they actively contribute to its operation by agreeing upon it through the shared consensus mechanism, which allows them to collectively hold control over the network.

The shared consensus mechanism that runs blockchain networks is both a proponent and a consequence of the fundamental features of the technology. In a certain way, it can also be said that the consensus mechanism is what keeps the decentralised and distributed network secure, as it is employed to achieve the shared agreement about the status of the ledger between all nodes involved.

2.1. Delving into blockchain: features and models.

To deepen blockchain's analysis, it is fundamental to take a further step and consider its fundamental characteristics, on the one hand, and the multitude of aspects it can acquire, on the other, being the most immediate consequence of the described dynamics that connote the technology. These aspects are, by all means, what identify blockchain and differentiate it from other technological tools that could be adopted for the same functions of synchronisation, recording, and storing of data.

As to the first profile, it was already mentioned that the main features of blockchain technology are its decentralisation, immutability, transparency, and safety.

It was said that blockchain relies upon a network of nodes connected one to the other, capable of directly interacting through one-to-one exchanges, and of autonomously carrying out the tasks necessary to guarantee the functioning of the system, without the need for a central entity holding the power to authorise transactions. This framework summarises the fundamental feature of blockchain, which is decentralisation: the technology's ability to work without external mediation, without the need for a third party or a central authority, to manage and control it⁹⁹. Indeed, unlike centralized databases, blockchain relies on a system that allows all

involved nodes by taking into account a set of predetermined features that reflect and demonstrate its trustworthiness, most times the number of cryptocurrencies that the node holds in its wallet. This consensus mechanism owes its name to the fact that the nodes indeed stake their cryptocurrencies to have the chance to validate new transactions, update the blockchain and, in this way, earn the reward. For an overview, see H. SHEIKH *et al.*, *Proof-of-Work Vs. Proof-of-Stake: A Comparative Analyses and an Approach to Blockchain Consensus Mechanism*, in *International Journal for Research in Applied Science & Engineering Technology*, 2018, 6, 12, pp. 786 ss.

⁹⁹ The topic of blockchain's decentralization is particularly stressed in A. WRIGHT, P. DE FILIPPI, *Decentralized Blockchain Technology and the Rise of the Lex Cryptographia*, 2015, available online at the link: <http://dx.doi.org/10.2139/ssrn.2580664> (last accessed 5.12.24), pp. 18 ss. Here, however, the A. also point out

participants to be connected and, most importantly, to operate within the network on a basis of absolute equity in terms of access to information: as already seen, all nodes possess a copy of the unique, shared version of the blockchain and, at the same time, they share the same position when it comes to adding a new block to the chain¹⁰⁰.

An equally relevant feature of the technology is its immutability. Blockchain is immutable because once the transactions are successfully verified by the nodes and then recorded into the system, it is no longer possible to modify their content or to delete them¹⁰¹. It should also be pointed out, anyway, that absolute immutability does not exist, as there are (rare) cases in which the record implemented in a blockchain platform can be reversed¹⁰². However,

some shortcomings that this specific feature brings about, including the risk in lack of strong checkpoints to govern and manage the flow of data, or the increased difficulties for blockchain platforms' control and regulation by part of governments. Understandably, these aspects are mainly a consequence of blockchain's decentralisation intended as the absence of any centralised form of management and control of the platform: if, on the one hand, this feature is fundamental and necessary to enable that environment of *trustless trust* that is typical of blockchain systems, on the other hand it can also lead to governance issues, depending on the fact that the latter does not follow a prefixed model but rather chases the fluctuations that result from the choices of nodes.

¹⁰⁰ Decentralisation brings about a further profile of complexity, that is, transnationality. Indeed, since blockchains' decentralised registries are diffused among all the nodes part of the system, it is absolutely plausible – and, sure enough, this is what happens with the most-known blockchain platforms – that the servers of the different nodes are located in different States, thus spread on a global scale. This aspect poses a new set of legal questions that, in particular, concern the attribution of legitimacy to establish rules applicable to such widespread databases, which go beyond the boundaries of the jurisdiction of individual States. See A. WRIGHT, P. DE FILIPPI, *Decentralized Blockchain Technology and the Rise of the Lex Cryptographia*, *op. cit.*, pp. 51 ss., which address the topic by drawing a comparison with the concerns that, some time ago, emerged with the rise of the internet. Indeed, although it was initially challenging for States to tackle the issues connected with the regulation of the internet, given its global and vast expansion, they soon realised that it was still possible to do so, as long as centralized points of control could be identified. That meant, in other words, to move forward not by directly regulating the internet as such, but rather by indirectly regulating its intermediaries and online operators. '*An analogous situation will likely to take place in the context of blockchain technology. Even in a world dominated by decentralized data and organizations, powerful intermediary will still remain. If threatened, states and governmental actors could adopt a series of draconian measures to regulate the emerging online ecosystem and to retain control over the blockchain ecosystem*'. In conclusion to these reflections, however, the A. also warn that the described functioning risks subject blockchain technology to increasing levels of surveillance and control, or even to make it itself an instrument of surveillance and control, exactly as it happened with the internet. Therefore, the protection offered by appropriate legal safeguards becomes indispensable when it comes to blockchain development.

¹⁰¹ That means, more precisely, that the information and data relating to a specific transaction can no longer be manipulated after being accepted and embedded in the blockchain network. See F. HOFMANN, S. WURSTER, E. RON, M. BÖHMECKE-SCHWAFERT, *The Immutability Concept of Blockchains and Benefits of Early Standardization*, in *ITU Kaleidoscope: Challenges for a Data-Driven Society*, 2017, p. 2. This feature can be traced back to blockchain cryptographic techniques, and more precisely to hash functions that are embedded in each block. Indeed, as seen before, each block of the network is marked by a hash, an alphanumeric string that identifies that specific block and which also holds part of the hash of the previous block. As a consequence of this, any action aimed at attacking or altering the content of a block (and the data it records) would immediately be detected, as it leads to the modification of its hash, which would no longer coincide with the hash of the previous block. Moreover, it would determine a forced recalculation of the hashes of all subsequent blocks, requiring large amounts of computational energy and huge costs. For these reasons, the longer the blockchain, the higher the possibilities to withstand any attack tampering with data.

¹⁰² In this sense see M. FINCK, *Blockchains and Data Protection in the EU*, in *European Data Protection Law Review*, 2018, 4, 1, p. 19, which states that the use of the adjective immutable in association with blockchain is misleading because, even if it is very difficult to amend blockchains, it is not impossible. On a closer look, indeed,

these passages always leave a mark of the tampering that has taken place, thus making it immediately detectable to the whole network. This is the reason why, rather than addressing blockchain as an immutable technology, it is sometimes more accurately said that the blockchain structure is tamper-resistant¹⁰³.

An equally important characteristic of blockchain is that of transparency, mainly affecting the level of the relationships between the nodes. Also in this case, blockchain transparency is due to the peer-to-peer structure lying underneath the system, and to the cryptographic techniques¹⁰⁴. Being its register distributed among all participants to the network, each node possesses its own copy of the unique version of the ledger, and any action that would affect the system – e.g., the recording of a new transaction – is immediately noticed by all of them. In addition to this, the nodes themselves are leading actors in the validation process that must take place before the addition of a new block to the chain, thanks to a shared consensus mechanism, and this aspect further strengthens the overall transparency of the system. The two concepts (i.e., the transparency of the blockchain and the consensus mechanism underlying it) are closely related and interdependent one with the other.

A further element of interest, which makes blockchain preferable when compared to similar technologies, is the high level of security it promises to achieve. Once again, the feature is fundamentally due to the cryptographic techniques adopted by blockchain, setting higher standards of protection for the data embedded in each transaction, as well as for the identity of the actors involved in the blockchain network, and ensuring security and confidentiality of

the immutability of blockchain and its recorded data can, under certain circumstances, be breached, as a result of bugs in the code or whenever a node (or more) pools sufficient computing power as to achieve the purpose. Even though such scenarios are rather unlikely or extremely difficult to happen, they might and should therefore be taken into account when assessing whether it is appropriate (or not) to speak of immutability when it comes to blockchain. In the past, for example, this is what happened during the famous DAO hack of 2016. The DAO was an early decentralized autonomous organization launched in 2016 on the Ethereum Blockchain; after raising 150 million dollars worth of Ether (that is, the native cryptocurrency implemented in the Ethereum network) through a token sale, The DAO was hacked due to vulnerabilities in its code base. For an in-depth analysis, see V. TOSOVIC, *Der DAO-Hack und die Konsequenzen für die Blockchain*, in D. BURGWINKEL (ed.) *Blockchain Technology: Einführung für Business- und IT Manager*, De Gruyter Oldenbourg, 2016, pp. 159-165; S. FALKON, *The Story of the DAO – Its History and Consequences*, in *Medium*, 2017, available online at: <https://medium.com/swlh/the-story-of-the-dao-its-history-and-consequences-71e6a8a551ee> (last accessed 6.12.2024).

¹⁰³ E. POLITOU, F. CASINO, E. ALEPIS, C. PATSAKIS, *Blockchain Mutability: Challenges and Proposed Solutions*, in *IEEE Transactions on Emerging Topics in Computing*, 2021, 9, 4, p. 1977.

¹⁰⁴ See P. DE FILIPPI, A. WRIGHT, *Blockchain and the Law. The Rule of Code*, Harvard, Harvard University Press, 2018, p. 37-38, which addresses the topic by highlighting that the concept of transparency must be read and interpreted precisely in light of the cryptography underlying the system. This means that if, on the one hand, cryptography makes the information registered on the blockchain transparent, in the sense that will shortly be explained, on the other hand, the data is always and in any case ‘confidential’, as it is encrypted. In other words, the nodes will indeed have access to all transactions embedded in the blockchain, but only through the hashes identifying a specific block, since the data relating to transactions themselves is encrypted.

transactions¹⁰⁵. Nevertheless, the described security of blockchain technology is exclusively projected within the system, as it affects the inner functioning of the platform; instead, it does not reflect or extend to the outside of the platform. In other terms, security of the blockchain does not imply security of the content of data and information recorded on the blocks; indeed, if it is certainly true that blockchain is a secure technology because it sets higher standards of protection for the data embedded in transactions, it would be improper to state that it is secure because it also sets higher standards for the content of the data – meaning its truthfulness, its reliability, its quality.

This observation leads to consider one of the most critical points of blockchain, usually summarized by the expression ‘garbage in, garbage out’¹⁰⁶, which basically highlights how every *off-chain* matter falls outside the sphere of control of blockchain itself.

Although the illustrated features are the most typical of the discussed technology, an additional layer of complexity is provided because not all blockchains function in the same way, or, to put it differently, different blockchains can be identified¹⁰⁷.

¹⁰⁵ As already mentioned in the previous pages, the identities of the subjects hidden behind nodes are not easily identifiable, as they do not operate within the system ‘in the light of the day’, but rather through an asymmetric protocol for security. Each node participating in the network is equipped with a double symmetric key, working as a sort of digital signature of that subject: one is the private key, which must be kept personal and secret; the other is the public key, shared with the nodes of the platform and disclosed to all of them. The protocol works according to the following rule: a transaction that is signed by a node with its public key, which encrypts the message, can only be decoded with the corresponding private key; therefore, whenever a transaction is carried out on a blockchain platform, the double asymmetric key gets in the game. For example, Bob wishes to send a transaction to Anna. Bob (the sender) will encrypt the message with Anna’s (the receiver) public key, which Bob knows because it is shared among all the nodes of the platform; once the message has been received, Anna will use her private key, which she only knows, and that will perfectly match the public key that encrypted the message. Through the cautious use of the double asymmetric key, the message exchanged between Bob and Anna will be known only to the sender and its receiver. For an in-depth analysis of this aspect, see D. CARBONI, *Le tecnologie alla base della blockchain*, op. cit., pp. 33-50.

¹⁰⁶ The ‘garbage in, garbage out’ (GIGO) problem is one of the most acknowledged weaknesses of blockchain technology, and it refers to the breach that risks emerging between the external, factual reality and the input data obtained from it, and the information registered on the blockchain. Indeed, for any information that is not native to the blockchain but rather is acquired from the outside world, blockchain protocols alone cannot verify and certify its authenticity, its truthfulness, and its quality. This implies that, if the input data is incorrect or does not correspond to the truth, the features of blockchain that ensure the tamper-resistance, the transparency, and the security of data will be of no use: garbage in, garbage out. On this topic, see V. BABICH, H. GILLES, *Distributed Ledgers and Operations: What Operations Management Researchers Should Know about Blockchain Technology*, in *Forthcoming in Manufacturing & Service Operations Management*, Georgetown McDonough School of Business Research Paper, 2018, 3131250, pp. 10-11, which identifies two ways for this discrepancy to happen: 1) as a consequence of the introduction on the platform of incorrect information about the physical world, made by mistake or by malicious intent; 2) when the physical world changes after the introduction of off-chain data on the platform, and those data is not updated. Anyway, the issue of the truthfulness and reliability of off-chain data comes to the fore in a variety of circumstances and affects many applications of blockchain technology.

¹⁰⁷ L. RICCI, *La tecnologia delle blockchain: concetti di base*, op. cit., pp. 20 ss.

The main classification criteria look in two directions: on the one hand, they focus on the accessibility of the record, i.e., *who* can become part of the system; on the other hand, they focus on participation, thus discerning the degree of participation in the system and how those participants are selected.

The first classification criterion is the one that compares public and private blockchains¹⁰⁸, whose differences are quite immediate to catch.

A public blockchain is a completely decentralised system, open to anyone willing to become part of the network. Indeed, after the login, any user can join the platform, become a node, and have access to the content of the record¹⁰⁹. In this case, the identity of the subjects hidden behind the nodes remains concealed: indeed, as anticipated, nodes normally operate in the blockchain platform by using a double asymmetric key that identifies that specific node in its operations and relations with the other components of the community, thus contributing to establishing the *trustless trust* that is pivotal in the blockchain¹¹⁰.

Taking into account the structure and functioning described so far, it is difficult to imagine anything *but* a public blockchain; indeed, the technology was originally planned and designed to crystallise the features of accessibility and publicity. Nevertheless, a different type of blockchain can be identified. It is the private blockchain, where access to the network is managed and controlled by a central authority, also entitled to make this authorisation undergo a set of pre-established requirements. Although the platform retains its distributed structure, the private blockchain is not open, but rather centralised or semi-centralised: it is managed by a

¹⁰⁸ A first overview on this criteria is provided by V. BUTERIN, *On Public and Private Blockchains*, in Ethereum Foundation Blog, available at the following link: <https://blog.ethereum.org/2015/08/07/on-public-and-private-blockchains> (last accessed: 7.12.24)

¹⁰⁹ Moreover, the possibility of freely accessing the public blockchain does not restrict to accessing to the content of the record, but rather it extends to any operation that is necessary for the functioning of the system: performing transactions, recording new blocks, validating them, taking part to the consensus mechanism, and so on.

¹¹⁰ Blockchain technology is indeed often described as a 'trustless' technology because it establishes an environment in which the nodes are not required to trust any other party, may it be the other participants to the system, or may it be a central authority, entitled of managing the platform. This is made possible by the fact that the trust of the node rather relies on the system itself, on the blockchain itself, and on the dynamics that ensure its functioning. On this aspect see, *ex multis*, K. D. WERBACH, *Trustless trust*, in *TPRC Conference on Telecommunications, Information, and Communications Policy*, 2016. Somehow different, but nevertheless curious, is the overview offered in P. DE FILIPPI, M. MANNAN, W. REIJERS, *Blockchain as a confidence machine: the problem of trust and challenges of governance*, in *Technology in Society*, 2020, p. 62, which, rather than narrowly focusing on the idea of blockchain as a trustless system, unsuited to include a number of implications, including the layers of trust that arise in blockchain governance, underline that blockchain should rather be qualified as a 'confidence machine', as it '*...increases the confidence in the operation of a particular system, and only indirectly (i.e. as a corollary to that) reduces the need for trust in that system*'.

central organisation holding the power to authorise users to interact with it, to access with different functions, as well as to set obligations or other duties to join the platform¹¹¹.

A third type of blockchain can be identified. It is a hybrid figure between the public and private models, holding some features of the former and some of the latter. In the federated or consortium blockchain, the network management is usually shared between two or more organisations that provide access to pre-selected nodes for reading, writing, and verifying the blockchain. Since control is, in any case, shared between multiple organisations, the system can still be defined as (partially) distributed, and the blockchain maintains a decentralised structure.

The second classification concerns, instead, the distinction between permissionless and permissioned blockchains, and, though closely related to the just-described comparison between public and private ones, it does not completely overlap with it. In this case, the reference point relates to the degree of participation in the network or, more precisely, how the participants are selected¹¹².

In permissionless blockchains, indeed, participation in the network (as a node, as a validator, or in both roles) is open to anyone satisfying the requirements established for the applicable protocol. Thus, participants are self-selected, but they are requested to invest some resources (i.e., computational energy, when the blockchain platform relies on *Proof-of-Work*, or cryptocurrencies when the platform relies on *Proof-of-Stake*) to participate. In this way, the decentralisation is complete, and the blockchain platform has an utterly transparent architecture.

On the other side lie permissioned blockchains, where participation in the network is subject to a qualification process typically handled by an entity retaining operational responsibility for the blockchain¹¹³. In this second case, therefore, participation is regulated by

¹¹¹ Whit such a centralized, for some aspects 'closed' system, private blockchains have become the most successful and widespread model among companies, proving to be appropriate for traditional business models where it is fundamental to hold control over data circulating within the system. On this aspect and on the current juxtaposition between public and private blockchains, an interesting reflection is provided in E. STREHLE, *Public Versus Private Blockchain*, in *Blockchain Research Lab Working Paper*, 2020, 14, p. 1: 'There seems to be a mismatch between the way blockchain technology is commonly described and the way enterprises actually use it. The main reason appears to be that the general perception of blockchain continues to be dominated by 'trustless' public block chains like Bitcoin and Ethereum. Enterprises, on the other hand, have mostly moved on to private blockchains...'. Of course, there is no shortage of criticism from those mostly anchored to the original idea of the technology, arguing that the private model can be considered blockchain technology at all, as it goes back to reestablishing a sort of centralization. On this and many other positive and critic considerations on private blockchains, see V. BUTERIN, *Ethereum: Platform Review. Opportunities and Challenges for Private and Consortium Blockchains*, 2016.

¹¹² A. MILLER, *Permissioned and Permissionless Blockchains*, in S.S. SHETTY, C.A. KAMHOUA, L.L. NJILLA (eds.) *Blockchain for Distributed Systems Security*, New York, Wiley-IEEE Press, 2019, pp. 193 ss.

¹¹³ Y. BAKOS, H. HALABURDA, *Permissioned vs Permissionless Blockchain Platforms: Tradeoffs in Trust and Performance*, in *NYU Stern School of Business working paper*, 2023, pp.1-36.

central organisations, which leads to two main consequences: participants can be identified, and the composition of the network can be customised. On the other hand, however, decentralisation is limited.

2.2. Blockchain applications: a quick look at smart contracts.

Bearing in mind the rules, the features, and the fundamental concepts underlying the functioning of blockchain, it is now possible to take a further step and look closer at some blockchain applications. The analysed profiles, in particular the decentralised and distributed nature of DLTs, highlight that the greatest potential of blockchain is to enable the management and performance of a large number of transactions through a peer-to-peer network, rather than through centralised structures. Therefore, blockchain rapidly became the architecture within which computer scientists could identify applications that would enable expanded uses of the technology, all driven by the will to protect and ensure the security, transparency, and immutability of involved data¹¹⁴.

From these premises, some of the main applications of blockchain technology have found fertile ground to plunge their roots and thrive, as is immediately clear in the case of smart contracts.

As is well known, smart contracts are nowadays one of the most developed applications of blockchain and, as a result, the two topics are often addressed jointly, as if they were two faces of the same coin. In reality, smart contracts do not need to rely on blockchain to work: indeed, the formulation of the concept predated the elaboration of the technology as we now understand it¹¹⁵. However, in recent times, blockchain and smart contracts have established a

¹¹⁴ This is also the context where the so-called *decentralised applications* (DApp) developed. The expression refers to applications or autonomous programs that operate in a decentralised way (that means, without the need for human intervention) as they run on decentralised computing, blockchains, or other distributed ledger systems. Thus, even though DApps share the ultimate scope of *traditional* applications – that is, to provide some utility to their users – the former are not owned by a central entity; ownership is distributed within the network. For a comprehensive analysis of distributed applications, see K. WU, Y. MA, G. HUANG, X. LIU, *A first look at Blockchain-based decentralized applications*, in *Software Practice and Experience*, 2019, 51, 10, pp. 2033-2050. With such a functioning, decentralised applications have been developed for a wide range of purposes, including exchanges, personal finance, social media, and gaming. Nevertheless, DApps face some shortcomings, as well. For example, even today, many functionalities or services offered by DApps remain outside the decentralised ledger, meaning that it is still possible to mark a distinction between *on-chain* and *off-chain* elements, with the latter necessarily relying on traditional programs. In these cases, DApps must deal with the well-known topic of information and input data taken from the external world.

¹¹⁵ The initial expression of the idea of smart contract dates back to 1994, when Nick Szabo presented for the first time this new instrument as '*A computerized transaction protocol that executes the terms of a contract. The general*

strong alliance, provided that the features of the former enable the latter to fully express their potential in automation¹¹⁶.

In general, the many definitions provided through time¹¹⁷ can be synthesised by saying that a smart contract is a computer protocol designed to execute contractual duties once the established conditions are met, responding to the logic *'if this, then that'*. In other words, it is a code that can be programmed to conclude, verify, and carry out contractual agreements, or their performance, automatically, being designed to immediately execute when the predetermined conditions occur. Once activated, indeed, smart contracts must necessarily execute (as long as the pre-established conditions are met), and this result cannot be avoided or stopped by any external event. The only way to prevent the execution is to have this possibility included in the

objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries. Related economic goals include lowering fraud loss, arbitration and enforcement costs, and other transaction costs'. See N. SZABO, Smart Contracts, 1994, accessible online at the following link <https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html> (last accessed 7.12.2024). Soon after, this first definition was integrated in the following terms: 'A smart contract is a set of promises, specified in digital form, including protocols within which the parties perform these promises (...) I called this new contracts "smart", because they are far more functional than their inanimate paper-based ancestors. No use of artificial intelligence is implied (...) The basic idea behind smart contracts is that many kind of contractual clauses (such as collateral, bonding, delineation of property rights, etc.) can be embedded in the hardware and software we deal with, in such a way as to make a breach of contract expensive (if desired, sometimes prohibitively so) for the breacher'. See N. SZABO, Smart Contracts: Building Blocks for Digital Markets, 1996, accessible online at the following link: https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html (last accessed 7.12.2024).

¹¹⁶ T. BELARDI, *Gli Smart Contract: storia e definizione di un ibrido contratto/software*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, op. cit., p. 230, which underlines that the large-scale diffusion of blockchain has led the debate on smart contracts to take into account the possibility offered by the former technology to enforce contractual agreements between parties without the need to resort to third parties, such as courts or arbitrators. Nevertheless, not all blockchain platforms provide tools to program smart contracts. The first opening in this regard was offered by Ethereum, which, even today, is the most used blockchain to develop and implement smart contracts, thanks to the Ethereum Virtual Machine (EVM).

¹¹⁷ Among the many definitions of smart contracts provided by scholars, some are purely technical and highlight the operational aspects of the technology, while others delve into and underline further profiles related to it. See V. BUTERIN, *Ethereum White Paper: A next-generation smart contract and decentralized application platform*, 2014, p. 1, defines smart contracts as 'Systems which automatically move digital assets according to arbitrary pre-specified rules'. Additionally, J. STARK, *How Close Are Smart Contracts to Impacting Real-World Law?*, 2016, available at the link <https://www.coindesk.com/markets/2016/04/11/how-close-are-smart-contracts-to-impacting-real-world-law/>, (accessed 7.12.2024) explains that 'Whereas a typical contract is drafted using natural language, the terms of smart contracts are expressed in code, similar to a programming language like JavaScript or HTML. The contract is then 'executed' by a computer – given the conditions of the agreement, and a set of defined inputs, the smart contract enforces its own terms'. C. CLACK, V. A. BAKSHI, L. BRAINE, *Smart Contract Templates: foundations, design landscape and research directions*, in *ArXiv*, 2016, p. 2, highlight a dual nature in smart contracts instead, stating that 'A smart contract is an automatable and enforceable agreement. Automatable by a computer, although some parts may require human input and control. Enforceable either by legal enforcement or rights and obligations or via tamper-proof execution of computer code'. For a more complete overview of terminology, see, E. MIK, *Smart contracts: terminology, technical limitations and real world complexity*, in *Law, Innovation and Technology*, 2017, 9, 2, pp. 271 ss.

programming code. When smart contracts are implemented in a blockchain, this effect is also irreversible and immutable¹¹⁸.

In recent years, smart contracts have found space for application in a variety of sectors and with a wide range of functions, also because of the contribution offered by their implementation on the blockchain. This is certainly true for supply chains (including agri-food supply chains) and their management. Notwithstanding this, blockchain-based smart contracts also raise numerous legal questions, which must be taken into account and answered to not hinder the inner potentialities of these innovative tools.

First of all, the interpretation that shall be attributed to the term ‘smart contract’ is still widely debated, mainly as to the choice of implementing the term ‘contract’. More precisely, the discussed topic is whether a smart contract can and should be considered as a proper contract, i.e., whether it should be traced back to the legal category of contractual agreements¹¹⁹.

Taking into account the definitions provided at the beginning of the paragraph, it would be immediate to exclude that smart contracts are contracts in a strictly legal sense¹²⁰. More than anything else, indeed, the term seems to express and communicate the existence of a relation

¹¹⁸ In this case, in fact, the smart contract is executed by the nodes of the blockchain; its output result in a transaction on which nodes must reach the shared consensus, so that it culminates in the addition of a new block. Indeed, the recording of the smart contract on the blockchain platform follows the same rules established for any other transaction: the smart contract code is embedded in a new transaction, which must be validated by the nodes of the chain, and once the validation process is successfully completed, the newly mined block containing the smart contract is permanently added to the chain. At this point, when the conditions established in the programme are met, the smart contract produces its effects: the execution is automatic and doesn't require any form of human intervention, from the subjects involved or from a third party acting as executor or validator.

¹¹⁹ As to this legal question, it is interesting to recall the reflections provided by C. CLACK, V. A. BAKSHI, L. BRAINE, *Smart Contract Templates: foundations, design landscape and research directions*, op. cit., p. 4, who elaborate the distinction between traditional means of enforcement of contracts, including binding or non-binding arbitration or recourse to courts, and non-traditional methods of enforcement. Tamper-proof technologies, so called because they make it difficult and highly improbable to tamper with the content of contracts, are included in this second category. It is more than reasonable to conclude that, due to its functioning and its features, as extensively described above, blockchain technology can be brought back to this second category.

¹²⁰ This position is expressed, among others, in L. PAROLA, P. MERATI, G. GAVOTTI, *Blockchain e smart contract: questioni giuridiche aperte*, in *Contratti*, 2018, 6, pp. 681-688, which conclude that since smart contracts do not belong to the phase of formation of the contract, but rather refer to the execution and fulfilment of the formal agreement established between the parties, they should not be considered as actual contracts. In the same direction, E. GABRIELLI, *La nozione di contratto e la sua funzione. Appunti sulla prospettiva di una nuova definizione di contratto*, in *Giustizia civile: rivista giuridica trimestrale*, 2019, 2, pp. 299-315; F. RAMPONE, *Smart contracts: né smart, né contracts*, in *Rivista di diritto privato*, 2020, 2, p. 241 ss. The statement does not exclude, however, the possibility to draw a connecting line with the legal framework of contracts, mainly when one considers that, in any case, a smart contract is an instrument that allows the exercise of negotiating power, which parties can employ to negotiate, conclude, or execute agreements. In this perspective, hence, the smart contract is not a contractual model as such, but rather a technological infrastructure through which parties can express their negotiating power. In this sense, S. A. CERRATO, *Contratti tradizionali, diritto dei contratti e smart contract*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, op. cit., pp. 276 ss., who also mentions P. CUCCURU, *Blockchain e automazione contrattuale. Riflessioni sugli smart contract*, in *La Nuova Giurisprudenza Civile Commentata*, 2017, 1, pp. 107-119.

between two or more parties, which takes the form of a transaction. Indeed, the question of the interpretation and legal qualification of smart contracts is mainly answered by scholars with a balancing solution, which identifies two different faces of this coin: the smart contract code and the smart legal contract¹²¹.

In a nutshell, the term *smart contract code* refers to the technical component of the smart contract in the strict sense, i.e., the computer code; instead, the term *smart legal contract* refers to the actual agreement established between two or more parties and operating on a blockchain platform, which can be attributed with contractual meaning and effectiveness. In other words, a smart contract can be interpreted as smart contract code when the underlying agreement is a legal agreement settled outside the technology and implemented, at least partially, on a software; it can be given the meaning of smart legal contract when the underlying agreement is reached and crystallized in the software, and it is not necessarily connected to a formal legal agreement, or depending from it¹²².

Leaving the legal debate on the employment of the term '*contract*' aside, no fewer questions arise around the use of the term '*smart*'. Indeed, while there are no doubts as to the possibility of allocating smart contracts in the context of new technologies, the so-called *smart* technologies, it is nevertheless also true that these tools cannot be considered as being completely smart, as they (still) do not possess the ability to self-determine or to self-adapt to changes in the surrounding framework¹²³.

¹²¹ On the distinction between smart contract code and smart legal contract, and on the content attributable to the two cases, see J. STARK, *Making Sense of Blockchain Smart Contracts*, 2016, available online at the following link: <https://www.coindesk.com/markets/2016/06/04/making-sense-of-blockchain-smart-contracts/> (last accessed 10.12.2024)

¹²² C. CLACK, V. A. BAKSHI, L. BRAINE, *Smart Contract Templates: foundations, design landscape and research directions*, *op. cit.*, p. 2. A comprehensive explanation is provided in G. REMOTTI, *Blockchain smart contract. Un primo inquadramento*, in *Osservatorio del diritto civile e commerciale*, 2020, 1, p. 219: '*smart contracts in the exact meaning are computer protocols that implement contracts in a technical sense; on the other hand, those that do not possess the (necessary and sufficient) requirements to be considered contracts are not smart contracts in the exact meaning, but rather smart contracts in a broad meaning, i.e. software capable of implementing contractual agreements*'. The translation from Italian is ours.

¹²³ Since the computer protocol lying underneath smart contracts depends on the instructions it receives, in different ways, the implementation of the term smart seems improper and inaccurate, and leaves some room for further (lexical) ambiguities. See S. A. CERRATO, *Contratti tradizionali, diritto dei contratti e smart contract*, *op. cit.*, p. 277. However, it is possible that in a not-too-distant future, blockchain-based smart contracts might also make use of Artificial Intelligence or additional technologies to take autonomous decisions, or adapt to unforeseen, external inputs. These further developments would validate the use of the term smart contract, but, on the other hand, it would pave the way for a wide range of original legal issues.

In short, these first two sets of reflections seem to be correctly summarised by the ironic observation shared by some scholars: on closer inspection, smart contracts are *neither contracts nor smart*¹²⁴.

Alongside the controversial issues belonging to the framing and (legal) qualification of smart contracts, further elements of complexity come to light concerning the effective implementation of blockchain-based smart contracts, when considering their use and application to the real world¹²⁵.

A substantial theme concerns the main features of smart contracts, namely their certainty¹²⁶, their automatic self-execution, and their immutability. In fact, these elements of strength and typicality become major weaknesses under a different perspective.

The certainty of the smart contract – that is, the certainty of its automatic execution when the preestablished conditions are met – runs the risk of turning into *inflexibility*, insofar as it does not allow for ‘going back’ or changes in the originally established terms and conditions, or its effects, even though they should become necessary due to unforeseen (and unforeseeable) circumstances. Smart contracts’ execution is always certain and automatic, even when the parties involved might have legitimate interests in suspending or avoiding it. The risk,

¹²⁴ P. SIRENA, *Le questioni degli smart contract con riguardo alla struttura ed alla patologia del contratto. Intervento al Convegno Il robot tra diritto e processo*, Roma, 21 febbraio 2019. This position is also confirmed by the words used by Vitalik Buterin, founder of the blockchain platform Ethereum, to address the discussed topic. As mentioned, the Ethereum White Paper adopts the term smart contracts, defining them as ‘*Systems which automatically move digital assets according to arbitrary pre-specified rules*’. However, in a successive Twitter post published in October 2018 (available at the following link: <https://bitcoinist.com/vitalik-buterin-ethereum-regret-smart-contracts/>), Buterin clarified his position, stating that ‘*To be clear, at this point I quite regret adopting the term ‘smart contract’. I should have called them something more boring and technical, perhaps something like ‘persistent scripts’*”. Although this statement was probably not the result of a deep legal reflection on the inner meaning of the term and its possible affinity with the category of contractual agreements, it still confirms that smart contracts must not necessarily be traced back to the classical concept of contract as a civil law case.

¹²⁵ In this context, it has been decided to address only a few of them, namely those that were considered mostly relevant for a broad-scope and comprehensive overview of the figure of smart contracts as one of the main applications of blockchain technology.

¹²⁶ The concept of certainty here mentioned is deeply analysed in G. REMOTTI, *Blockchain smart contract. Un primo inquadramento*, op. cit., pp. 201 ss., who identifies at least three different moments in which a smart contract is capable of providing certainty. Firstly, a smart contract is certain in its linguistic meaning. Unlike traditional contracts, being negotiated and then drafted using natural language, which is always subject to interpretation and therefore may leave room for misunderstandings, vagueness, and ambiguity, smart contracts adopt an ‘artificial’ language. Indeed, being written in a programming language, they allow for a unique interpretation of their content and avoid any risk of discordant readings. Secondly, a smart contract is certain in its formal meaning. Thanks to the blockchain platform they can be implemented in, smart contracts autonomously verify and attest various contractual elements, including the exact time and date of their establishment, the authorship of each transaction, or any additional amendment that the parties, without the need to resort to a third party (e.g., a notary) confirming the truthfulness of the facts. This also entails significant savings in terms of economic costs. Finally, a smart contract is certain in its execution, hence in the punctual and automatic compliance of the undertaken obligations once the preestablished conditions are met. In the execution of smart contracts, indeed, the contracting parties no longer have discretionary powers, which also makes it impossible for the obligations not to be complied with.

in other words, is for the interested parties to remain trapped by the inner mechanisms of the smart contract.

A second question to consider arises when the execution of a smart contract depends on the occurrence of conditions that lie outside the blockchain, i.e., off-chain data. Blockchain-based smart contracts, in fact, typically run in a closed system and thus have no possibilities or ways to interact with the outer environment. As blockchain, taken on its own, is not capable of acquiring off-chain data, an obstacle is likely to arise when the conditions or the events activating the smart contract occur outside the blockchain itself. In this case, it is necessary to resort to additional applications, tools, or other solutions, external but still interconnected to the blockchain, capable of performing this *out-in* activity, to retrieve the off-chain data and transfer the related information within the platform. These operations, or rather the ‘entities’ that carry out these tasks, are named oracles,¹²⁷ and they become necessary when, as said, the conditions activating the smart contract are external to the blockchain. The need to resort to oracles, however, brings about some profiles of concern that should further be taken into account, e.g., that of trust in the employed oracle¹²⁸, as well as the one relating to the need to verify that the information and data taken from the outside correspond to the truth¹²⁹.

¹²⁷ The term ‘oracle’ actually has a rather broad range, and it encompasses a variety of instruments that, while serving the same function, may be quite different in their nature. The three types of oracles that are normally presented and described by scholars, though not exhaustive of the whole category, are: software oracles, hardware oracles, and human oracles. In the first case, software oracles extract the requested information from the web or from other blockchains. Of course, the advantages entailed by this functioning are many, but just as many weaknesses can be identified: first and foremost, the issue concerning how much trust shall be given to the sources accessed, in this case, by software oracles (for example, it is not difficult to imagine the risk of malicious tampering with the information provided by a website). Hardware oracles, on the other hand, rely on other digital devices, namely, sensors and the Internet of Things (IoT), to collect data from the outer world directly and without interference. Finally, human oracles are normally involved in more complex or borderline situations, where machine intervention is not sufficient or would be excessively costly; in particular, human oracles shall be employed in cases where a subjective evaluation is needed. An example can be useful, in this case, to better understand the case: the employment of a human oracle could be the most appropriate, for instance, to assess the degree, level, or entity of a car accident, eventually activating the smart contract that specifies the conditions for the insurance policy.

¹²⁸ Upon this profile hinges the so-called ‘oracle paradox’: whenever a smart contract, or the blockchain platform it is implemented on, must necessarily connect to external elements to function, they start to depend on the mean that allows this connection: the elimination of the ‘single point of failure’, that is typical and characteristic of blockchain technology, lacks. In other words, oracles re-propose a need for trust in blockchain systems, too. This profile is accurately analysed, also in the possible solutions, in M.T. GIORDANO, *Il problema degli oracoli*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, op. cit., pp. 255 ss.

¹²⁹ This point was discussed in detail in the first parts of this chapter when addressing security as one of the main features of blockchain technology, and it refers to the ‘garbage in, garbage out’ problem. As already explained, the GIGO problem summarizes the idea that any off-chain matter falls outside the sphere of control of the blockchain itself, because its protocols are not capable of verifying and certifying the authenticity, truthfulness, and quality of information that does not originate from the blockchain (on-chain) but is acquired from the outside (off-chain). Hence, if the acquired data is incorrect, or it does not correspond to the truth, the platform and its protocols alone

2.3. Reviewing the legislative background of blockchain.

While the legal analysis of digital phenomena cannot disregard a preliminary recognition of the functioning and main features of the observed technology, it also requires a reconstruction of the relevant political and legislative background. In this way, regardless of whether one intends to look at the international framework or, on the contrary, to focus on specific contexts, such as the European legal system or domestic ones, building the political and regulatory background up makes it possible to recreate the position of the observed institutions and to understand whether, and to what extent, the concerned technology is taken into account at the regulatory level.

For the same reasons, blockchain regulation has always caught the attention of numbers of scholars¹³⁰: ever since the legal debate started to deal with this disruptive innovation, indeed, the question concerning the possibility and the convenience of regulating blockchain came to the floor, pushing legal scholars to investigate the meanings attributable to the term ‘regulation’, when it comes to new technologies, and to identify ways to achieve this result¹³¹.

The inner doubts that inevitably characterise any investigation concerning the regulation of new technologies are mostly a consequence of the awareness that innovations are constantly moving and changing, and they certainly evolve faster than the law can¹³². Notwithstanding

will not be able to detect the error and prevent the mistaken data from being recorded inside a new block, and then permanently stored in the blockchain.

¹³⁰ Among the many authors that, through time, have dealt with this topic, consider: A. WRIGHT, P. DE FILIPPI, *Decentralized Blockchain Technology and the Rise of the Lex Cryptographia*, 2015, pp. 1-58, available online at the following link: <http://dx.doi.org/10.2139/ssrn.2580664> (last accessed 3.12.2024); P. DE FILIPPI, A. WRIGHT, *Blockchain and the law. Rule of code*, Harvard University Press, 2018; F. SARZANA DI S. IPPOLITO, M. NICOTRA, *Diritto della Blockchain, Intelligenza Artificiale e IoT*, Milano, Ipsoa, 2018; M. FINCK, *Blockchain regulation and governance in Europe*, Cambridge, Cambridge University Press, 2019.

¹³¹ In general, it must be observed that, in the relationship between law and technology, the dialogue between legal norms and the so-called *lex informatica* has always been difficult, though maybe inescapable. However, since the latter surmounts every other form of regulation, including legislative regulation, the law has the complex task of finding ways to govern innovation, with a dual aim: on the one hand, escaping the risk of the unlimited predominance of technology; on the other hand, preventing regulation from crushing or excessively hindering innovation. These and other reflections on the delicate balance between law and technology can be found in G. FINOCCHIARO, *Riflessioni su diritto e tecnica*, in *Il diritto dell'informazione e dell'informatica*, 2012, 4-5, pp. 831-840; F. FAINI, *Il diritto nella tecnica: tecnologie emergenti e nuove forme di regolazione*, in *Federalismi.it*, 2020, 16, pp. 79-117.

¹³² D. COLLINGRIDGE, *The Social Control of Technology*, New York, St. Martin's Press, 1982, pp. 1-200. Prof. Collingridge, who has been an important contributor to the field of Science and Technology Studies, extensively addressed this topic in his work, describing the dilemma that arises in the relationship between innovation and regulation as a paradox. Indeed, to perceive the real impact of any innovation, it is necessary to wait for it to develop and spread; thus, to intervene in its downing makes it impossible to foresee and govern future developments. At the same time, however, once the technology is mature and well established, the risk is to lose the power and possibility to regulate it. This concept is taken up and theorized in L. DOWNES, *The Laws of*

this, as to blockchain regulation, it has firmly been stated that ‘...*the blockchain is – and will fundamentally remain – a regulatable technology*’¹³³. Therefore, moving from this assumption, the next sections will attempt to reconstruct the steps taken by the European legislator, on the one hand, and by the Italian legislator, on the other, as to blockchain regulation. This brief overview, which starts from defining the first attempts of intervention¹³⁴ and leads up to the most recent steps, makes it possible to identify and describe some relevant passages of the European and national policies on blockchain.

In addition to this, the following analysis will also show a significant switch in the approach adopted by the involved institutions (mostly at the European level), which is probably the result of some lessons learned from the past. For sure, higher levels of awareness as to the most efficient ways to approach the regulation of innovative technologies have been acquired with time.

2.3.1 *The European Strategy for Blockchain.*

As carefully illustrated in the previous passages of this work¹³⁵, the importance of innovative technologies and digital tools, as well as the contribution offered by their implementation in many different economic areas, including the agri-food sector, has been well-known to the European legislator for several years now. Consequently, the need to target investments, research, and development in these sectors is an equally acknowledged effect.

Indeed, already with the priorities outlined by the European Commission for the period 2019-2024¹³⁶, further confirmed by the re-election of Ursula von der Leyen as President of the

Disruption: Harnessing the New Forces That Govern Life and Business in the Digital Age, New York, Basic Books, 2009, pp. 1-298, and translated into the idea that technology evolves exponentially while legal, social, and economic systems evolve incrementally.

¹³³ A. WRIGHT, P. DE FILIPPI, *Decentralized Blockchain Technology and the Rise of the Lex Cryptographia*, *op. cit.*, p. 51.

¹³⁴ As it will shortly be seen, these first steps date back to 2017. It was almost ten years ago that the European Institutions began to devote attention to the subject of distributed ledger technologies, acknowledging the need to take into account and provide legislative answers to the growing applications and uses of the technology, together with its effects and possible social, economic, legal implications. This distance in time further confirms the assumption that, when addressing the topic of blockchain, it is no longer correct to adopt the adjective *new*. Indeed, even more than scientific or academic interest, the now decade-long attention of European institutions, and the commitment to seek solutions for governing and regulating blockchain, as well as to support and incentive its development, undoubtedly confirm the relevance and the possible impacts of this disruptive technology when applied to the widest range of economic sectors.

¹³⁵ *Supra*, chapter I, par. 1.1.

¹³⁶ *Supra*, fn. 12.

EU Commission for the period 2024-2029¹³⁷, the digital strategy aimed at building more opportunities for Europe and its citizens, through a new generation of technologies, found absolute centrality.

Moving from the awareness that the digitalisation is transforming people's lives, the European Commission lead by President von der Leyen wishes to make a change in this direction for people and businesses, while still contributing to achieving the established targets for climate neutrality by 2050¹³⁸. To make this possible, however, it is still fundamental to invest more and more in resources, capacities, and infrastructures, that allow the development of advanced digital solutions.

In this broader scenario, the European Blockchain Strategy was launched¹³⁹, where, indeed, blockchain is seen and presented as '*...one of the key emerging technologies that is shaping Europe's future*'¹⁴⁰, thus fundamental, within the next frontier of technologies, to build a European digital society that is sustainable, transparent, inclusive, and citizen-centric, and to strengthen the technological sovereignty of the European Union.

To achieve these results without quitting some 'gold standards' (including environmental sustainability, data protection, digital identity, cybersecurity, and interoperability) the Strategy holds some key points: a) incentives and fundings for research and innovation¹⁴¹; b) a strong political partnership, as it is the public sector that must primarily

¹³⁷ See U. von der Leyen, Speech in the European Parliament Plenary Session, 27.11.2024: '*For us to be competitive, Europe must be home to the next wave of frontier technologies ... Europe can use digital technologies to boost its prosperity, to unleash innovation and to help keep people safer*'. Following the direction already taken in the previous mandate, indeed, the Commission presents the 'Competitive Compass' as a major initiative, whose first pillar is to close the innovation gap with the US and China. To do so, the EU must rely on research and innovation, science and technology, to be put at the heart of the European economy, by investing more and focusing better.

¹³⁸ See EUROPEAN COMMISSION, *Shaping Europe's digital future*, COM(2020)67final, p. 1. As already illustrated, this Communication is the core of the program 'A Europe Fit for the Digital Age', designed to empower EU people with a new generation of technologies that allow Europe to lead the transition to a healthy planet and a new digital world. Blockchain technology does not fall far from this scenario: indeed, among its key actions, the Communication also highlights the importance of developing and applying advanced joint digital capacities in the area of blockchain, as well. See EUROPEAN COMMISSION, *Shaping Europe's digital future*, p. 7.

¹³⁹ EUROPEAN COMMISSION, *Blockchain Strategy*, available online at the following link: <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy> (last accessed 7.12.2024). A comprehensive description of the main elements of the strategy is provided in T. DAMVAKERAKI, *EU Blockchain Strategy*, EU Blockchain Observatory and Forum, available at: <https://eufordigital.eu/wp-content/uploads/2023/04/Tonia-Damvakeraki-Overview-of-the-EU-blockchain-strategy.pdf> (last accessed 7.12.2024).

¹⁴⁰ EUROPEAN COMMISSION, *European Blockchain Strategy – Brochure*, 23.9.2019, available online at: <https://digital-strategy.ec.europa.eu/en/library/european-blockchain-strategy-brochure#Partnership> (last accessed 7.12.2024).

¹⁴¹ Ivi: '*The EU provides fundings for Blockchain research and innovation through grants and by supporting investments. Grants are given through the Horizon programme. The EC supports investment in Blockchain startups*

drive the digitalisation; c) promoting legal certainty, as an effect of recognizing the importance of a clear regulatory regime in areas pertaining to blockchain-based applications; d) cooperation with international bodies to establish interoperability and standards¹⁴²; e) supporting skills programs, which are essential to ensure that Europe's citizens possess the digital skills they need to access, use and develop the latest digital technologies; f) interacting with other subjects, such as the private sector, the academia, and the blockchain community.

With the launch of the described Strategy, hence, the institutional commitments towards blockchain technology at the European level certainly went a step ahead. Nevertheless, going a few years back in time, the first attempts to hinge the legislative debate on blockchain, and to support the system while encouraging its evolution, had already been made. As early as 2017, indeed, following the publication of a European Parliamentary Research Service document¹⁴³, the Council asked the European Commission to develop and present its approach on blockchain, pushing the presentation of initiatives involving the (by that time, new) technology: in response, the Commission created and launched the EU Blockchain Observatory & Forum¹⁴⁴.

A few months later, additionally, some Member States signed a declaration¹⁴⁵ whose purpose was to bring the signatories together in a continuous exchange of skills, experience,

and projects through the new AI & Blockchain Investment fund (...). Additional funding for Blockchain innovation ecosystem can be leveraged through the Recovery and Resilience Facility'.

¹⁴² Ivi, 'Standards are an important key to success for any nascent technology, and Blockchain is no exception. The right standards, set at the right time in a technology's development, can ensure interoperability, generate trust and help ensure ease of use of the technology, and support its development and pathway to mass adoption. The EU takes an active role in the Blockchain standards community... '.

¹⁴³ P. BOUCHER, S. NASCIMENTO, M. KRITIKOS, *How blockchain technology could change our lives. In-depth analyses*, EPRS – European Parliamentary Research Service, 2017, pp. 1-28.

¹⁴⁴ The EU Blockchain Observatory & Forum is an initiative of the European Commission to accelerate innovation and the development of a blockchain ecosystem within the EU, to cement Europe's position as a global leader in this transformative technology. The Observatory & Forum is concerned with: monitoring blockchain initiatives all over Europe; collecting the results achieved in research and development; creating an active network for sharing knowledge and information; producing recommendations and guidelines to contribute to blockchain research and development. For more details, see: https://blockchain-observatory.ec.europa.eu/index_en (last accessed 9.12.2024). One of the first activities of the Observatory & Forum was the production of a document evaluating the legal framework applicable to blockchain technology and smart contracts. See EU BLOCKCHAIN OBSERVATORY & REPORT, *Legal and regulatory framework of blockchains and smart contracts*, Thematic Report, Brussels, 2019. The Report, in particular, recognises the need for clarification to further support the development of blockchain and the possibilities provided by its implementation in different economic sectors. At the same time, the Report highlights the main areas in which an intervention of the European legislator is deemed indispensable: for blockchain, the discussed topics include the acknowledgment of the legal value of blockchains as registries, territoriality, liability, and protection of entered data; as to smart contracts, the focus is instead on the identification of their legal implications.

¹⁴⁵ Declaration, *Cooperation on a European Blockchain Partnership*, 10.4.2018. Originally, the declaration was signed by 21 EU Member States, including Belgium, Germany, Spain, France, Austria, the Netherlands, and the UK, plus Norway. Over time, other countries joined the Partnership, bringing the total up to 30 signatories at the last update.

and expertise on blockchain: the European Blockchain Partnership (EBP) was born, and, soon after, it also established the European Blockchain Service Infrastructure (EBSI)¹⁴⁶.

Riding the wave of this brand new enthusiasm, in the same year, blockchain and distributed ledger technologies became the protagonists of two additional interventions by the European Parliament.

In October 2018, a first resolution on distributed ledger technologies and blockchains¹⁴⁷ was presented. Dwelling with the multiple and multidimensional potentialities of innovative distributed ledger technologies, including blockchain, on the one hand¹⁴⁸, and addressing the profiles relating to their regulation and governance¹⁴⁹, on the other, the EU Parliament seeks a balance between measures that shall incentivize the implementation of the technology, while respecting the principle of technological neutrality, and forms of protection to ensure legal certainty¹⁵⁰.

A few months later, the EU Parliament once again approached blockchain with another resolution of December 2018¹⁵¹, in which the innovative technology is expressly observed in the context and perspective of EU trade policy, as an instrument for trade facilitation, cross-

¹⁴⁶ EBSI is the first public sector blockchain infrastructure in Europe. More precisely, it consists of a peer-to-peer network of interconnected nodes running a blockchain-based system for services, with the components of the European Blockchain Partnership and the European Commission running at least one node. The infrastructure works through a closed number of case studies, including, among others, the implementation of a European digital identity and trusted data sharing. In general, however, the scope underlying the initiative is to create cross-border services for public administrations, businesses, and citizens that are trustworthy and verifiable as they rely on blockchain technology, and eventually to integrate them with the private sector, too. The webpage is available at: <https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/Home> (last accessed, 10.12.24).

¹⁴⁷ EUROPEAN PARLIAMENT, *European Parliament resolution of 3 October 2018 on distributed ledger technologies and blockchains: building trust with disintermediation*, 3.10.2018, 2017/2772(RSP).

¹⁴⁸ See, for example, recitals A, B, and C of the Resolution: 'A. *whereas Distributed Ledger Technology (DLT) and blockchain can constitute a tool that promotes the empowerment of citizens by giving them the opportunity to control their own data and decide what data to share in the ledger, as well as the capacity to choose who else can see them*'; 'B. *whereas DLT is a general-purpose technology which can improve transaction cost efficiency by removing intermediaries and intermediation costs, as well as increasing transaction transparency, also reshaping value chains and improving organizational efficiency through trustworthy decentralization*'; 'C. *whereas DLT can introduce, through the necessary encryption and control mechanisms, an IT-based paradigm that can democratize data and improve trust and transparency, providing a secure and efficient route for the execution of transactions*'.

¹⁴⁹ *Ivi*, 'E. *whereas DLT is a still evolving technology which necessitates an innovation-friendly, enabling and encouraging framework that provides legal certainty and respects the principle of technology neutrality, while at the same time promoting consumer, investor and environmental protection, increasing the social value of the technology, reducing the digital divide and improving the digital skills of citizens*'.

¹⁵⁰ *Ivi*, par. 68: 'Underlines that the Union should not regulate DLT per se, but should try to remove existing barriers to implementing blockchains; welcomes the Commission's approach of following a use-case method in exploring the regulatory environment around the use of DLT and the actors using it by sector, and calls on the Commission and the Member States to foster the convergence and harmonization of regulatory approaches'.

¹⁵¹ EUROPEAN PARLIAMENT, *European Parliament resolution of 13 December 2018 on Blockchain: a forward-looking trade policy*, 13.12.2018, 2018/2085/INI.

border exchange of data and their protection, and to benefit small and medium-sized enterprises (SMEs).

In both cases, the Parliament invited the EU Commission to keep an eye on distributed ledger technologies and blockchains and to actively follow their development and adoption in different areas, to become a leading actor in these fields.

The outlined framework of policies and actions shows that, for some time now, the European legislator has been well aware of the importance of blockchain technology and the potentialities it entails, mostly due to the countless fields of application it entails¹⁵², as well as the risks and difficulties that may arise when relying on such a complex, distributed technology. The latter, without any doubt, makes it necessary to intervene from the perspective of regulation and governance, to avoid its uncontrolled (i.e., uncontrollable) diffusion. From this second point of view, however, equally robust is the awareness, by part of EU institutions, of the difficulties lingering in any activity of governance of such a disruptive innovation, consequence of the elements connoting it, but also of the general problem of regulating technologies, which was addressed before.

These positions, emerging quite clearly in the words spoken on several occasions by the European legislator, have translated into a precise choice of action: in February 2023 the European Commission launched the European Blockchain Regulatory Sandbox¹⁵³, an initiative that established a framework for regulatory dialogues, with the final aim of increasing legal certainty to foster innovative solutions and use cases for blockchain and DLTs. More precisely, the initiative, which is intended to run from 2023 to 2026, is structured in such a way as to finance and support 20 projects per year, chosen through calls for expression of interest, all of which involve blockchain technology to different degrees and from different sectors. The cohorts are then matched with relevant national and EU regulators to establish a constructive

¹⁵² In this regard, it must be recalled that, alongside the regulatory interventions referred to in this section, which directly consider and address blockchain or distributed ledger technologies as disruptive innovations, the EU legislator has also regulated blockchain technology, as an element ascribable to a specific area and subjectable to specific uses. For instance, this is the case with Regulation (EU) 2024/1183 of the European Parliament and of the Council of 11 April 2024 amending Regulation (EU) No 910/2014 as regards establishing the European Digital Identity Framework (mostly known as Reg. eIDAS 2.0 on EU digital identity) which, as far as it is relevant here, refers more than once to 'temper-proof solutions'. A similar consideration can be made for Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, the so-called MiCA Regulation, which includes distributed ledger technologies and blockchains among the '*...transformative technologies in the financial sector...*' (ivi, recital 1).

¹⁵³ The official website of the European Blockchain Regulatory Sandbox is available at the following link: <https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/Sandbox+Project> (last accessed 15.12.2025).

and safe dialogue, devoid of legal consequences¹⁵⁴, on the most significant regulatory issues met by the involved parties, also thanks to the establishment of a network involving consulting law firms, blockchain experts, and independent academics from EU universities¹⁵⁵.

2.3.2. *The national framework.*

As noted by the passages mentioned in the previous paragraph, the European institutions have been recognising the relevance and potential of blockchain technology for several years now. Consequently, they have been calling for the adaptation of current regulatory regimes to this innovation, in particular by devising strategies aimed at increasing the level of digital skills and fostering the diffusion of the technology.

Riding the wave of these suggestions, Italy was among the first European Member States to deepen the issue of blockchain regulation, taking a step that – albeit scattered of undeniable criticalities, as it will shortly be seen – must certainly be considered as courageous and avantgarde, as it opened the national legal systems to the many possibilities offered by the implementation of distributed ledger technologies.

¹⁵⁴ This is, after all, the key feature that characterizes this particular instrument. Regulatory sandboxes are, by definition, (physical or virtual) controlled environments in which companies and operators are free to experiment with innovative technological products and services under the supervision of competent authorities, for a limited period of time and with the possibility to benefit from temporary exemptions to existing regulations applying in that specific sector. In other words, participation in a sandbox allows operators to test products and services in a real but risk-controlled environment, in close synergy and dialogue with regulators and supervising authorities that, at the same time, gather new data and expertise to eventually build an effective regulatory framework. Regulatory sandboxes can thus be identified as spaces for regulatory experimentation or tools for an ‘organised’ experimental legislation. For an overview on regulatory sandboxes, see also S. RANCHORDAS, V. VINCI, *Regulatory sandboxes and innovation-friendly regulation: between collaboration and capture*, in *Italian Journal of Public Law*, 2024, 1, pp. 107-139. For a general reflection on the role of experimental norms, see A. DI LAURO, *Norme sensoriali incitative e norme sperimentali. Il caso Rémunérascoré*, in *Rivista di diritto alimentare*, 2024, 1, pp. 22-23.

¹⁵⁵ To date, the experience has achieved its third round. In February 2023, soon after the launch of the Regulatory Sandbox, applications for the first cohort opened; almost 90 applications were submitted, and among them, the 20 founded projects were selected. The content and area of interest of the winning projects varied widely: from logistics to notarization of digital assets; from cross-border payments to solutions for digital passports. At the same time, the initiative also presented an open invitation for regulators and authorities to join in; among others, the involved partners from Italy were Agenzia per l’Italia digitale, Garante per la protezione dei dati personali, Banca d’Italia, and Commissione Nazionale per la Società e la Borsa. The activities carried out by the established network during the interested year underwent some regulatory dialogues between the actors involved: the lessons learned, best practices and recommendations were then brought together in the ‘Best practices Report – 1st Cohort, Part A-B’, jointly published with the European Commission, where it is openly recognized that the European Blockchain Regulatory Sandbox is having a clearly positive impact for the whole blockchain ecosystem, by contributing to strengthen the perceived maturity and potentiality of the innovative technology.

The D.L. No. 135, 14 December 2018¹⁵⁶, converted with amendments by Law No. 12, 11 February 2019, introduced in the Italian legal system two definitions that are substantial for the purposes of the ongoing analyses: that of *technologies based on distributed ledgers*, and that of *smart contract*¹⁵⁷.

Even though the productive impetus of the Italian legislator is appreciable and remarkable, there is no lack of critical remarks, by part of legal scholars and academists, on the definitions provided by D.L. No. 135, 14 December 2018, as they still appear in many ways ambiguous, contradictory, and excessively restrictive¹⁵⁸.

However, blockchain has also attracted the attention of the Italian legislator for its exploitability in many economic sectors; anticipating some profiles that will be addressed in the following sections, this happened, for example, with the agri-food sector.

As early as 2019, a first proposal to develop a blockchain platform to implement traceability services for agri-food products was presented¹⁵⁹. Although the proposal did not see

¹⁵⁶ D.L. No. 135, 14 December 2018, *Disposizioni urgenti in materia di sostegno e semplificazione per le imprese e per la pubblica amministrazione*, also known as ‘Decreto Semplificazioni’.

¹⁵⁷ Under art. 8-ter, c. 1, technologies based on distributed ledgers are defined as those technologies and protocols that use a shared, distributed, replicable, simultaneously accessible, decentralised ledger on cryptographic basis, such as to allow the recording, validation, updating and storage of data, as such or further encrypted, that are verifiable by each participant, non-alterable and non-modifiable. In addition to this, art. 8-ter, c. 2, further defines a smart contract as a computer programme that operates on technologies based on distributed ledgers, and whose execution automatically binds two or more parties on the basis of effects pre-defined by them. Smart contracts meet the requirement of ‘written form’ after informatic identification of the parties involved, which takes place through a process that fills the requisites set by the Agenzia per l’Italia digitale. The English translation is ours. The second disposition also entrusts the Agenzia per l’Italia digitale (AgID) with the task of identifying and establishing technical standards and requirements for technologies based on distributed registers (see art. 8-ter, c. 4). This assignment was fulfilled soon after the disposition. See AGENZIA PER L’ITALIA DIGITALE, *Linee guida relative alle best practice di secure design per le architetture basate su registri distribuiti (DLT)*, 2020.

¹⁵⁸ In this sense, see M. SIMBULA, *La normativa italiana sulle DLT*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche, op. cit.*, pp. 140 ss, that, in particular, criticises the decisions of the Italian legislator of providing such a rigid definition of technologies based on distributed ledger and smart contracts, and of attributing such extensive integrative tasks to the AgID. By doing so, claims the A., the former has crystallized within the rigidity of a rule an image that is clearly more restrictive, when compared to what can actually be traced back to the category of DLTs. A similar conclusion is presented in R. BATTAGLINI, *La normativa italiana sugli smart contract*, in R. BATTAGLINI, M.T. GIORDANO (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche, op. cit.*, p. 387, with specific reference to the dispositions on smart contracts. Of particular interest is the closing reflection where the A. observes how the Italian regulation on smart contracts, after all, appears rushed and clumsy, probably a result of an unjustified haste of the legislator, moved by the desire of being the first Member State in Europe to regulate blockchain.

¹⁵⁹ Law proposal n. 1414 ‘Sviluppo piattaforma informatica blockchain – Sviluppo di una piattaforma informatica multifunzionale blockchain e applicazione dei servizi di tracciabilità e rintracciabilità dei prodotti agroalimentari’, 12.07.2019. The proposal was under discussion in January 2020, but its exam was never concluded. Nevertheless, its objectives and purposes are worthy of consideration, in particular the goal of promoting and supporting the establishment, development, and application of a multifunctional, open source, blockchain-based platform, capable of creating a digital register that is free, public, directly accessible to consumers, and whose aim is to increase their trust in institutions and businesses in the agri-food sector.

its happy ending, it is nevertheless interesting to point out how it formally recognised the potential applications of blockchain in the agri-food sector, mainly to the relation of trust between producers and consumers, and the essential requirement of traceability of agricultural products and foodstuffs. More recently, blockchain once again caught the interest of the Italian legislator for the opportunities offered to the national agri-food sector: in December 2023, Law No. 206 was presented, containing provisions for the valorisation, promotion, and protection of ‘Made in Italy’ products¹⁶⁰. This legislative act, in a more general context of measures aimed at supporting and enhancing Italian productions of excellence, its cultural heritage, and its national roots in Italy and abroad, includes a chapter that is expressly dedicated to ‘new technologies’ and, in particular, an article that refers to blockchain technology for the traceability of supply chains¹⁶¹.

The statement that shall be drawn from the above-mentioned legislative references, especially from the latter, involves the acknowledgment of the fact that, although apparently silent, blockchain technology has come to the surface in several areas, to catch the attention of institutions, and to play a role of recognized relevance as a tool that can potentially be implemented to achieve a wide range of objectives in different sectors, thus attracting fundings for ongoing research and development.

Following the path outlined so far, equally interesting are the efforts made at the local level by some Italian regions that, on several occasions and with great enthusiasm, have expressly regulated the introduction and implementation of blockchain technology in the agri-food sector¹⁶².

¹⁶⁰ L. No. 206, 27 December 2023, *Disposizioni organiche per la valorizzazione, la promozione e la tutela del made in Italy*.

¹⁶¹ Art. 47, ‘*Blockchain per la tracciabilità delle filiere*’. The disposition, in general, recognizes the importance of promoting and supporting applied research, as well as the development and diffusion of distributed ledger technologies (DLT), and, to this end, authorizes the expenditure of € 4 million for the year 2023 and € 26 million for the year 2024. Additionally, the disposition envisages the establishment of a national catalogue to register technological solutions of this kind, as well as the nodes meeting the requirements posed by the EBSI, to promote the creation of a network based on distributed ledger technologies that foster interoperability with the technological solutions developed within the Italian Blockchain Services Infrastructure.

¹⁶² This is not the place to delve into the details of these interventions, but they are noteworthy and deserve to be mentioned for the level of commitment shown by regional legislators. Just to mention a few examples, see: Campania Regional Law No. 3, 2 March 2020, to develop and establish a system of traceability for agricultural and fish products in Campania through a blockchain-based system to register and manage data; Marche Regional Law No. 36, 30 July 2020, to implement distributed ledger technologies for the certification of public records, for the traceability of typical and local agri-food products, and to foster honest behaviour.

3. Implementing blockchain technology in the agri-food sector.

The opening paragraphs of this chapter have shown how, nowadays, the agri-food sector is largely headed towards digitalisation. This has brought new methods and strategies and, in general, determined a systemic rethinking of the whole sector and its functions.

As already shown, blockchain technology fits into the broad panorama of the digital transformation of the agri-food sector, and it is precisely the illustrated scenario that should be kept in mind while understanding the large diffusion that the technology has had, in recent years. Indeed, despite varying in its conditions of use and responding to different purposes, the implementation of blockchain technology in the agri-food sector has already been largely investigated and documented by the relevant literature, which acknowledges that it constitutes one of the means for the digitalisation of the agri-food sector.

Therefore, it is important to provide an up-to-date overview of the use and spread of blockchain in the agri-food sector: on the one hand, to present the manifold opportunities offered by the implementation of blockchain-based solutions in the sector and, on the other hand, to identify the main obstacles (also, legal ones) still hindering its complete diffusion.

The following paragraphs will thus attempt to delve into these elements, not only with the final aim of illustrating the state of the art and the most significant literature on the topic, but also and above all to give a more tangible explanation of what it means to implement blockchain technology in the agri-food sector, and what the possible consequences and effects are. In addition, this investigation allows to outline the reference background to take the following steps of research. Indeed, alongside the preliminary examination of blockchain technology, its features, functioning, and applications, it is equally important to understand its diffusion in the agri-food sector, how it is implemented, and for which purposes. Combining these points will provide the starter pack to proceed further and focus on the research and identification of the delicate interconnections that may emerge when blockchain is applied to the realm of Geographical Indications.

3.1. An innovative tool for well-known challenges.

As anticipated above, it is a fact that blockchain-based solutions have found fertile soil in the agri-food sector. Not surprisingly, the topic has long been catching the attention of scholars¹⁶³, and it has given rise to a great number of case studies and projects around the world that, albeit different in their structure, scopes, and diffusion, are all fundamentally aimed at testing the feasibility, effectiveness, and consequences of blockchain implementation in agri-food production chains¹⁶⁴.

¹⁶³ The recognition of the state of the art, and the study of the most significant literature on the interested topic, have shown that the implementation of blockchain technology to the agri-food sector is mainly approached by consistent part of legal scholars to: 1) assess and describe the different fields of application and the purposes pursued in each sector; 2) stress and underline the advantages and the positive outcomes that blockchain technology may bring in each field of intervention; 3) emphasize the critical aspect, the barriers and limits hindering the effective diffusion of the technology in this sector and thus requesting further research and investigation. For a general overview on the topic see, *ex multis*, L. GE, C. BREWSTER, A. SMEENK, J. SPEK, J. TOP, *Blockchain for Agriculture and Food, findings from a pilot study*, Wageningen, Wur, 2017; G. SPOTO, *Gli utilizzi della Blockchain e dell'Internet of Things nel settore degli alimenti*, in *Rivista di diritto alimentare*, 2019, 1, pp. 25-35; M. TRIPOLI, J. SCHMIDHUMBER, *Emerging Opportunities for the Application of Blockchain in the Agri-Food Industry*, FAO, ICTSD, 2020; M. ALABRESE, A. SABA, *Sistema agroalimentare e Blockchain. Opportunità, punti di debolezza e prospettive*, in *Economia Trentina*, 2021, 3; W. D'AVANZO, *Blockchain e smart contracts per la gestione della filiera agroalimentare, Potenzialità, progetti e problemi dell'internet del valore*, *op. cit.*, pp. 93-118; A. DI LAURO, *Blockchain nel settore agroalimentare come discorso e come dispositivo*, in E. NAVARRETA, A. VALLINI (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di Blockchain*, Vol. II, Torino, Giappichelli, 2021; G. REMOTTI, *Blockchain Technologies per la filiera agroalimentare*, in *Alimenta*, 2021, 3-4, pp. 473-513; V. PANDEY, M. PANT, V. SNASEL, *Blockchain technology in food supply chains: review and bibliometric analysis*, in *Technology in society*, Elsevier, 2022, 69, pp. 1-26; G. PISCIOTTA TOSINI (eds.), *Comunicazioni di sostenibilità e Blockchain. Strumenti giuridici e prospettive tecnologiche per il settore vitivinicolo*, Atti del Convegno, Palermo, Palermo University Press, 2022; S. ROLANDI, *La Blockchain nei sistemi agroalimentari*, in *Trattato breve di diritto agrario italiano e dell'Unione europea*, *op. cit.*; N. TESTI, L. BORSACCHI, F. SPIGARELLI, *Blockchain technology for supply chain traceability: a literature review*, in *L'Industria*, 2023, 1, pp. 77-100; L. RUSSO, *Blockchain e smart contracts nei contratti della filiera agroalimentare*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea*, *op. cit.*, pp. 361-374. Of great interest are the legal studies that have particularly delved into blockchain's application in the wine sector. See, *ex multis*, K. BISWAS *et al.*, *Blockchain-based wine supply chain traceability system*, in *Future Technologies Conference*, 2017, pp. 56-62; A. SABA, *Blockchain e vino: una nuova frontiera*, in *Diritto agroalimentare*, 2019, 3, pp. 491-502; J.I. JIMÉNEZ, *Wine NFT cryptoassets: EU regulatory issues and market challenges*, in *BIO Web of Conferences. 44th World Congress of Vine and Wine*, 2023, 68, pp. 1-10; A. BASTARD, A. CHAILLET, *Blockchain: No pain, no gain? An examination of blockchain technology in the vitivinicultural sector*, *ivi*, pp. 1-7; B. SILENZI, *In Vino Veritas: la Blockchain per la lotta alla contraffazione del vino*, 2024, accessible online at the following link: <https://www.praxi-ip.praxi/news-detail/190/blockchain-per-combattere-contraffazione-vino> (last: 15.12.24).

¹⁶⁴ The first well-known project related to blockchain implementation in the agri-food sector dates back to 2016, when IBM, a leading American IT company, presented the first modular solution for food traceability based on blockchain: IBM Food Trust. The pilot project aimed to develop a platform capable of improving the traceability of foodstuffs along production chains, employing innovative technology to do so. The first case study was conducted in collaboration with Walmart (an American multinational corporation, also owner of the world's largest chain in the retail channel) and involved, in particular, the supply chains of two products sold in Walmart shops: mangos; and pork meat imported from China. The results of this pilot project show how the IBM Food Trust platform can significantly reduce the time needed to track foodstuffs back along production chains: in the case of mangos, for example, the time needed to locate a specific lot went from around 7 days to just a few seconds. See F. YIANNAS, *A New Era of Food Transparency Powered by Blockchain*, in *Innovations: Technology, Governance*,

For blockchain, having raised this interest within the agri-food sector, and achieved such a wide appeal, is mostly a consequence of the fact that the technology has been proposed as a valuable instrument to address some of the issues and challenges that agri-food systems face today¹⁶⁵. In the complex and fragile framework characterizing them, the opportunities offered by innovative technologies come to light, and this is also the case for blockchain, whose solutions find plausible grounds for use in each and single passage of production chains¹⁶⁶, with cases of application directed, among other things, at controlling and guaranteeing food safety, managing supply chains, and fostering the financial efficiency of the sector. The lowest common denominator that arises in every scenario in which blockchain shows its potential, as it will shortly be highlighted, is the ability of the technology to comply with the increasing demand for complete, precise, and (hopefully) true information¹⁶⁷, a need energetically expressed by consumers who, in present globalised agri-food systems, perceive access to information as an essential tool to achieve higher levels of protection in their relationships with producers and to fight back asymmetries and the lack of knowledge¹⁶⁸.

Globalization, 2018, 12, 1-2, pp. 46-56. As a natural effect of the excellent results obtained in the pilot project, the IBM platform has become very popular and is nowadays adopted by numerous FBOs in Europe and around the world. Some research, for example, showed that the use of the solution increased during the Covid-19 pandemic, as a result of a growing demand for fresh, safe food, whose provenance could be precisely known (R. ANZALONE, *IBM Blockchain is growing in the Food Industry during Covid-19*, in *Forbes*, 2020). Some interesting case studies can be found in A. GIORDANO, *Blockchain per l'agrifood. Scenari, applicazioni, impatti*, in *I quaderni di RuralHack, Societing 4.0*, 2019; L. COMPAGNUCCI *et al.*, *Uncovering the potential of blockchain in the agri-food supply chain: An interdisciplinary case study*, in *Journal of Engineering and Technology Management*, Elsevier, 2022, 65, pp. 1-18.

¹⁶⁵ L. GE, C. BREWSTER, A. SMEENK, J. SPEK, J. TOP, *Blockchain for Agriculture and Food, findings from a pilot study*, *op. cit.*, pp. 1 ss.

¹⁶⁶ R.L. RANA, C. TRICASE, L. DE CESARE, *Blockchain technology for a sustainable agri-food supply chain*, in *British food journal*, 2021, 123, 11, pp. 3471-3485.

¹⁶⁷ L. AMMANATI, *Information in agri-food market: the role of digital technologies*, in *Rivista di diritto alimentare*, 2020, 1, pp. 51-56. In the same sense, see also G. PISCIOTTA TOSINI, *Contratti tecnologici per l'effettività del diritto a una libertà alimentare informata*, in *Rivista di diritto alimentare*, 2024, 4, pp. 18-24.

¹⁶⁸ As acknowledged by the European Commission, '...to make informed decisions, consumers need certain skills, such as the ability to perform simple calculations, to read a label, or to recognise relevant logos' (EUROPEAN COMMISSION, Commission Staff Working Paper *Consumer Empowerment in the EU*, SEC(2021) 469 final). For this reason, the EU legislator gradually tried to reduce the information asymmetries between producers and consumers, mostly through a re-organisation of the provisions concerning information to the public, revealed by Regulation (EU) 1169/2011, which indeed focuses on food labelling and, more in general, on food information made available by any means, including digital technologies. On these aspects, see L. AMMANATI, *Information in agri-food market: the role of digital technologies*, *op. cit.*, p. 51. It has also been pointed out that consumers do not always demand additional information or more detailed labels to satisfy their hunger for knowledge as, on the contrary, an overload of information, together with a lack of time, or the absence of technical skills, can sometimes limit consumers' ability and will to understand the core content of these messages. In this sense, P. BORGHI, *Risk-related Communication and Food-related Communication: what Information to Consumers?*, in *Rivista di diritto alimentare*, 2011, 2, pp. 3-4. However, as some scholars have instead underlined how the ambitious measures formalised in European texts as to consumer protection and the need for transparency in the agri-food sector have failed to become widely applied (see, I. KRAGL, *Failure to Deliver the Transparency Promised by European Law*,

At the same time, the timely exchange of precise, detailed, complete, and up-to-date information is an undeniable circumstance in the layer of relationships between producers and producers, as well¹⁶⁹.

Willing to identify the elements that make blockchain such a promising technology for the agri-food sector, one cannot help but mention the pivotal contribution it provides to the fundamental aspect of agri-food traceability, improving the overall efficiency of the system by ensuring integrity, immutability, and security of data and information¹⁷⁰. From this point of view, blockchain comes to the forefront in different fields (supply and production processes, controls over food safety and food quality, transport, waste management, etc.) and for many purposes. Within the context of food safety¹⁷¹, for instance, the technology provides significant

in *European Food and Feed Law Review*, 2025, 2, pp. 87-95), the pair 'blockchain-information' cannot be overlooked.

¹⁶⁹ In this regard, it is interesting to dwell on the contribution that blockchain can offer in opposing unfair trading practices in agri-food contracts. Indeed, if, on the one hand, it is true that blockchain does not eradicate the typical problems of the sector (i.e., contractual power disparities and information asymmetries), on the other hand, it is also true that the features of the technology can have positive impacts on the weaker contracting party. This is the case with the time-stamping of recorded information (including, for example, the date of conclusion of a contract, or products' delivery), or with the tamper-resistance of registered data. These features may provide several advantages for the weaker subject, both from a substantial and evidence perspective, whenever a commercial transaction is registered on a blockchain. At the same time, however, some pitfalls still arise. For example, the inner rigidity and automatism of blockchain-based solutions, including smart contracts, risk predetermining potentially burdensome effects, taking the form of abusive or unfair practices, which cannot be avoided by the weaker party precisely because they are established by the stronger one (see *supra*, chapter I, par. 2.2). For an in-depth analysis of the contribution that blockchain offers in hindering unfair trading practices, see L. RUSSO, *L'uso della blockchain nella lotta alle p.c.s. nei contratti di cessione nella filiera agroalimentare*, in *La rilevanza della digitalizzazione per un mercato agroalimentare sostenibile*, op. cit., pp. 109-131. More in general, on unfair trading practices, see *ex multis* A. JANNARELLI, *La tutela dei produttori agricoli nella filiera agro-alimentare alla luce della direttiva sulle pratiche commerciali sleali business to business*, in *Rivista di diritto agrario*, 2019, 1, I, pp. 3-59; L. RUSSO, *Le pratiche commerciali scorrette nella filiera agroalimentare tra diritto UE e diritto interno*, in *Diritto agroalimentare*, 2020, 2, pp. 401-425; F. ALBISINNI, *La direttiva 2019/633 tra PAC e mercati*, in *Rivista di diritto alimentare*, 2021, 4, pp. 7-21; A. GENOVESE, *Le pratiche commerciali sleali nella filiera agricola e alimentare*, in *Trattato di diritto alimentare Italiano e dell'Unione europea*, op. cit., pp. 226-238.

¹⁷⁰ *Supra*, chapter I, fn. 56-57. See also F. PRETE, *La Tracciabilità*, in *Trattato di diritto alimentare Italiano e dell'Unione europea*, op. cit., p. 359-360, where blockchain is consistently identified as the last bastion for traceability, calling for further exploration by legal scholars, mainly as to liability and regulatory issues.

¹⁷¹ In this regard, significant potentialities also open up for Regulation (EU) 2017/625 (Official Controls Regulation), mostly to finally introduce a common integrated system of official controls. As is well known, indeed, Regulation (EU) 2017/625 was approved to simplify and rationalise controls in the face of an excessive plurality of legislative sources, following the introduction of the Hygiene Package and its subsequent integrations. In this fragmented context, blockchain technology could contribute to systematically implementing the ensemble of instruments for official controls in the agri-food sector, not only for hygiene and health purposes but also in terms of quality, guaranteeing high and impartial controls while reducing the need for supervision and external coordination. This would result in a system that is fully aligned with the objectives of the Regulation which, among other things, promotes the adoption of unified information processing systems (see, recital 86: '*To support a more efficient management of official controls, a computerised information system integrating and upgrading as necessary all relevant existing information systems should be set up by the Commission, allowing for the use of advanced communication and certification tools, and for the most efficient use of the data and information related to official controls*'). and greater cooperation between Member States. In this sense, see G. SPOTO, *Gli utilizzi della Blockchain e dell'Internet of Things nel settore degli alimenti*, op. cit., p. 27. For an in-depth analysis of the

support with important repercussions both from a private and a public perspective¹⁷², further enhancing the transparency and reliability of supply chains¹⁷³.

At the same time, blockchain's well-known features make it a powerful tool to fight back against some phenomena that deeply affect the Italian agri-food sector, namely those placed in the broader scenario of food fraud¹⁷⁴, including those relating to the sophistication

European Regulation on official controls, see M. GIOIA, *Prime note sul regolamento n. 625/2017*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2017, 4, pp. 1-7; F. ALBISINNI, *Il Regolamento (UE) 2017/625: controlli ufficiali, ciclo della vita, impresa e globalizzazione*, in *Rivista di diritto alimentare*, 2018, 1, pp. 11-36; L. CARRARA, *Dal Regolamento (UE) 2017/625 alle misure applicative unionali e nazionali: un percorso innovativo ma non concluso*, in *Rivista di diritto alimentare*, 2020, 4, pp. 37-47. See also F. TIAN, *A supply chain traceability system for food safety based on HACCP, blockchain & Internet of things*, in *2017 International Conference on Service Systems and Service Management*, 2017, pp. 1-6, which illustrates a food supply chain traceability system for real-time tracing based on the interaction between blockchain technology and the IoT for the application of the HACCP system, providing a reliable, secure, and transparent platform, useful to all actors of the studied supply chain.

¹⁷² See S. ROLANDI, *La Blockchain nei sistemi agroalimentari*, *op. cit.*, pp. 647-648, which highlights how the possibility of tracing agricultural products and foodstuffs, on the one hand (i.e., the private one), allows operators and companies to control every single passage of production chains, and, on the other hand (i.e., the public one), represents a tool that competent authorities could adopt to facilitate and ease controls on the compliance with food safety regulation. Indeed, the analysed technology makes it possible to carry out controls quickly and automatically (that means, without the need for human intervention or interaction). If necessary, a blockchain-based system of control would allow identifying the source of potential problems in a short time and with extreme precision.

¹⁷³ See G. BARALLA, S. IBBA, M. MARCHESI, R. TONELLI, S. MASSINEO, *A blockchain based system to ensure transparency and reliability in food supply chain*, in *Lecture notes in computer science*, LNCS, 2019, 11339, p. 381: 'In fact, the blockchain technology can provide an appropriate solution in all those cases in which a system of relationships entirely based on a concept of trust and transparency is needed...', between all subjects composing the production chain, consumers included. In this regard, it is not irrelevant to recall that the principle of transparency is one of the pillars of Regulation (CE) 178/2002 and, not by chance, transparency is here declined in the perspective of consumers, as a means to ensure consultation of and information to citizens. As known, a few years ago the EU legislator adopted Regulation (EU) 2019/1381 (Regulation (EU) 2019/1381 of the European Parliament and of the Council of 20 June 2019 on the transparency and sustainability of the EU risk assessment in the food chain and amending Regulations (EC) No 178/2002, (EC) No 1829/2003, (EC) No 1831/2003, (EC) No 2065/2003, (EC) No 1935/2004, (EC) No 1331/2008, (EC) No 1107/2009, (EU) 2015/2283 and Directive 2001/18/EC), to ensure communication transparency as an essential element in the process of risk analysis, as well as to endorse the ability of consumers in accessing to transparent information and understanding them. In this sense, transparency is thus primarily defined in the interest of consumers. On these aspects, see F. ALBISINNI, *Trasparenza e scienze della vita nella codificazione europea*, in *Rivista di diritto alimentare*, 2019, 3, pp. 32-53; I. CANFORA, *L'evoluzione delle regole europee sulla trasparenza: verso un sistema di "Sicurezza alimentare 2.0"*, in *Rivista di diritto alimentare*, 2020, 3, pp. 4-14.

¹⁷⁴ For an overview of the criminal sanction in the context of food production, including food frauds, see E. MAZZANTI, *La disciplina sanzionatoria penale nella produzione degli alimenti*, in *Trattato di diritto alimentare Italiano e dell'Unione europea*, *op. cit.*, pp. 944-958. For an in-depth analysis of the broad area of food fraud, see F. BRICOLA, *Tipologia delle frodi nella normativa penale sugli alimenti* in ID., *Scritti di diritto penale*, 2nd ed., Milano, 1997.

and counterfeiting of agricultural and foodstuffs¹⁷⁵, as well as to *Italian Sounding*¹⁷⁶. These events, which are as widespread as difficult to detect and eradicate, are a huge scourge for the national agri-food industry, with heavy repercussions not just in economic and financial terms, but also in terms of reputation¹⁷⁷.

These latter profiles are further underlined within another perspective, that is the one of quality agri-food production, where blockchain technology is mostly attributed the task of controlling, assessing, and verifying the compliance with the rules that are necessary for the acquisition of certifications, as well as of guaranteeing more effective controls, as it is immediately clear in the case of products' specifications compliance to adopt the PDO or PGI indication in commercialised products¹⁷⁸.

More generally, then, it should be acknowledged that blockchain technology contributes to significantly improving the management of supply chains, also when it comes to agri-food production chains, with a wide range of effects. The improvement in efficiency immediately comes to light when faced with the possibility of converting the documentation into a digital

¹⁷⁵ A valuable use of blockchain that comes to the fore, in this case, is related to agri-food products' monitoring along the whole production chain, where the technology contributes to assessing and opposing possible manipulations of the goods. Consider, for example, the possibility of implementing blockchain in combination with other technologies or digital tools, such as automatic detection sensors, to verify compliance with correct storage conditions during transport, including, in particular, the conditions relating to temperature or the cold chain, essential to guarantee the preservation of the final product.

¹⁷⁶ The locution is commonly used to identify the well-known conduct of using words, images, colour combinations, geographical references, and marks that are evocative of Italy to promote products – mostly, though not exclusively, agri-food products – that are not made in Italy. On this aspect, see A. BRANDONISIO, *Il fenomeno dell'Italian Sounding e la tutela dell'agroalimentare italiano*, in *Cultura e diritti*, 2019, 1, pp. 101-127; S. MASINI, *Italian sounding: la pirateria commerciale ostacolo allo sviluppo dell'agroalimentare*, in *Geopolitica*, 2023, 2, pp. 310-327.

¹⁷⁷ On these aspects, see A. GIORDANO, *Blockchain per l'agrifood. Scenari, applicazioni, impatti*, op. cit., p. 12. It is precisely to address these threats that the national legislator recently intervened with the aforementioned Law No. 206, 27 December 2023, *Disposizioni organiche per la valorizzazione, la promozione e la tutela del made in Italy*.

¹⁷⁸ For some preliminary reflections on this topic, may it be allowed to refer to A. ISIDORI, *When Blockchain Technology and Intellectual Property Meet: Perspectives and Limits in the Protection of Geographical Indications*, in R. BIEDA, A. BLECHOVÁ, E. F. LÓPEZ, R. POTENZANO (eds.) *Legal Challenges of Disruptive Technologies*, op. cit., pp. 245-259. Blockchain implementation in the field of Geographical Indications will be the core content of chapter III. In this regard, it suffices to anticipate that the adoption of blockchain-based solutions could ease controls on the compliance of product specifications both from the *inside* and from the *outside*. From the inside, the establishment of a blockchain network involving all producers interested in the use of a Geographical Indication would allow all of them to access the information shared by others so that each GI producer could verify compliance with product specifications. From the outside, on the other hand, the technology works as a collaborative tool in the monitoring activities carried out by the competent authorities. In this way, indeed, blockchain would allow capillary and precise controls, even on small quantities of goods, both as to the compliance with the provisions contained in product specifications and with the rules of competition between enterprises, creating a system of transparency, fairness, and reliability, where any source of anomaly is immediately detected and hindered. These aspects are illustrated in G. SPOTO, *Gli utilizzi della Blockchain e dell'Internet of Things nel settore degli alimenti*, op. cit., pp. 28-29.

form. Although seemingly trivial, indeed, this consideration comes to terms with a reality that is still strongly paper-based, or grounded on basic, closed information systems, susceptible to human mistakes and voluntary tampering. Therefore, the passage to blockchain-based systems ensures the integrity of data and information, freely and immediately accessible to all subjects part of the network, including final consumers, without further information asymmetries. In this way, information becomes more accessible and more secure because verifiable.

Again, and from the same perspective, the advantages in economic terms that blockchain promises to achieve should additionally be recalled: an increase in economic efficiency that, at the same time, is both *reason* and *effect* of the general improvement in the degree of efficiency of production chains, a consequence of the many operations that the technology would make autonomous and automatic¹⁷⁹.

In light of the illustrated panorama, it can be said that, also in the agri-food sector, blockchain is an empty container, waiting to be filled¹⁸⁰. As seen, indeed, the features identifying the technology make it a useful tool to manage agri-food production chains, in general, adaptable to a wide range of different purposes. These functions can also significantly change depending on the type of blockchain intended to use: whether a public or a private blockchain, whether a permissionless or a permissioned blockchain, and also in different combinations with one or the other. At the same time, however, it is also clear that *all that glitters is not gold*: the implementation of blockchain-based solutions in the agri-food sector meets several difficulties, both *inner* challenges, linked to the technology itself, and *external* ones. It is fundamental, at this point, to move on to the analysis of these profiles, to identify and understand which obstacles still hinder the complete diffusion of blockchain technology in the agri-food sector.

¹⁷⁹ Indeed, it has been noted that blockchain also contributes to improving the financial efficiency of the agri-food sector, namely the costs associated with international trades, payment systems, agricultural and foodstuffs verification mechanisms, and, more generally, with all those operations that would be facilitated by the introduction of blockchain-based solutions handling them. Indeed, the waiver or reduction of human intervention significantly decreases the costs needed to accomplish them. See S. ROLANDI, *La Blockchain nei sistemi agroalimentari*, *op. cit.*, p. 648. The financial profiles related to the implementation of blockchain technology in agriculture are also illustrated in G. SYLVESTER, *E-Agriculture in Action: Blockchain for Agriculture. Opportunities and Challenges*, FAO, ITU, 2019, p. 20, which mostly focuses on the contribution to financial risk management.

¹⁸⁰ L. RUSSO, *Blockchain e smart contracts nei contratti della filiera agroalimentare*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea*, *op. cit.*, p. 368.

3.2 Not all that glitters is gold: enduring limits.

The critical aspects effectively limiting blockchain diffusion in the agri-food sector are usually grouped into three major areas¹⁸¹. The first area refers to technical and technological challenges, thus depending on the structure, features, and functioning of blockchain itself: this is the area where issues like the garbage in, garbage out (GIGO) problem, or scalability issues, are addressed. The second area is instead dedicated to institutional and regulatory challenges, mostly a consequence of the absence of a comprehensive and systemic framework to govern blockchain and, in general, distributed ledger technologies. Finally, the third area concerns infrastructural and capacity development challenges: here, topics like the disparity in the access to the infrastructure needed to make use of the technology, e.g., an internet connection, or the lack of know-how, are taken into account.

Starting with the first area, many scholars agree on the identification of the major technical and technological barriers hindering blockchain adoption in the agri-food sector¹⁸².

First of all, the lack of scalability is considered a serious challenge by the blockchain research community, as the technology is currently incapable of increasing or decreasing the resources needed to work, in terms of transaction throughput, computational energy, and costs, according to the different circumstances and cases¹⁸³. As was illustrated, the adoption of innovative technologies meets a big environmental barrier, mostly due to the large amounts of energy that these solutions require to work, especially with more pervasive tools, such as distributed ledger technologies. Looking at blockchain implementation in the agri-food sector, the lack of scalability thus appears rather relevant, especially in light of the environmental, economic, and social sustainability demands that agricultural and food productions are required to take on. Once bypassed, scalability would, in fact, allow calibrating the resources needed to run blockchain platforms according to what is needed.

¹⁸¹ See M. TRIPOLI, J. SCHMIDHUMBER, *Emerging Opportunities for the Application of Blockchain in the Agri-Food Industry*, *op. cit.*, pp. 21-23.

¹⁸² See, for example, F. ANTONUCCI, S. FIGORILLI, C. COSTA, *A review on blockchain applications in the agri-food sector*, in *Journal of the Science of Food and Agriculture*, 2019, 14, pp. 6129-6138.; J. ASTILL *et al.*, *Transparency in food supply chains: A review of enabling technology solutions*, in *Trends in Food Science & Technology*, 2019, 91, pp. 240-247; V. PANDEY, M. PANT, V. SNASEL, *Blockchain technology in food supply chains: review and bibliometric analysis*, *op. cit.*, p. 12.

¹⁸³ On this topic, M. CREYDT, M. FISCHER, *Blockchain and more – Algorithm driven food traceability*, in *Food Control*, 2019, 105, p. 49.

Equally problematic is the lack of interoperability, i.e., the incapability of blockchain platforms to share and communicate with one another when they are written in different programming languages, thus determining severe network isolation and information asymmetries. At present, there is in fact no standardised technology or shared software capable of making different architectures communicate with each other¹⁸⁴. If one specifically considers agri-food supply chains, the lack of interoperability conveys a paramount obstacle to the implementation of a data sharing systems that, as seen, are fundamental to advancing the digitalisation process in agriculture. Consequently, this critical profile also acquires a legal perception, as it also intertwines with legal issues involving data sharing.

A further technical obstacle, which also acquires quite a relevant legal value, relates to security, privacy, and data protection, and is strongly connected to blockchain's main function to permanently store data within a decentralised network made up of peer-to-peer communication. In this scenario, a first set of issues appears from the fact that blockchain platforms, especially the largest ones, are gold mines for data and risk becoming an easy target for hackers¹⁸⁵. At the same time, paramount questions arise as to how to ensure compliance with the EU regulations on data¹⁸⁶.

¹⁸⁴ This circumstance further poses the problem of coordinating the different intellectual property rights that enable the functioning of these highly innovative technological products. In this sense, see W. D'AVANZO, *Blockchain e smart contracts per la gestione della filiera agroalimentare, Potenzialità, progetti e problemi dell'internet del valore*, op. cit., p. 115. This aspect was addressed by the European Commission, as well. See EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Making the most of the EU's innovative potential. An intellectual property action plan to support the EU's recovery and resilience*, Brussels, 25.11.2020, COM(2020)760 final, p. 14, which emphasises the importance of developing appropriate regulatory solutions to grant the so-called Standard Essential Patents (SEP), fundamental to ensuring the continuous progression of digitalisation.

¹⁸⁵ J. ASTILL *et al.*, *Transparency in food supply chains: A review of enabling technology solutions*, op. cit., p. 245. More generally, this aspect already emerged in previous passages of this first chapter, when illustrating the main challenges in the diffusion of technological innovation and digitalisation in the agri-food sector. Among them, strong concerns by some farmers and operators of the sector concern data ownership and protection, in terms of both security from external attacks and confidentiality of shared information. See *supra*, chapter I, par. 1.2.

¹⁸⁶ Even the information recorded on a blockchain platform, in fact, raises the question of the qualification or nature of the involved data. On this point, P. GUARDA, *Riflessioni in merito alla natura giuridica dei dati nell'agricoltura di precisione: un'interpretazione teleologicamente orientata*, op. cit.. It follows, in particular, that one must understand whether this data should be brought back to the rules established by the European legislator for personal data, namely, Reg. (EU) No 2016/679. See Regulation (EU) No 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). The rules laid down under the GDPR, indeed, pose serious concerns for blockchain implementation, as the technology is not easily settled with the principles of data minimisation, purpose limitation, and storage limitation, laid down under art. 5, as well as the exercise of the rights attributed to the data subject, including the right to erasure, 'right to be forgotten', as provided under art. 17. For an in-depth analysis of these aspects, see M. ARISI, *Coltivare la fiducia? Una prospettiva giuridica su dati, blockchain e tracciabilità lungo la filiera agroalimentare*, in *Rivista di diritto alimentare*, Quaderno n. 1, 2023, pp. 66 ss.

In this perspective, it is fundamental to remember that the described hurdles may be lessened in the case of private and permissioned blockchains, which is exactly the blockchain model mostly adopted in agri-food supply chains, as the presence of a central organization coordinating the platform allows greater control and supervision over the entered data, and, at the same time, overcomes the obstacle linked to the identification of the subject responsible for the data itself. Nevertheless, hurdles connected to privacy, security, and data protection cannot be overlooked when framing the main shortcomings in blockchain implementation.

Finally, the issue of data authentication should be brought back to the area of technical and technological problems, as well. As widely illustrated, blockchain technology as such does not have a verification mechanism to establish and ensure whether the raw data are legitimate or not, i.e., whether they correspond to true and trustworthy information, even though, once recorded in the platform, they remain immutable. To overcome this major obstacle, the adoption of blockchain-based solutions often comes with the employment of sensors or other ‘supporting’ technologies, used to capture data from the outer world without the need to resort to human intermediation¹⁸⁷.

The second area refers, instead, to institutional and regulatory challenges¹⁸⁸, and it mainly involves two issues: on the one hand, the absence of an adequate framework for regulation¹⁸⁹; on the other hand, the lack of shared standards and guidelines for the adoption of blockchain-based solutions¹⁹⁰.

¹⁸⁷ On these aspects, see also J. F. GALVEZ *et al.*, *Future challenges on the use of blockchain for food traceability analysis*, in *Trends in Analytical Chemistry*, 2018, 107, pp. 222-232. Data authentication is the cornerstone of one of the main critical issues related to blockchain technology, that is, the ‘garbage in, garbage out’ (GIGO) problem, which will not be dwelt on again as it was extensively described in previous passages of this chapter. See *supra*, fn. 106 and 129.

¹⁸⁸ For an in-depth analysis of the regulatory challenges concerning, more in general, the implementation of distributed ledger technologies, see F. SARZANADI S. IPPOLITO, M. NICOTRA, *Diritto della Blockchain, Intelligenza Artificiale e IoT*, *op. cit.*

¹⁸⁹ See *supra*, chapter I, par. 2.3. As illustrated, and although any legal investigation concerning the regulation of innovative technologies must necessarily come to terms with the awareness that digital innovations change constantly, and evolve faster than law can, blockchain has been considered by renowned doctrine as a ‘fundamentally regulable technology’. See A. WRIGHT, P. DE FILIPPI, *Decentralised Blockchain Technology and the Rise of the Lex Cryptographia*, *op. cit.*, p. 51. Consequently, as seen, the European legislator tried to actively contribute to the debate around blockchain regulation through a *European Strategy for Blockchain*, with its proposals, initiatives, and projects. Nevertheless, it cannot be said that the efforts made in this direction have been sufficient to provide a uniform and comprehensive regulatory framework capable of supporting and encouraging companies in the race to blockchain adoption. In addition to this, it should be underlined that in recent years the political debate on blockchain development and regulation has significantly slowed down, to the benefit of other technologies (first and foremost, Artificial Intelligence) which have overwhelmingly caught the attention and interest of European institutions.

¹⁹⁰ In this perspective, the absence of voluntary but shared standards for implementing blockchain in agri-food production chains, mostly as to data recording activities, makes it even more difficult to create the necessary

These shortcomings are further worsened by the fact that, as blockchain has no geographical barriers, because the nodes composing the same network can hypothetically be located in many different geographical areas, it is not always easy or immediate for operators and companies willing to adopt blockchain-based solutions to identify the applicable regulatory framework. This is also the reason why the identification of worldwide shared standards or guidelines arises as a golden key to blockchain diffusion in many economic scenarios, including the agri-food sector.

Finally, the third area to consider involves infrastructure and capacity development challenges, which arise intensely when looking at the physical, social, and cultural contexts in which agri-food actors may find themselves operating. As trivial as it may seem, the first consideration concerns the fact that blockchain technology, just like all other digital tools, can only function properly if supported by adequate infrastructure, that is, above all, a strong and stable internet connection. In this perspective, a first element of criticality must be highlighted: indeed, despite the substantial public investments made in recent years towards this direction, the infrastructure available at the national level is still not sufficient to enable adequate management of the functions of these tools¹⁹¹. The most immediate consequences are, on the one hand, the exclusion of rural areas from access to these technologies and, on the other hand, the difficulties in implementing blockchain-based solutions in production chains, especially large ones, where the information flow requires a fast, secure, and uninterrupted connection.

In addition to this, the criticalities related to the costs that operators bear to introduce, update, and uptake new software for the management of blockchain-based solutions must be considered¹⁹², enlarged by the strong resistance to change and the heavy scepticism towards the introduction of such innovative technologies that, under many points of view, is still typical of

interconnections between different blockchain platforms, between networks and networks, and it stands next to the interoperability problem as an obstacle hindering data sharing in agriculture.

¹⁹¹ In this sense, W. D'AVANZO, *Blockchain e smart contracts per la gestione della filiera agroalimentare, Potenzialità, progetti e problemi dell'internet del valore*, op. cit., p. 114.

¹⁹² In this regard, it has been observed that in some production chains, under certain circumstances, the results provided by blockchain adoption – namely, digitising the supply chain to increase efficiency and reduce costs, disputes, and fraud, while providing more accurate and precise information – can be also achieved through centralised, less-costly, digital solutions, that do not necessarily require the decentralisation provided by blockchain. This is the conclusion offered in S. L. BAGER *et al.*, *Blockchain is not a silver bullet for agro-food supply chain sustainability: Insights from a coffee case study*, in *Current Research in Environmental Sustainability*, 2022, 4, p. 10. In the case study addressed there, in fact, ‘...the lack of digitization, the low value of most products, and the lack of technological know-how and access among many actors implies that a blockchain is likely too costly to implement and brings too few benefits to justify the expense. These problems are likely to apply to many other coffee and agro-food supply chains, especially mass-market, non-segregated chains involving a large number of smallholder farmers’.

the agri-food sector. These obstacles are partially determined also by the lack of sufficient know-how¹⁹³, which prevents the complete appreciation of the contribution that blockchain technology might provide and, consequently, hinders its widespread adoption, especially in smaller realities¹⁹⁴. In this perspective, capacity development and awareness-raising programs still prove to be necessary for the involved actors – mostly farmers and the smallest operators, who risk remaining marginalised, because unable to keep up with the progress, until they increase their awareness and capacity in this area – and the hope is that governments and intergovernmental organisations do not remain silent to this need.

This framing makes it possible to identify several critical profiles that, as seen, do impact the diffusion of blockchain technology in the agri-food sector¹⁹⁵. These long-lasting gaps should, however, act as an incentive to move forward with blockchain research. It would probably be a mistake, indeed, to let these obstacles be diriment in determining the failure of the technology, mainly in light of the manifold potentialities it promises to achieve.

¹⁹³ These considerations are also reflected in The Digital Economy and Society Index (DESI) report for the year 2022, which summarises indicators of Europe's digital performance and tracks the progress of EU Member States. The report is available at the following link: <https://digital-strategy.ec.europa.eu/en/policies/desi> (last accessed 1.3.2025). The report for the year 2022 is the most recent available as, starting from 2023, the DESI was integrated into the Report on the state of the Digital Decade, used to monitor, more in general, the progress of EU countries towards digital targets. What is mostly interesting to underline is that, concerning the 'Human Capital', i.e., the digital skills possessed by the citizens of different Member States, the DESI report of 2022 places Italy in the last slots when compared to the other European countries (see p. 20). It must be admitted, therefore, that Italy records very low levels of digital skills in its citizens, an element that inevitably spills over to the degree of the use of technologies in daily and economic activities.

¹⁹⁴ These aspects are well outlined in M. TRIPOLI, J. SCHMIDHUMBER, *Emerging Opportunities for the Application of Blockchain in the Agri-Food Industry*, op. cit., p. 22, which underline how the complexity of DLTs and blockchain represent a significant challenge for the wide-spread understanding of the technology, which could hinder their adoption in the short term. *'It is unrealistic to expect that all participants will adopt the technology initially, as there will likely be hesitation and resistance from some actors. In addition, some will lack the skills and knowledge required (...). The lack of such digital skills will be an obstacle for adoption, especially for MSMEs'*.

¹⁹⁵ To the point that some have critically wondered whether it is really correct to state that blockchain is a win-win solution to address all the challenges that agriculture and the food sector are currently experiencing. The conclusion is sometimes negative, as in S. PEARSON et al., *Are Distributed Ledger Technologies the panacea for food traceability?*, in *Global Food Security*, 2019, 20, pp. 145-149.

CHAPTER II

Approaching the field of interest. Geographical Indications between origin and quality, tradition and innovation

SUMMARY: 1. Framing Geographical Indications. - 1.1. The core components of the system: Quality. - 1.2. (follows) Origin. - 1.3. The multidimensional and multifunctional appearance of Geographical Indications. - 1.3.1. The pursuit of the market. Economic-related benefits of GIs. - 1.3.2. Traditional knowledge, cultural heritage, and biodiversity conservation. Non-market functions of GIs. - 2. The European Union framework for Geographical Indications - 2.1. Prodrumes: EU quality schemes and their thirty-year legislative evolution. - 2.2. New perspectives: protected designation of origin and protected geographical indication under Regulation (EU) No 2024/1143. - 2.2.1. Protection of PDO and PGI and *ex officio* protection. - 2.2.2. PDO and PGI as ingredients. - 2.2.3. Looking at the procedures: Registration, opposition, and amendments to product specifications. - 3. Between the known and the new. Challenges of Geographical Indications. - 3.1. Infringements. - 3.1.1. The broad scope of evocation through the lens of the Court of Justice of the European Union. - 3.1.2. Protecting Geographical Indications on the *World Wide Web*. - 3.2. The hard path to sustainability.

1. Framing Geographical Indications.

The reflections presented in the previous chapter enabled to highlight and understand how agriculture and the agri-food sector are adapting to a relentless digitalisation process, which is already a reality and is even strongly supported and incentivised at an institutional level. In the farsighted vision of the European legislator, digitalisation is conceived as one of the fundamental pillars for building present and future policies for the agri-food sector¹⁹⁶.

Taking a step forward, and starting to approach the field of interest of the research, it is out of question that these considerations also extend to the specific and peculiar context of

¹⁹⁶ *Supra*, chapter I, par. 1.1.

Geographical Indications (GIs)¹⁹⁷, agri-food¹⁹⁸ intellectual property rights¹⁹⁹ fundamentally rooted around the element of quality which, in this scenario, is unbreakably anchored to the origin of the product, i.e., the provenance from a specific geographical area or territory which confers on the product certain quality, characteristics, or a reputation²⁰⁰.

In general terms, names registered as Geographical Indications are indeed protected as intellectual property rights within the EU, in accordance with Reg. (EU) No 608/2013²⁰¹, in the

¹⁹⁷ In this regard, a clarification seems appropriate. Throughout this work, reference will always and exclusively be made to the term 'Geographical Indications', and to the meaning it expresses. This is due to two main reasons: first, for the sake of simplicity; second, because the adopted perspective is that of the European framework, thus the legislation on Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI). These are, indeed, the Geographical Indications protected and enforced under the EU legislation. However, some of the considerations that will follow, particularly those concerning the identification of core components and functions, as well as the main challenges arising in the governance and protection of GIs, apply as well to the '*indications of source*' considered by the Paris Convention for the Protection of Industrial Property of 1883 and by the Madrid Agreement of 1981, to the '*designations of origin*' referenced in the Lisbon Agreement of 1958, and to the '*geographical indications*' established by the TRIPs Agreement. These aspects, and the worldwide regime for the protection of GIs, will be briefly mentioned below. However, except for a few references, the focus of this work and this second chapter will strictly be on the EU *sui generis* regime for GIs, as the scope here is to frame the field of interest by providing a general overview of the main features, functions, challenges, and applicable discipline at the European level, to build a bridge to the core of the research, which will be addressed in the third chapter.

¹⁹⁸ On this point, a further clarification is necessary. For the thesis, only Geographical Indications for agricultural products and foodstuffs will be taken into account, i.e., the Geographical Indications for wine, spirit drinks, and agricultural products. Indeed, these are the products that, so far, have been receiving the special protection provided by the EU *sui generis* regime for GIs. It is nevertheless important to recall that the European legislator has extended the system of protection built for Geographical Indications to craft and industrial products, as well. This is the case of Regulation (EU) 2023/2411 of the European Parliament and of the Council of 18 October 2023 on the protection of geographical indication for craft and industrial products and amending Regulation (EU) 2017/1001 and (EU) 2019/1753, which established the registration and protection of Geographical Indications designating craft and industrial products, taking up in many aspects, including the definitions and tools of protection, from the experiences developed in the agri-food sector. On these aspects, see A. ZAPPALAGLIO, F. GUERRIERI, S. CARLS, *Sui Generis Geographical Indications for the Protection of Non-Agricultural Products in the EU: Can the Quality Schemes Fulfil the Task?*, in *IIC – International Review of Intellectual Property and Competition Law*, 2020, 51, pp. 31-69; C. BUDILEANU, *European Union Geographical Indications for Craft and Industrial Products. A Comparative Look at Geographical Indications for other types of products*, in *Lex et Scientia International Journal*, 2024, 1, pp. 481-493.

¹⁹⁹ The intellectual property dimension of Geographical Indications is the core of the comparative work proposed in M. FERRARI, *La dimensione proprietaria delle Indicazioni Geografiche. Uno studio di diritto comparato*, Trento, Editoriale Scientifica, 2015.

²⁰⁰ For general overviews of the Geographical Indications systems in the EU, and its evolution through time, together with the works that will be mentioned in the course of the chapter, see, L. PETRELLI, *Prodotti DOP (denominazione di origine protetta), IGP (indicazione geografica protetta) e certificazione*, in *Rivista di diritto agrario*, 1999, 1, I, pp. 72-85; G. SGARBANTI, *DOP, IGP e STG: strumenti per la valorizzazione della qualità dei prodotti agroalimentari*, in *Annali. Accademia Nazionale di Agricoltura*, CXXV, 2005; S. BOLOGNINI, *La legislazione europea per la valorizzazione delle tipicità enogastronomiche*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2011, 12, pp. 751-759; A. I. TRAPÈ, *Le indicazioni geografiche: un sistema plurale tra esigenze di semplificazione, diversificazione e tutela*, in *Rivista di diritto agrario*, 2019, 4, I, pp. 664-695; S. MASINI, *Le indicazioni geografiche*, in *Diritto agroalimentare*, 2019, 3, pp. 447-470. For a comparative analysis, see M. FERRARI, *Il nesso fra origine geografica e qualità dei prodotti agroalimentari: i diversi modelli di tutela europei e nordamericani*, in *Rivista di diritto agrario*, 2014, 2, I, pp. 142-198.

²⁰¹ Regulation (EU) No 608/2013 of the European Parliament and of the Council of 12 June 2013 concerning customs enforcement of intellectual property rights and repealing Council Regulation (EC) No 1383/2003.

same way as trademarks, copyrights, and patents are, but with some peculiarities deriving from the *public nature* of GIs. To reward producers for their additional efforts to obtain quality agri-food products, as well as to protect them from unfair practices, ‘counterfeit goods’ are also the goods infringing a Geographical Indication in the Member State where they are found²⁰². As a consequence, the use of a PDO or PGI to designate an agricultural product or foodstuff that does not comply with the relevant product specification infringes the intellectual property right stemming from that PDO or PGI.

As will be shown in the course of the second chapter, the realm of Geographical Indications is continuously progressing. Today, more than ever, Geographical Indications must come to terms with an internal tension caused, on the one hand, by the will to preserve and withstand their typical features (meaning the link with the territory or area of origin and the consequent relation with tradition, population, and cultural heritage) and, on the other hand, by the need to innovate and evolve to adapt and react to old and new challenges, such as those connected with the protection of products and designations online, or those related to sustainability. Facing these hurdles, innovation – above all, as it is most relevant here, technological innovation – represents a potential ally, whose contribution cannot be disregarded by those involved in the governance and enforcement of Geographical Indications, primarily producers and producer groups²⁰³.

As anticipated, this chapter intends, first of all, to frame the context of interest. To this end, the first paragraph will put together Geographical Indications, their core components (with a specific focus on the concepts of quality and origin), and their multidimensional and

²⁰² Under Art. 5, par. 2, Reg. (EU) No 608/2013, ‘counterfeit goods’ means: ‘(a) goods which are the subject of an act infringing a trade mark in the Member State where they are found and bear without authorisation a sign which is identical to the trade mark validly registered in respect of the same type of goods, or which cannot be distinguished in its essential aspects from such a trade mark; (b) goods which are the subject of an act infringing a geographical indication in the Member State where they are found and, bear or are described by, a name or term protected in respect of that geographical indication; (c) any packaging, label, sticker, brochure, operating instructions, warranty document or other similar item, even if presented separately, which is the subject of an act infringing a trade mark or a geographical indication, which includes a sign, name or term which is identical to a validly registered trade mark or protected geographical indication, or which cannot be distinguished in its essential aspects from such a trade mark or geographical indication, and which can be used for the same type of goods as that for which the trade mark or geographical indication has been registered’.

²⁰³ These reflections are confirmed by the increasing interest of stakeholders, involved parties, and their associations, in the digitisation and technological innovation in the context of GIs governance. Consider, for example, the recent FAO International Conference on Geographical Indications for 2025 (FAO, *Worldwide perspectives on Geographical Indications. International conference for researchers, policy makers and practitioners. Innovations and traditions for sustainability*, Rome, 18-21.02.2025). On this occasion, it was illustrated how the opportunities and advantages digitalisation can bring to Geographical Indications, especially for certification and control processes, are undeniable, as they make these activities more effective and inclusive.

multifunctional appearance. Subsequently, an attempt will be made to outline the legislation applicable to Geographical Indications within the European regulatory context, specifically the EU *sui generis* regime for GIs. In doing so, the chapter will delve into the novel legislation introduced under Reg. (EU) No 2024/1143²⁰⁴, particularly focusing on those innovations which appear as mostly relevant for this work and the main research question that will be addressed in chapter III. In its last paragraph, then, the chapter will illustrate some of the main (old and new) challenges that GIs face and that producers and producer groups meet. Starting from these, an attempt will be made to identify and outline the possible spaces of intersection with technological innovation, to assess if, and to what extent, digitalisation can play a role in this panorama, as well as to act as a tool at the service of GIs.

1.1. The core components of the system: Quality.

The two fundamental pillars on which the GI system for agricultural products and foodstuffs is built, i.e., its *core components*, are most certainly to be found in the concepts of *quality* and *origin*²⁰⁵.

Indeed, as mentioned above, Geographical Indications form part of the European Union's quality policy, which, in this particular context, aims to protect the names and designations of specific products to promote their unique characteristics, which are linked to their geographical origin and traditional skills. In other words, product designations can benefit from a Geographical Indication and enjoy the *sui generis* regime of protection established at the EU level when they possess a specific link with the territory of origin, as it is this origin which gives these products certain characteristics, specific qualities, or a particular reputation.

These are, after all, the elements that immediately come to the fore when looking at Reg. (EU) No 2024/1143, and to the regulatory definitions of PDO and PGI²⁰⁶ therein included. Since

²⁰⁴ Regulation (EU) No 2024/1143 of the European Parliament and of the Council of 11 April 2024 on geographical indications for wine, spirit drinks and agricultural products, as well as traditional specialties guaranteed and optional quality terms for agricultural products, amending Regulations (EU) No 1308/2013, (EU) 2019/787 and (EU) 2019/1753 and repealing Regulation (EU) No 1151/2012.

²⁰⁵ F. ALBISINNI, *L'origine dei prodotti agro-alimentari e la qualità territoriale*, in *Rivista di diritto agrario*, 2000, I, pp. 23-43.

²⁰⁶ Under Article 46, par. 1 and par. 2, Reg. (EU) No 2024/1143, a designation of origin of an agricultural product is '...a name which identifies a product: (a) originating in a specific place, region or, in exceptional cases, a country; (b) whose quality or characteristics are essentially or exclusively due to a particular geographical environment with its inherent natural and human factors; and (c) the production steps of which all take place in the defined geographical area'; a geographical indication is instead '...a name which identifies a product: (a) originating in a specific place, region or country; (b) whose given quality, reputation or other characteristic is

both refer to names identifying products originating from a place, region, or (exceptionally) a country²⁰⁷, whose quality or features are essentially attributable to that territory, it is soon

essentially attributable to its geographical origin; and (c) at least one of the production steps of which takes place in the defined geographical area’.

²⁰⁷ In this regard, it should be clarified that it was Reg. (EU) No 1151/2012 [Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality schemes for agricultural products and foodstuffs] which ‘reshaped’ the definitions of PDO and PGI and delated any uncertainty as to the possibility of recognising, as protected designations or indications, non-geographical names that are nonetheless capable of identifying a product as originating from a specific territory. See, A. DI LAURO, *Le denominazioni d’origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, in *Trattato di diritto alimentare Italiano e dell’Unione Europea*, op. cit., p. 608. This clarification is far from trivial and, as is known, it also reflects the teachings of the Court of Justice case law. The reference, in particular, is to the famous ‘Feta’ case. The designation for this brined, curd, white cheese, made from sheep’s and goat’s milk bred according to traditional systems adapted to the pedoclimatic features of mainland Greece and the Lesbos’ island, was registered as PDO under Commission Regulation (EC) No 1107/96 of 12 June 1996 on the registration of geographical indications and designations of origin under the procedure laid down in Article 17 of Council Regulation (EEC) No 2081/92. However, the registration was immediately opposed by some countries (The Kingdom of Denmark, the Federal Republic of Germany, and the French Republic), based on the circumstance of the widespread and established commercial use of the same name for the generic designation of brined, curd, white cheeses produced in States other than the Hellenic Republic. The registration was thus annulled by the Court of Justice (Judgment of the Court of 16 March 1999, *Kingdom of Denmark, Federal Republic of Germany and French Republic v Commission of the European Communities*, joined cases C-289/96, C-293/96 and C-299/96). On this case law, see L. COSTATO, *Brevi note a proposito di tre sentenze su circolazione dei prodotti, marchi e protezione dei consumatori*, in *Rivista di diritto agrario*, 1999, II, pp. 157-161; A. DI LAURO, *Denominazione di origine protetta e nozione di dominazione generica: il caso «FETA»*, *ivi*, pp. 161-174. After some time, the protected designation of origin was again registered under Commission Regulation (EC) No 1829/2002 of 14 October 2002 amending the Annex to Regulation (EC) No 1107/96 with regard to the name ‘Feta’, adopted following the opinion of the Scientific Committee on Designations of Origin. Indeed, the Committee concluded unanimously that the designation ‘Feta’ was non-generic, also pointing out that a PDO or PGI can be considered as having become the common name of a product only when, in the relevant territory, no significant part of the public concerned still considers the indication as a geographical indication. The Kingdom of Denmark and the Federal Republic of Germany again opposed the registration; however, the Court of Justice dismissed the action (Judgment of the Court of 25 October 2005, *Federal Republic of Germany and Kingdom of Denmark v Commission of the European Communities*, joined cases C-465/02 and C-466/02). The Court, indeed, finally seemed to favor the promotion of the historical and cultural identity of territories and the practices and methods handed down through generations by recognising the causal link between the geographical environment and the features based on local customs, thus confirming the decision to protect the challenged ‘Feta’ designation. Indeed, although ‘Feta’ is an *indirect* geographical name (which makes it difficult to specify the link with the area of origin), the Court recognises that the quality and distinctiveness of the product asserted in communication with the consumer relate exclusively to the Hellenic community. For an analysis of this case law see C. BENATTI, *Il revirement della Corte di giustizia sul caso «Feta»*, in *Rivista di diritto agrario* 2006, II, pp. 110-129; S. MASINI, *Territorio di origine, nomen e mercato: il caso Feta ancora alla ribalta*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2006, III, p. 168. Recently, the protection of the designation again requested the intervention of the Court of Justice, which was called upon to rule on the possibility of exporting to third countries cheese products that, despite not complying with the product specification for the PDO, are nevertheless named ‘Feta’ (see, Judgment of the Court of 14 July 2022, *European Commission v Kingdom of Denmark*, case C-159/20). The Court observed that products that are produced within the EU and intended for export to third countries are not excluded from the prohibition established under Art. 13 of (the now repealed) Reg. (EU) No 1151/2012, which prohibits the unlawful use of PDO and PGI. Therefore, by failing to prevent and put an end to the misuse carried out on its territory, Denmark had failed to fulfil its obligations. For more precise information on the latest case law, see G. TORRE, *La tutela delle indicazioni geografiche originarie dell’Unione europea oggetto di esportazione in Paesi terzi. Il caso «Feta» nel contesto*

explained why it is from these two elements, their meanings, and the effects they have on Geographical Indications, that we intend to start to frame and understand the field of interest.

Moving on from the first identified component, it must be acknowledged that the concept of quality is rather difficult to grasp, both in general terms and, as it is mostly relevant here, in legal terms²⁰⁸. Indeed, despite the efforts of renowned authors and despite the clues that can be gleaned from positive law and case law, which will be illustrated soon after, quality lacks a unique and precise definition and is thus ideally ascribable to a wide range of meanings²⁰⁹.

In framing this element, the first obstacle is thus a conceptual one, as it concerns the definition attributable to the idea of agri-food quality; and this question is far from being redundant, especially when legislation attaches legal effects to it, as in the case of Geographical Indications. Therefore, a preliminary reconstruction of the concept of quality has always seemed indispensable and unavoidable²¹⁰.

In attempting to overcome this hurdle, a primary work tool comes from the doctrine²¹¹ and from the comprehensive reconstructions that scholars have provided over time.

And yet, even in this perspective, agri-food quality comes to light as a multidimensional and fluid concept, difficult to grasp in a single and unified direction.

della giurisprudenza della Corte di giustizia, in *Diritto e giurisprudenza agraria alimentare e dell'ambiente*, 2022, 6, pp. 1-13.

²⁰⁸ See P. BORGHI, *Qualità alimentare e controlli*, in R. SAIJA, P. FABBIO (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, Milano, Wolters Kluwer, 2019, p. 84, who, in addressing the relationship between quality and controls, moves from the awareness of the evanescence of the concept of quality.

²⁰⁹ This aspect has been deeply analysed by the doctrine. See, *ex multis*, G. MACCIONI, *L'ambiguità della qualità*, in *Rivista di diritto alimentare*, 2009, 1, pp. 31-32; A. BONADONNA, *I diversi significati del termine "qualità" nel settore agroalimentare*, in G. PEIRA, A. BONADONNA, S. ARNOLDI (eds.), *La qualità nel settore agroalimentare. Sistemi di qualità e strumenti innovativi*, Torino, Celid, 2014, pp. 8-37; F. ALBISINNI, *Le declinazioni della qualità agroalimentare. Regole e prospettive*, in R. SAIJA, P. FABBIO (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato, op. cit.*, pp. 207-217; M. GIUFFRIDA, *Declinazioni della qualità alimentare nelle regole europee*, *ivi*, pp. 13-29.

²¹⁰ See A. GERMANÒ, *Qualità alimentare: un'Europa, due sistemi*, in *Rivista di diritto alimentare*, 2009, 1, p. 22: 'Preliminare, cioè, è la necessità di avere chiaro il concetto di qualità (...) nonostante questa "deificazione della qualità" o, probabilmente, proprio per siffatta deificazione, ci si lascia, di solito, a un generico discorrere, ad espressioni indefinite quali "cibi saporiti, tradizionali, genuini", senza la preliminare acquisizione del concetto "qualità", la cui precisione è, invece, assolutamente necessaria – perché vincolante – nelle elaborazioni giuridiche'.

²¹¹ As it is clear, scientific literature on the topic of agri-food quality is quite vast. In addition to the contributions mentioned in the previous and following footnotes, see, *ex multis* L. PETRELLI, *Qualità, politiche di qualità dei prodotti agricoli e principio di libera circolazione delle merci nel mercato comunitario*, in E. CAPIZZANO (ed.), *Diritti fondamentali qualità dei prodotti agricoli e tutela del consumatore*, Camerino, Università di Camerino, 1993, pp. 67-94; F. ALBISINNI, *La qualità in agricoltura e nell'alimentazione*, in F. ADORNATO, F. ALBISINNI, A. GERMANO' (eds.), *Agricoltura e alimentazione. Principi e regole della qualità. Disciplina internazionale, comunitaria, nazionale*, Atti del Convegno di Macerata del 9-10 ottobre 2009, Milano, Giuffrè, 2010; F. CAPELLI, *Tutela della qualità dei prodotti agroalimentari sotto il profilo giuridico: riflessioni sulla riforma della disciplina dell'Unione europea*, in L. COSTATO, P. BORGHI, L. RUSSO, S. MANSERVISI (eds.), *Dalla riforma del 2003 alla PAC dopo Lisbona. I riflessi sul diritto agrario, alimentare e ambientale*, Napoli, Jovene, 2011.

Indeed, by its very nature (and by intuition), quality is certainly contrasting with *quantity*; but neither can it be absorbed or overlapped with the concepts of ‘hygiene’ or ‘food safety’²¹², as conveniently pointed out²¹³. At the same time, quality is also conceived as a ‘social construction’ where the human factor is likewise relevant and must be taken into account²¹⁴.

As a result, the idea of quality takes on many shades, which not only involve the definition itself, but also the scope and the width of the concept²¹⁵.

In addition to this, quality can also mutate its meaning depending on the subject that is taken into consideration²¹⁶. In other words, quality reflects a different perception and takes on several connotations depending on whether, for example, it is observed from the perspective of *producers* (who, by nature, tend to look at the inner features of products and the production techniques)²¹⁷ or from the viewpoint of *consumers* (who, on the other hand, normally emphasize other elements, which reflect their preferences, needs, and purchase choices)²¹⁸.

It follows, therefore, that the concept of quality is not only multidimensional and fluid, as it is abstractly endowed with multiple meanings. In this sense, it is also *relative*, because it is conditioned by the blurry and shimmering perception of consumers.

²¹² As is known, the General Food Law sets the requirements that must be present in all products for them to be qualified as food. More precisely, under art. 14, Reg. (CE) 178/2002, to be placed on the market, food must not be unsafe; food shall be deemed unsafe if it is considered to be injurious to health or unfit for human consumption. In this regard, it is also interesting to recall the reflection proposed in A. BARDI, *La Tutela della Proprietà Intellettuale Agroalimentare nel mercato Nazionale, Europeo e Internazionale*, PhD Thesis, Università di Foggia, 2022-2023, p. 16, who consequently underlines how, for the European paradigm, both food safety and hygiene are not to be considered as part of the concept of quality, but rather as ‘*ontological prerequisites*’ of any foodstuff.

²¹³ A. GERMANÒ, *Qualità alimentare: un’Europa, due sistemi*, *op. cit.*, p. 22.

²¹⁴ A. JANNARELLI, *La qualità dei prodotti agricoli: considerazioni introduttive ad un approccio sistemico*, in *Diritto e Giurisprudenza agraria, alimentare e dell’ambiente*, 2004, 1, p. 8.

²¹⁵ G. MACCIONI, *L’ambiguità della qualità*, *op. cit.* p. 31. The A., indeed, observes that quality can be discussed from multiple perspectives: from the viewpoint of commodities, addressing commercial features and external appearance; from the nutritional standpoint, focusing on the composition and ingredients; from the angle of organoleptic quality, thus considering sensory and taste-related aspects of the product; from the viewpoint of hygiene, specifically regarding food safety standards and requirements; and finally from the environmental, ethical, and cultural perspectives. The A. also mentions quality in relation to the origin of the product, whose connection is with protected designations of origin and protected geographical indications. See the cited article also for some bibliographical references on these profiles.

²¹⁶ *Ibidem*.

²¹⁷ The perspective of producers raises the issue of the potential (or presumed?) objectivity of quality, as ‘objective’ quality is that which refers to physical, chemical, etc., features of the product. In this sense, see A. CAVICCHI, *Qualità alimentare e percezione del consumatore*, in *Agriregionieuropa*, 2008, 15.

²¹⁸ *Ibidem*. In opposition to the just-mentioned ‘objective’ quality, the perspective of consumers sheds light on a ‘subjective’ quality, which is instilled with the perception of consumers. The ‘subjective’ quality may differ from the *actual* one, as it is exemplified by the fact that different consumer groups, in diverse circumstances, may have different opinions on the quality of the same product.

It is further illustrative of these considerations that the very definition of quality developed by the International Organization for Standardization (ISO)²¹⁹ has deeply changed over time²²⁰. Whereas the ISO 8420:1986 standard, drawn up more than 30 years ago, defined quality as ‘...*the set of properties and characteristics of a product or service that gives it the ability to satisfy expressed or implied needs*’, the more recent ISO 9000:2015 standard states that quality is the ‘*degree to which a set of inherent characteristics or distinguishing features of an object* (meaning a product, service, process, person, organization, system, or resource) *fulfils requirements*’, where ‘requirements’ signifies expectations that may be expressed. In other words, that means that a product, service, process, etc., is qualitatively high if it meets the expectations and needs of the consumer. In this way, the standard emphasises that quality is not satisfied with meeting minimum levels but requires continuous improvement and consumer satisfaction.

In the wake of these reflections, it seems possible to draw a line between two ideas: the ‘quality of agri-food products’ and ‘quality agri-food products’²²¹. These two expressions, albeit similar, actually reflect different notions: in the first case, the term quality is used as a synonym of ‘features’ and ‘properties’, which allow the product to be classified; in the second case, the term is used to express the presence of a *quid pluris*, a *something* which adds value to an already-classified product.

In an effort to shed some light on the topic, a second work tool comes from tips in positive law that addressed the theme of agri-food quality. Reference, in particular, is to the

²¹⁹The International Organization for Standardization (ISO) is an independent, non-governmental international organization that develops and publishes a wide range of proprietary, industrial, and commercial standards. It was established in 1947. It is composed of national standards bodies from over 160 countries, with one member per country. These members collaborate in technical committees whose purpose is to draft standards based on consensus. ISO standards aim to ensure quality, safety, efficiency, and interoperability across industries and borders, and, despite operating on voluntary adherence, its standards often become the basis for regulations or best practices worldwide. For a comprehensive analysis, see C. N. MURPHY, J. YATES, *The International Organization for Standardization (ISO): Global Governance through Voluntary Consensus*, Londra, Routledge, 2009.

²²⁰ For an overview see D. VITI, *Certificazioni di qualità di organismi privati*, in *Trattato di diritto alimentare Italiano e dell’Unione Europea*, op. cit., pp. 177-185. On the ISO definition of quality and its applicability to agri-food production, see also L. PETRELLI, *I regimi di qualità nel diritto alimentare dell’Unione europea. Prodotti DOP, IGP, STG, biologici e delle regioni ultraperiferiche*, Napoli, Editoriale Scientifica, 2012, pp. 83-88.

²²¹ The juxtaposition is provided in M. GIUFFRIDA, *Declinazioni della qualità alimentare nelle regole europee*, in R. SAIJA, P. FABBIO (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, op. cit., p. 17. In the translation from Italian into English, the immediacy of the distinction between ‘quality of agri-food products’ and ‘quality agri-food products’ is somehow faded, while it can instantly be caught in the Italian version. The Author, in fact, speaks of ‘*qualità dei prodotti agricoli e alimentari*’ and ‘*prodotti agricoli e alimentari di qualità*’.

Green Paper on agricultural product quality²²², which, despite being a *soft law* act²²³, apparently clarifies the concept of quality²²⁴. Although it has not been free from criticisms by some authors who have investigated and analysed it, it is precisely this document that we want to examine further, to understand whether, and if so, what the Green Paper can add to the ongoing debate on quality.

Among the many profiles of reflection that surface from a reading of the Green Paper, two main aspects grasp our attention.

On the one hand, the Green Paper begins by highlighting the scope of the European quality policy, i.e., the reason why the EU should bet on quality schemes, which turns out to be globalisation²²⁵. Indeed, in a scenario where EU farmers are faced with evergreen commercial challenges and must deal with products from other countries, where production costs are lower and so is the final price, quality is perceived as the '*most potent weapon*' EU farmers can use to make their way in globalised markets. As this condition has essentially remained unchanged, the reflection does not lose its meaning even in present times.

Then, some passages in the Green Paper define the concept of quality, but fail to do so unambiguously and straightforwardly; on the contrary, in the words of the Commission, quality is emphasised under different lenses.

²²² COMMISSION OF THE EUROPEAN COMMUNITIES, *Green Paper on agricultural product quality: product standards, farming requirements and quality schemes*, Brussels, 15.10.2008, COM(2008) 641 final. The Green Paper is an official document issued by the European Union to trigger debate and discussion on the EU policies on the quality of agricultural products. As it appears from the reading of the document, the Green Paper represents a first step for the creation of a global strategy for the EU agri-food quality, including the promotion and valorisation of local producers, as well as the acknowledgment of the diversity and specificity of local productions. For an extensive review on the Green Paper, see, *ex multis*, A. GERMANÒ, *Il Libro verde della Commissione europea del 15 ottobre 2008: alla ricerca di una definizione di alimenti di qualità*, in *Rivista di diritto agrario*, 2008, 4, I, pp. 480-500; AA. VV., *Rivista di diritto alimentare*, 2009, 1; A. GERMANÒ, *La qualità dei prodotti agro-alimentari secondo la Comunità europea*, in *Rivista di diritto agrario*, 2009, 3, I, pp. 359-395; G. MACCIONI, *Qualità delle produzioni e "sostegno specifico"*, in *Rivista di diritto alimentare*, 2009, 3, pp. 45-48.

²²³ As is known, Green papers are part of the EU legal instruments, available to the European institutions to carry out their tasks. Indeed, in addition to the instruments listed in Article 288 of the TFEU, practice has led to the development of a whole series of non-binding documents, including resolutions, conclusions, communications, green papers, and white papers. In this context, Green papers are documents published by the European Commission to stimulate discussion on given topics at the European Union level, as they invite the involved parties to participate in a consultation process and debate based on the proposals they put forward. Green papers may give rise to legislative developments that are then outlined in White papers, which contain proposals for EU action in a specific area.

²²⁴ G. MACCIONI, *L'ambiguità della qualità*, *op. cit.* p. 32.

²²⁵ COM(2008) 641 final, p. 4: '*As globalisation spreads, products from emerging countries with low production costs are putting greater pressure on EU farmers. There is growing competition for both agricultural commodities and value-added products. Faced with these new commercial challenges, the EU farmers' most potent weapon is quality.*'

Initially, quality is considered in relation to food safety²²⁶. However, immediately afterwards, willing to identify the ‘other aspects’ that can strengthen quality from a global and globalised perspective, the Green Paper goes on to connect the concept to consumers and their expectations. In this sense, the Commission states that *‘Quality is about meeting consumer expectations’*²²⁷ and thus the consumer becomes pivotal, since it is taken as a reference point in identifying the *qualities* of agricultural products, i.e., their features and characteristics *‘...that a farmer wants to be better known and a consumer wants to know’*²²⁸, including the adopted methods, the place of origin, and so on²²⁹.

However, the Green Paper also acknowledges that *‘Quality is an issue for every farmer and every buyer, whether they are dealing with commodities produced to baseline standards or with the high-end quality products in which Europe excels’*²³⁰. By saying that, the Commission seems to be assuming that quality *belongs* to EU agricultural products and foodstuffs, irrespective of whether they meet the minimum requirements or are of high quality. In this way, however, the idea that surfaces is an almost platonic idea of quality, which seems to exist, always and no matter what, in EU agri-food products, without any fundamental distinction on how they are produced.

In light of the recalled passages, it cannot be denied that even the reading of the Green Paper conveys some confusion on the meaning to be attributed to quality. This sentiment was also highlighted by the doctrine that, soon after the Green Paper was issued, started to wonder whether the Commission itself had a clear vision of quality²³¹.

²²⁶ *Ibidem*. ‘The EU has an advantage on quality given the very high level of safety ensured across the food chain by EU legislation in which farmers, and producers more globally, have invested.’ In this way, the Green Paper would seem to associate the success of EU farmers’ agri-food quality productions precisely with European regulations on food safety and hygiene. However, this idea clashes with the interpretation that most frequently emerged because, as it has been observed before and repeatedly emphasised by renowned scholars, it is not possible to overlap the aspects of hygiene and food safety with those of quality. Nevertheless, as it will immediately be clarified, the Green Paper does not fall into line with this reconstruction, since it recognises that *‘...there are more aspects which can reinforce quality in the more global sense of the term’*. *Ibidem*.

²²⁷ *Ibidem*.

²²⁸ *Ibidem*.

²²⁹ As much as these elements might be objective, they take on a markedly subjective sense when they are seen from the perspective of the consumer, i.e., when they become relevant because of how they are perceived by the consumer and because they are appreciated by the consumer, who looks for them to steer its preferences and purchasing choices. Therefore, in commenting on these initial passages of the Green Paper, it was critically observed that the document raises an initial perplexity as it seems to take for granted that quality essentially relies on subjective profiles, by that overlooking other profiles also highlighted by the EU case law. In this sense, see M. D’ADDEZIO, G. MACCIONI, S. BOLOGNINI, “Nota” al Libro verde sulla qualità, in *Rivista di diritto alimentare*, 2009, 1, pp. 7.

²³⁰ COM(2008) 641 final, p. 4.

²³¹ The Green Paper has been critically observed from many points of view. Some of the most incisive critical remarks can be recalled and are summarised soon after. See, *ex multis*, F. ALBISINNI, *Un Libro Verde sulla*

Notwithstanding this, it is interesting to point out how the Green Paper somehow still proposes and reflects the distinction between *quality* (understood as a set of characteristics and features belonging to a product)²³² and *quality* (conceived as the specific, added value of a product) that was mentioned above, albeit in an imprecise way and sometimes mixing up the two ideas. Such a distinction can thus be perceived as a pivotal one and, once again, it seems impossible to break free from it.

Indeed, it is precisely the latter that the European policies have been chasing since the 1990s²³³, with a CAP reform²³⁴ aimed, among other things, at promoting agricultural and food productions possessing specific characteristics and additional requirements, i.e., an added value, in comparison with ‘basic’ ones. In this perspective, it cannot be forgotten that the first regulations aimed at establishing a legislative framework to produce and commercialise agricultural and food products possessing distinctive requirements date back to the early 1990s,

comunicazione, verso il 2013, in *Rivista di diritto alimentare*, 2009, 1, p. 15, who underlines that the Green Paper is depicted more by what it *does not* say and deal with, rather than by what it *does* say and deal with, thus running the risk of heavily affecting businesses with its legal uncertainty and instability. The Commission's approach to the Green Paper is, to some extent, incomplete and confused – as the title itself suggests. In addressing agricultural product quality, the Green Paper shifts from product standards to farming requirements and again to quality schemes, thus lumping together different profiles and criteria, and resulting in a hodgepodge of elements that in the end do not help in the attempt to define quality. This muddle is further associated with a substantial lack of quality requirements linked to the origin of agri-food products, or their history, overwhelmed by an almost exclusive attention to elements referring to the communication. In this sense A. GERMANÒ, *Il Libro verde della Commissione europea del 15 ottobre 2008: alla ricerca di una definizione di alimenti di qualità*, *op. cit.*, p. 480. It is precisely based on this consideration that, again, F. ALBISINNI, *ivi*, p. 16, states that the Green Paper does not concern quality, but rather communication, and it does not concern agricultural products, but rather food products. An additional argument to consider, highlighted by the A., is the fact that the whole structure of the Green Paper seems to reflect a big confusion between what the document itself classifies as ‘baseline standards’ and ‘high-end quality’. This continued overlapping of languages ends up blurring such a distinction. In general, and consistently with the reflections summarised so far, it has been observed that the Green Paper ends up putting quality aside, as it is essentially proposed by the European Commission as a synonym for hygiene and food safety, being addressed alongside and together with these concepts. See A. GERMANÒ, *Qualità alimentare: un'Europa, due sistemi*, *op. cit.*, p. 24.

²³² In this sense, see also P. BORGHI, *Qualità alimentare e controlli*, in R. SAIJA, P. FABBIO (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, *op. cit.*, p. 84, who observes that what truly matters on the market, but also at the contractual and legal level, are the *qualities* of a product; those which, in a much more neutral and less suggestive way, can be appointed as its characteristics.

²³³ M. GIUFFRIDA, *Declinazioni della qualità alimentare nelle regole europee*, *op. cit.*, p. 19.

²³⁴ Reference is to the first large-scale CAP reform of 1992, better known as the MacSherry reform, which came into force on 1 January 1993. Adopted to reduce the overall budget and move away from unlimited guaranteed prices, the policy shifted from a market support system to direct income support for farmers. Indeed, direct payments to farmers were introduced, based on the area of land cultivated or the number of livestock maintained. At the same time, the reform proposed new obligations for farmers, including some concerning the protection of the environment, and new incentives to improve food quality, indeed. For a detailed study of the 1992 CAP reform, see F. SOTTE, *La politica agricola europea. Storia e analisi*, chapter 4 – *La prima riforma della PAC*, Ancona, Agregionieuropa. Collana Economia Applicata, 2023, pp. 17-29.

as it was with the regulations introducing the protection of Geographical Indications in the European regime²³⁵, and other cases²³⁶.

It is clear, then, that these early legislative approaches did follow a very precise idea, in which the quality of agricultural products and foodstuffs would lie in the presence of an added value, crystallised and guaranteed by the compliance with specific legislative provisions, and suited to satisfying the needs and preferences of a more or less wide user base. To a certain extent, the same passage is witnessed by the case law of the Court of Justice and by the evolving interpretation of the concept of quality given by European courts²³⁷, which seems to introduce a distinction between a measurable, objective quality and a quality closely intertwined with reputation²³⁸.

²³⁵ In the context of the deep transformation brought about by the CAP reform of 1992, two regulations were adopted that same year to promote quality agri-food production at the European level. They were: Council Regulation (EEC) No 2081/92 of 14 July 1992 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs; and Council Regulation (EEC) No 2082/92 of 14 July 1992 on certificates of specific character for agricultural products and foodstuffs. These legislative acts introduced the legal regime for Geographical Indications at the community level through the establishment of three categories: Protected Designations of Origin and Protected Geographical Indications, on the one hand; and certificates of specific character (which later became Traditional Specialities Guaranteed), on the other. These were to replace the variety of names, designations, and symbols, which gave life to the different systems of protection hitherto individually granted by Member States, thus harmonising the relative national legislations. See M. GIUFFRIDA, voce *Segni degli alimenti: DOP, IGP e STG*, in *Digesto delle Discipline Privatistiche, Sez. Civile*, XI, Torino, Utet Giuridica, 2018, p. 436. With that, the then European Communities expressed for the first time what is now a robust and firm will: to enhance and support agricultural products and foodstuffs with unique qualities, and whose characteristics are deeply linked to the geographical origin and traditional skills, while promoting the harmonic development of rural areas and fostering the incomes of farmers, in full harmony with the aims of the Common Agricultural Policy, now set out in Article 39 TFUE. For a first overview of the legal regime applicable to Geographical Indications under Reg. (ECC) No 2081/1992 and Reg. (ECC) No 2082/1992, see R. SAIJA, *La qualità alimentare nel diritto europeo dal 1992 a oggi*, in G. AMBROSIO, R. SAIJA, L. CARRARA (eds.), *Prodotti alimentari di qualità. Regole. Casi. Questioni*, Padova, Cedam, 2022, pp. 35-48.

²³⁶ Consider, by way of example, Council Regulation (CEE) No 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs.

²³⁷ On this aspect, see the analysis proposed in F. ALBISINNI, *Nomi geografici e marchi commerciali: regole del mercato e sistemi locali*, in *Economia & Diritto Agroalimentare*, 2007, 2, pp. 23-55.

²³⁸ Emblematic, in this sense, is the decision issued by the CJEU in the famous ‘Exportur’ case in the early 1990s. See Judgement of the Court of 10 November 1992, *Exportur SA v LOR SA and Confiserie du Tech SA*, case C-3/91. The case concerned the product ‘Turrón de Alicante’ which, at the time of the decision, was produced and sold under the same commercial name both by a Spanish company and two companies located in France. Following the adoption of a ‘Franco-Spanish Convention’ signed between the two Countries in 1973, which limited the right to make use of the designation to the Spanish company alone, the Court of Justice was asked to rule on the legitimacy of any national agreement reserving the use of certain designations to products located in specific geographical areas. In its decision, the Court underlined that the prohibition from using certain designations to protect commercial property is justified not only if the product to which the protected name applies possesses qualities and characteristics which are due to its geographical origin, as this position ‘...would have the effect of depriving of all protection geographical names used for products which cannot be shown to derive a particular flavour from the land and which have not been produced in accordance with quality requirements and manufacturing standards (...). Such names may nevertheless enjoy a high reputation amongst consumers and constitute for producers established in the places to which they refer an essential means of attracting custom. They are therefore entitled to protection’ (point 28). For an in-depth analysis of this and other cases brought before the CJEU, see F. ALBISINNI, *L’Aceto balsamico di Modena, il Torrone di Alicante e la Birra di Warstein*

Reputational quality (or the reputational link to quality)²³⁹ is, in fact, another aspect that surfaces in the European regime of Geographical Indications, as anticipated in the opening passages of the section. However, even defining the borders of the reputational link²⁴⁰, and

(*Denominazioni geografiche e regole del commercio alimentare*), in *Rivista di diritto agrario*, 2001, 1, II, pp. 101-130. The ‘Exportur’ decision soon became a leading case guiding other rulings by the Court of Justice, thereby marking a sharp distinction with the position expressed by the European judges in previous case law, which, on the contrary, held that the specific function of geographical designations is to protect only those products possessing particular features or qualities, which are due to their geographical provenance and distinguish them from all other products. This is, for instance, the position of the CJEU in the ‘Sekt’ case (see Judgement of the Court of 20 February 1975, *Commission of the European Communities v Federal Republic of Germany*, case C-12/74).

²³⁹ For a comprehensive reflection on this aspect, see D. S. GANGJEE, *From Geography to History: Geographical Indications and the Reputational Link*, in I. CALBOLI, W. L. NG-LOY (eds.), *Geographical Indications at the Crossroads of Trade, Development, and Culture*, Cambridge, Cambridge University Press, 2017, pp. 36-60.

²⁴⁰ The meaning to be attributed to the reputational requirement is of paramount importance, to the point that it has also been the object of interesting jurisprudence by both national authorities and the European judges. One case law that can be considered as an example, as here reputation was among the main points addressed by courts, is the ‘Piadina Romagnola PGI’ case, which was brought to the attention of both the Italian Administrative Tribunal and the EU Court of Justice. As to the Italian jurisprudence, the case law, although less commented on than others, deserves attention because it allows to reflect on the opposing views concerning the functions and rationale of the European GIs, especially PGI. For a first commentary on this case law, see A. ZAPPALAGLIO, *The ‘Piadina Romagnola’ mess. A new legal case for an old question: what is a GI?*, Second International Conference on ‘Agriculture in an Urbanizing Society. Reconnecting Agriculture and Food Chains to Societal Needs’, 2015, pp. 1-2. For a comprehensive overview and critical remarks, see V. PAGANIZZA, *Dalla padella alla brace: la Piadina Romagnola IGP, dal “testo” al Consiglio di Stato*, in *Rivista di diritto alimentare*, 2014, 3, pp. 45-57. See also L. COSTANTINO, *Le alterne vicende della piadina romagnola tra competenze amministrative e giurisdizionali nazionali, ruolo della Commissione e legame con il territorio*, in *Giustiziavivile.com*, 2018, 11. The case started when the application for the registration of the designation ‘Piadina Romagnola’ as PGI was opposed before the Italian Administrative Tribunal of First Instance by a company that had been producing Piadina for over 25 years, but fell outside the interested geographical area as defined in the *new* product specification (see TAR Lazio, Sez. Seconda Ter, decision n. 5148 of 15 May 2014). The latter, thus, asked for the annulment of D.M. of 27 December 2012 establishing the national temporary protection of the designation, of the product specifications, and of any other related, preliminary, and consequential acts. For this analysis, it is important to mention that the plaintiff produced Piadina using industrial methods and, in this regard, was claiming that both the artisanal and the industrial product lacked a genuine connection with the territory; therefore, any possible protection of the designation as a PGI could not be based on a presumed *terroir* paradigm, but rather on the reputational link which, according to the plaintiff, existed both for artisanal production methods, and for industrial ones. This last aspect is highlighted, among other things, in the TAR Lazio decision, as the Italian Administrative Tribunal argues that, since no material difference between the handmade and the industrially-made product can be found, the former is the only type deserving legal protection, because in consumers’ opinion this is the ‘original’ Piadina. Consequently, the Italian judge partially annulled the product specification. The decision of the TAR Lazio was promptly appealed by the relevant producer group before the Consiglio di Stato, which reversed the decision and preserved the product specification. See Consiglio di Stato, Sez. Terza, decision n. 6933 of 13 May 2015. According to the decision, indeed, the judges of first instance misinterpreted the relevant law – i.e., Reg. (EU) No 1151/2012, the applicable legislation at the time of the dispute – on three points: 1) under Art. 5, par. 2, Reg. (EU) No 1151/2012, the reputational link between the product and its place of origin is sufficient for a designation to be protected as PGI; 2) no distinction between artisanal and industrial methods of productions is to be found in the Regulation; 3) this distinction is furthermore of no relevance when it is proved that there is no difference in the final product obtained in one way or in the other. Pending the decision of the Italian Administrative Tribunal, the EU Commission nevertheless included the ‘Piadina Romagnola PGI’ in the Official Register of the European Union, and by that (temporarily) ended the dispute. See Commission Implementing Regulation (EU) No 1174/2014 of 24 October 2014 entering a name in the register of protected designations of origin and protected geographical indications [Piadina Romagnola/Piada Romagnola (PGI)]. As stressed in V. PAGANIZZA, *Dalla padella alla brace: la Piadina Romagnola IGP, dal “testo” al Consiglio di Stato*, *op. cit.*, p. 56, this step raises a question on the relation between

therefore explaining when a product's reputation can be said to be essentially attributable to its geographical origin, is neither easy nor straightforward, since no legislative definition exists²⁴¹.

Ultimately, the framework we attempted to provide, by walking through relevant literature, positive law, and case law, in an effort to frame the concept of agri-food quality, may lead only to one solid and certain conclusion. That is, to accept the possibility that this idea will essentially remain ambiguous in its scope and content, possibly undefined and undefinable.

Despite the *mare magnum* of definitions and meanings that may potentially arise, it is nevertheless crucial to consider that, in the particular framework of Geographical Indications, from which we started and to which we wish now to return, quality comes to the light first and foremost as *organoleptic quality*, thus being related to senses and taste. The term, as agreeably observed by scholars, ends up precisely revoking that *quid pluris*, thus referring to voluntary attributes and specific characteristics that are deeply connected with consumers' liking and taste, with their purchasing preferences and their desire, and which prove to be successful²⁴².

national and European competences. Indeed, the European procedure of registration came to a conclusion for a PGI whose product specification had been partially annulled by the Italian competent authority. Apart from that, with the registration of the 'Piadina Romagnola PGI', the plaintiff was excluded from the possibility of making use of the indication in its products: therefore, it appealed to the General Court to obtain the suspension of the Implementing Reg. (EU) No 1174/2014. The General Court however dismissed the requests for interim measures and upheld the validity of the registration of the protected geographical indication, thereby acknowledging that the 'Piadina Romagnola PGI', regardless of whether it is made following artisanal or industrial production methods, can only be produced within the borders of the indicated geographical area (the Romagna region). Despite its complexity, the described case law is of no little interest, as it helps the interpreter to really grasp the intricacies of the reputational link, while further showing that, in the field of PGI, different ways of interpreting this concept can be found and that, while the approach adopted by courts is sometimes broad, in other cases it can be much narrower.

²⁴¹ In this sense, A. ZAPPALAGLIO, *The Transformation of the EU Geographical Indications Law. The Present, Past and Future of the Origin Link*, *op. cit.*, p. 79, which however considers reputation as: '*...the image conveyed by the product to the public, that distinguishes it from similar foods and that links it to a specific place*'. While for the terroir paradigm, the quality or characteristics of a GI product derive from natural and human elements, under the reputational link, a product is connected to a specific area because consumers broadly associate the two of them, even without evidence of physical connection. Based on the existing literature and on empirical research, the A. suggests that the two factors composing the reputational link are market reputation and the historical element, which are often intertwined and both included in product specifications, together with references to the terroir link. A third component of the reputational link is then to be found in the 'current socio-economic reality', which refers to the present situation of the area of production. A similar setting is proposed in D. S. GANGJEE, *From Geography to History: Geographical Indications and the Reputational Link*, *op. cit.*, pp. 19-20, which observes that cumulative evidence of three aspects, interrelated and overlapping with each other, is required to identify the reputational link. They are: contemporary reputation, historic reputation, and the history of the product, including the specific production methods which gave rise to the distinctive product within that region.

²⁴² Again, A. GERMANÒ, *Qualità alimentare: un'Europa, due sistemi*, *op. cit.*, pp. 23: '*Perciò sono dell'opinione che con qualità si voglia – si debba – fare riferimento a quegli altri fattori organolettici che determinano nel consumatore una sensazione di gradimento (...) Nei confronti dei prodotti di qualità entra in gioco, allora, non la sicurezza del consumatore, ma la sua soddisfazione, il suo piacere*'. On this point see also, F. ADORNATO, *Le "declinazioni della qualità": una nota introduttiva*, in *Rivista di diritto alimentare*, 2009, 3, pp. 5-7.

1.2. (follows) Origin.

To frame Geographical Indications, the concept of quality, which has been discussed up to this point, must be placed alongside another concept: that of *origin*.

Indeed, the European policy for Geographical Indications is primarily aimed at protecting names and designations of specific agricultural products and foodstuffs to promote their unique and peculiar characteristics, which are indissolubly linked to their origin and are a direct consequence of the origin itself, i.e., the geographical provenance of that product. In other words, Geographical Indications are protected precisely because they refer to agricultural products and foodstuffs that originate from a specific geographical area²⁴³, and which owe their quality precisely to the link with that geographical area: the origin link²⁴⁴. Origin, in this sense, is expressed in the pedoclimate – the set of characteristics involving climate, soil, territory, and agricultural influences – but also in the people, know-how, and traditional skills developed over time by farmers and producers in that specific place, which give life to the key notion of *terroir*²⁴⁵.

²⁴³ D. S. GANGJEE, *Proving Provenance? Geographical Indications Certification and its Ambiguities*, in *World Development*, 2017, 98, pp. 12-24.

²⁴⁴ The origin link is the link between an agri-food product and a specific place. More precisely, it can be defined as a ‘...set of rules that identify the elements whose presence must be proved in order to establish a connection between a product and a place’. In this sense, see A. ZAPPALAGLIO, *The Transformation of the EU Geographical Indications Law. The Present, Past and Future of the Origin Link*, Londra, Routledge, 2021, p. 3. If such a connection between a product and a place can be found, demonstrated, and proved, then legal protection is given to the name that identifies the provenance of the good, usually that of a geographical area. In this perspective, the origin link distinguishes agricultural products and foodstuffs protected by Geographical Indications, and covers the *sui generis* legal regime that is attributed to GIs as intellectual property rights, as they are the result of a peculiar relationship with their place of origin, which, as anticipated, gives them some distinctive features and a specific quality. Thus, the origin link constitutes the legal basis for the EU *sui generis* regime of Geographical Indications. As to EU quality schemes, the origin link can be found in the definition provided by Article 46, par. 1 and par. 2, Reg. (EU) No 2024/1143 (see *supra*, chapter II, fn. 206). Reference can be made to the mentioned monographic contribution for a detailed study on the nature and the evolution of the origin link in the European legislative framework of Geographical Indications. For an introduction to the concept of ‘origin product’ and an overview of the connection between a product and its place of origin, see G. ALLAIRE, F. CASABIANCA, E. THÉVENOD-MOTTET, *Geographical origin: a complex feature of agro-food products*, in E. BARHAM, B. SYLVANDER (eds.), *Labels of origin for food: local development, global recognition*, CABI Digital Library, 2011, pp. 1-12; G. BELLETTI, A. MARESCOTTI, *Origin products, geographical indications and rural development*, in E. BARHAM, B. SYLVANDER (eds.), *Labels of origin for food: local development, global recognition*, *op. cit.*, pp. 75-91.

²⁴⁵ This French expression, far from being translated into the mere ‘territory’, encompasses this combination of natural and human factors and, in general ‘...postulates the existence of a substantial and unique causal link between, on the one hand, a place, with its natural and environmental characteristics, i.e. the ‘natural element’ of *terroir*; a community of producers with specific know-how, i.e. the ‘human element’ and, on the other, territory specific resources’. In this sense, again, A. ZAPPALAGLIO, *The Transformation of the EU Geographical Indications Law. The Present, Past and Future of the Origin Link*, *op. cit.*, p. 32. One of the most authoritative official definitions of *terroir* is provided in INSTITUT NATIONAL DE L’ORIGINE ET DE LA QUALITE (INAO), *Guide du demandeur d’une appellation d’origine protégée (AOP) ou d’une indication géographique protégée (IGP)*, 2017, p. 26, available at the link: https://www.inao.gouv.fr/sites/default/files/2025-01/201711_guideAOPIGP_0.pdf (last

Consequently, willing to frame the core components of Geographical Indications, it is precisely the concept of origin that we must address and dwell on now. An attempt that is not exempt from obstacles, as we once again find ourselves dealing with a concept that, from a legal perspective, remains blurry and not precisely or univocally defined, as widely highlighted²⁴⁶.

It is not by coincidence that the doctrine has spoken of '*mystery of origin*'²⁴⁷, with that reflecting how tricky and demanding the identification of the concept of origin can be.

The reasons for this, which are undoubtedly multiple and heterogeneous, can partially be searched in the fact that the European legal acts that, in the last decades of the previous century, have in various ways dealt with the topic of origin, in the effort of harmonising the

accessed: 12.04.25), and refers to a geographical area with defined boundaries where a human community generates and accumulates across its history a collectively developed knowledge of production based on a system of interactions between a physical and a biological environment. The social and technical itineraries involved confer 'typicality', reveal originality, and lead to a reputation for a product originating from a geographical area ('*Qu'est-ce que le terroir? Un terroir est un espace géographique délimité, dans lequel une communauté humaine, construit, au cours de son histoire, un savoir collectif de production, fondé sur un système d'interactions entre un milieu physique et biologique, et un ensemble de facteurs humains. Les itinéraires sociotechniques ainsi mis en jeu, révèlent une originalité, confèrent une typicité, et aboutissent à une notoriété, pour un bien originaire de cet espace géographique*'). Consequently, the concept of *terroir* comes to light at least in a double perspective: on the one hand, because it attributes to a specific agricultural product or foodstuff its features and its uniqueness, i.e., its quality; on the other hand, because it is a *condicio sine qua non* for the registration of a PDO or PGI. For an overview of the topic of *terroir*, see J. E. WILSON, *Terroir*, University of California Press, 2012; L. BÉRARD, *Terroir and the sense of place*, in D. GANGJEE (ed.), *Research handbook on Intellectual Property and Geographical Indications*, Cheltenham, Edward Elgar Publishing Limited, 2016, pp. 72-94. For a comparative perspective, see M. FERRARI, *Il territorio nelle denominazioni geografiche: spunti comparatistici*, in *Il foro italiano*, 2015, 3, pp. 358-363.

²⁴⁶ For an analysis of the meaning of origin in agricultural and food legislation, as well as a detailed study of the topic see, *ex multis*, S. VENTURA, *L'origine dei prodotti e la promozione collettiva agroalimentare: aspetti giuridici*, in *Il diritto comunitario e degli scambi internazionali*, 1998, 4, pp. 759-768; F. ALBISINNI, *L'origine dei prodotti agro-alimentari e la qualità territoriale*, in *Rivista di diritto agrario*, 2000, I, pp. 23-29; F. ALBISINNI, *L'origine dei prodotti alimentari*, in A. GERMANÒ, E. ROOK BASILE (eds.), *Il diritto alimentare tra comunicazione e sicurezza dei prodotti*, Torino, Giappichelli, 2005, pp. 41-71; A. I. TRAPÈ, *I segni del territorio. Profili giuridici delle indicazioni di origine dei prodotti agroalimentari tra competitività, interessi dei consumatori e sviluppo rurale*, Milano, Giuffrè, 2012; A. GERMANÒ, V. RUBINO (eds.), *La tutela dell'origine dei prodotti alimentari in Italia, nell'Unione europea e nel commercio internazionale*, Atti del Convegno di Alessandria del 21-25 maggio 2015, Milano, Giuffrè, 2015, and, among them, A. DI LAURO, *La tutela dell'origine degli alimenti o la composizione (im)possibile del tempo e dello spazio*, pp. 34-52; M. MAURO, *La provenienza geografica dei prodotti agroalimentari tra marchi di certificazione, collettivi e denominazione di origine. Prime riflessioni a margine dell'art. 11 bis del Codice della proprietà industriale*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, op. cit., pp. 565-595.

²⁴⁷ S. MASINI, *Dal «mistero» dell'origine al diritto all'informazione nella presentazione dei prodotti agro-alimentari*, in *Diritto e Giurisprudenza agraria, alimentare e dell'ambiente*, 2003, 2, p. 72, who further recalls T. ASCARELLI, *Nota a Corte d'appello di Roma, 13 agosto 1924*, in *Foro Italiano*, 1924, 1, p. 1114. Reference is made to the fact that the possibility that the name of a place actually fulfils a distinctive function, and that its use is detectable to third parties to avoid confusion on the market, is a matter of fact, which must be examined on a case-by-case basis. See also F. ALBISINNI, *Strumentario di diritto alimentare europeo*, 5th ed., Milano, Wolters Kluwer, 2023, p. 258, which recalls J. P. BRANLARD, *La reconnaissance et la protection par le Droit des mentions d'origine géographique comme élément de qualité des produits alimentaires*, in *Revue de droit rural*, 1995, p. 409, emphasising the polysemy of the word origin, that not necessarily can be traced back to geographical provenance.

fragmented national legislations and attempting to shed light on it, on the contrary did so without offering a single or standardised definition²⁴⁸, and instead adopted indistinctively the concepts of *geographical origin* and *geographical provenance*, thus leaving room for further confusion and overlapping²⁴⁹.

In addition to this, the European legislator has primarily adopted a vertical approach to regulating the geographical origin of agri-food products, which involves introducing mandatory information provisions on the indication of origin for specific categories of agricultural products and foodstuffs²⁵⁰. This approach, although functional, has clearly hindered the possibility of framing the regulatory framework uniformly.

In this regard, it is also relevant to remember that the concept of origin actually acquires a different connotation depending on whether it is observed from the viewpoint of quality agri-food productions, distinguished by specific signs or indications (as in the case of PDO and PGI), or from the perspective of agricultural products and foodstuffs which lack such an indication²⁵¹.

Indeed, it is in the former (and *only* in the former) that the indication of the provenance of the product is indispensable, precisely because it is the place of production (i.e., the place of origin) of certain agri-food products that provides the specific quality that characterizes them and distinguishes them from similar products that are on the market. The indication of the place of origin crystallises the above-mentioned concept of *terroir*, and ensures that all the information that is conveyed by such a key notion reaches the final consumer.

²⁴⁸ Consider, by way of example and not exhaustively, Directive 79/112/CEE of the Council of 18 December 1978 on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs for sale to the ultimate consumer, which in many points and articles (see art. 2, par. 1, lett. a, p. i, and art. 3.1, p. 7) refers to 'origin' and 'provenance' but neither provides further explanation of the meanings to be attributed to them, nor unfolds the distinction between the former and the latter. See also Directive 84/450/CEE of the Council of 10 September 1984 relating to the approximation of the laws, regulations and administrative provisions of the Member States concerning misleading advertising, which ambiguously refers to 'geographical or commercial origin', without further clarification (see art. 3, lett. a).

²⁴⁹ It has been observed that these regulatory interventions probably exacerbated the problem instead of solving it, as they have forged paradigms that are difficult to coordinate. See A. BARDI, *La Tutela della Proprietà Intellettuale Agroalimentare nel mercato Nazionale, Europeo e Internazionale*, op. cit., p. 42.

²⁵⁰ For instance, this is the case of honey (Directive 2001/110/EC of 20 December 2001 relating to honey), fish (Regulation (EU) No 1379/2013 of the European Parliament and of the Council of 11 December 2013 on the common organisation of the markets in fishery and aquaculture products, amending Council Regulations (EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000), beef and beef products (see Regulation (EC) No 1760/2000 of the European Parliament and of the Council of 17 July 2000 establishing a system for the identification and registration of bovine animals and regarding the labelling of beef and beef products and repealing Council Regulation (EC) No 820/97), and olive oil (see Commission Delegated Regulation (EU) 2022/2104 of 29 July 2022 supplementing Regulation (EU) No 1308/2013 of the European Parliament and of the Council as regards marketing standards for olive oil, and repealing Commission Regulation (EEC) No 2568/91 and Commission Implementing Regulation (EU) No 29/2012).

²⁵¹ F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit., p. 258.

It is precisely for this reason, and acknowledging the importance that the origin link displays for Geographical Indications, that the European legislator has always allowed the place of origin of the product, through geographic or non-geographic names, to be specified in the GI²⁵².

In the latter, instead, information on geographical origin is not mandatory. This means, more precisely, that provenance does not fall within the mandatory information that food operators must provide to consumers²⁵³; rather, it is communicated voluntarily to bestow the consumer with an additional message, whose aim is to distinguish the agri-food product from

²⁵² In the words adopted in Reg. (EEC) No 2081/92 – which, as said, introduced the legal regime for Geographical Indications in the then European Community (see *supra*, chapter II, fn. 235) – the territorial element, or the origin link, seems even more stressed. Indeed, according to Art. 2, par. 2: ‘...for the purposes of the Regulation: (a) designation of origin: means the name of a region, a specific place or, in exceptional cases, a country, used to describe an agricultural product or a foodstuff: -originating in that region, specific place or country, and; - the quality or characteristics of which are essentially or exclusively due to a particular geographical environment with its inherent natural and human factors, and; - the production, processing and preparation of which take place in the defined geographical area; (b) geographical indication: means the name of a region, a specific place or, in exceptional cases, a country, used to describe an agricultural product or a foodstuff: - originating in that region, specific place or country, and; - which possesses a specific quality, reputation or other characteristics attributable to that geographical origin and; - the production and/or processing and/or preparation of which take place in the defined geographical area’. The definition of PDO and PGI provided by the European legislator remained unchanged even in the following legislative act, i.e., Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs, and so did the presence of the territorial element. As already mentioned (see *supra*, chapter II, fn. 207), Reg. (EU) No 1151/2012 instead ‘reshaped’ the definitions of PDO and PGI, thereby delating any uncertainty regarding the possibility of recognising, as protected designation or protected indication, non-geographical names that are nevertheless capable of identifying a product originating from a specific geographical area. This step forward, as illustrated above, was the result of the reception, in legislation, of the case-law consolidated by the Court of Justice of the EU.

²⁵³ Art. 26, par 2, Reg. (EU) No 1169/2011, states that the indication of the country of origin or place of provenance shall be mandatory *only* in two cases: when the omission might mislead the consumer as to the true country of origin or place of provenance of the food; and for certain types of meat. Under Art. 26, par. 3, moreover, in addition to the country of origin or place of provenance of the food, the country of origin or place of provenance of the primary ingredient shall be indicated, if it does not coincide with the former or only the information regarding the primary ingredient shall be provided, clarifying that it does not coincide with the country of origin or place of provenance of the food. This second provision was further clarified with Commission Implementing Regulation (EU) No 2018/775 of 28 May 2018 laying down rules for the application of Article 26(3) of Regulation (EU) No 1169/2011 of the European Parliament and of the Council on the provision of food information to consumers, as regards the rules for indicating the country of origin or place of provenance of the primary ingredient of a food. What follows, in general, is that information on the origin of the product is not compulsory. Scholars have not failed in commenting critically on the illustrated provision, wondering whether the system truly allows the consumer to be better informed. In this sense, see L. COSTATO, L. RUSSO, *Corso di diritto agrario italiano e dell'Unione europea*, 4 ed., Milano, Giuffrè, 2019, p. 219, who talks about ‘...una disciplina alquanto contorta’. See also V. RUBINO, *Sulle ragioni dell'incoerenza fra il dire e il fare: l'indicazione dell'origine degli alimenti, il mercato interno e il regolamento di esecuzione della Commissione (UE) n. 2018/775*, in *Diritto agroalimentare*, 2019, 2, p. 319, which also focuses on the non-implementation of Art. 26, whose reasons are largely identified in the cultural and economic resistance to full transparency on labelling, especially on the part of Northern European countries.

others placed on the market²⁵⁴. In this case, reference to provenance is explained above all to guarantee the traceability²⁵⁵ of agricultural products and foodstuffs. The *ratio* is therefore different, although undoubtedly important, as well, because origin no longer comes to the fore to convey and communicate the quality of the product itself (that is, the *quid pluris* which has been addressed previously) but rather as a tool at the service of food safety objectives²⁵⁶, as well as a promotional and competitive instrument for farmers and producers²⁵⁷.

It is also for this reason, moreover, that some scholars suggested the possibility of distinguishing between origin and provenance from a semantic perspective, not only from a conceptual one, using the first term to address the causal connection between the *origin* of a product and its characteristics, and the second term to merely indicate the geographical territory of *provenance* of the product, with no further implications as to its features or presumed quality²⁵⁸.

And after all, these considerations are reflected in the case law of the Court of Justice of the EU, whose positions have significantly contributed to framing the concept of origin²⁵⁹.

Since the 1970s, indeed, the Court of Justice, through its rulings, has firmly developed and nurtured the following theory: the geographical origin of agricultural products and foodstuffs²⁶⁰ has relevant legal effects only, and insofar as it is supported by objective and solid

²⁵⁴ M. MAURO, *La provenienza geografica dei prodotti agroalimentari tra marchi di certificazione, collettivi e denominazione di origine. Prime riflessioni a margine dell'art. 11 bis del Codice della proprietà industriale*, op. cit., p. 570.

²⁵⁵ For an introduction to the topic of traceability and the indication of some bibliographic references, see *supra*, chapter I, fn. 56 and 57.

²⁵⁶ It is barely the case to recall that the European system for traceability laid its roots in food safety and hygiene foundations, therefore connected to the primary need of ensuring the food safety of agricultural products and foodstuffs produced and commercialised in the European single market. It was precisely to cope with several emergency episodes – among others, the mad cow disease (Bovine spongiform encephalopathy, *BSE*), which spread in the 1990s and had a significant impact on food legislation, as it raised doubts on the degree to which food safety could be guaranteed in the European Union and highlighted the need to ensure greater transparency along food supply chains – that food traceability entered the EU political agenda at the end of the previous millennium, eventually leading to the entrance into force of the fundamental General Food Legislation (Reg. (CE) 178/2002) and determining a radical shift in the paradigm of agri-food production in the European Union, from that moment on. On these aspects, see M. FERRARI, *Risk Perception, Culture, and Legal Change. A Comparative Study on Food Safety in the Wake of the Mad Cow Crisis*, Londra, Routledge, 2009.

²⁵⁷ See L. COSTATO, *L'origine conta: nell'alimentare e in agricoltura*, in *Rivista di diritto alimentare*, 2020, 1, p. 1.

²⁵⁸ F. RONCIN, *Appellation d'origine et usages locaux: de la nécessité de l'innovation*, Presentation at the Conference in Les Mans, 28-30 October 1999, 67 EAAE Seminar.

²⁵⁹ In this sense, see F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit., p. 273.

²⁶⁰ And not only agricultural products and foodstuffs, as, more recently, the Court of Justice could also address the topic of origin by ruling on different products. See, for example, Judgment of the Court of 16 July 2015, *Unione Nazionale Industria Conciaria (UNIC) and Unione Nazionale dei Consumatori di Prodotti in Pelle, Materie Concianti, Accessori e Componenti (Uni.co.pel) v FS Retail and Others*, case C-95/14.

material evidence, appropriately and sufficiently proved or provable. If this is not the case, any indication of the origin of a product would be abstractly suitable, on the one hand, to mislead the consumer as to the true origin of the product (making them believe a product comes from a specific geographical area, when it actually does not)²⁶¹ and, on the other hand, to establish unfair competition and give rise to anti-competitive behaviour, incompatible with the EU legislation, in as far as the mere presence of a sign or indication concerning the geographical provenance could advantage national products at the expenses of those imported from other Member States, without a valid or reasonable justification, i.e., not because of an effective difference in quality.

Through its case law²⁶², the Court of Justice has therefore unequivocally denied that geographical origin, *as such* and *a priori*, always takes on a connotation in terms of quality. The only exception is offered by those cases where objective material elements, demonstrating the link between origin and quality, can be found, and are therefore appropriately marked by an indication, as in the case of Geographical Indications²⁶³. The principle that surfaces is thus rather unequivocal: exception made for those cases in which it is objectively possible to identify and demonstrate the existence of what was defined as the *origin link*, i.e., a connection between the geographical area of provenance of an agri-food product and its quality, any further and different claim of association with a specific territory goes beyond European paradigms and the rules and precepts governing the European single market²⁶⁴. In this sense, the origin-marking

²⁶¹ S. VENTURA, *L'origine dei prodotti e la promozione collettiva agroalimentare: aspetti giuridici*, op. cit., p. 763.

²⁶² See, *ex multis*, Judgement of the Court of 12 October 1978, *Joh. Eggers Sohn & Co. v Freie Hansestadt Bremen*, case C-13/78, which clarifies that: 'However desirable may be the introduction of a policy on quality by a Member State, such a policy can only be developed within the Community by means which are in accordance with the fundamental principles of the Treaty (...) A presumption of quality which is linked to a requirement that the whole or part of the production process should take place on national territory, thereby restricting or treating unfavourably a process some or all of the phases whereof are carried out in other Member States is, always excepting the rules relating to registered designation of origin and indication of origin, incompatible with the common market.' (see point 25); Judgment of the Court of 25 April 1985, *Commission of the European Communities v United Kingdom of Great Britain and Northern Ireland*, case C-207/83, where the Court observes that: '...the treaty, by establishing a common market and progressively approximating the economic policies of the member states, seeks to unite national markets in a single market (...). Within such a market, the origin-marking requirement not only makes the marketing in a member state of goods produced in other member states in the sectors in question more difficult; it also has the effect of slowing down economic interpenetration in the community by handicapping the sale of goods produced as the result of a division of labour between member states.' (see point 17).

²⁶³ See F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit.

²⁶⁴ V. RUBINO, *Sulle ragioni dell'incoerenza fra il dire e il fare: l'indicazione dell'origine degli alimenti, il mercato interno e il regolamento di esecuzione della Commissione (UE) n. 2018/775*, p. 329.

requirement ‘...also has the effect of slowing down economic interpenetration in the community...’²⁶⁵.

Although the case law consolidated by the CJEU, and the words therein adopted, make the interpretation of the concept of origin apparently and abstractly clear, it is nevertheless undeniable that to navigate within the ‘theory’ of origin is not so easy or immediate, both for interpreters and practitioners, and the players of the agri-food sector. For producers, for instance, it might not be easy to steer through the relevant legislation and vertical rules²⁶⁶, to figure out whether indicating the place of provenance of the product is mandatory, and, when it is not, to understand which messages can be correctly passed on to the final consumer without behaving unfairly on the market. At the same time, it may be difficult for consumers to easily and immediately detect which messages are conveyed through the indication of the origin, with the additional risk of being misled about the presence of specific characteristics or a particular quality that the product does not actually possess.

That said, it should also be added that, while the concepts of origin and geographical provenance might seem abstract and more difficult to grasp in general terms, in the case of Geographical Indications, they are more clearly defined as the product specification of each PDO and PGI must identify the area of production of the GI product and delimit its borders. In this case, then, the ambiguity does not concern the origin itself, but rather the methods and criteria used to define the production area and to pose its borders. This choice – which must appear justified and grounded in the product specification, but is essentially established by each producer group – risks being ambiguous and triggering disputes, as its effect is to cut out those producers who are located outside the area from the use of the GI. Hence, as will be seen, identifying means to support this choice is far from trivial.

²⁶⁵ Judgment of the Court of 25 April 1985, C-207/83, point 17.

²⁶⁶ Consider, by way of example, Commission Implementing Regulation (EU) No 1337/2013 of 13 December 2013 laying down rules for the application of Regulation (EU) No 1169/2011 of the European Parliament and of the Council as regards the indication of the country of origin or place of provenance for fresh, chilled and frozen meat of swine, sheep, goats and poultry. Simultaneously, Member States moved in the same direction, in an attempt to bring about legal certainty for producers and food operators with respect to specific categories of products. In Italy, this was the case with D.M. 26 July 2017, *Indicazione dell'origine, in etichetta, del riso*, and D.M. 26 July 2017, *Indicazione dell'origine, in etichetta, del grano duro per paste di semola di grano duro*, which made it mandatory to provide information on the origin of rice (specifically, the place of farming, processing, and packaging) and on the origin of wheat for pasta (specifically, the place of farming and milling). These ministerial decrees, initially introduced on an experimental basis for a term of two years, have ultimately been extended up to 31 December 2025, with D.M. 23 December 2024, *Proroga dei regimi sperimentali dell'indicazione di origine da riportare nell'etichetta degli alimenti*.

1.3. The multidimensional and multifunctional appearance of Geographical Indications.

The many peculiarities of Geographical Indications as quality agri-food productions, which have already begun to surface from the illustration of their *core components*, are further reflected in the description of the main functions GIs display.

Indeed, although the legal debate on this topic is quite broad²⁶⁷, one must acknowledge that Geographical Indications can be traced back to a wide range of functions²⁶⁸ which differ significantly from one another. While some of these have a purely economic essence, and it is possible to refer to them as *market* functions, others have a different nature and are addressed as *non-market* functions²⁶⁹.

In simpler words, that means that Geographical Indications work as valuable tools to promote, at the same time, trade-related interests, as well as interests which belong to other spheres and do not have a typically economic content²⁷⁰. The latter also includes culture-related interests and, above all, the intangible cultural heritage of local communities and populations

²⁶⁷ For an in-depth analysis of the multidimensional appearance of Geographical Indications, see I. CALBOLI, *Geographical Indications of Origin at the Crossroads of Local Development, Consumer Protection, and Marketing Strategies*, in *International Review of Intellectual Property and Competition Law*, 2005, 7, pp. 760-780; I. CALBOLI, *Of Markets, Culture, and Terroir: The Unique Economic and Culture-Related Benefits of Geographical Indications of Origin*, in D. J. Gervais (ed.), *International Intellectual Property: A Handbook of Contemporary Research*, Cheltenham, Edward Elgar Publishing Limited, 2015, pp. 433-464; and lastly, I. CALBOLI, *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, in *Indian Journal of Intellectual Property Law*, 2020, 11, pp. 11-34. For an overview of the legal debate concerning the multidimensional appearance of Geographical Indications see, *ex multis*, K. RAUSTIALA, S. R. MUNZER, *The Global Struggle over Geographical Indications*, in *European Journal of International Law*, 2007, 2, pp. 337-365; D. GANGJEE, *Relocating the Law of Geographical Indications*, Cambridge, Cambridge University Press, 2012; D. GANGJEE (ed.), *Research handbook on Intellectual Property and Geographical Indications*, *op. cit.*

²⁶⁸ See Reg. (EU) No 2024/1143, recital 8: 'Quality products represent one of the biggest assets that the Union has, both for its economy and for its cultural identity. Those products are the strongest representation of the 'made in the EU' brand, recognisable throughout the whole world, which generate growth and preserve the Union's heritage. Wines, spirit drinks and agricultural products, including foodstuffs, are Union assets that need to be further strengthened and protected'.

²⁶⁹ See B. PICK, *Intellectual Property and Development. Geographical Indications in Practice*, Londra, Routledge, 2022, p. 187, which underlines how the potential of GIs to generate positive outcomes even *outside* the market has been carefully observed and studied in the latest years, both at the academic and policy level.

²⁷⁰ This aspect is perfectly described in B. PICK, *ibidem*: '...the objectives attached to GIs have thus evolved over time to embrace: (1) the protection of the consumers and producers' interests against fraud and unfair competition practices; (2) the control of supply and demand on the agrifood markets; (3) local rural development; and (4) preservation of cultural heritage, traditional methods of production and natural resources. However, while the first two functions of GIs, which are concerned with the role of GIs in the marketplace, are rarely questioned, the last two functions, which emphasise the 'non-market values' of GIs, are still highly disputed'.

belonging to a specific geographical area or territory, which, indeed, today finds one of the best legal means of promotion and protection precisely in Geographical Indications²⁷¹.

Following this direction, the present section is dedicated to the reconstruction, illustration, and analysis of the multidimensional appearance of Geographical Indications, moving from the economic-related benefits and addressing then the non-market functions.

1.3.1 The pursuit of the market. Economic-related benefits of GIs.

Walking in this direction, the perspective that most immediately comes to mind is that of the economic-related benefits of GIs.

As is evident, indeed, Geographical Indications can provide economic advantages for both producers and consumers.

Moving from producers' perspective, it is pivotal to observe how granting rights on Geographical Indications can turn into a way to encourage and promote local and rural development²⁷², motivating regional or local groups of producers to invest in the production of specific agricultural products or foodstuffs that originate from that geographical area, with the perspective of obtaining the greater economic return that is provided by the indications itself and the messages it conveys²⁷³.

Notably, Geographical Indications are not individual, but rather collective rights²⁷⁴. More precisely, they constitute intellectual property rights whose attribution to producer groups,

²⁷¹ See I. CALBOLI, *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, *op. cit.*, p. 12.

²⁷² In this sense, D. BARJOLLE, *Geographical Indications and protected designations of origin: intellectual property tools for rural development objectives*, in D. GANGJEE (ed.), *Research handbook on Intellectual Property and Geographical Indications*, *op. cit.*, pp. 440-462.

²⁷³ See Reg. (EU) No 2024/1143, recital 19: '*...the collective organisation of the producers of a product designated by a geographical indication can better ensure a fair distribution of the value added amongst the actors in the supply chain, to provide a fair income to producers, which covers their costs and allows them to invest further in the quality and sustainability of their products. The use of geographical indications rewards producers fairly for their efforts in producing a diverse range of quality products. At the same time, that can benefit the rural economy, which is particularly the case in areas with natural or other specific constraints, such as mountain areas and remote regions, including the outermost regions, where the farming sector accounts for a significant part of the economy and production costs are high. In that way, quality schemes are able to contribute to and complement rural development policy as well as market and income support policies of the common agricultural policy...*'.

²⁷⁴ This aspect is carefully addressed in I. CALBOLI, *Of Markets, Culture, and Terroir: The Unique Economic and Culture-Related Benefits of Geographical Indications of Origin*, *op. cit.*, pp. 447-452, that, while summarising the economic arguments in favor of GIs protection, recalls how Geographical Indications are not individual, rather collective rights, as the possibility of adopting them to identify products is attributed to a group of producers as a whole. Consequently, GIs also promote collaboration between different local producers belonging to the producer group, as they inevitably must cooperate to coordinate and organise the many collective passages in the governance of a GI. This is what happens, by way of example, during the process of registration of a PDO or PGI, or with the

in this perspective, turns into a significant incentive to invest in PDO and PGI productions. The greater efforts required to produce high-quality GI products, for instance, the investments and major attention necessary to comply with product specifications, are counterbalanced by the recognition of an intellectual property right on the name, accessible to all producers, located in the designated territory, who follow the product specification. The collective intellectual property right on the Geographical Indication, as is well known, entails a peculiar legal regime and a very strong system of protection on the market.

In this way, Geographical Indications become a valuable instrument to foster investments in high-quality productions and niche markets, thus promoting local trade and development. Indeed, they further incentivise producer groups to keep investing to maintain their production, or to enhance it, even after the registration of the GI, as the registered PDO or PGI becomes established in the market as a symbol of agri-food quality²⁷⁵.

Considering the viewpoint of consumers, on the other hand, allows for the perception of the economic benefits of Geographical Indications in terms of product information²⁷⁶, since GIs offer an additional layer of information for consumers. As already mentioned, this information mostly concerns the geographical origin of the product itself and all the associated characteristics (influences of climate and soil, established methods of production, etc.) that

identification and agreement on the established rules included in the product specification. In Reg. (EU) No 2024/1143, chapter 2 is dedicated to 'Registration of geographical indications' and, in this context, art. 9, par. 1, specifies that the application for the registration of a Geographical Indication may only be submitted by an applicant producer group, i.e., an association, irrespective of its legal form, composed of producers of the same product, the name of which is proposed for registration. Exceptionally, registration of a PDO or PGI can also be proposed by a single producer. Under art. 9, par. 3: *'...a single producer may be deemed to be an applicant producer group, where it is shown that all of the following conditions are fulfilled: (a) that producer is the only producer willing to submit an application for the registration of a geographical indication; (b) the geographical area concerned is defined on the basis of the link referred to in Article 49(1), point (f), of this Regulation, Article 94(1), point (i), of Regulation (EU) No 1308/2013 and Article 22(1), point (f), of Regulation (EU) 2019/787 and not on the basis of property boundaries; and (c) the geographical area concerned has characteristics which differ appreciably from those of neighbouring areas or the characteristics of the product are different from those produced in neighbouring areas or, with respect to geographical indications of a spirit drink, the spirit drink has a specific quality, reputation or other characteristic which is clearly attributable to its geographical origin'*.

²⁷⁵ In this sense D. GANGJEE, *Relocating the Law of Geographical Indications*, op. cit., p. 266, which observes: *'Since consumers are willing to pay more for such goods, this encourages farmers to invest in making the transition from producing undifferentiated bulk commodities, towards producing higher quality niche products'*. This means that the well-established disposition of consumers to pay more to buy higher quality agricultural products or foodstuffs, especially when such higher quality is expressed through a PDO or PGI, works as a driving force for farmers and producers to move away from baseline standards and to invest in directing their resources towards higher quality productions.

²⁷⁶ Consider M. AGDOMAR, *Removing the Greek From Feta and Adding Korbelt to Champagne: The Paradox of Geographical Indications in International Law*, in *Ford. Intellectual Property, Media & Entertainment Law Journal*, 2007, 18, pp. 577-580.

determine the quality, understood as that *quid pluris*, of the agricultural product or foodstuff the GI identifies²⁷⁷.

The additional information that GIs convey can also contribute to reducing the information asymmetry that consumers normally have to deal with²⁷⁸, providing them with a tool they can adopt to make informed purchasing choices²⁷⁹.

Finally, always looking at the market functions, it is significant to recall that Geographical Indications also work as instruments to promote greater competition in the single market, both from the perspective of competition between a PDO or PGI product and a similar, non-GI one, and from the perspective of competition between similar and interchangeable PDO or PGI products. The enhancement of competition in the market is mostly a consequence of the fact that Geographical Indications, in general, encourage and support the improvement of agri-food production chains, and not only for PDO or PGI productions. Indeed, even with non-GI productions, operators are generally pushed to enhance the features and characteristics of their agri-food products to stay competitive in the market²⁸⁰. Still on this subject, it is also interesting to note that GIs display the appointed competitive function at the global level, as well. Indeed, as the higher production costs in the EU do not allow European producers and businesses to play the ‘quantity game’, they compete on quality. In this perspective, quality expressed through Geographical Indications becomes a competitive factor to be spent in international markets, further justifying the higher prices of EU products compared to those of non-EU ones.

²⁷⁷ Ivi, pp. 587-588.

²⁷⁸ See *supra*, chapter I, fn. 168.

²⁷⁹ These involve, among other things, relevant details concerning the methods of production, information on working conditions and involving human rights, and suggestions on the impacts of the involved practices on the environment.

²⁸⁰ For an in-depth analysis of competition-related effects of Geographical Indications, see I. CALBOLI, *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, *op. cit.*, pp. 24-25. Nevertheless, it is interesting to point out that some scholars, on the contrary, argued that Geographical Indications are strongly anti-competitive, expressing critical concerns over the language monopoly that GI producers can exercise. In this sense, see J. HUGHES, *Champagne, Feta, and Bourbon: The Spirited Debate About Geographical Indications*, in *Hastings Law Journal*, 2006, 58, p. 357; K. RAUSTIALA, S. R. MUNZER, *The Global Struggle over Geographical Indications*, *op. cit.*, p. 359. However, one cannot forget that Geographical Indications secure collective intellectual property rights *only over the indications*, thus the adopted names, and *not over the products themselves*, meaning that competitors are always allowed to produce identical goods for identical markets. For example, cheese-makers are not prevented from making a hard, cooked, and slowly matured cheese from cow milk, but they are not allowed to name it Parmigiano Reggiano PDO because the product does not originate from the GI-denominated production area. See also D. GANGJEE, *Quibbling Siblings: Conflicts Between Trademarks and Geographical Indications*, in *Chicago-Kent Law Review*, 2007, 82, pp. 1253-1291. Nor do Geographical Indications eliminate competition amongst GI producers of similar products coming from the same or different geographical regions. In this sense, see I. CALBOLI, *Time to Say Local Cheese and Smile at Geographical Indications?*, in *Huston Law Review*, 2015, 2, pp. 373-419.

1.3.2. Traditional knowledge, cultural heritage, and biodiversity conservation. Non-market functions of GIs.

If the observations concerning the market functions of Geographical Indications are straightforward and broadly accepted, it is equally important, and less obvious, to remember that GIs can also protect *other* interests that, albeit not possessing a strictly economic essence, eventually display their influence on the market, as well. They reflect the non-market functions of GIs²⁸¹.

As anticipated, a first topic that surfaces in this context involves culture-related interests, thus the role Geographical Indications play in terms of preserving intangible cultural heritage²⁸².

Cultural heritage²⁸³ and Geographical Indications are closely intertwined because the latter not only protect and promote agricultural products and foodstuffs originating from a

²⁸¹ Among them, it is possible to include GIs' capacity to participate in territorial development dynamics by acting on multiple fronts. By way of example, Geographical Indications work as a driver in job creation, as they contribute to maintaining the workforce in the region or territory; they foster the development of new economic activities or initiatives, which further encourage the growth of the area; they promote training, innovation, and exchange of good practices, as functions attributed to producer groups, which thereby foster local actors' empowerment through the advancement in skills and know-how. On these aspects, see B. PICK, *Intellectual Property and Development. Geographical Indications in Practice*, *op. cit.*, pp. 188-197.

²⁸² For an in-depth overview on this topic, see, *ex multis*, T. KONO (ed.), *Intangible cultural heritage and intellectual property: communities, cultural diversity and sustainable development*, Antwerp, Intersentia Publishing, 2009; A. KAMPERMAN SANDERS, *Incentives for and Protection of Cultural Expression: Art, Trade and Geographical Indications*, in *The Journal of World Intellectual Property*, 2010, 13, pp. 81-93; D. GANGJEE, *Geographical Indications and Cultural Heritage*, in *WIPO Journal*, 2012, 4, pp. 92-102; I. CALBOLI, *Of Markets, Culture, and Terroir: The Unique Economic and Culture-Related Benefits of Geographical Indications of Origin*, *op. cit.*; B. UBERTAZZI, *EU Geographical Indications and Intangible Cultural Heritage*, in *International Review of Intellectual Property and Competition Law*, 2017, 48, pp. 562-587; I. CALBOLI, *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, *op. cit.*

²⁸³ Cultural heritage was first framed and defined in 2003 with the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage (see UNESCO, *Convention for the Safeguarding of the Intangible Cultural Heritage*, 17.10.2003). In particular, Art. 2, par. 1 defines 'intangible cultural heritage' as: '*...the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artifacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognise as part of their cultural heritage*'. Art. 2, par. 2, moreover, provides a non-exhaustive list of five domains in which intangible cultural heritage is expressed, including: oral traditions and expressions (also, language); performing arts; social practices, rituals, and festive events; knowledge and practices concerning nature and the universe; and traditional craftsmanship. Although the Convention of 2003 does not directly refer to Geographical Indications, they can certainly be implemented to protect any of the identified domains, and, at the same time, any of the identified domains can be included in the processes and techniques to produce GI products. The 2005 UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions can also be considered in this scenario (see UNESCO, *Convention on the Protection and Promotion of the Diversity of Cultural Expressions*, 20.10.2005). The Convention aims at addressing everlasting concerns on cultural diversity (that is praised as a '*defining characteristic of humanity*') and, in its Preamble, underlines that: '*cultural activities, goods and services have both an economic and a cultural nature, because they convey identities, values and meanings, and must therefore not be treated as solely having commercial value*'. These 'cultural activities, goods and services' are further specified

specific territory or geographical area, but also the traditional knowledge and know-how associated with them, as a form of cultural expression²⁸⁴. In this perspective, also acknowledged at the institutional level²⁸⁵, the multidimensional appearance of GIs implies that they can also be attributed with a high heritage dimension, meaning that Geographical Indications are also pivotal for the protection and conservation of the cultural identity of the regions and territories they identify, and the communities composing them, through their culture, traditional knowledge, and consolidated know-how²⁸⁶.

In this way, and progressively, the legal protection granted to Geographical Indications could enhance the maintenance and continuation of traditional techniques and methods, which otherwise would run the risk of surrendering to the competition of mass production techniques²⁸⁷, while rewarding local actors for shielding cultural identity and traditional knowledge, and fostering cultural diversity on a larger scale, both nationally and internationally.

as: 'those activities, goods and services, which at the time they are considered as a specific attribute, use or purpose, embody or convey cultural expressions, irrespective of the commercial value they may have' (see Art. 4). In the same provision, furthermore, 'cultural diversity' is brought back to '...the manifold ways in which the cultures of groups and societies find expression. These expressions are passed on within and among groups and societies. Cultural diversity is made manifest not only through the varied ways in which the cultural heritage of humanity is expressed, augmented and transmitted through the variety of cultural expressions, but also through diverse modes of artistic creation, production, dissemination, distribution and enjoyment, whatever the means and technologies used'. Even though just indirectly, it is evident that both the 2003 and 2005 UNESCO Conventions affirm the value of Geographical Indications to work as a tool to protect and promote cultural identity and cultural diversity. On these aspects, see also I. CALBOLI, *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, *op. cit.* pp. 30-34.

²⁸⁴ D. GANGJEE, *Geographical Indications and Cultural Heritage*, *op. cit.*, in this sense, speaks of 'cultural heritage argument'. These aspects are also proposed in M. FERRARI, *The narratives of geographical indications*, in *International Journal of Law in Context*, 2014, 2, pp. 222-248, where the A. wonders if GIs can be understood as a mode of cultural creativity in their own right.

²⁸⁵ See, for example, EUROPEAN COMMISSION, *Why do Geographical Indications matter to us?*, Brussels, 30.07.2003, MEMO/03/160, accessible at: https://ec.europa.eu/commission/presscorner/detail/en/memo_03_160 (last accessed: 25.04.25), where the EU Commission underlines that Geographical Indications are key to European and developing countries' cultural heritage, traditional methods of production and natural resources.

²⁸⁶ T. BROUDE, *Taking "Trade and Culture" Seriously: Geographical Indications and Cultural Protection in WTO Law*, in *University of Pennsylvania Journal of International Law*, 2005, 26, p. 640, which highlights three dimensions of culture that can be relevant within Geographical Indications. They are: the 'culture of production', which is the knowledge and techniques needed to create GI products; the 'culture of consumption', which is the experience related to the consumption of GI products; and the 'culture of identity' since Geographical Indications refer to products that are representative of regions of origin, and thus the communities' cultural identities. All of these aspects contribute to establishing the cultural dimension of Geographical Indications.

²⁸⁷ Indeed, as Geographical Indications represent a means to support the preservation of culture and cultural identity, tradition, and local know-how, they can also contribute to contrasting those business models which, on the contrary, call on uniformity and standardization. In this sense, see T. BROUDE, *Taking "Trade and Culture" Seriously: Geographical Indications and Cultural Protection in WTO Law*, *op. cit.*, p. 635.

Although it is not usually traced back to GIs' protection objectives, another non-market function should be further addressed: biodiversity conservation²⁸⁸. As it has been observed, indeed, Geographical Indications may contribute to the conservation of *local* natural resources because GI products draw on features of the natural environment from which they originate²⁸⁹.

Nevertheless, the possibility of a PDO or PGI to fulfil this additional non-market function is essentially a consequence of what is envisaged in the product specification, which once again behaves as a powerful tool to direct the effects of the Geographical Indication. In fact, GIs' impacts on biodiversity conservation depend on the sensitivity of producer groups that, when putting their product specifications together, may establish the use of specific biological and genetic resources that are essential to the distinctive character of the PDO or PGI product (including, for example, native plant varieties or breeds), or may impose production practices or methods that have positive impacts on biodiversity or the ecosystem²⁹⁰. Otherwise, the opposite scenario is clearly still possible: Geographical Indications could also lead to negative effects on the environment, ecosystems, and biodiversity, for instance, if the product specifications require the use of specific or unique landraces or breeds that may result in a loss of genetic diversity²⁹¹.

The proposed scenario ultimately allows to acknowledge that Geographical Indications are a valuable instrument to promote both trade-related and other interests, including cultural ones. On the one hand, GIs' advantages emerge in the economic perspective, with specific reference to economic incentives for local actors and communities, the development of niche markets, and investments in high-quality production. On the other hand, as it was also proposed,

²⁸⁸ For an overview of both the positive and negative effects of Geographical Indications on biodiversity and biodiversity conservation, see B. PICK, *Intellectual Property and Development. Geographical Indications in Practice*, *op. cit.*, pp. 200-204.

²⁸⁹ *Ivi*, p. 200. On these aspects, see also M. BLAKENEY, *Geographical Indications and Environmental Protection*, in *Frontiers of Law in China*, 2017, 2, pp. 162-173.

²⁹⁰ See J. LARSON, *Relevance of geographical indications and designations of origin for the sustainable use of genetic resources*. Study prepared for the Global Facilitation Unit for Underutilized Species, FAO, 2007, pp. 4-5.

²⁹¹ Again, J. LARSON, *Relevance of geographical indications and designations of origin for the sustainable use of genetic resources*, *op. cit.*, p. 39. An interesting example in this sense is provided by the case of Tequila. The Geographical Indication for Tequila was established by the Mexican government in 1974, making it the oldest and one of the best-known GIs outside Europe. Originally, however, the product specification imposed the exclusive use of the blue variety of the agave plant, to the exclusion of any other variety, and with that led to loss and marginalisation of half a dozen other varieties, providing Tequila with a narrow genetic base. For an analysis of the case, see S. BOWEN, A. ZAPATA, *Geographical indications, terroir, and socioeconomic and ecological sustainability: The case of tequila*, in *Journal of Rural Studies*, 2009, 25, pp. 108-119. In 2019, Tequila also received recognition and legal protection as a Geographical Indication under the EU legal regime. See Commission Regulation (EU) No 2019/335 of 27 February 2019 amending Annex III to Regulation (EC) No 110/2008 of the European Parliament and of the Council as regards the registration of the spirit drink 'Tequila' as a geographical indication.

the non-market functions of Geographical Indications come to the fore rather clearly, and unfold mostly in the protection and promotion of cultural identity, cultural diversity, and traditional knowledge of the same communities, as well as, under certain circumstances, in the conservation and restoration of biodiversity and local ecosystems.

In this way, Geographical Indications variously participate in the growth and development of rural areas, as well, providing them with a '*new vitality*' which may translate into an equitable distribution of value between the actors collectively holding the GI and their communities²⁹², further advantaging society as a whole.

It is also, and above all, the described multidimensional appearance of Geographical Indications, combined with the set of peculiar, inner features they possess, that grounds and motivates the particular legal regime attributed (at the European level, as far as it is mostly relevant for the purposes of the present work) to Geographical Indications. Starting from this premise, and bearing in mind the many aspects deepened in this first paragraph, it is now interesting to move on to framing precisely the legislation applicable to Geographical Indications in the European regulatory context.

2. The European Union framework for Geographical Indications.

Building the regulatory framework applicable to Geographical Indications is an essential and unavoidable step to adequately frame the field of interest.

Therefore, as already anticipated in previous passages and the opening of this chapter, in this second paragraph, an attempt will be made to draw the EU *sui generis* regime for GIs.

Moving from the reconstruction of the prodromes and the legal basis of PDO and PGI discipline, and following the chronological evolution of the European regulatory framework – also, and above all, as a result of the teachings of the CJEU case law which, through time, has shaped concepts, definitions, and the scope of application of legal provisions – the paragraph will come to an analysis of the 2024 EU quality schemes reform, dwelling on the perspectives offered by the new Reg. (EU) No 2024/1143. In this regard, it should be premised that, to avoid an overly descriptive presentation, particular emphasis will be placed on the main innovation

²⁹² D. ZOGRAFOS, *Geographical Indications & Socio-Economic Development*, in *IQsensato Working Paper*, 2008, 3, p. 12.

introduced by the 2024 Regulation and on the aspects of the GI regulation that are mostly relevant for the research question, which will then be explored in the following chapter.

Before proceeding in this direction, however, a preliminary remark is deemed necessary and appropriate.

The present work, as already mentioned, will only focus on the European regulatory framework applicable to Geographical Indications. Nevertheless, the EU *sui generis* legal regime is only one of the existing systems of protection of GIs, which does not work in isolation, but rather is part of a wider context: that of the international protection of Geographical Indications²⁹³.

²⁹³ Prior to the 1990s, the most relevant sources for GI protection were three international agreements, but their effectiveness was limited to the (few) implementing countries. The 1883 Paris Convention for the Protection of Industrial Property offered protection against the use of Geographical Indications as '*false, fictitious, or deceptive trade names*' (see Art. 10, par. 1 of the Paris Convention), when such use was to mislead the public as to the nature, the manufacturing process, the characteristics, the suitability for their purpose, or the quantity, of the goods. However, the provided protection was not specifically tailored for GIs, and it concerned exclusively unfair competition. The 1891 Madrid Agreement for the Repression of False or Deceptive Indications of Source on Goods, and the later adopted Lisbon Agreement for the Protection of Appellations of Origins and their International Registration of 1958, offered instead a more specific and extensive protection; nevertheless, their international impacts were still limited, mostly due to the limited number of signatories. It was only with the adoption of the TRIPS Agreement (The Agreement on Trade Related Aspects of Intellectual Property Rights) of 1994 that the international system of protection of GIs was finally formalized, and still today it is crystallized in Articles 22-24, which take care of the definition of Geographical Indications and the general offered to them, the enhanced protection for wines and spirits, exceptions, and future negotiations. According to Art. 22, par. 1, Geographical Indications are '*...indications which identify a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin*'. Thus, the system aims to protect a sign, usually a word or symbol, which indicates the geographical origin of the referent product and information associated with that origin. The real value of the system, however, is given by the fact that, under TRIPS, all WTO Members must provide the legal means to prevent the use of Geographical Indications that '*...misleads the public as to the geographical origin of the goods*' or that '*constitutes an act of unfair competition*...' (see Art. 22, par. 2, lett. a and b, TRIPS Agreement). To this end, the Agreement further requires that Members '*...refuse or invalidate the registration of a trademark which contains or consists of a geographical indication with respect to goods not originating in the territory indicated, if use of the indication in the trademark for such goods in that Member is of such a nature as to mislead the public as to the true place of origin*' (see Art. 22, par. 3 TRIPS Agreement). Under Art. 24, the TRIPS Agreement also deals with a topic as important as it is thorny, i.e., that of pre-existing trademarks that were in use or had been registered before the date of implementation of the TRIPS Agreement, or before the corresponding GI was protected in the country of origin. Finally, the Agreement promotes and encourages negotiations between WTO Members to enhance GI protection. In this perspective, indeed, it is also important to remember that States' positions on the protection of Geographical Indications have always diverged sharply, with some countries taking a pro-GI stand (among them, many EU Member States like Italy, or France), and others deeply GI-sceptical (for instance, the U.S.A., Australia, and New Zealand). See, as an example, the positions that emerged on the extension of Art. 23 coverage, in WTO GENERAL COUNCIL TRADE NEGOTIATIONS COMMITTEE, *Issues related to the extension of the protection of geographical indications provided for in Article 23 of the TRIPS Agreement to products other than wines and spirits*, 21.04.2011, TN/C/W/61, p. 4: '*Delegations continued to voice the divergent views that have characterized this debate, with no convergence evident on the specific question of extension of Article 23 coverage: some Members continued to argue for extension of Article 23 protection to all products; others maintained that this was undesirable and created unreasonable burdens*...'. As a result, discussions over GIs' protection and enforcement mostly took place under the umbrella of bilateral or plurilateral agreements, defined as an defined as '*alternative pathway*' [see F. ALBISINNI, *Indicazioni geografiche e tutela internazionale e transfrontaliera: nuovi scenari, tra condivisione e contaminazione*, in N. LUCIFERO (ed.), *La tutela internazionale*

And the European legislator cannot fail to take this worldwide perspective into account²⁹⁴. However, exceptions made for some references, the international regime for Geographical Indications will not be examined in the present work²⁹⁵, and this is for several reasons. As said above, the purpose of this second chapter, and of the reconstruction that will follow, is to frame the field of interest by providing insights on the main features, functions, challenges, and applicable discipline at the European level. In this perspective, the aim is to provide as complete and comprehensive an overview as possible, while keeping in mind that the core of the present research is to offer a legal reflection on the possibilities and challenges

delle indicazioni geografiche dei prodotti agroalimentari, *op. cit.*, p. 140] that combines a plurality of sources and systems of protection, sometimes replicating the European discipline, and sometimes mixing different models. Consider, by way of example and not exhaustively, the 2016 CETA Agreement between Canada and the European Union [for a commentary, see V. RUBINO, *Accordi preferenziali di nuova generazione e fragilità nella cooperazione fra unione europea e stati membri: alcune riflessioni sul caso “ceta” e la tutela delle indicazioni geografiche dei prodotti alimentari*, in N. LUCIFERO (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari, op. cit.*, pp. 157-194] the EU-Mercosur Agreement, signed in 2019 between the European Union and Argentina, Brazil, Paraguay, and Uruguay [on this topic, see R. BLASETTI, *Geographical Indications: A Major Challenge for MERCOSUR*, in *GRUR International*, 2020, 11, pp. 1113-1122; L. F. PASTORINO, *Indicazioni geografiche tra UE e Mercosur*, in S. TROIANO, M. SCHMIDT-KESSEL (eds.), *Diritto, cambiamenti e tecnologie nel dialogo italo-tedesco*, Napoli, Edizioni Scientifiche Italiane, 2022, pp. 149-164], or the EU-Japan Economic Partnership Agreement of 2019 [for an analysis, see G. TORRE, *L'accordo di partenariato UE-Giappone: l'impatto sull'agricoltura e sulla filiera alimentare*, in N. LUCIFERO (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari, op. cit.*, pp. 309-346]. On these profiles, see also, A. SCIAUDONE, *Le regole dell'UE in tema di qualità dei prodotti agroalimentari e il commercio con i paesi terzi*, in *Rivista di diritto alimentare*, 2010, 4, pp. 4-13.

²⁹⁴ As part of the WTO, the European Union is among the signatories of the TRIPS Agreement.

²⁹⁵ Thus, to have a comprehensive overview of the worldwide protection of Geographical Indications, see *ex multis*; D. GANGJEE (ed.), *Research handbook on Intellectual Property and Geographical Indications*, Cheltenham, Edward Elgar Publishing Limited, 2016; ECHOLS M. A., *Geographical Indications For Food Products*, 2nd ed., Kluwer Law International, 2016; M. BLAKENEY, *The protection of geographical indications. Law and practice*, 2nd edition, Cheltenham, Edward Elgar Publishing Limited, 2019; M. LIGHTBOURNE, *What's in a Name? The Journey of Geographical Indications from Paris 1883 to Geneva 2015*, in *GRUR International*, 2021, 10, pp. 932-942; A. I. TRAPÈ, *Le indicazioni geografiche tra territorio e mercato internazionale*, in S. CARMIGNANI, N. LUCIFERO (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza, op. cit.*, pp. 469-488; N. LUCIFERO (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023; ID., *Il modello europeo sulle indicazioni geografiche a seguito dell'adesione dell'Unione europea all'Atto di Ginevra dell'Accordo di Lisbona per la protezione e la registrazione internazionale delle indicazioni geografiche*, in *Rivista di diritto alimentare*, 2022, 4, pp. 40-58; ID., *International Protection of Geographical Indications*, in A.A. V.V. *European and Global Food Law*, Milano, Wolters Kluwer, 2025, pp. 600-622. With specific reference to the TRIPS Agreement, see A. GERMANÒ, *Le indicazioni geografiche nell'Accordo TRIPS*, in *Rivista di diritto agrario*, 2000, 3, I, pp. 412-426; S. CARMIGNANI, *La tutela delle indicazioni geografiche nell'accordo TRIPS. Localizzazione geografica del prodotto e mercato globale*, in A. GERMANÒ, E. ROOK BASILE (eds.), *Agricoltura e alimentazione tra diritto, comunicazione e mercato*, Atti del Convegno “Gian Gastone Bolla” di Firenze del 9-10 novembre 2001, Milano, Giuffrè, 2003, pp. 149-177; M. BLAKENEY, *Geographical Indications and TRIPS*, in *UWA Faculty of Law Research Paper*, 2012, 9, pp. 1-30; L. F. PASTORINO, *Gli accordi bilaterali in materia di IG e il loro legame con il WTO come chiave di lettura*, in *Rivista di diritto alimentare*, 2022, 3, pp. 47-54; P. BORGHI, *L'Accordo TRIPS*, in L. COSTATO, F. ALBISINNI (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed, Padova, Cedam, 2023, pp. 61-63; G. SPOTO, *Dagli accordi multilaterali a quelli bilaterali: la fine del WTO?*, *ivi*, pp. 1238-1245.

proposed by blockchain technology implementation to the field of Geographical Indications, which will be addressed in the third part.

This chapter, in other words, aims to provide the tools and basis to fully grasp the reflections that will follow; and this premise was kept in mind also while understanding which topics to explore and analyse. Consequently, the decision to deepen the multiple regimes applicable to Geographical Indications – regarding the worldwide protection of GIs, the EU *sui generis* regime, as well as the instruments available in different countries – would have likely led to another piece of work, with different research objectives and a distinct focus.

2.1. Prodrômes: EU quality schemes and their thirty-year legislative evolution.

As anticipated, at the end of the 1980s, the European Communities began to imagine the first shared rules on protected designation of origin and protected geographical indications, which then turned into Regulations in the early 1990s²⁹⁶. They were Regulation (EEC) No 2081/92, which addressed geographical indications and designations of origin for agricultural products and foodstuffs, and Regulation (EEC) No 2082/92, expressly dedicated to certificates of specific character for agricultural products and foodstuffs²⁹⁷.

²⁹⁶ See *supra*, chapter II, fn. 235.

²⁹⁷ When introducing the framework on Geographical Indications, the EC legislator decided to maintain a distinction between the rules applicable to protected designations of origin and protected geographical indications, and those applicable to certificates of specific character (which later became, and are now known as, traditional specialties guaranteed). The reason behind this decision probably lies in the peculiar nature of the latter: in fact, although it is true that certificates of specific character (now TSG) also identify products made according to the established product specifications, and which maintain a connection with a territory, this relationship is less strong and intense if compared to the one characterising PDO and PGI, as it is not required that the product originates exactly from that territory. In other words, it is not the geographical origin as such that provides the product with a special quality, but rather the conformity to the traditions and consolidated know-how of that territory. Ultimately, it can be said that TSG products are not tied to a specific geographical area, but rather they become an integral part of the gastronomic and cultural heritage of the entire community. In this sense, see E. ROOK BASILE, *Attestazioni di specificità e prodotti tipici*, in L. COSTATO (ed.), *Trattato breve di diritto agrario Italiano e comunitario*, Padova, Cedam, 2003, p. 738. From this perspective, certificates of specific character and traditional specialties guarantee's function has always been to safeguard the workforce, skills, and traditions of a territory, even when exported abroad. However, it must be acknowledged that since the entry into force of the 1992 Regulation, certificates of specific character failed to bring the expected outcomes, to the point that, over time, they have been the object of severe reforms. Among them, Council Regulation (EC) No 509/2006 of 20 March 2006 on agricultural products and foodstuffs as traditional specialties guaranteed, which, as said, introduced TSG to replace the former. Nevertheless, these efforts failed in reviving the indication. Indeed, TSG still lacks appeal to producers and their associations, probably due to its unsteady nature and the absence of clear requirements for protection. The general uncertainty that traditional specialties guaranteed bring about hinders investments for the recognition procedure; furthermore, they fail to translate into added value for producers, as it is immediately evident when considering the case of 'Pizza Napoletana' TSG, one of the few existing ones among Italian agri-food products. For an in-depth analysis of TSG, its features, and the critical remarks, see, *ex multis*, S. MASINI, *Sulla funzione delle specialità tradizionali garantite: una nomenclatura tra tradizione e delocalizzazione*, in *Diritto e giurisprudenza agraria*

The 1992 Regulations finally officialised the European policy to promote agri-food quality linked to origin, further pursuing the dual objective of encouraging agricultural production's diversification and boosting high-quality products on the EU market, while simultaneously promoting the development of rural, suburban, and disadvantaged areas and improving the income of agricultural communities²⁹⁸. In this way, the new formalised quality policy also mirrored the CAP objectives as expressed in Article 39 TFEU (before, Art. 33 TEC)²⁹⁹. Indeed, the introduced discipline was intended as a compromise between producers' interests for a higher remuneration for added-value products originating from their territory, and consumers' interests to be properly informed on the characteristics and high quality of agricultural products and foodstuffs, and by that trusting in the labels identified by European Institutions³⁰⁰.

What is particularly relevant to highlight is that the 1992 Regulations were conceived as a tool for introducing a single, harmonised protection system for Geographical Indications, applicable to all Member States. In other words, the discipline therein crystallised was not intended as a complementary means to national legislation, but rather to have an exhaustive nature³⁰¹ capable of replacing the heterogeneous national practices reserved to GIs, which,

alimentare e dell'ambiente, 2006, 9; A. ZAPPALAGLIO, *Anatomy of Traditional Specialities Guaranteed: Analysis of the Functioning, Limitations and (Possible) Future of the Forgotten EU Quality Scheme*, in *GRUR International*, 2022, 12, pp. 1147–1161; A. I. TRAPÈ, *Le specialità tradizionali garantite*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea*, op. cit., pp. 633–643

²⁹⁸ See Reg. (EEC) No 2081/92: 'Whereas, as part of the adjustment of the common agricultural policy the diversification of agricultural production should be encouraged so as to achieve a better balance between supply and demand on the markets; whereas the promotion of products having certain characteristics could be of considerable benefit to the rural economy, in particular to less-favoured or remote areas, by improving the incomes of farmers and by retaining the rural population in these areas'. In this sense, V. RUBINO, *La protezione delle denominazioni geografiche dei prodotti alimentari nell'Unione europea dopo il regolamento 1151/2012 UE*, in *Rivista di diritto alimentare*, 2013, 4, p. 5. See also, B. UBERTAZZI, E. MUNIZ ESPADA (eds.), *Le indicazioni di qualità degli alimenti, Diritto internazionale ed europeo*, Milano, Giuffrè, 2009, and, among them, P. BORGHI, *I requisiti di tutela*, pp. 179–190.

²⁹⁹ It is barely the case to remember that, according to Art. 39 TFEU: '1. The objectives of the common agricultural policy shall be: (a) to increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, in particular labour; (b) thus to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture; (c) to stabilise markets; (d) to assure the availability of supplies; (e) to ensure that supplies reach consumers at reasonable prices. 2. In working out the common agricultural policy and the special methods for its application, account shall be taken of: (a) the particular nature of agricultural activity, which results from the social structure of agriculture and from structural and natural disparities between the various agricultural regions; (b) the need to effect the appropriate adjustments by degrees; (c) the fact that in the Member States agriculture constitutes a sector closely linked with the economy as a whole'.

³⁰⁰ See I. CANFORA, *La politica della qualità dei prodotti agroalimentari dell'UE*, op. cit., p. 426.

³⁰¹ L. PETRELLI, *I regimi di qualità nel diritto alimentare dell'Unione europea*, op. cit., p. 289. The legal debate on the exhaustive nature of the European system of protection on Geographical Indications has been ongoing since Reg. (EEC) No 2081/92. The issue, in particular, concerned whether or not the European *sui generis* regime for

before that moment, had triggered numerous disputes between Member States, and between Member States and the European Communities³⁰².

Upon closer examination of its contents, Regulation (EEC) No 2081/92 on geographical indications and designations of origin primarily sought to provide the necessary definitions, and then outlined the legal regime of protection applicable to them within the single market³⁰³. This second element leaves room for one of the most significant reflections on the 1992 Regulation, that is, the fact that originally the EC legislation on Geographical Indications did not allow, or imposed, any *ex officio* protection of GIs, as it did not establish any obligations for Member

PDO and PGI could override the intellectual property rights attributed to national legislations on geographical designation. The positions were essentially two: on the one hand, some believed that the nature of the European system for the enforcement of GIs in any case deprives Member States of the possibility of separately and independently protecting products whose quality, reputation, or other such characteristics, are essentially due to their geographical origin; on the other hand, some proposed downsizing the exhaustive nature of the EU regime, denying that the EU legislation can prejudice a subjective situation attributed by domestic law, as in the case of intellectual property rights on geographical indications. After the entrance into force of Reg. (EC) No 510/2006, which repealed Reg. (EEC) No 2081/92, the legal debate around the exhaustive nature of the EU regime became even more acute, to the point that the question went under the scrutiny of the Court of Justice. See Judgement of the Court of 8 September 2009, *Budvar v Ammersin*, case C-478/07, where the Court observes that '*A number of characteristics of the system of protection as laid down by Regulations No 2081/92 and No 510/2006 also support the view that that system is exhaustive in nature*' (point 115) and concludes that '*...that regulation precludes the application of a system of protection laid down by agreements between two Member States (...) which confers on a designation, which is recognised under the law of a Member State as constituting a designation of origin, protection in another Member State where that protection is actually claimed, despite the fact that no application for registration of that designation of origin has been made in accordance with that regulation*'. Reference is also made to L. PETRELLI, *ivi*, pp. 289-290, fn. 12, for an overview of this topic and some further bibliographical references.

³⁰² See, again, V. RUBINO, *La protezione delle denominazioni geografiche dei prodotti alimentari nell'Unione europea dopo il regolamento 1151/2012 UE*, *op. cit.*, p. 5, which identifies the reasons behind the harmonisation of the legal framework in the high level of litigation between Member States resulting from the fragmentation of national rules, as well as in consumers' mistrust of agricultural products and foodstuffs lacking credible and uniform authenticity guarantees. Before the emission of Reg. (EEC) No 2081/1992, indeed, agri-food products whose quality was linked to their origin used to be protected individually, by Member States, mainly through the use of individual or, more often, collective trademarks, *ad hoc* laws and, in some cases, bilateral and multilateral agreements. In Italy, for instance, the first normative act aimed at recognising and enforcing Geographical Indications dates back to the 1950s. See Law No. 125, 10 April 1954, *Tutela delle denominazioni di origine e tipiche dei formaggi*. In particular, the Italian law distinguished between 'designation of origin', meaning those relating to cheeses produced in defined geographical areas, according to consistent local practices, and whose characteristics derived mainly from the *terroir*; and 'typical designation', meaning those relating to cheeses produced in the national territory, according to consistent practices, and whose characteristics derived from particular production methods or techniques.

³⁰³ According to Art. 13, par. 1, Reg. (EEC) No 2081/92, registered names were to be protected against: '(a) any direct or indirect commercial use of a name registered in respect of products not covered by the registration in so far as those products are comparable to the products registered under that name or insofar as using the name exploits the reputation of the protected name; (b) any misuse, imitation or evocation, even if the true origin of the product is indicated or if the protected name is translated or accompanied by an expression such as 'style', 'type', 'method', 'as produced in', 'imitation' or similar; (c) any other false or misleading indication as to the provenance, origin, nature or essential qualities of the product, on the inner or outer packaging, advertising material or documents relating to the product concerned, and the packing of the product in a container liable to convey a false impression as to its origin; (d) any other practice liable to mislead the public as to the true origin of the product (...)':

States to automatically move on in protecting their own PDO or PGI, or those of a different Member State³⁰⁴. In other words, the 1992 legal regime did not impose on Member States an obligation to intervene *ex officio* to protect a PDO or PGI. And, on closer inspection, it would be necessary to wait a decade for this significant step to be taken³⁰⁵.

It was, above all, the need to pledge greater clarity and transparency that, sixteen years later, led to the first reform of the EC regime for Geographical Indications, which culminated in the approval of Reg. (EC) No 509/2006 and Reg. (EC) No 510/2006³⁰⁶. The former, as said, introduced traditional specialities guaranteed to replace certificates of specific character; the latter, instead, was expressly dedicated to protected designations of origin and protected geographical indications³⁰⁷.

³⁰⁴ The relevance of the topic is further confirmed by the interest shown by the CJEU. Indeed, the issue of the *ex officio* protection of Geographical Indications was at the centre of a famous case addressed by the Court of Justice, the ‘Parmesan II’ case. See Judgment of the Court of 26 February 2008, *Commission of the European Communities v Federal Republic of Germany*, case C-132/05. The case law stems from the Commission’s requests to the Court to declare that Germany had failed to fulfil its obligations under Article 13, par. 1, Reg. (EEC) No 2081/92, as it had not taken any action against the placement on the German market of a cheese called ‘Parmesan’, which was considered evocative of the well-known and widespread Parmigiano Reggiano PDO. Addressing the doubts involving the interpretation of rules in force at the time, and in particular, Article 10 of Reg. (EEC) No 2081/92 – which essentially imposes on Member States to take all measures necessary to ensure compliance with the product specifications of products having the name of registered designations or indications – the Court observed that only the State of provenance of a designation of origin or geographical indication had to take action and carry out the necessary controls, excluding any imposition in terms of *ex officio* protection. In simpler terms, if the PDO or PGI product originates from the State where the violation has been committed, that Member State can take action; otherwise, it is not compelled to do so under Reg. (EEC) No 2081/92. For a commentary on the Parmesan case and some reflections on Member States’ obligations to protect Geographical Indications see, *ex multis*, A. GERMANÒ, *Gli Stati membri hanno l’obbligo di difendere d’ufficio le denominazioni geografiche protette?*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2008, pp. 478-482; I. CANFORA, *Il caso «Parmigiano Reggiano»: denominazioni di origine composte e strumenti di tutela tra competenze nazionali e diritto comunitario*, in *Rivista di diritto agrario*, 2008, II, pp. 16-39; N. LUCIFERO, *Denominazioni composte, denominazioni generiche e la tutela delle denominazioni di origine protette. Il caso “parmesan”*, in *Giurisprudenza italiana*, 2009, pp. 579-599; F. ALBISINNI, *Prodotti alimentari e tutela transfrontaliera*, in *Rivista di diritto alimentare*, 2009, 2, pp. 1-15; G. SGARBANTI, *La cooperazione tra Stati UE (il caso Parmesan, il regolamento 2006/2004)*, in B. UBERTAZZI, E. MUNIZ ESPADA (eds.), *Le indicazioni di qualità degli alimenti. Diritto internazionale ed europeo. L’Italia e la vita giuridica internazionale*, Milano, Giuffrè, 2009, pp. 56-64; S. BOLOGNINI, *La giurisprudenza della Corte di Giustizia nella definizione del Sistema di tutela delle Indicazioni Geografiche*, in N. LUCIFERO (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, op. cit., pp. 71-79. For some critical remarks on the Court decision, see F. CAPELLI, *La sentenza Parmesan della Corte di giustizia: una decisione sbagliata (Nota a Sentenza del 26 febbraio 2008 in causa n. C-132/05)* in *Diritto comunitario e degli scambi internazionali*, 2008, 1, pp. 329-339; S. VENTURA, *Il caso Parmesan visto dalla Corte di giustizia. Una sentenza deludente – A proposito della DOP «Parmigiano Reggiano» e del suo sinonimo «Parmesan»*, *ivi*, pp. 323-238.

³⁰⁵ Indeed, this enhanced form of protection will be achieved only with Reg. (EU) No 1151/2012. However, this aspect will be better addressed shortly.

³⁰⁶ See Reg. (EC) No 510/2006, recital 20: ‘*In the interests of clarity and transparency, Regulation (EEC) No 2081/92 should be repealed and replaced by this Regulation*’.

³⁰⁷ For an analysis of the legislative framework applicable under Reg. (EC) No 510/2006, see F. CAPELLI, *Tutela delle denominazioni d’origine e delle indicazioni geografiche dei prodotti agroalimentari nel nuovo regolamento comunitario n. 510/2006 e nel decreto italiano 19 novembre 2004 n. 297*, in *Diritto comunitario e degli scambi*

Indeed, legislative action in the direction of reform had also become necessary due to the many significant regulatory changes that had taken place in those years, both in the European Communities and internationally, and which, directly or indirectly, had deeply influenced the European food law system³⁰⁸.

The 2006 reform thus affected the discipline applicable to PDO and PGI without making major substantive changes³⁰⁹, but introducing some procedural innovations mostly aimed at improving and streamlining procedures, as well as at making the European regime more compatible with the revised structure of international sources³¹⁰.

internazionali, 2006, 1, pp. 115 ss.; L. PETRELLI, *I regimi di qualità nel diritto alimentare dell'Unione europea*, *op. cit.*, pp. 285-342.

³⁰⁸ In this regard, an example that is already sufficiently explanatory is provided by the introduction of Reg. (EC) No 178/2002, the General Food Law. But it is also possible to consider the legislative interventions on food labelling, which had brought to the replacement of Council Directive 79/112/EEC of 18 December 1978 on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs for sale to the ultimate consumer, with Directive 2000/13/EC of the European Parliament and of the Council of 20 March 2000 on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs. As is known, Directive 2000/13/EC is no longer in force and has been repealed by Reg. (EU) No 1169/2011. In addition to this, and looking at the international context, it is worth mentioning the ratification of the TRIPS Agreement, with all the consequences and effects it brought for the European Communities, as well.

³⁰⁹ For example, as anticipated above, the definitions of *designation of origin* and *geographical indications*, as originally outlined in Art. 2, par. 2, Reg. (EEC) No 2081/92, remain unchanged in Art. 2, par. 1, Reg. (EC) No 510/2006 (see *supra*, chapter II, fn. 252). And so does the legal protection accorded to them, as provided under Art. 13, Reg. (EC) No 510/2006, which once again covers any direct or indirect commercial use, any misuse, imitation, or evocation, any translation of protected names or use of expression such as 'style', 'type', 'method', 'as produced in', 'imitation', or similar, any other false or misleading indication as to the provenance, origin, nature, or essential qualities, and any other practice liable to mislead the consumer as to the true origin of the product. The terminology itself remains unchanged from that used in Reg. (EEC) No 2081/92. On this aspect, see also P. BORGHI, *I requisiti di tutela dei prodotti di qualità*, in *Rivista di diritto alimentare*, 2009, 2, p. 11.

³¹⁰ The question sprang because some provisions included in the 1992 Regulation were deemed incompatible with the TRIPS Agreement. For this reason, in particular, in 1999, the United States requested consultation with the European Communities before the Dispute Settlement Body of the WTO. The Dispute Settlement Body (DSB) is a session of the General Council of the World Trade Organization that is appointed with the task of settling disputes between WTO Members; to this end, the DSB establishes dispute settlement Panels, adopts Reports, oversees the implementation of the rulings and recommendations provided in the Reports, and authorizes retaliatory measures. For an overview of the DSB, see D. PALMETER, P. C. MAVROIDIS, N. MEAGHER, *Dispute Settlement in the World Trade Organization*, 3rd ed., Cambridge, Cambridge University Press, 2022. In its request for consultation, the U.S. argued that there was a lack of protection for pre-existing trademarks that were similar or identical to geographical indications, and considered the situation to be inconsistent with the EC's obligations under the TRIPS Agreement (see DISPUTE SETTLEMENT BODY, *European Communities – Protection of Trademarks and Geographical Indications for Agricultural Products and Foodstuffs*, 1.06.1999, WT/DS174/R). After some years, Australia raised similar concerns against the European Communities (see DISPUTE SETTLEMENT BODY, *European Communities – Protection of Trademarks and Geographical Indications for Agricultural Products and Foodstuffs*, 17.04.2003, WT/DS290/R). In 2005, the DSB adopted its Panel Report on the issue. It agreed with the United States and Australia, stating that the European Communities' regulation on GIs did not provide national treatment to other WTO Members' right holders and products, and confirmed the international illegitimacy of both the registration and opposition procedures, which were seen as unfairly penalising non-EC countries. After the Panel Report, the European Communities expressed their intention to implement the recommendations. Therefore, the European Institutions also had to consider these aspects when drafting the new Regulation for PDO and PGI. For further information on these topics, and on the effects of the TRIPS Agreement and the 2005 Dispute Settlement Body

To this end, for example, Reg. (EC) 510/2006 provides for a reduction of the time necessary for the registration of a new Geographical Indication, also with the view to making up for the delays accumulated in previous years, and introduces the ‘single document’³¹¹. In addition to this, the 2006 quality schemes reform is also geared towards ensuring a higher level of protection for consumers, as to the distinctiveness of agricultural products and foodstuffs identified as PDO and PGI³¹².

Six years later, the European legislator again engaged in a discussion on quality production regulation³¹³, which led to the publication of Reg. (EU) No 1151/2012³¹⁴, also known as ‘*pacchetto qualità*’³¹⁵. The reasons behind the regulatory intervention can be

decision, on the European Communities framework for GIs, see L. COSTATO, *DOP, IGP, e STG, nei regolamenti del 2006 adottati anche in relazione ai negoziati WTO*, in *Rivista di diritto agrario*, 2006, I, pp. 351 ss.; A. GERMANÒ, *Il panel WTO sulla compatibilità del regolamento comunitario sulle indicazioni geografiche con l'accordo Trips*, in *Agricoltura, Istituzioni e Mercati*, 2005, 2, pp. 69 ss.; L. PETRELLI, *I regimi di qualità nel diritto alimentare dell'Unione europea*, op. cit., pp. 292-293.

³¹¹ Art. 5, par. 2, lett. c, Reg. (EC) 510/2006, while listing the information to be added to the application for registration, includes the ‘single document’, which must set out the main points of the specification (i.e., the name, a description of the product including, where appropriate, specific rules concerning packaging and labelling, and a concise definition of the geographical area), and a description of the link between the product and the geographical environment or geographical origin. With this content, the ‘single document’ is intended as a means to publish some important information concerning the interested designation or indication, prior to the registration itself, thus allowing for timely preventive checks by part of other Member States or third countries, and a better exercise of the right to objection.

³¹² In this regard, for instance, it has been observed that, while Art. 8, Reg. (EEC) 2081/92 provided that: ‘*The indications PDO, PGI, or equivalent traditional national indications, may appear only on agricultural products and foodstuffs that comply with this Regulation*’, the corresponding provision of the 2006 Regulation adopts the term ‘shall’, rather than ‘may’. See Art. 8, par. 2, Reg. (EC) 510/2006: ‘*In the case of the agricultural products and foodstuffs originating in the Community marketed under a name registered in accordance with this Regulation, the indications protected designation of origin and protected geographical indication or the Community symbols associated with them shall appear on the labelling*’ (emphasis added). On this aspect, see again R. SAIJA, *La qualità alimentare nel diritto europeo dal 1992 a oggi*, op. cit., p. 49.

³¹³ Nevertheless, it should be recalled that, before 2012, the EU legislator had already returned to the matter, albeit with an act of soft law. Reference is to the Green Paper on agricultural product quality, which was addressed before. See *supra*, chapter II, par. 1.1.

³¹⁴ For an introduction to Reg. (EU) No 1151/2012 see, *ex multis*, L. COSTATO, *Il regolamento n. 1151/2012 del Parlamento europeo e del Consiglio sui regimi di qualità dei prodotti agricoli e alimentari*, in *Rivista di diritto agrario*, 2012, I, pp. 648-664; S. BOLOGNINI, *Il reg. (UE) n. 1151/2012 sui regimi di qualità dei prodotti agricoli e alimentari: cinquanta sfumature di valore aggiunto*, in *Agricoltura, Istituzioni, Mercati*, 2014, 2, pp. 23-55; A. DI LAURO, *Le denominazioni d'origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, op. cit.

³¹⁵ Renowned doctrine has not hesitated in criticising the adopted terminology, highlighting how the 2012 Regulation cannot be understood as a complete and coherent one-piece of legislation concerning all aspects of quality agri-food productions – if that is the meaning to be attributed to the term ‘*pacchetto qualità*’ – but rather as a step along the way, a component of such a comprehensive approach, given the partial nature of the Regulation itself. In these terms, F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit., p. 318: ‘*L’ambizioso titolo del Regolamento «Sui regimi di qualità dei prodotti agricoli e alimentari», si propone così come enunciazione programmatica di una generalità ed onnicomprensività che, pur non corrispondendo appieno agli effettivi contenuti disciplinari, più limitati di quanto l'intitolazione possa far intendere, prefigura comunque la consapevolezza della necessità di sistematici e coordinati interventi normativi*’. In this sense, see also F. CAPELLI, *Il Regolamento (UE) n. 1151/2012 sui regimi di qualità dei prodotti agro-alimentari: luci ed ombre*, in *Rivista di diritto alimentare*, 2014, 1, pp. 52-60.

fundamentally traced back to two strands: on the one hand, the desire to simplify legislation concerning the Common Agricultural Policy as much as possible³¹⁶; on the other hand, the need to achieve an even higher level of clarity and transparency³¹⁷.

Regulation (EU) 1151/2012 introduces some meaningful changes compared to the previous legislation, which should be deepened not only for their innovative scope, but also because these aspects have consolidated over time and remain part of the legal regime currently applicable to PDO and PGI.

First of all, it should be noted that, for the first time, the whole EU *sui generis* regime for Geographical Indications and traditional specialties guaranteed is contained in a single piece of legislation, which brings together the rules applicable to PDO, PGI, and TSG kept separate up to this point. Moreover, the 2012 Regulation also presents new quality indications, whose objective is to facilitate the communication within the internal market of the value-adding characteristics or attributes of agricultural products. These indications are quoted as ‘optional quality terms’ and are: mountain product, and product of island farming³¹⁸.

As a matter of fact, it is not by coincidence that the 2012 Regulation is entitled ‘*on quality schemes for agricultural products and foodstuffs*’, hinting at a new and unified approach to all indications capable of conveying a message related to quality and origin.

From a substantial point of view, the following novelties are noteworthy.

A significant difference is provided by the legal basis supporting the 2012 Regulation. Indeed, in addition to the legal basis set for legislative acts relating to the CAP (namely, Art. 43 TFEU), Reg. (EU) No 1151/2012 also involves the legal basis set for measures relating to intellectual property (Art. 118 TFEU). This shift is symptomatic of the Institutions’ awareness that the EU quality policy is not only a tool to facilitate investments in agriculture, but also a means for market support, fair competition, and IP rights protection policies. That means, in different words, that the European Union quality policy not only contributes to achieving the

³¹⁶ See Reg. (EU) No 1151/2012, recital 11: ‘*The Union has for some time been pursuing an approach that aims to simplify the regulatory framework of the CAP. This approach should also be applied to regulations in the field of agricultural product quality policy, without, in so doing, calling into question the specific characteristics of those products*’.

³¹⁷ See Reg. (EU) No 1151/2012, recital 14: ‘*In the interests of clarity and transparency, Regulations (EC) No 509/2006 and (EC) No 510/2006 should therefore be repealed and replaced by this Regulation*’. In this sense, also R. SAIJA, *La qualità alimentare nel diritto europeo dal 1992 a oggi*, op. cit., p. 51.

³¹⁸ For a general introduction to optional quality terms, see S. BOLOGNINI, *Il reg. (UE) n. 1151/2012 sui regimi di qualità dei prodotti agricoli e alimentari: cinquanta sfumature di valore aggiunto*, op. cit., p. 46. Specifically, on mountain products, see C. AGOSTINI, *I prodotti di montagna*, in *Trattato di diritto alimentare Italiano e dell’Unione Europea*, op. cit., pp. 677-684.

CAP's objectives, but also to fostering and incentivising the development of intellectual property rights in agriculture, which are essential to the structure of the internal market³¹⁹.

Furthermore, the 2012 Regulation modifies the definitions established for designations of origin and geographical indications, respectively '*...a name which identifies a product: a) originating in a specific place, region or, in exceptional cases, a country; b) whose quality or characteristics are essentially or exclusively due to a particular geographical environment with its inherent natural and human factors; and c) the production steps of which all take place in the defined geographical area*' and '*...a name which identifies a product: a) originating in a specific place, region or country; b) whose given quality, reputation or other characteristic is essentially attributable to its geographical origin; and c) at least one of the production steps of which take place in the defined geographical area*'³²⁰.

Protected designations of origin and protected geographical indications are no longer *names of a region, a specific place or, in exceptional cases, a country*, used to describe an agricultural product or a foodstuff, but become *names which identify a product originating in a specific place, region or (in exceptional cases) a country*. In addition to the novelty itself, the new wording eliminates any uncertainty as to the possibility of recognising, as a protected designation or protected indication, non-geographical names that are capable of identifying a product as originating from a specific geographical area³²¹.

In any case, the prohibition to register as PDO or PGI generic terms, or names conflicting with plant varieties or animal breeds, and are likely to mislead the consumer as to the true origin of the products, remains in force³²².

Moving to the procedural aspects, other novelties are also worth mentioning.

The first reflection concerns the fact that the 2012 Regulation introduces a single procedure³²³ for the registration of PDO and PGI, as illustrated under Article 49³²⁴, which

³¹⁹ For a more detailed reflection on Reg. (EU) No 1151/2012 legal basis, see, again, F. ALBISINNI, *Strumentario di diritto alimentare europeo, op. cit.*, pp. 318-321.

³²⁰ Art. 5, par. 1 and par. 2, Reg. (EU) No 1151/2012.

³²¹ See *supra*, chapter II, fn. 207. Based on the CJEU case law on this point, and the new terminology adopted by the Regulation, it was possible to register Geographical Indications such as Ciauscolo PGI [see Commission Regulation (EC) No 729/2009 of 10 August 2009 entering a name in the register of protected designations of origin and protected geographical indications (Ciauscolo PGI)] or Finocchiona PGI [see Commission Implementing Regulation (EU) 2015/629 of 22 April 2015 entering a name in the register of protected designations of origin and protected geographical indications (Finocchiona PGI)].

³²² Art. 6, Reg. (EU) No 1151/2012.

³²³ In this way, Reg. (EU) No 1151/2012 overcomes the provision for the simplified procedure of registration, allowed by Reg. (EEC) 2081/92 under Art. 17.

³²⁴ Looking more closely at Art. 49, it is possible to read the procedure for applying to register names under the EU quality schemes. Applications can only be submitted by groups of producers who work with the product in

envisages cooperation between interested parties, Member States, and the EU Commission. Once registered, as is well known, Geographical Indications are enforced and protected within the internal market, and the 2012 Regulation also affects the content and range of the legal protection attributed to registered PDO and PGI. Indeed, addressing critical observations and long-standing uncertainties³²⁵, the 2012 Regulation also amends Art. 13, once again dedicated to ‘protection’³²⁶, introducing the (long-awaited) *ex officio* protection of Geographical Indications³²⁷.

Reg. (EU) No 1151/2012, in fact, entrusts Member States with the implementation of a series of controls to ensure legal compliance with PDO and PGI discipline. More specifically, with its new formulation, Art. 13 requires Member States to take appropriate administrative and judicial steps to prevent or stop the unlawful use of protected designations of origin and protected geographical indications that are produced or marketed in that Member State³²⁸. From

question. However, in certain cases – e.g., when the product originates from a cross-border geographical area (for PDO or PGI), or when applying for a TSG – groups from different Member States or even third countries may submit a joint application. A single producer may also be allowed to apply alone, but only if they are the only one willing to do so. If the application concerns a product from within the EU, it must be submitted to the national authorities of the relevant Member State, which is in charge of reviewing the application to ensure it meets the legal requirements. As part of this process, the Member State must carry out a national opposition procedure that involves publishing the application and allowing a reasonable timeframe during which any person with a legitimate interest can object to the registration. After considering any oppositions, if the Member State concludes that the application complies with applicable legislation, it may approve the application and forward the full dossier to the European Commission. In doing so, it must inform the Commission of any admissible objections, particularly from parties who have used the name continuously for at least five years before the application was published. The Member State must also make its favourable decision public, provide for the possibility of appeal, and publish the product specification. For PDO and PGI, the Member State must also ensure publication of the version of the product specification on which the Commission bases its decision. Instead, if the application relates to a geographical area in a third country or is submitted by a group based outside the EU, it must be lodged directly with the Commission or through the authorities of that third country.

³²⁵ See *supra*, chapter II, fn. 304.

³²⁶ Under Art. 13, par. 1, registered names are protected against: ‘(a) any direct or indirect commercial use of a registered name in respect of products not covered by the registration where those products are comparable to the products registered under that name or where using the name exploits the reputation of the protected name, including when those products are used as an ingredient; (b) any misuse, imitation or evocation, even if the true origin of the products or services is indicated or if the protected name is translated or accompanied by an expression such as ‘style’, ‘type’, ‘method’, ‘as produced in’, ‘imitation’ or similar, including when those products are used as an ingredient; (c) any other false or misleading indication as to the provenance, origin, nature or essential qualities of the product that is used on the inner or outer packaging, advertising material or documents relating to the product concerned, and the packing of the product in a container liable to convey a false impression as to its origin; (d) any other practice liable to mislead the consumer as to the true origin of the product’. Except for a few slight differences, such as the reference to the possibility of using Geographical Indications as ingredients, the legal protection framed under Reg. (EU) No 1151/2012 does not differ from the one provided in Reg. (EEC) No 2081/92 and Reg. (EC) 510/2006.

³²⁷ See V. RUBINO, *La protezione delle denominazioni geografiche dei prodotti alimentari nell’Unione europea dopo il regolamento 1151/2012 UE*, op. cit., p. 4.

³²⁸ See Art. 13, par. 3, Reg. (EU) No 1151/2012. The disposition goes on by specifying that, to this end, Member States also designate the authorities that are responsible for carrying out these tasks, following the procedures established by each Member State, and which must offer adequate guarantees of objectivity and impartiality.

this moment onwards, unlike the previous regime, Member States are under an obligation to intervene to prevent or inhibit any violation of the legal regime applicable to PDO and PGI, and must also be endowed with the necessary tools and resources for the purpose.

The 2012 Regulation shelved the regime applicable to Geographical Indications for more than ten years, albeit with some subsequent amendments³²⁹.

Only recently³³⁰, indeed, have the European Institutions begun to reflect on the possibility of amending the rules applicable to EU quality schemes, developing an ambitious

Looking at the Italian framework, for instance, these responsibilities are attributed to the Ispettorato centrale della tutela della qualità e della repressione frodi dei prodotti agroalimentari (ICQRF).

³²⁹ In this regard, particular attention should be paid to the amendments introduced by Reg. (EU) No 2021/2117. As anticipated, in December 2021, three regulations were published on the Official Journal of the EU: Regulation (EU) No 2021/2015, Regulation (EU) No 2021/2116, and Regulation (EU) No 2021/2117, which laid the foundations for the Common Agricultural Policy reform (see *supra*, chapter I, fn. 32). Without delving into the details of the CAP 2023-2027 reform, what is most interesting, in this context, is to highlight some of the main changes brought by Reg. (EU) No 2021/2117 to Reg. (EU) No 1151/2012. First of all, Reg. (EU) No 2021/2117 reflects on the opportunity to align the definitions of designation of origin and geographical indication for foodstuffs and wines to those provided by the TRIPS Agreement (see recital 29). To this end, it modifies Art. 5, par. 1 and par. 2 of the 2012 Regulation, on the definitions of PDO and PGI, introducing a reference to *traditionally used names*. That means, in other words, that the definitions of PDO and PGI, as provided under Reg. (EU) No 1151/2012, have been modified as to the possibility of also registering names traditionally used to identify a specific product, provided that the other requirements and conditions foreseen by the legislation, which remain unchanged, are met. Equally significant is the role that Reg. (EU) No 2021/2117 attributes to the so-called human factors in establishing the link between the quality of a product and its geographical origin. Human factors, in this perspective, do not only include specific production or processing methods, but also refer to other elements: soil and landscape management, cultivation practices, or any other relevant human contribution to the maintenance of the natural factors of the geographical environment. These aspects flow into the amendment to Art. 7, par. 1, concerning product specification, where lett. f is modified to refer to such human factors, which may be included in PDO product specifications (but do not extend to Protected Geographical Indications). In addition, Reg. (EU) No 2021/2117 also increases the elements that product specifications may contain, including a description of the contribution of the designation of origin or geographical indication to sustainable development. Worth mentioning is also the amendment made to Article 12, par. 2: for products originating in the Union that are marketed under a protected designation of origin or protected geographical indication, the associated Union symbols must appear not only on the labelling, but also on advertising materials. Of great importance is to mention the novelty brought to Art. 13, dedicated to protection. Indeed, the European legislator extends the protection of PDO and PGI to cover any form of commercial use that weakens or dilutes the reputation of the protected name. That means that the legal protection provided for Geographical Indications no longer covers only commercial uses that exploit the reputation of PDO and PGI, but also those that are likely to weaken or undermine that reputation. Finally, Reg. (EU) No 2021/2117 looks at procedures and introduces some novelties aimed, above all, at simplifying and speeding up applications and oppositions, as well as amendments to product specifications. In this regard, with an update to Art. 53, par. 2, amendments to product specifications are classified into two categories: Union amendments and standard amendments. The former, which are punctually listed in Art. 53, par. 2, lett. a-d, require an opposition procedure at the Union level. This includes changes: in the name of the protected designation of origin or protected geographical indication, or in the use of that name; that may alter the link between quality, other characteristics, or reputation, and the geographical environment; that concern a traditional speciality guaranteed; that entail further restrictions on the marketing of the product. The latter, instead, are managed at the Member State or third country level, and are the amendments that do not fall within the exhaustive list provided under Art. 53, par. 2, lett. a-d.

³³⁰ European Commission, Proposal for a Regulation of the European Parliament and of the Council on European Union geographical indications for wine, spirit drinks and agricultural products, and quality schemes for agricultural products, amending Regulations (EU) No 1308/2013, (EU) 2017/1001 and (EU) 2019/787 and repealing Regulation (EU) No 1151/2012, Brussels, 31.3.2022, COM(2022) 134 final.

project of reform intended to replace Reg. (EU) No 1151/2012 and to unify the legal regime applicable to agricultural products and foodstuffs, wines and spirit drinks, in a single regulation, with a *systemic ambition* much broader than before³³¹. Implementing the commitments already undertaken in the Farm to Fork Strategy³³², the EU legislator moved forward primarily to address the criticalities mostly perceived after ten years of implementation of Reg. (EU) No 1151/2012, including: incomplete and insufficient protection of producers' rights on GIs; complexity of registration procedures; lack of emphasis on sustainability, with particular reference to environmental sustainability and animal welfare; producers' vulnerability within production chains; consumers' lack of recognition for PDO and PGI's systems and logos; limited attractiveness of TSG³³³.

These political understandings led to the approval of the new Regulation (EU) No 2024/1143. And it is precisely on this piece of legislation that, at this point, specific attention will be paid to analyse and examine the EU legal regime currently applicable to Geographical Indications. Keeping in mind the many insights of the thirty-year legislative evolution, however, is still important to understand which elements, considered successful, have been maintained, and which, controversially or not, have been abandoned, as well as to identify the new features the EU legislator has chosen to target.

2.2. New perspectives: protected designation of origin and protected geographical indication under Regulation (EU) No 2024/1143.

Reg. (EU) No 2024/1143 was published on 23rd April 2024 and entered into force in May 2024.

Continuing along the path initiated by Reg. (EU) No 2021/2117, the new reform was intended by the EU legislator as a means to use quality schemes to pursue the main objective of the CAP 2023-2027: to create a smart, resilient, and competitive primary sector, capable of

³³¹ In this sense, F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit., p. 318, which speaks of '*ambizione sistemica*'.

³³² With the Farm to Fork Strategy, indeed, the Commission also committed to strengthening the legislative framework on Geographical Indications and, where appropriate, to include specific sustainability criteria.

³³³ For an introduction to the initial stages of the EU quality schemes revision, see A. DI LAURO, *Le denominazioni d'origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, op. cit., p. 623-629. For a first commentary on the new Regulation, see F. ALBISINNI, *Il nuovo Pacchetto Qualità*, in *GeorgofiliINFO. Notiziario di informazione a cura dell'Accademia dei Georgofili*, 8.05.2024, available online at the following link: <https://www.georgofili.info/contenuti/il-nuovo-pacchetto-qualita/29778> (accessed: 15.05.2025); S. CARMIGNANI, *Pacchetto qualità e diritti: una diversa prospettiva*, in *Persona e Mercato*, 2025, 2, pp. 515-522.

facing the current global (climatic and environmental, social and economic) challenges³³⁴. Indeed, Reg. (EU) No 2024/1143 introduces an original and innovative regulation, which confirms the *expansive* capacity of the Common Agricultural Policy³³⁵. It has brought relevant novelties if compared to the previous legislation, both from a substantial and a procedural perspective, but without making significant changes to the fundamental normative structure of Geographical Indications³³⁶.

A first consideration, which was already anticipated, concerns the fact that the new Regulation reflects the systemic ambition of the European legislator, who moves further on the path of unification³³⁷ by incorporating the rules applicable to agricultural products and foodstuffs, wines, and spirit drinks into Reg. (EU) No 2024/1143³³⁸.

³³⁴ COM(2022) 134 final, p. 1: *'The proposal contributes to the objectives pursued by the Common Agricultural Policy (CAP), in particular to improve the response of Union agriculture to societal demands on economic, social and environmental sustainability outcomes of agricultural production'*.

³³⁵ In this sense, see F. ALBISINNI, *Il nuovo Pacchetto Qualità*, *op. cit.*, which highlights how in this context the Common Agricultural Policy no longer takes into account only the rules for production, but it extends to including rules for communication on the market, as well. Also, the market is considered not only from the European viewpoint, but rather as a global market.

³³⁶ As underlined in the proposal for the new Regulation, the European Commission aims to intervene only in the identified *'space(s) for improvement'* and *'with a view to strengthening the system of GIs'*. See COM(2022) 134 final, p. 1.

³³⁷ This path was initiated with the 2012 Regulation, which, as seen, brought together the rules governing PDO, PGI, and TSG.

³³⁸ Until the 2024 EU quality schemes reform, the rules governing the quality production of wines and spirit drinks had always followed a different legal path from those applicable to agricultural products and foodstuffs. The foundations of the first European policy linking wine quality to geographical origin were laid down in Regulation (EEC) No 24/62, which introduced the category of *'quality wine produced in specified regions'* and gave Member States a central role in regulating them. However, it was only Council Regulation (EEC) No 1493/1999 of 17 May 1999, on the common organisation of the market in wine, that formally introduced rules for quality wines within the Common Market Organisation (CMO) for the wine sector. This framework was eventually replaced in 2008 by Regulation (EC) No 479/2008, also referred to as the *'new wine CMO'*. See Council Regulation (EC) No 479/2008 of 29 April 2008 on the common organisation of the market in wine, amending Regulations (EC) No 1493/1999, (EC) No 1782/2003, (EC) No 1290/2005, (EC) No 3/2008 and repealing Regulations (EEC) No 2392/86 and (EC) No 1493/1999. However, just one year later, Reg. (EC) No 479/2008 was repealed, and its provisions were integrated into the broader Single CMO Regulation. See Council Regulation (EC) No 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products. Finally, the provisions concerning quality wine productions were incorporated into Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007, Articles 92 to 110. This legislative act is still the reference point for Geographical Indications of wine, despite the amendments introduced in this framework by Reg. (EU) No 2024/1143. As for Geographical Indications of spirit drinks, their protection at the EC level was introduced by Council Regulation (EEC) No 1576/89 of 29 May 1989 laying down general rules on the definition, description and presentation of spirit drinks. This was later incorporated into Regulation (EU) 2019/787 of the European Parliament and of the Council of 17 April 2019 on the definition, description, presentation and labelling of spirit drinks, the use of the names of spirit drinks in the presentation and labelling of other foodstuffs, the protection of geographical indications for spirit drinks, the use of ethyl alcohol and distillates of agricultural origin in alcoholic beverages, and repealing Regulation (EC) No 110/2008. Also in this case, the provisions relating to Geographical Indications of spirit drinks were then amended by Reg. (EU) No 2024/1143. Given this brief overview, the regulatory framework applicable to PDO and PGI for wines and spirits would certainly deserve a

Moving on, and starting from the observation and analysis of the substantial novelties, it is important to highlight that the definitions of protected designation of origin and protected geographical indication stay unchanged³³⁹ from the wording adopted in Reg. (EU) No 1151/2012, and thus remain the accomplishment of a regulatory and interpretative process begun in 1992. At the same time, this element further confirms the legislator's intention not to overturn the fundamental structure of the GIs system.

The main and essential difference between PDO and PGI remains: while PDO identifies products that derive their quality or characteristics essentially or exclusively from a particular geographical environment, and whose production steps all take place in the defined area³⁴⁰, PGI

much more in-depth analysis, which, however, appears perhaps out of context in this work. Therefore, for a detailed overview of the legislative evolution of the regime, see L. PETRELLI, *I regimi di qualità nel diritto alimentare dell'Unione europea*, op. cit., pp. 343-380. For a detailed analysis of the regime applicable under Reg. (EU) No 1151/2012, see P. BORGHI, *Le indicazioni geografiche dei vini: i vini DOP e IGP*, in L. COSTATO, P. BORGHI, S. RIZZIOLI, V. PAGANIZZA, L. SALVI (eds.), *Compendio di diritto alimentare*, 9th ed., Milano, Wolters Kluwer, 2019, pp. 309-318. For a reading of the legal regime currently applicable to GIs for wines, ID., *Il reg. (UE) 2024/1143: norme verticali per i vini*, in L. COSTATO, P. BORGHI, S. RIZZIOLI, V. PAGANIZZA, L. SALVI (eds.), *Compendio di diritto alimentare*, 11th ed., Milano, Wolters Kluwer, 2025, pp. 314-323. For a more general reconstruction of the vertical rules applying to the wine sector, including specifically to designations and trademarks, see F. ALBISINNI, *Strumentario di diritto alimentare europeo*, op. cit., pp. 391-416. Anyway, as to the merger carried out by Reg. (EU) No 2024/1143, it was observed that the legislative intervention didn't really affect or influence the specificity of the designations provided for agricultural products and foodstuffs, for wines, and for spirit drinks. In this sense, G. DE LUCA, *I regimi delle DOP, delle IGP, delle STG e delle indicazioni facoltative di qualità nel Reg. UE 2024/1143*, in *Le nuove leggi civili commentate*, 2025, 2, p. 363. The A. notes how the regulatory framework continues to be divided into three distinct regulations: Reg. (EU) No 2024/1143, formalising the basic rules on Geographical Indications, TSG, and optional quality terms; Reg. (EU) No 1308/2013, Articles 92 to 110, on Designations of origin, geographical indications and traditional terms in the wine sector, and Reg. (EU) No 2019/787, Articles 21 to 42, on the protection of Geographical Indications for spirit drinks.

³³⁹ As already said, PDO and PGI definitions are provided in Article 46, par. 1 and par. 2, Reg. (EU) No 2024/1143. Again, a designation of origin of an agricultural product is '...a name which identifies a product: (a) originating in a specific place, region or, in exceptional cases, a country; (b) whose quality or characteristics are essentially or exclusively due to a particular geographical environment with its inherent natural and human factors; and (c) the production steps of which all take place in the defined geographical area'; a geographical indication is instead '...a name which identifies a product: (a) originating in a specific place, region or country; (b) whose given quality, reputation or other characteristic is essentially attributable to its geographical origin; and (c) at least one of the production steps of which takes place in the defined geographical area'.

³⁴⁰ Reference is thus to all stages of production, processing, packaging, and, more in general, any form of conditioning of the agricultural product or foodstuff. An issue that appeared many times in the CJEU case law is whether the use of the PDO or PGI can be subordinated to the condition of conducting some final operations, intended to prepare the product for consumption, within the defined area. These operations take the name of 'conditioning', and they include the bottling of wines, grating, slicing, packaging, etc. The Court of Justice was invested with the question on several occasions, giving rise to a generous body of case law. At the beginning, the problem arose in relation to the possibility of bottling PDO or PGI wines outside the defined area, and it was addressed by the Court in the famous 'Rioja I' case (Judgment of the Court of 9 June 1992, *Établissements Delhaize frères and Compagnie Le Lion SA v Promalvin SA and AGE Bodegas Unidas SA*, case C-47/90). Here, the Court excluded that a national legislation could deprive a wine bottled outside the defined geographical area of its designation, as '...it has not been shown that the bottling of the wine in question in the region of production was an operation which endowed it with particular characteristics or was essential in order to maintain the specific characteristics acquired by it' (point 19). Shortly afterwards, however, the Court reconsidered its position. See Judgment of the Court of 16 May 2000, *Kingdom of Belgium v Kingdom of Spain*, case C-388/95. In the decision, which again concerned Rioja wine (the case is known as 'Rioja II'), the Court concluded that, in some cases, a

national legislation excluding the recognition of the designation of origin because the wine is bottled outside the defined geographical area is compatible with the EC Treaty (now TFEU). In fact: ‘...in the case of bottling, the best conditions are more certain to be assured if the bottling is done by undertakings established in the region of those entitled to use the designation and operating under their direct control, since they have specialised experience and, what is more, thorough knowledge of the specific characteristics of the wine in question which must not be impaired or lost at the time of bottling’ (point 65). For a commentary on this case law, see M. BORRACCETTI, *La tutela del vino di qualità può ammettere una deroga al divieto di misure di effetto equivalente: il caso Rioja*, in *Rivista di diritto agrario*, 2000, II, pp. 306-310; E. MONTELLONE, *Alcune considerazioni di tipo economico e giuridico a margine del «caso Rioja»*, in *Giurisprudenza italiana*, 2000, pp. 1777-1780. See also the overview provided in S. BOLOGNINI, *La giurisprudenza della Corte di Giustizia nella definizione del Sistema di tutela delle Indicazioni Geografiche*, op. cit., pp. 79-86. On the same points, sometime after, S. MASINI, *Sull’imbottigliamento in zona di origine: conflitto di filiera e modello di sviluppo territoriale*, in *Rivista di diritto alimentare*, 2012, I, pp. 55-59. The principle of law was soon extended to Geographical Indications of agricultural products and foodstuffs. This happened, for example, in the ‘Prosciutto di Parma’ case (Judgment of the Court of 20 May 2003, *Consorzio del Prosciutto di Parma and Salumificio S. Rita SpA v Asda Stores Ltd and Hygrade Foods Ltd*, case C-108/01). Here, the CJEU assumed the legitimacy of the provision included in the product specification, which subjected the adoption of the protected designation to the fact that both the slicing and the packaging of the Prosciutto di Parma PDO would take place in the defined area. Indeed, ‘The risk to the quality and authenticity of the product finally offered to consumers is consequently greater where it has been sliced and packaged outside the region of production than when that has been done within the region...’ (point 76); ‘Consequently, the condition of slicing and packaging in the region of production, whose aim is to preserve the reputation of Parma ham by strengthening control over its particular characteristics and its quality, may be regarded as justified as a measure protecting the PDO which may be used by all the operators concerned and is of decisive importance to them...’ (point 78). The same principle also steered the Court’s decision in the ‘Grana Padano’ case (Judgment of the Court of 20 May 2003, *Ravil SARL v Bellon import SARL and Biraghi SpA*, case C-469/00), where the European judge recognised the legitimacy of the provision included in the product specification and which requested the Grana Padano PDO to be grated *in loco* and then sold in sealed packages. According to the Court, indeed, such a provision ‘...is intended to allow the persons entitled to use the designation of origin to keep under their control one of the ways in which the product appears on the market. The condition it lays down aims better to safeguard to quality and authenticity of the product, and consequently the reputation of the designation of origin, for which those who are entitled to use it assume full and collective responsibility.’ (point 50). For a comprehensive reconstruction of the case law that stands behind the conditioning of PDO and PGI products, see, *ex multis*, P. BORGHI, *La giurisprudenza della Corte di Giustizia sul condizionamento dei prodotti a indicazione geografica e il Regolamento (UE) N. 1151/2012*, in *Compendio di diritto alimentare*, op. cit., pp. 304-308. The literature addressing conditioning in its different forms is quite vast. See, *ex multis*, M. BORRACCETTI, *Trasformazione di un prodotto e suo confezionamento nel rispetto delle denominazioni d’origine*, in *Rivista di diritto agrario*, 2003, 4, II, pp. 447-458; S. RIZZIOLI, *Il condizionamento dei prodotti con denominazione d’origine*, *ivi*, pp. 458-481; L. COSTATO, *Tracciabilità e territorio: il confezionamento delle DOP e IGP in loco*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2003, 5, pp. 294-295; P. BORGHI, *L’insostenibile leggerezza delle versioni linguistiche: condizionamento e confezionamento dei prodotti DOP e IGP nel recente regolamento UE n. 1151/2012*, in *Rivista di diritto alimentare*, 2013, 3, pp. 29-32. In any case, and even though for PDO all production steps must take place in the territory identified by the product specification, Reg. (EU) No 2024/1143 confirms an exception for raw materials. Under Article 46, par. 3, certain names can be registered as designations of origin even if the raw materials, consisting of live animals, meat, and milk, come from a geographical area larger than the defined one, provided that the conditions laid down by the disposition are met. In particular: a) the production area of the raw materials must be defined; b) special conditions for the production of the raw materials must exist; c) there must be controls to ensure the previous conditions are adhered to; and d) the designations of origin concerned must have been recognised as designations of origin in the country of origin before 1 May 2004. On this point, see M. GIUFFRIDA, *I prodotti a qualità certificata: DOP, IGP e STG*, op. cit., p. 981. Specific rules are also laid down for the sourcing of feed for animals from which PDO products are obtained. According to Art. 47, par. 1, in the case of PDO products of animal origin, feed must be sourced entirely from within the defined geographical area. However, the strictness of the provision is softened in the following paragraph, whereby if sourcing entirely from within the defined geographical area is not practicable, feed sourced from outside that area may be allowed, provided that the product quality or characteristics are not compromised, and that the pre-established threshold is not exceeded.

refers to products whose given quality, reputation or other characteristic is essentially attributable to its geographical environment, and *at least one* of the production steps of which takes place in the defined area. Furthermore, while PDO mentioned quality or characteristics refer to one or more *inner* features of the product (i.e., its taste, the aroma, its colour, nutritional properties, etc.), PGI also adjusts to products that solely derive their reputation from a specific territory.

A few considerations can be drawn from the definitions provided above. First of all, the 2024 Regulation does not waive the possibility of registering non-geographical names as PDO or PGI, provided they are suitable for identifying an agricultural product or foodstuff as originating from a specific territory. The EU legislator confirms a point introduced in 2012, as a result of the CJEU case law on the matter³⁴¹, and, in this way, once again stresses the ability of a name to convey the relation between a product, its characteristics, and its geographical origin, regardless of whether it is a geographical or non-geographical name.

However, Reg. (EU) No 2024/1143 takes a step back as it abandons any reference to *traditionally used names*. As seen³⁴², Reg. (EU) No 2021/2117 amended the definitions of PDO and PGI as provided under Art. 5, par. 1 and par. 2 of the 2012 Regulation, by introducing a reference to traditionally used names. This sentence is no longer included in the new formulation, marking a reversal that, on the one hand, imposes searching for any logical reason, but, on the other hand, is likely to remain unclear, or at least unsatisfying³⁴³.

³⁴¹ See *supra*, chapter II, fn. 207.

³⁴² *Supra*, chapter II, fn. 329.

³⁴³ Indeed, it is interesting to dwell on some critical reflections raised on this point by scholars, which, in particular, questioned whether this U-turn was the result of a deliberate choice by part of the EU legislator, or a mere oversight. See G. DE LUCA, *I regimi delle DOP, delle IGP, delle STG e delle indicazioni facoltative di qualità nel Reg. UE 2024/1143*, *op. cit.*, pp. 366-367, who observes how some elements do suggest the idea that, by erasing the reference to traditionally used names, the legislator wanted to avoid any juxtaposition between geographical and non-geographical names, focusing only on the ability of the registered name to convey the message of the relation between a product and its origin. In this perspective, mentioning traditional names would have been superfluous. However, the A. also notes a significant inconsistency. Indeed, Reg. (EU) No 2021/2117 introduced the reference to traditionally used names for designations of origin and geographical indications of wines, as well, and it was maintained after the 2024 reform [see Article 93, par. 1, lett. a and lett. b, Reg. (EU) No 1308/2013]. This aspect suggests the idea that the lack of any reference to traditionally used names for PDO and PGI of agricultural products and foodstuffs may also be the result of the legislator's lapse of memory.

2.2.1. Protection of PDO and PGI and ex officio protection.

Following the lead of the substantial changes brought by the 2024 EU quality schemes reform, another relevant profile to address involves the protection of Geographical Indications on the market, including *ex officio* protection.

Under this perspective, it should be premised that, again, Reg. (EU) No 2024/1143 did not overturn the preexisting system. The mechanisms of protection established for names registered as designations of origin and geographical indications essentially remained unchanged. Nevertheless, as will be seen in the following chapter, it raises the question of how this broad protection can actually be ensured, and whether technological solutions could play a role or not.

Geographical Indications are still protected against any *direct or indirect commercial use* for comparable products that are not covered by the registration, as well as any use that *exploits, weakens, dilutes, or is detrimental* to the reputation of the protected name; any *misuse, imitation, or evocation*, including when the protected name is translated, transcribed or transliterated or accompanied by expressions such as ‘style’, ‘type’, ‘like’ and others; any other *false or misleading indication* concerning provenance, origin, nature or essential qualities of the product; any other practice liable to *mislead the consumer* as to the true origin of the product³⁴⁴.

³⁴⁴ Art. 26, par. 1, Reg. (EU) No 2024/1143: ‘Geographical indications entered in the Union register of geographical indications shall be protected against: (a) any direct or indirect commercial use of the geographical indication in respect of products not covered by the registration, where those products are comparable to the products registered under that name or where use of that geographical indication for any product or any service exploits, weakens, dilutes, or is detrimental to the reputation of, the protected name, including when those products are used as an ingredient; (b) any misuse, imitation or evocation, even if the true origin of the products or services is indicated or if the protected name is translated, transcribed or transliterated or accompanied by an expression such as ‘style’, ‘type’, ‘method’, ‘as produced in’, ‘imitation’, ‘flavour’, ‘like’ or similar, including when those products are used as an ingredient; (c) any other false or misleading indication as to the provenance, origin, nature or essential qualities of the product that is used on the inner or outer packaging, on advertising material, in documents or information provided on online interfaces relating to the product concerned, and the packing of the product in a container liable to convey a false impression as to its origin; (d) any other practice liable to mislead the consumer as to the true origin of the product’. It should be noted that the 2024 Regulation on Geographical Indications, just like the previous ones, does not provide a strict explanation of the unfair practices listed in Art. 26, par. 1, and against which PDO and PGI are protected. Therefore, the identification of their exact borders has always been the object of close attention by legal scholars, practitioners, and interpreters. Understandably, it has also been the core of numerous judicial decisions, from both national courts and the EU Court of Justice. For a first recognition of the most relevant case law on this point, see, *ex multis*, F. GUALTIERI, S. VACCARI, B. CATIZZONE, *La protezione delle indicazioni geografiche: La nozione di evocazione*, in *Rivista di diritto alimentare*, 2017, 2, pp. 15-42. See also the general overview provided in A. DI LAURO, *Le denominazioni d’origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, *op. cit.*, pp. 612-616. To have a better idea of the meaning to be attributed to the words now crystallised in the aforementioned Art. 26, par. 1, it is useful to recall the guidelines provided on this point by the EU Intellectual Property Office. See EUIPO, *Guidelines for the examination of*

Once again, therefore, the EU legislator recalls a broad spectrum of cases to detect and sanction the widest possible range of acts of unfair competition taking place to the detriment of consumers, and which can fundamentally all be traced back to the need to prevent a producer from attributing a certain quality to products that do not really possess the necessary characteristics, by associating them with PDO or PGI products that, on the contrary, do³⁴⁵.

The high level of protection granted to Geographical Indications within the EU *sui generis* system of protection, which is immediately clear once one reads the wide formulation provided under Article 26, par. 1, is further strengthened by the fact that Reg. (EU) No 2024/1143 has maintained the *ex officio* protection introduced by the 2012 Regulation³⁴⁶.

In this regard, indeed, Art. 42 establishes a multi-level system. On the one hand, each Member State must identify the competent authority that is appointed with the task of verifying and taking enforcement actions for the protection of registered designations of origin and geographical indications on the market, and is responsible for that. On the other hand, and at the same time, Member States must take the appropriate administrative and judicial measures to prevent or stop the use of names of products or services that are produced, provided, marketed

European Union Trademarks, 1.05.2025, pp. 633-661. In these guidelines, for example, the ‘*direct and indirect use*’ refers to the physical manner in which the use of a GI appears on the market: while the former implies that the GI is affixed directly to the product or its packaging, the latter requires the GI to feature in supplementary marketing or information sources. Particular attention is also offered to the cases of ‘*misuse, imitation, and evocation*’. A misuse of a PDO or PGI can be observed when another product name provides false indications as to the geographical source of the goods, with the result that it benefits from the perceived quality of the GI. There is imitation, in the common meaning of the term, where the name of a product intends to simulate or copy the registered GI. Opposing the subjectivity of imitation, which postulates the will of the imitating producer, evocation is instead deemed objective. In fact, by listing the broad case law of the CJEU on this point, the guidelines provide the fundamental parameter to identify evocation, which occurs when, if the consumer is confronted with a disputed name, the image triggered directly in their mind is that of the PDO or PGI product. In other words, evocation can be identified when consumers establish a sufficiently clear and direct link between the term used to designate the product and the product whose name is protected as a registered Geographical Indication, meaning any kind of association between the two, taking into account the viewpoint of the average consumer, who is reasonably well informed, observant, and circumspect. Finally, as to the ‘*other false or misleading indication*’, the guidelines take into account any information that is capable of conveying a false impression as to the product’s origin, or to the nature or essential qualities of the product.

³⁴⁵ The interpretative activity of the CJEU on GIs’ infringement and evocation will be addressed more carefully in the following passages (see *infra*, chapter II, par. 3.1). Indeed, the following paragraph will focus on the (old and new) challenges that Geographical Indications must face, which clearly still include the fight against infringements. Thus, reference is made to the following passages for a more detailed analysis of these profiles, as well as a specific examination of the phenomenon of evocation, whose scope and meaning will be provided. To this end, attention will be paid to the case law of the Court of Justice of the European Union, which, over time, has attempted to define the blurry boundaries of this concept. Reference is also made to the following passages for an overview of the most relevant literature on this point.

³⁴⁶ See *supra*, chapter II, fn. 304.

in their territory, or intended for export to third countries, and which contravene the legal protection established for registered Geographical Indications³⁴⁷.

The requested measures of protection, moreover, do not only concern the physical market, but also extend to the online market (i.e., electronic commerce and online interfaces)³⁴⁸.

At first glance, thus, Reg. (EU) No 2024/1143 does not seem to bring any striking changes to the existing legal system of protection of Geographical Indications, except for the recalled references to the need to defend GIs online – certainly significant, but not revolutionary.

Nevertheless, some meaningful effects of the reform are to be found precisely on the side of the *ex officio* protection of GIs, whose application has been generalised by the 2024 Regulation. Indeed, while Reg. (EU) No 1151/2012 introduced the *ex officio* protection with an innovative formula, but still only applicable to protected designations of origin and protected geographical indications of agricultural products and foodstuffs, Reg. (EU) No 2024/1143 now extends its scope of application to wines and spirit drinks, as well³⁴⁹.

³⁴⁷ See Art. 42, Reg. (EU) No 2024/1143: ‘1. Member States shall designate one or more competent authorities responsible for verification of, and enforcement actions on, the use of geographical indications after the product designated by a geographical indication has been placed on the market, which includes operations such as storage, transit, distribution or offering for sale, including in electronic commerce. Those authorities may be the same as the competent authorities referred to in Article 39(3), point (a), of this Regulation and Article 116 a(2) of Regulation (EU) No 1308/2013. 2. The authorities referred to in paragraph 1 shall, regularly and with appropriate frequency based on risk analysis and on notifications received, including from producer groups, act to ensure compliance with the product specification or with the single document or an equivalent to the single document for the geographical indication concerned, including in online presentations and labelling. 3. Member States shall take appropriate administrative and judicial steps to prevent or stop the use of names of products or services, including through online interfaces, that are produced, provided or marketed in their territory, or intended for export to third countries, and that contravenes Articles 26 and 27. 4. Member States shall take appropriate administrative and judicial steps to disable access to domain names that contravene Article 26(2) from their territory. 5. The authority or authorities designated in accordance with paragraph 1 shall facilitate the information exchange among relevant departments, agencies and bodies, such as police, anti-counterfeiting agencies, customs, intellectual property offices, food law authorities and retail inspectors, to ensure efficient enforcement’.

³⁴⁸ Forwarding a topic that will be addressed below (see *infra*, chapter II, par. 3.1.2), it is interesting to highlight that one of the main novelties introduced with the 2024 EU quality schemes reform is an original attention for the protection of Geographical Indications online. Indeed, in the attempt to respond and react to new forms of threat, the 2024 Regulation introduces provisions aimed at defending names registered as PDO and PGI on the internet, as well. Alongside specific provisions (as with Art. 35, dedicated to the protection of geographical indication in domain names), the urgency to protect Geographical Indications online also surfaces in other dispositions, having different purposes, as in the case of the just-mentioned articles concerning the protection and the *ex officio* protection of GIs.

³⁴⁹ As to Geographical Indications of wines, see, for example, Art. 116a of the amended Reg. (EU) No 1308/2013, dedicated to ‘checks’. The extension of the scope of application of the *ex officio* protection for Geographical Indications is highlighted, among other things, in F. ALBISINNI, *Il nuovo Pacchetto Qualità*, *op. cit.*.

2.2.2. PDO and PGI as ingredients.

Interesting novelties have also been introduced with regard to the legitimate use of a PDO or PGI in the commercial name of agri-food products, mostly transformed, processed, or prepacked ones, that include the GI product among their ingredients³⁵⁰.

In fact, the previous legislation already took into account and regulated the use of PDO and PGI products as ingredients. To this end, Reg. (EU) No 1151/2012 extended the ‘protection’ referred to in Art. 13 also to the case in which PDO and PGI products were used as an ingredient.

However, to provide greater clarity and make the use of PDO and PGI as ingredients less controversial³⁵¹, the 2024 Regulation takes a step forward: not only does it maintain the

³⁵⁰ The Commission has long expressed a clear position on this point, stressing and underscoring the precautions that are deemed necessary when it comes to using PDO or PGI products as ingredients in transformed or processed products, especially as for labelling and other forms of communication. See EUROPEAN COMMISSION, *Guidelines on the labelling of foodstuffs using protected designations of origin (PDOs) or protected geographical indications (PGIs) as ingredients*, Brussels, 16.12.2010, 2010/C 341/03, pp. 1-2. In the document, the Commission agrees on the possibility of legitimately using a name registered as a PDO or PGI in the list of ingredients of a foodstuff, and on mentioning it in or close to the name of a foodstuff incorporating the PDO or PGI product, as well as in the labelling, presentation, and advertising, provided that some conditions are met. More precisely: *‘The foodstuff in question should not contain any other ‘comparable ingredient’, i.e., any other ingredient which may partially or totally replace the ingredient benefiting from a PDO or PGI. As a non-restrictive example of the concept of ‘comparable ingredient’, the Commission considers that a blue-veined cheese (commonly known as ‘blue cheese’) could be considered comparable to ‘Roquefort’ cheese. - This ingredient should also be used in sufficient quantities to confer an essential characteristic on the foodstuff concerned. However, given the wide range of possible scenarios, the Commission is not able to suggest a minimum percentage to be uniformly applied. As an example, the incorporation of a minimum amount of a spice benefiting from a PDO/PGI in a foodstuff could, if appropriate, be sufficient to confer an essential characteristic on that foodstuff. By contrast, the incorporation of a minimum amount of meat benefiting from a PDO/PGI in a foodstuff would not a priori be sufficient to confer an essential characteristic on a foodstuff. - Finally, the percentage of incorporation of an ingredient with a PDO or PGI should ideally be indicated in or in close proximity to the trade name of the relevant foodstuff or, failing that, in the list of ingredients, in direct relation to the ingredient in question’*. Anyway, even if such conditions are met, the EU terms, abbreviations, and symbols for GIs can be used on the labelling of the transformed or processed foodstuff *‘...only if it is made clear that the said foodstuff is not itself a PDO or PGI’*.

³⁵¹ As is well known, the matter has often been the object of clarification by the Court of Justice, which, on several occasions, had to assess whether the use of a Geographical Indication in the commercial name of another product, containing the PDO or PGI as an ingredient, was legitimate or not. This is what happened, for example, with the famous ‘Champagner Sorbet’ case (Judgment of the Court of 20 December 2017, *Comité Interprofessionnel du Vin de Champagne v Aldi Süd Dienstleistungs-GmbH & Co.OHG*, case C-393/16). The main question the Court had to address in this case was whether, when a PDO or PGI (for example, ‘Champagne’) is used as an ingredient in a foodstuff (for example, ‘Champagner Sorbet’), indicating the presence of the former in the commercial name of the latter should be considered legitimate, or not. To answer the proposed questions, the Court first of all observed that the use of a PDO in the commercial name of a foodstuff that has the PDO product among its ingredients is not always and automatically illegitimate. Indeed, *‘the use of a PDO as part of the name under which is sold a foodstuff that does not correspond to the product specifications for that PDO but contains an ingredient which does correspond to those specifications cannot be regarded, in itself, as an unfair use and, therefore, as a use against which PDOs are protected in all circumstances (...). As a consequence, it is for the national courts to determine, in the light of the particular circumstances of each individual case, whether such use is intended to take unfair advantage of the reputation of a PDO’* (point 46). According to the Court, moreover, the use of a PDO as part of the designation of foodstuff that contains the PDO as an ingredient is intended to take unfair advantage of the reputation of the PDO if that ingredient does not confer on that foodstuff one of its essential characteristics. To

case of PDO and PGI used as ingredients under the range of application of Art. 26, but also dedicates a specific provision to this possibility, thereby increasing the level of protection provided to protected designation of origin and protected geographical indications in these circumstances³⁵².

On the one hand, indeed, Article 27, Reg. (EU) No 2024/1143 expressly states which conditions must occur so that the Geographical Indication designating a product used as an ingredient in a processed one may be used in the name of the second, in its labelling, or in its advertising material³⁵³. In addition to this, the provision also introduces a system of prior written notification to the recognised producer group, if such a group exists for the involved Geographical Indication, which falls on the producer who intends to use the PDO or PGI product as an ingredient³⁵⁴.

this end, a *qualitative assessment* is needed: indeed, the CJEU observes that it is not a question of identifying in the foodstuff the essential characteristics of the ingredient protected by a PDO, but of establishing that the foodstuff has an essential characteristic connected with that ingredient, such as the aroma or taste. If, on the contrary, this essential characteristic is more attributable to other ingredients, the use of such a name will take unfair advantage of the reputation of the PDO (see points 50-52). Based on these reflections, the Court concluded that ‘(...) By incorporating in the name of the foodstuff in question the name of the ingredient protected by a PDO, direct use is made of the PDO to claim openly a gustatory quality connected with it, which does not amount to misuse, imitation or evocation’. For a commentary of the ‘Champagner Sorbet’ case, see, *ex multis*, A. MAHY, F. D’ATH, *The Case of the “Champagner Sorbet” - Unlawful Exploitation or Legitimate Use of the Protected Name “Champagne”?*, in *European Food and Feed Law Review*, 2017, 12, pp. 43-48; V. RUBINO, *La Corte di giustizia chiarisce i criteri per l’uso legittimo di una DOP – IGP come ingredienti caratterizzante nell’etichettatura degli alimenti trasformati o composti*, in *Alimenta*, 2018, 9, pp. 189-192. For a more general reflection on the subjective/objective nature of taste and on the issue of proving the organoleptic features of foodstuffs, starting from the ‘Champagner Sorbet’ case, see M. FERRARI, *De gustibus non disputandum est?: il ruolo del sapore nella disciplina degli alimenti*, in *Rivista di diritto agrario*, 2020, 2, II, pp. 68-90.

³⁵² For an overview of the novelties introduced by the 2024 Regulation on the use of PDO and PGI as ingredients, see T. GEORGIOPOULOS, *‘Selling GIs by the Pound’? Geographical Indications as Ingredients under Article 27 of Regulation (EU) 2024/1143*, in *European Food and Feed Law Review*, 2024, 19, pp. 192-198; J. NICOLINI, D. MONDIN, *IG come ingredienti di prodotti trasformati: per fama o per qualità?*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2025, 1, pp. 1-8.

³⁵³ The requirements listed under Art. 27, par. 1, are the following: ‘(a) the processed product does not contain any other product comparable to the ingredient designated by the geographical indication; (b) the ingredient designated by the geographical indication is used in sufficient quantities to confer an essential characteristic on the processed product concerned; and (c) the percentage of the ingredient designated by the geographical indication in the processed product is indicated in the label’.

³⁵⁴ According to Art. 27, par. 2: ‘In addition, producers of a prepacked food, as defined in Article 2(2), point (e), of Regulation (EU) No 1169/2011, containing as an ingredient a product designated by a geographical indication, who want to use that geographical indication in the name of that prepacked food, including in advertising material, shall give a prior written notification to the recognised producer group where such a group exists for that geographical indication’. The notification should include all the information necessary to demonstrate that the conditions listed in the previous paragraph are complied with. In any case, it is important to note that the purpose of the prior notification is merely to inform, not to request any authorisation or permission for the use of the GI. Indeed, the recognised producer group must acknowledge receipt of the notification within four months; after receiving the acknowledgment, or once the established period of four months expires, the notifying producer is allowed to start using the Geographical Indication in the name of the prepacked food. That also means that the recognised producer group cannot oppose the use of the PDO or PGI in the name of the transformed, processed, or prepacked product, if the conditions established under Art. 27, par. 1, are all met. At most, the recognised

In any case, Art. 27, par. 2, preserves the possibility for Member States to provide for additional rules concerning the producers established on their territory. This opening, however, should be carefully considered as it could lead to a prosecution of old uncertainties concerning the compatibility of some national provisions relating to the use of PDO and PGI as ingredients with the European legislation, which already surfaced with Reg. (EU) No 1151/2012³⁵⁵.

2.2.3. Looking at the procedures. Registration, opposition, and amendments to product specifications.

Looking now at the procedural novelties, Reg. (EU) No 2024/1143, in great part, upholds the changes proposed under Reg. (EU) No 2021/2117, mostly affecting the procedure of registration of designations of origin and geographical indications, the opposition procedure, and the amendments to a product specification. The recurrent aim is, once again, to simplify and make the regulatory framework more coherent³⁵⁶.

Starting with the requirements for registration, Reg. (EU) No 2024/1143 substantially maintains the requirements set out in the 2012 Regulation³⁵⁷, which, however, are broken down into more detailed and precise provisions.

Generic terms cannot be registered as Geographical Indications³⁵⁸, nor is it possible to register names that are wholly or partially homonymous to already registered Geographical Indications, or for which the registration has already been requested, ‘...unless there is sufficient

producer group may provide information on the use of the Geographical Indication concerned, which, however, is non-binding, or may conclude a contractual agreement with the other producer about the specific technical and visual aspects for the presentation of the Geographical Indication as an ingredient in the name, labelling, and advertising material.

³⁵⁵ This aspect is highlighted in A. DI LAURO, *Le denominazioni d’origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, op. cit., p. 617, who, in this regard, recalls the Italian example and the uncertainty provoked by the national legislation on the use of PDO and PGI as ingredients. Indeed, D. Lgs. No 297 of 19 November 2004, *Disposizioni sanzionatorie in applicazione del regolamento (CEE) n. 2081/92, relativo alla protezione delle indicazioni geografiche e delle denominazioni di origine dei prodotti agricoli e alimentari*, last updated on 13 July 2024 – i.e., after the entry into force of Reg. (EU) No 2024/1143 –, in its Art. 1, lett. c, provides that the use of names registered as PDO and PGI on the label, presentation, or advertisement of a prepared or processed foodstuff is generally illegitimate, and thus sanctionable, unless prior authorisation has been obtained from the producer group or, in its absence, by the MASAF. Even though these national rules do not go far enough as to demand that the prepared or processed product has ‘minimum qualities’ to access such authorisation, it is quite intuitive to understand how many disputes have been, and might be, triggered by such a provision.

³⁵⁶ See recital 26.

³⁵⁷ Reference is to the rules provided under Art. 6, Reg. (EU) No 1151/2012.

³⁵⁸ Art. 28, Reg. (EU) No 2024/1143. The definition of ‘generic term’ is provided in Art. 2, par. 1, lett. h, according to which a generic term is: ‘...the name of a product which, although relating to the place, region or country where a product was originally produced or placed on the market, has become the common name of a product in the Union’.

*distinction in practice between the conditions of local and long-established usage and the presentation of the two wholly or partially homonymous indications, taking into account the need to ensure equitable treatment of the producers concerned and that consumers are not misled as to the true identity or geographical origin of the products*³⁵⁹. According to Article 30, moreover, it is not possible to register a name as a Geographical Indication when it corresponds to an existing trademark, if, based on the trademark's reputation and the length of time it has been used, the requested registration would mislead the consumer as to the true identity of the product³⁶⁰. Again, Reg. (EU) No 2024/1143 prohibits registering names that might conflict with a plant variety or animal breed denomination, and which are likely to mislead the consumer or cause confusion between GI products and the plant variety or animal breed concerned³⁶¹, while it allows for the registration as PDO and PGI of names referring to

³⁵⁹ See Art. 29, par. 1, Reg. (EU) No 2024/1143. Indeed, according to par. 2, a wholly or partially homonymous Geographical Indication which might mislead the consumer cannot be registered, even if the reference to the territory, region, or place of origin of the products concerned is accurate.

³⁶⁰ The relationship between Geographical Indications and trademarks constitutes a quite complex and manifold topic. As observed by renowned doctrine, this difficult coexistence is mostly due to the different natures of these signs. See F. ALBISINNI, *Marchi e indicazioni geografiche: una coesistenza difficile*, in *Rivista di diritto agrario*, 2015, I, p. 467. Indeed, as it is well known, GIs are public goods, which cannot be possessed, even by the producer group applying for the registration of the PDO or PGI itself. In this sense, ID, *Strumentario di diritto alimentare*, *op. cit.*, pp. 335-338. Trademarks, on the other hand, are private instruments owned by individual or collective entities. Given the wideness and complexity of the topic, delving into it would require a separate, in-depth analysis, which is beyond the scope of the present reconstruction and would perhaps go too far afield. However, the literature that has investigated the topic is vast, and many scholars can be referenced for an in-depth analysis of the relationship between Geographical Indications and trademarks. See, *ex multis*, D. GANGJEE, *Quibbling Siblings: Conflicts Between Trademarks and Geographical Indications*, *op. cit.*; E. SIRIONI, *Conflitti tra marchi e indicazioni comunitarie di qualità (DOP, IGP, STG)*, in B. UBERTAZZI, E. MUNIZ ESPADA (eds.), *Le indicazioni di qualità degli alimenti, Diritto internazionale ed europeo*, *op. cit.*, pp. 208-242; A. GERMANÒ, *Protezione europea delle DOP e delle IGP da marchi simili e protezione nazionale delle denominazioni geografiche protette da simili denominazioni sociali*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2012, 1, pp. 7-10; M. ALABRESE, *"Toscana" batte "toscoro": un nuovo match nella competizione tra marchi e indicazioni geografiche*, in *Rivista di diritto agrario*, 2014, 2, pp. 194-202; A. GERMANÒ, *Sulla titolarità dei segni DOP e IGP*, in *Diritto agroalimentare*, 2017, 2, pp. 287-312; M. MAURO, *La provenienza geografica dei prodotti agroalimentari tra marchi di certificazione, collettivi e denominazione di origine*, *op. cit.*; F. ALBISINNI, *Strumentario di diritto alimentare europeo*, *op. cit.*, pp. 349-366. For the present framing, it suffices to remember that the regime regulating the relationship between Geographical Indications and trademarks is provided under Art. 31, Reg. (EU) No 2024/1143. What is mostly important to recall is that a request for the registration of a trademark that would violate the legal protection of GIs, as provided under Article 26, should be rejected if it is submitted *after* the date of submission to the Commission of the application for the registration of the Geographical Indication. In this case, Union trademarks should be declared invalid by the EUIPO, while national trademarks should be declared invalid by the competent national authority. However, a trademark which might contravene Article 26, but has been applied for, registered, or established through use in good faith within the territory of the Union, *before* the date of submission of the application for registration of the GI, may continue to be used and renewed notwithstanding the registration of the GI, provided that no grounds for invalidity or revocation exist.

³⁶¹ See Article 48, par. 1 and par. 2. However, according to par. 3, the Regulation should not prevent the placing on the market of a product that does not conform to the product specification of a registered GI, the labelling of which includes the name or part of the name of that GI, that contains or comprises the plant variety or animal breed denomination, if some conditions are met. More precisely: '(a) the product concerned comprises or is derived from the plant variety or animal breed indicated; (b) consumers are not misled; (c) the usage of the plant variety

non-European products, even when such designations are not legally protected in the country of origin.

Passing to the examination of the registration procedure, the 2024 Regulation again builds on the novelties introduced by Reg. (EU) No 2021/2117, confirming these choices while also organising them in an attempt to outline a uniform discipline³⁶².

The two-stage structure for the registration procedure – comprising a first stage, which takes place at the national level, and a second stage, which takes place at the European level – is clearly upheld. However, the 2024 Regulation stresses the importance of the national stage, strengthening the role and responsibilities of national authorities³⁶³.

Indeed, Member States continue to be responsible for the examination of the different applications, to check that they meet the conditions respectively laid down for wines, spirit drinks, or agricultural products³⁶⁴. The European Commission, on the contrary, is no longer required to pass through and re-examine the applications, as it was in the past, but only to verify that the applications contain the needed information and that they do not contain manifest errors, taking into account the outcomes of the national examination³⁶⁵.

Applications for the registration of a new designation of origin or geographical indication are thus submitted to the competent national authority, and there they await at least one month from the date of publication. Within that period, any natural or legal person having a legitimate interest³⁶⁶, and established or resident in the involved Member State, may lodge an

or animal breed denomination constitutes fair competition; (d) the usage of the plant variety or animal breed denomination does not exploit the reputation of the registered geographical indication; and (e) the production and marketing of the product concerned had spread beyond its area of origin prior to the date of application for registration of the geographical indication’.

³⁶² In this sense, see G. DE LUCA, *I regimi delle DOP, delle IGP, delle STG e delle indicazioni facoltative di qualità nel Reg. UE 2024/1143*, op. cit., p. 380.

³⁶³ In this perspective, the reflections proposed by the EU legislator at the time of the amendments introduced with Reg. (EU) No 2021/2117 are already enlightening. See recital 33: *‘The assessment carried out by the competent authorities of Member States is an essential step in the registration procedure. Member States have knowledge, expertise and access to data that make them the best placed to verify whether the information provided in the application is correct and truthful (...) Having regard to the principle of subsidiarity, the Commission should subsequently examine applications to ensure that there are no manifest errors, in order to ensure, in particular, that they contain the required information, that they are free of obvious substantive errors, that the reasoning presented supports the application, and that Union law and the interests of stakeholders outside the Member State of application and outside the Union are taken into account’.*

³⁶⁴ Art. 10, par. 1 and par. 2, Reg. (EU) No 2024/1143.

³⁶⁵ Art. 15, par. 1, Reg. (EU) No 2024/1143.

³⁶⁶ For an analysis of this topic, and the legitimacy to propose an opposition to the application for registration, see M. MAURO, *La legittimazione a proporre opposizione alle richieste di registrazione di una DOP o IGP e modifica del disciplinare: la nozione europea di interesse legittimo*, in *Rivista di diritto alimentare*, 2022, 4.

opposition to the application³⁶⁷. After the period has expired, or once any opposition within the Member State has been overcome, the Member State forwards the documents to the European Commission³⁶⁸.

According to Article 15, the Commission then has a period of six months from the day of the reception of the application, which can be further extended by one month only in some justified cases, to carry out its checks. If all the conditions for the registration of the PDO or PGI are met, the Commission publishes in the Official Journal of the European Union the single document and the reference to the publication of the product specification. This moment marks the beginning of the period of three months during which any authority of a Member State or of a third country, or a natural or legal person having a legitimate interest and established or resident in a third country, may submit any opposition against the registration of a Geographical Indication with the Commission³⁶⁹.

An important novelty that was also introduced in this scenario concerns the notice of comments, as provided under Article 18. Within the three months from the above-mentioned publication by part of the EU Commission, the authorities of a Member State or of a third country, or a natural or legal person established or resident in a third country, may in fact submit to the Commission a notice of comments, intended to point out any error or provide additional information in relation to the application, including possible infringement of Union law.

Finally, the Commission decision on the application for registration is regulated by Article 21. If, based on the information available, the Commission excludes that each condition requested by the Regulation is met, it rejects the application for registration by means of

³⁶⁷ Art. 10, par. 4, Reg. (EU) No 2024/1143. The modalities for the opposition procedure are established by each Member State, including the admissibility of the opposition, a period of consultation between the applicant producer group and each opponent, the submission of a report from the applicant producer group on the outcome of the consultations, including any changes the applicant producer group has made to the application for registration. If, after this, the Member State considers that the requirements for the registration of the GI are met, it may still submit an application for registration at the Union stage.

³⁶⁸ Art. 14, Reg. (EU) No 2024/1143.

³⁶⁹ Art. 17, Reg. (EU) No 2024/1143. Article 17 regulates the whole Union opposition procedure, which has substantially remained unchanged from the 2012 Regulation, as are the grounds of opposition, now provided under Article 19, par. 1. Indeed, an opposition lodged in accordance with Article 17 is admissible only if the opponent shows that: '(a) the proposed geographical indication does not comply with the definition of the geographical indication or with the requirements referred to in this Regulation, Section 2 of Chapter I of Title II of Part II of Regulation (EU) No 1308/2013 or Article 3(4) and Chapter III of Regulation (EU) 2019/787 as applicable; (b) registration of the proposed geographical indication would be prevented by one or more of the circumstances referred to in Article 28, Article 29, Article 30 or Article 48(1); or (c) the registration of the proposed geographical indication would jeopardise the existence of a wholly or partially identical name or of a trade mark or the existence of products which have been legally on the market for at least five years preceding the date of the publication of the information provided for in Article 15(4)'.

implementing acts. If, on the contrary, all the conditions requested by the Regulation are met, and no admissible opposition is proposed, the Commission registers the new Geographical Indication by means of implementing acts.

Registered names are entered in the Union register of Geographical Indications, which is divided into three parts (GIs of wine, of spirit drinks, and of agricultural products and foodstuffs) and whose maintenance and update is entrusted to EUIPO³⁷⁰.

Finally, as to the procedure for amending product specifications, the 2024 Regulation confirms the distinction between Union amendments and standard amendments³⁷¹, introduced by Reg. (EU) No 2021/2117. While the former requires an opposition procedure at the Union level³⁷², the latter can be addressed at the Member State or third country level³⁷³.

Bearing in mind this framework and the main novelties introduced by the 2024 Regulation with respect to the procedural profiles, it is now inevitable to wonder whether the objectives of simplification and efficiency that guided the EU legislator have actually been achieved. Indeed, despite the numerous changes, it is clear that the level of bureaucracy involved is still very high; this aspect, combined with the documentary burdens that fall on the involved subjects, especially producer groups, probably still makes the procedures very slow, tangled, and confusing³⁷⁴. Furthermore, while the EU legislator seems to have clearly defined

³⁷⁰ Art. 22, Reg. (EU) No 2024/1143.

³⁷¹ Art. 24, par. 2, Reg. (EU) No 2024/1143.

³⁷² According to Art. 24, par. 3, an amendment is to be considered as a Union amendment when it entails a change of the single document, or another equivalent document, and when it: '*(a) includes a change: (i) for agricultural products, in the name or in the use of the name; (ii) for wine, in the name or in the use of the name, or in the category of product or products designated by the geographical indication; (iii) for spirit drinks, in the name or any part of the name or in the use of the name, or in the category of product or products designated by the geographical indication, or in the legal name; or (b) risks voiding the link to the geographical area referred to in the single document; or (c) entails further restrictions on the marketing of the product*'.

³⁷³ According to Art. 24, par. 4, any amendment that does not fall within the range provided by the previous paragraph, and is thus not a Union amendment, should be considered as a standard amendment. Also, according to par. 5, a standard amendment is a temporary one when it only implies temporary changes in the product specification, which are the result of some extraordinary measures deemed necessary by competent national authorities (e.g., measures that are necessary because of a natural disaster or adverse weather condition).

³⁷⁴ See, in this perspective, G. DE LUCA, *I regimi delle DOP, delle IGP, delle STG e delle indicazioni facoltative di qualità nel Reg. UE 2024/1143, op. cit.*, pp. 384-385, who critically comments on the overly optimistic attitude of the EU legislator. Moreover, the A. also underlines how the 2024 Regulation, which is already complex *per se*, in several points refers to delegated acts and implementing acts by the Commission (see recital 77 and 78). On the one hand, the purpose behind the broad powers attributed to the Commission is to propose and develop detailed rules, when needed; on the other hand, however, there is a clear risk of making the regulatory framework even more fragmented. Here are some of the delegated acts and implementing acts that have already been adopted, and which already prove these considerations. Commission Implementing Regulation (EU) 2025/26 of 30 October 2024 laying down rules for the application of Regulation (EU) 2024/1143 of the European Parliament and of the Council as regards registrations, amendments, cancellations, enforcement of the protection, labelling and communication in respect of geographical indications and traditional specialties guaranteed, and amending Implementing Regulation (EU) 2019/34 as regards geographical indications in the wine sector, and repealing

the ‘*what*’ of these procedural novelties, the ‘*how*’ remains blurry, leaving room to reflect on the contribution that may be derived from the implementation of innovative technologies in this framework, as well.

3. Between the known and the new. Challenges of Geographical Indications.

Up to this point, this second chapter has attempted to build the framework of Geographical Indications, paying particular attention to the identification of the core components of GIs, their market and non-market functions, the legal regime applicable in the European landscape, and the *sui generis* system of protection that PDO and PGI enjoy under Reg. (EU) No 2024/1143.

In this way, the chapter has hopefully provided some tools that can be used to navigate the field of interest and, consequently, to address some of the questions that arise in this scenario. In particular, reference is to some of the challenges that Geographical Indications meet, which are multifaceted and quite heterogeneous in their nature.

On the one hand, indeed, GIs are now called upon to face entirely new and unprecedented hurdles. This is the case with the challenges imposed by technological advances, connected to the most recent need to find tools to properly protect Geographical Indications online, as well, and to mitigate the risks that frequently derive from electronic commerce and the use of online platforms to sell and buy GI agri-food products. Or, again, this is the case with those challenges mostly associated with the opportunity (*rectius*, the necessity) of adapting PDO and PGI to the demands of sustainability, which might affect the environmental, social, or economic related profiles of GI productions.

On the other hand, alongside these original challenges, some old and well-known pitfalls persist and continue to arise, and it is necessary to address them both from the viewpoint of producers and producer groups, who are responsible for the governance and control of their

Implementing Regulations (EU) No 668/2014 and (EU) 2021/1236; Commission Delegated Regulation (EU) 2025/27 of 30 October 2024 supplementing Regulation (EU) 2024/1143 of the European Parliament and of the Council with rules concerning the registration and the protection of geographical indications, traditional specialities guaranteed and optional quality terms and repealing Delegated Regulation (EU) No 664/2014; Commission Delegated Regulation (EU) 2025/28 of 30 October 2024 amending Delegated Regulation (EU) 2019/33 supplementing Regulation (EU) No 1308/2013 of the European Parliament and of the Council as regards applications for protection of designations of origin, geographical indications and traditional terms in the wine sector, the objection procedure, restrictions of use, amendments to product specifications, cancellation of protection, and labelling and presentation.

own GI, and from the perspective of interpreters and legal scholars who, today as in the past, still deal with this topic. Reference is, most of all, to GI infringements.

Faced with these challenges, protected designations of origin and protected geographical indications are implicitly required to evolve and innovate, seeking a balance with the (apparently) contradictory and conflicting necessity to uphold and safeguard their typical features, which are an effect of their relationship with the area of origin and, consequently, the tradition, population, and cultural heritage of that territory.

Starting from these premises, the following pages will delve into these profiles, going through well-known and new challenges of Geographical Indications, and outlining the possible spaces of intersection with technological innovation.

3.1. Infringements.

As highlighted above, and as also emerged from the illustration of the legal regime applicable to PDO and PGI, in the European framework Geographical Indications for wine, spirits, agricultural products and foodstuffs are protected as *sui generis* intellectual property rights, whose distinctiveness is fundamentally rooted in the public nature of these designations, as well as in the specific message they convey and which concerns the presence of a particular quality, characteristics, or given reputation, essentially attributable to their geographical origin and method of production³⁷⁵.

As a consequence of this, the scope of protection of GIs, as defined in EU legislation, is quite broad and diverse, as it includes not only the false or misleading use of a protected designation of origin or geographical indication, but also the marketing of GI products that do not actually originate in the place indicated by the involved GI. In fact, reconsidering the content of Art. 26, par. 1, Reg. (EU) No 2024/1143, which has already been extensively

³⁷⁵ In this regard, it has been observed that Reg. (EU) No 2024/1143 also emphasises the peculiarity of the legal qualification of Geographical Indications. In fact, the European legislator structures the new path for GIs, on the one hand, by highlighting their link with the natural environment and the traditional skills of local producers, as is obvious, and, on the other hand, by tracing them back to the category of intellectual property rights. In this sense, S. CARMIGNANI, *La nuova disciplina delle indicazioni geografiche. Profili di qualificazione e tutela*, in *Rivista di diritto alimentare*, 2025, 2, pp. 30-40. This aspect, after all, is immediately stressed in the opening passages of the new Regulation: '*Ensuring uniform recognition and protection throughout the Union for the intellectual property rights related to names protected in the Union is a priority that can be effectively achieved only at Union level. A unitary and exhaustive system of geographical indications, therefore needs to be provided for in Union law. Geographical indications are a collective right held by all eligible producers in a designated area willing to adhere to a product specification*' (see recital 18).

analysed³⁷⁶, Geographical Indications are protected against: any direct or indirect commercial use for comparable products that are not covered by the registration, as well as any use that exploits, weakens, dilutes, or is detrimental to the reputation of the protected name; any misuse, imitation, or evocation, including when the protected name is translated, transcribed or transliterated or accompanied by expressions such as ‘style’, ‘type’, ‘like’ and others; any other false or misleading indication concerning provenance, origin, nature or essential qualities of the product; any other practice liable to mislead the consumer as to the true origin of the product.

Any violation of the instructions provided under Art. 26, par. 1, regardless of the form, entails an infringement of the involved GI. Given the width of the range of behaviours that, today more than in the past³⁷⁷, are deemed illegitimate by the EU legislator because they breach the legal protection provided for protected designation of origin and protected geographical indications, and thus are sanctioned, it is clear that infringements still constitute one of the major threats to the stability and health of the system, and, consequently, one of the main challenges that producers and producer groups meet in the governance of their GI³⁷⁸.

After all, it is not by coincidence that also the Court of Justice has contributed, with a striking number of judgments, to defining the borders of the system of protection of Geographical Indications and their infringements, stepping in to solve many questions regarding the interpretation of the recalled provisions and, consequently, to settle disputes

³⁷⁶ See *supra*, chapter II, par. 2.2.1.

³⁷⁷ In this sense, it is worth recalling that the protection offered in the European legal framework to registered PDO and PGI over time has always been characterised by a certain conformity. This aspect can be noted when looking at the wording respectively adopted in Art. 13, par. 1, Reg. (EEC) No 2081/92, Art. 13, par. 1, Reg. (EC) No 510/2006, Art. 13, par. 1, Reg. (EU) No 1151/2012, and Art. 26, par. 1, Reg. (EU) No 2024/1143. Nevertheless, it does not mean that the content of these provisions has remained unaltered over time. On the contrary, as has appeared in the previous passages, the European legislator gradually improved the formulation of these provisions, in some cases even extending their scope of application, mostly to embrace and adjust to the rulings of the CJEU case law.

³⁷⁸ In this regard, it is interesting to recall the findings of a study by the EU Intellectual Property Office, which specifically addresses the topic of GIs’ infringements. See EUIPO, *Infringement of Protected Geographical Indications for wine, spirits, agricultural products and foodstuffs in the European Union*, 2016. The study examines infringements taking place in the EU market and involving any protected GI, considering products coming from both Member States and a third country. The main objective of the study is to assess the size and value of the EU GI product market and the proportion of products in that market that, on the contrary, infringe protected Geographical Indications, also considering the impact of these infringements on EU consumers. Although dating back almost ten years, the findings of the study are still meaningful. Indeed, they clearly indicate that GIs’ infringements have a relevant dimension in terms of negative impact, corresponding to 9% of the total GI product market and valued at € 4.3 billion. Also, the study evaluated that EU consumers lose approximately € 2.3 billion annually by paying a premium price for what they believe to be a genuine GI product, while in fact they are victims of deception (see p. 36).

concerning the legitimacy and fairness of certain commercial conduct³⁷⁹. And, as will be understood in the following pages, the Court's approach in this regard has generally been characterised by a discrete flexibility, highlighting that the system of protection of Geographical Indications takes into account a gradual number of different forbidden behaviours, which reflect connections with the protected name that vary in their intensity³⁸⁰.

Although the CJEU has had the opportunity to rule on each of the four cases of infringement of GIs provided under the EU *sui generis* regime, it is certainly in relation to one of these that the case law has been most abundant and frequent: it is the case of the evocation of a registered designation of origin or geographical indication³⁸¹.

3.1.1. The broad scope of evocation through the lens of the Court of Justice of the European Union.

In the broad panorama of infringements currently established by Art. 26, par. 1, Reg. (EU) No 2024/1143, evocation is included in the cases provided under lett. b, and it is mentioned alongside the concepts of 'misuse' and 'imitation'.

Even at a first glance, there are at least two elements of complexity that stand out when approaching evocation: the first one concerns the meaning to be attributed to the concept of evocation, in absence of a more precise legislative definition³⁸²; the second, instead, involves

³⁷⁹ In this sense, and for a general but complete and accurate overview of the CJEU case law on Geographical Indications, see, *ex multis*, S. BOLOGNINI, *La giurisprudenza della Corte di Giustizia nella definizione del sistema di tutela delle Indicazioni Geografiche*, *op. cit.*

³⁸⁰ *Ivi*, pp. 87-88.

³⁸¹ As is understandable, the legal literature on the subject of evocation is immense. In addition to the references that will be mentioned in the following pages, see, *ex multis*, I. CANFORA, *Il carattere evocativo della traduzione per le menzioni tradizionali dei vini. Il ruolo della Corte di giustizia nell'uniformazione dei principi del settore alimentare*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2009, pp.100-103; V. PAGANIZZA, *More Holes than Cheese: PDOs, Evocation and a Possible Solution*, in *European Food and Feed Law Review*, 2015, 3, pp. 222-226; V. RUBINO, *From "Cambozola" to "Toscoro": The Difficult Distinction between "Evocation" of a Protected Geographical Indication, "Product Affinity" and Misleading Commercial Practices*, in *European Food and Feed Law Review*, 2017, 4, pp. 326-334; A. ZAPPALAGLIO, *EU Geographical Indications and the protection of producers and their investments*, in E. BONADIO, P. GOOLD (eds.), *The Cambridge Handbook of Investment-Driven Intellectual Property*, Cambridge University Press, Cambridge, 2023, pp. 308-328.

³⁸² In this sense, see A. ZAPPALAGLIO, *EU Geographical Indications and the protection of producers and their investments*, *op. cit.*, p. 311, which, talking about evocation, observes that: 'this concept is nowhere to be found in all the international rules on Geographical Indications or Appellations of Origin. In particular, it appears neither under the arts. 22 and 23 of the TRIPs Agreement, nor at art. 3 of the Lisbon Agreement. Furthermore, it is completely alien to the law and theory of Trade Marks (...). The EU rules on the protection of GIs do not provide any definition of evocation or a test to establish it'. Even the doctrine has struggled to provide a more precise definition of evocation and, consequently, shed some light on this point. See, for example, the reconstruction offered in F. GUALTIERI, S. VACCARI, B. CATIZZONE, *La protezione delle indicazioni geografiche: La nozione di evocazione*, *op. cit.*, p. 16, according to which evocation should be understood as the unfair commercial practice

the distinction from the related concepts of misuse and imitation which, in reality, is not always easy or immediate³⁸³.

In response to these enduring doubts, the case law of the Court of Justice has especially attempted, over time, to outline the concept of evocation to explain and clarify which commercial practices are to be traced back to this scenario. In this regard, it can already be disclosed that the Court's position has been characterised by a gradual, yet progressive, broadening of the borders of evocation.

According to the Court, indeed, '*...evocation covers a situation where the term used to designate a product incorporates part of a protected designation, so that when the consumer is confronted with the name of the product, the image triggered in his mind is that of the product whose designation is protected*'³⁸⁴.

Among the elements that may be relevant to identify an evocation of a protected Geographical Indication, and which must therefore be taken into consideration when evaluating whether a name could trigger the consumer to think of the GI product, at least *two* stand out: the *similarity* of the involved products; and the *phonetic and visual affinity* of the commercial names³⁸⁵.

capable of instilling in consumers the idea that a product has the same characteristics and qualities as the PDO or PGI one, or that it is itself a PDO or PGI product.

³⁸³ *Ibidem*. To offer useful suggestions for distinguishing between cases of misuse, imitation, and evocation, the A. also provide definitions of the first and second concepts. More precisely, misuse represents the appropriation of a protected designation or indication, with undue acquisition of non-existing qualities or features. Imitation, on the other hand, is the activity of reproducing the protected name by plagiarism, and therefore presupposes the existence of a model to reproduce.

³⁸⁴ This principle was first formulated by the Court of Justice in the famous 'Cambozola' case, which is considered the leading case on the evocation of protected names. See Judgment of the Court of 4 March 1999, *Consorzio per la tutela del formaggio Gorgonzola v Käserei Champignon Hofmeister GmbH & Co. KG and Eduard Bracharz GmbH*, case C-87/97. In this case, an Austrian court asked the CJEU whether stopping a producer from using the designation 'Cambozola' for a German blue-veined cheese, on the grounds of being such a name evocative of the 'Gorgonzola PDO', constituted a measure having equivalent effect to a quantitative restriction to the free movement of goods, especially considering that the origin of the product was indicated on the packaging. In addressing the question, the Court developed this idea of evocation as an *image-triggering* use of a commercial name (see point 25), which, over time, became the keystone to interpret the concept. For a commentary on the case law, see F. CAPELLI, *Corte di giustizia tra «Feta» e «Cambozola»*, in *Diritto comunitario e degli scambi internazionali*, 1999, 1, pp. 273-280; L. COSTATO, *Brevi note a proposito di tre sentenze su circolazione dei prodotti, marchi e protezione dei consumatori*, *op.cit.* For some recent reflections, see also A. KYRYLENKO, *Sprechen Sie Cambozola? On the Lessons from the Early Years of 'Evocation'*, in H. BOSHER, E. ROSATI (eds.), *Developments and Directions in Intellectual Property Law*, Oxford University Press, Oxford, 2023.

³⁸⁵ Both of these aspects, for example, are highlighted in the 'Cambozola' decision, where the Court observed that: '*(s)ince the product at issue is a soft blue cheese which is not dissimilar in appearance to Gorgonzola, it would seem reasonable to conclude that a protected name is indeed evoked where the term used to designate that product ends in the same two syllables and contains the same number of syllables, with the result that the phonetic and visual similarity between the two terms is obvious*' (point 27). The importance of the similarity between the disputed products and of the phonetic and visual affinity of the involved designations as golden keys to identify evocative behaviours is also stressed in another important decision of the CJEU, concerning the 'Parmesan II'

Next to these elements, however, the Court also considers the existence of a *conceptual proximity* to be equally relevant³⁸⁶ and, by that, further broadens the boundaries of evocation,

case. This case was already discussed in the previous passages, as with it the Court addressed the question of the *ex officio* protection of Geographical Indications (see *supra*, chapter II, fn. 304, to which reference is also made for some bibliographical references). However, the ‘Parmesan II’ case is quite remarkable also because here the Court was assigned the task of determining whether the commercial name ‘Parmesan’ could be considered evocative of the registered name ‘Parmigiano Reggiano PDO’. The Court’s conclusion is affirmative and, among other reflections, the European judge highlights the similarity between the cheese put in commerce under the name ‘Parmesan’ and the protected one, both of them being hard cheeses grated or intended for grating, as well as the ‘*phonetic and visual similarity between the names*’ (see point 46). Indeed, ‘*...regardless whether the name Parmesan is or is not an exact translation of the PDO Parmigiano Reggiano or of the term Parmigiano, the conceptual proximity between those two terms emanating from different languages, which was revealed in discussions before the Court, must also be taken into account*’ (point 47). Another case law can be recalled here, as once again the Court’s decision as to the existence of any evocative conduct was fundamentally rooted in the principles of similarity between the involved products, and of phonetic and visual affinity of the commercial names. In the ‘Verlados’ case (see Judgement of the Court of 21 January 2016, *Viiniverla Oy v Sosiaali- ja terveysalan lupa- ja valvontavirasto*, case C-75/15), likewise the previous ones, the Court of Justice was asked to establish the validity of the use of the name ‘Verlados’ by a Finnish company for a Finnish cider spirit and to verify the compatibility of said name with the GI ‘Calvados’. In providing an affirmative conclusion to the questions submitted by the Finnish judge, the Court again upholds both legal arguments, highlighting that ‘*...it is not disputed that the name Verlados is used in Finland for products similar to those with the protected geographical indication Calvados, that those products have objective characteristics in common, and they are consumed, from the point of view of the relevant public, on occasions which are largely identical*’ (point 37), and that ‘*As regards the visual and phonetic relationship between the names Verlados and Calvados, the referring court must take into account the fact that they both contain eight letters, the last four of which are identical, and the same number of syllables, and that they share the suffix ‘dos’, which confers on them a certain visual and phonetic similarity*’ (point 38). For a commentary on this case law see, *ex multis*, F. PRETE, *Evocazione di indicazione geografica di bevande spiritose: la nozione eurocomunitaria di consumatore e il ruolo della Corte di giustizia nel processo di uniformazione dei principi del settore alimentare*, in *Rivista di diritto agrario*, 2016, II, pp. 167-180; B. CALABRESE, *La Corte di giustizia dell’Unione europea si pronuncia sulla protezione delle indicazioni geografiche relative alle bevande spiritose: il caso Verlados*, in *Diritto comunitario e degli scambi internazionali*, 2016, 2-3, pp. 273-302. For some critical remarks, see N. COPPOLA, *Viiniverla: too much ‘ado’ about nothing*, in *Journal of Intellectual Property Law & Practice*, 2016, 6, pp. 406-408.

³⁸⁶ The Court takes this step forward with the famous ‘Scotch Whisky’ case. See Judgement of the Court of 7 June 2018, *Scotch Whisky Association v Michael Klotz*, case C-44/17. For an overview of the case, see V. MANTROV, *Do you Prefer Scotch or German Whisky? CJEU Judgment in the Scotch Whisky and Glen Buchenbach Dispute*, in *European Journal of Risk Regulation*, 2018, 4, pp. 719-729. The case concerned the marketing in Germany of a German-made whisky under the name ‘Glen-Buchendbach’, which was conceived as an evocation by The Scotch Whisky Association, because the word ‘glen’, meaning ‘valley’, is found in the names of many famous Scotch whiskies. Having to decide on the existence or non-existence of an evocative conduct, the Court moves from the acknowledgement of the decisiveness of the presumed reaction of consumers in the light of the term used to designate the product at issue, as those consumers must establish a link between that term and the protected Geographical Indication. In other words, what is diriment for the Court is that, when confronted with the name of the product, the image triggered in the consumer’s mind is that of the product whose indication is protected (see point 45). And indeed ‘*...identifying phonetic and visual similarity between the disputed designation and the protected geographical indication is likewise not an essential condition for establishing that there is an evocation (...). It is only one of the factors to be taken into account by the national court when it assesses whether, when the consumer is confronted with the name of the product concerned, the image triggered in his mind is that of the product whose geographical indication is protected. Accordingly, it is possible that an evocation may be found to exist even in the absence of such similarity*’ (point 49). As a consequence of this, rather than just the phonetic and visual affinity, the Court suggests also taking into account, where appropriate, the *conceptual proximity* between the involved terms, since such proximity, like the other criteria, may also trigger the image of the protected product in the consumer’s mind (point 50).

while still clarifying that the latter should not, in any case, be mistaken with *any association of ideas* between the involved products³⁸⁷.

On closer inspection, however, in some following decisions, the Court of Justice went even further and recognised that the evocative effect of a Geographical Indication may also derive from the use of *figurative signs*, as in the case of images or illustrations³⁸⁸.

The lesson that can be learned from the CJEU case law on evocation is, essentially, as follows. To determine whether there has been evocation of a protected Geographical Indication, the national judge must ascertain if the contested element, whether verbal or figurative, is capable of triggering in the consumer's mind the protected name, or the product entitled to use the protected name, directly and unambiguously. To this end, the national court must look at and take into account several factors, including the similarity between the involved products, the phonetic and visual affinity, and the conceptual proximity.

³⁸⁷ In the 'Scotch Whisky' case, the European judge also clarifies that such a conceptual proximity should not be mistaken with other general associations of ideas. Indeed, it is not sufficient that the commercial name at issue evokes *any kind of association* with the protected GI, or the protected geographical area associated to it, as this would not convey a sufficiently clear and direct link, and would on the contrary give rise to significant risks, especially for the legal certainty of the economic actors involved (see points 53-55). In simpler words, what matters for the Court is that the name at issue leads consumers to think of the product that is entitled to the protected designation, clearly and unambiguously.

³⁸⁸ The European judge had the opportunity to address this point in the 'Queso Manchego' case (Judgement of the Court of 2 May 2019, *Fundación Consejo Regulador de la Denominación de Origen Protegida Queso Manchego v Industrial Quesera Cuquerella SL e Juan Ramón Cuquerella Montagud*, case C-614/17). In this case, a company established in the Spanish region La Mancha, which produced and marketed cheese using illustrations associated with the character Don Quixote de La Mancha, was opposed by the producer group responsible for the governance of the 'Queso Manchego PDO' on grounds that the commercial practice constituted an unlawful evocation of the registered name. In addressing the question, the Court acknowledged that the appointed behaviour could be considered as evocative, as the decisive criterion for establishing if an element evokes a registered name is whether that element is capable of directly triggering in the consumer's mind the image of the product whose designation is protected, and it is not possible to exclude, by principle, that figurative signs may not do that (see points 21-22). As it is understandable, there has been no shortage of critical comments on a decision that, although extremely in favour of the beneficiaries of a GI, is disputable. In this sense, see A. ZAPPALAGLIO, *EU Geographical Indications and the protection of producers and their investments*, op. cit., p. 316: 'This case does not consider the fact that many traditional products are related to a specific local/regional imagery and that this often contributes, together with various other elements, to the creation of the essential or exclusive link that constitutes the foundation of a sui generis GI as an origin label. However, the imagery itself should not be monopolised by the GI for at least two reasons: first, the use of the image of 'Don Quixote' on a cheese made in 'La Mancha' simply means that the product has something to do with that region, not with 'Queso Manchego PDO' specifically. The association that the CJEU considers present in this case is therefore extremely weak. Second, and above all, the local imagery and characters that belong to the heritage of an area should be accessible to all as they usually pre-exist the GI good and would likely survive it if the production ever stopped for any reason'. For some additional critical remarks on the CJEU decision in the 'Queso Manchego' case, see F. PRETE, *Le nuove frontiere della protezione delle indicazioni geografiche tra evocazione suggestiva dei luoghi legati ad una Dop e vera origine del prodotto*, in *Rivista di diritto agrario*, 2019, 3, II, pp. 81-113. For a general commentary on the case law, see F. CAPELLI, B. KLAUS, *Protection of Geographic Indications and Designations of Origin in the Queso Manchego Case*, in *European Food and Feed Law Review*, 2019, 5, pp. 453-458; V. RUBINO, *The "indirect" or "conceptual" evocation of a protected designation of origin and its practical and juridical effect after ECJ case Queso Manchego*, in *Revista de derecho comunitario europeo*, 2019, 64, pp. 963-979.

The consumer, and the *presumed* reaction that the use of a commercial name may elicit in the consumer, is therefore pivotal. But that is not all.

The Court's case law on evocation has also helped shape the figure of the average consumer of the European Union³⁸⁹, well-informed and reasonably observant and circumspect, to whom national courts must precisely look when evaluating the evocative nature of the disputed denomination³⁹⁰.

³⁸⁹ For a reconstruction of the figure of the 'average consumer of the European Union' through the eyes of the CJEU see, *ex multis*, V. RUBINO, *L'evocazione di una denominazione geografica protetta ed il "consumatore medio dell'Unione europea"*, in *Il diritto dell'economia*, 2016, 2, pp. 489-496; ID., *L'evoluzione della nozione di "consumatore" fra tutela dei diritti della persona, economia collaborativa e futuro del mercato interno dell'Unione europea*, in E. TRIGGIANI, F. CHERUBINI, I. INGRAVALLO, E. NALIN, R. VIRZO (eds.), *Dialoghi con Ugo Villani*, Bari, Cacucci Editore, 2017, pp. 363-369; ID., *L'evoluzione della nozione di consumatore nel processo di integrazione europea*, in *Il diritto dell'Unione europea*, 2017, 2, pp. 343-365. More in general, on the image of the European consumer, see D. LECZYKIEWICZ, S. WEATHERHILL (eds.), *The Images of the Consumer in EU Law*, Oxford, Hart Publishing, 2016.

³⁹⁰ The relation with the average consumer of the European Union is highlighted, for example, in the 'Verlados' case, where the Court recognises that *'It is apparent from established case-law relating to consumer protection, that, in general, it is necessary in that field to take account of the presumed expectation of the average consumer, who is reasonably well informed and reasonably observant and circumspect (...)'* (point 25) and that *'(...) in order to assess whether there is an evocation within the meaning of that provision, the national court is required to refer to the perception of the average consumer who is reasonably well informed and reasonably observant and circumspect, that concept being understood as covering European consumers and not only consumers of the Member State in which the product giving rise to the evocation of the protected geographical indication is manufactured'* (point 28). Similarly, in the 'Scotch Whisky' decision: *'In that regard, the national court must, in making that assessment, refer to the perception of an average European consumer who is reasonably well informed and reasonably observant and circumspect'* (point 47). The Court goes to great lengths to emphasise that the average consumer that national courts must take into account is not that of the Member State where the questioned product is mainly made or consumed, but rather the European one. And such an elucidation is necessary to ensure effective and uniform protection of Geographical Indications throughout the whole territory of the Union. This is what happened, for example, in the 'Queso Manchego' case, where referring to the average consumer of the involved geographical area (i.e., the consumer of the region La Mancha), rather than the average consumer of the European Union, could have significantly affected the decision on evocation. Indeed: *'The Court has also made clear that the fact that the disputed designation in the case that gave rise to the judgment cited in the preceding paragraph refers to a place of production that is known to consumers in the Member State where the product is made is not relevant for the purpose of assessing the concept of evocation (...), since that provision protects registered geographical indications against any evocation throughout the territory of the European Union and, in view of the need to guarantee effective and uniform protection of those indications in that territory, it covers all European consumers'* (point 46). As a consequence of this *'(...) the concept of the average consumer who is reasonably well informed and reasonably observant and circumspect, to whose perception the national court has to refer in order to assess whether there is evocation within the meaning of Article 13(1)(b) of Regulation No 510/2006, must be understood as covering European consumers, including consumers of the Member State in which the product giving rise to evocation of the protected name is made or with which that name is geographically associated and in which the product is mainly consumed'* (point 50). The same reflection, after all, had been made a few years before, with respect to the fact that the Finnish average consumer would have known that the name 'Verlados' referred to the place where the product at issue was made (see case C-75/15, point 27). When discussing the figure of the average consumer of the European Union, however, one cannot fail to recall the reflections proposed by the Advocate General G. Pitruzzella in the 'Queso Manchego' case (see Opinion of the Advocate General Pitruzzella delivered on 20 January 2019, case C-614/17): *'It is clear that the concept of European consumer has inherent limits, since it is in any event a fictio juris which tends to reduce to a common denominator situations which are very varied and hardly uniform. In the context of protection of registered designations against unlawful evocation – in which what matters for the purposes of the assessment is the presumed perception of the consumer of a mere association of ideas and not as to whether there is a likelihood of confusion – that concept,*

Different principles have instead been established in the case of the evocation of compound names registered as Geographical Indications³⁹¹. Looking at this scenario, the Court of Justice has clarified that compound names enjoy the legal protection established at the European level for registered GI even when only one or more terms composing the designation, which individually would not benefit from any protection, are used in another commercial name, provided that they cannot be considered generic or common terms³⁹².

Approaching an end, it is then possible to say that the reconstruction that was attempted in the previous pages, albeit inevitably concise³⁹³, allows to identify some of the key principles

as, more generally, that of the average consumer who is reasonably well informed and reasonably observant and circumspect, must also be applied with particular caution’ (point 49).

³⁹¹ Many legal scholars have deepened the subject of compound names and their protection as Geographical Indications. For an overview, see, *ex multis* I. CANFORA, *Il caso «Parmigiano Reggiano»: denominazioni di origine composte e strumenti di tutela tra competenze nazionali e diritto comunitario*, *op. cit.*; N. LUCIFERO, *Denominazioni composte, denominazioni generiche e la tutela delle denominazioni di origine protette. Il caso “parmesan”*, *op. cit.*. For a more recent overview, see R. SAIJA, *La tutela delle denominazioni composte e la peculiarità in tema di evocazione. Nuovi percorsi della giurisprudenza di merito*, in *Rivista di diritto alimentare*, 2023, 2, pp. 31-43.

³⁹² These aspects – and, in particular, the condition according to which the single terms composing the compound name must not be generic or common, for each of them to benefit from the legal protection established for the designation as a whole – are highlighted by the Court of Justice in the ‘Aceto Balsamico’ case. See Judgment of the Court of 4 December 2019, *Consorzio Tutela Aceto Balsamico di Modena v Balema GmbH*, case C-432/18. The European judge, questioned about the legal protection to be ascribed to the PGI ‘Aceto Balsamico di Modena’ and the single terms composing it, concluded that the Geographical Indication could only be protected as a whole, excluding its individual non-geographical components. According to the Court, in fact, in the case of a compound name registered as a PDO or PGI, the protection afforded by the applicable legal provisions covers not only the compound name as a whole, but also each of its constituent parts, only if that constituent part is not a generic or a common term (point 26). Consistently, having ascertained the generic and common nature of the terms composing the compound name (namely, ‘aceto’ and ‘balsamico’), the Court refrained addressing their evocative power: *‘It thus follows unequivocally (...) that the non-geographical terms of the PGI at issue, namely aceto and balsamico, and their use in combination and in translation cannot benefit from the protection for the PGI Aceto Balsamico di Modena that was granted by Regulation No 510/2006 and is now ensured by Regulation No 1151/2012’* (point 33). For some reflections on the case law, see S. BOLOGNINI, *La IGP “Aceto Balsamico di Modena” e le denominazioni “Balsamico” e “Aceto Balsamico”: un legame indissolubile (anche in Germania)*, in *Rivista di diritto agrario*, 2015, 2, I, pp. 253-272. For a commentary on the decision, see B. KLAUS, *Scope of Protection of the Protected Geographical Indication ‘Aceto Balsamico di Modena’: The Ghosts of the Past Return*, in *European Food and Feed Law Review*, 2019, 2, pp. 160-173; F. CAZZINI, *Corte di Giustizia e denominazioni composte: il caso «Aceto Balsamico di Modena»*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2020, 3, pp. 1-9; G. MORETTI, *Evocazione e tutela di indicazioni geografiche composte: le scelte della giurisprudenza in tema di Aceto Balsamico*, in *Rivista di diritto alimentare*, 2021, 2, pp. 62-85; For an overview of this case law and an in-depth analysis of the recalled principles, see I. CANFORA, *La tutela delle denominazioni di origine composte, tra termini divenuti generici, nomi comuni ed evocazione del prodotto: il caso dell’aceto balsamico*, in *Rivista di diritto agrario*, 2020, 4, I, pp. 125-181. The unstable events surrounding the designation ‘Aceto Balsamico di Modena’ have been recently addressed by Italian courts, as well. On these aspects, see the analysis provided in G. DE LUCA, *La tutela della denominazione composta «Aceto Balsamico di Modena» (IGP) in alcune recenti pronunce della giurisprudenza di merito italiana*, in *Rivista di diritto alimentare*, 2025, 1, pp. 74-107. On the same case, see also M. C. RIZZUTO, *L’uso del termine “Balsamico” è generico e non crea “confusione per evocazione” con la IGP Aceto Balsamico di Modena*, in *Rivista di diritto alimentare*, 2025, 3, pp. 106-126.

³⁹³ It would be impossible to go through the entire case law of the Court of Justice on evocation, as, since the late ‘90s, the judgments on the subject have been countless. For example, no mention has been made of the ‘Champanillo’ case (see Judgement of the Court of 9 September 2021, *Comité Interprofessionnel du Vin de*

that the Court of Justice has developed on evocation. Although some positions should be approached with greater caution, as there the line between *GI protection* and *fair competition* becomes particularly thin and fragile, there is no doubt that these principles represent a valuable compass for national courts, interpreters, and legal scholars. At the same time, however, this framework has also highlighted how complex and variable it is to navigate within evocation and, more generally, to find a way out of the labyrinth of GI infringements. Given the width of the categories outlined by the jurisprudence of the Court of Justice of the European Union, and in light of the rapidity with which new warning phenomena arise, it is immediately clear why, even today, GI infringements continue to pose a serious challenge for all those involved and for the law.

Champagne v GB, case C-783/19), in which the CJEU addressed evocation in cases where the disputed sign refers to a service (specifically, a chain of tapas bar) and not a product. To address the concerns proposed by the association of producers of Champagne, the Court held that although only products are eligible for a protected designation of origin, the scope of the protection conferred by that name extends to any use of that PDO by products or services (points 45 and 46), furthermore excluding that the concept of evocation requires that the product covered by the PDO and the product or service covered by the name at issue are necessarily identical or similar (point 61). Once again, indeed, the Court acknowledged that: ‘(...) neither the partial incorporation of a PDO in a sign borne by products or services which are not covered by that designation nor the identification of phonetic and visual similarity between that sign and that designation are essential conditions for establishing that there is an evocation of that designation. Evocation may also result from a conceptual proximity between the protected name and the sign at issue’ (point 57). For a commentary on this case law, see M. LAMORGIA, *Il caso Champanillo: protezione ad ampio raggio per le DOP*, in *Diritto & Giustizia*, 2022, 101, pp. 3-10. Nor has the reconstruction delved into the broad cases concerning other unlawful behaviours, as in the recent ‘Morbier’ case (see Judgement of the Court of 17 December 2020, *Syndicat interprofessionnel de défense du fromage Morbier v Société Fromagère du Livradois SAS*, case C-490/19), where the Court focused on the other practices liable to mislead the consumer as to the true origin of the product, i.e., the infringement now regulated under art. 26, par. 1, lett. d, Reg. (EU) No 2024/1143. In this case, the Association of Producers of ‘Morbier’ cheese sued a producer who was making a similar product, a cheese which featured the same dark-blue line of ash in the middle of it. The European judge moved from previous famous decisions, such as those adopted in the ‘Verlados’ case or the ‘Queso Manchego’ one, to observe that the legal regime offered to Geographical Indications does not protect only the names of the GI products, but can have a broader scope; and that, although GIs protect the names of the products, a PDO or PGI and the product covered by it are deeply intertwined (point 30). Therefore, the Court concludes that the protection provided for Geographical Indications might also extend to the point of prohibiting the reproduction of the shape or appearance characterising a product covered by the registered name ‘(...) where that reproduction is liable to lead the consumer to believe that the product in question is covered by that registered name. It is necessary to assess whether such reproduction may mislead the European consumer, who is reasonably well informed and reasonably observant and circumspect, taking into account all the relevant factors in the case’ (point 41). On the ‘Morbier’ case, see C. GERNONE, *Il caso «Morbier» e la protezione contro l’evocazione di DOP e IGP nella giurisprudenza della Corte di Giustizia dell’Unione europea*, in *Rivista di diritto agrario*, 2021, 1, II, pp. 26-55; A. BARDI, *La tutela delle DOP e IGP contro il maquillage parassitario dei prodotti generici alla luce del caso «Morbier»*, in *Diritto e giurisprudenza agraria, alimentare e dell’ambiente*, 2021, 2, pp. 1-22; M. TERENCE, *Riprodurre la forma di una DOP: un caso di evocazione o prassi idonea a indurre in errore il consumatore?*, in *Alimenta*, 2021, 1, pp. 150-169. Despite some omissions, an attempt was nevertheless made to research and illustrate the most significant case law on GI infringements and evocation, or at least those in which the Court of Justice most successfully formalised the leading principles described above.

It is precisely these considerations that must be borne in mind when looking at the *new frontiers* of GI infringements or, more precisely, at the original shape and features that commercial practices detrimental to PDO and PGI have acquired in recent times.

3.1.2. Protecting Geographical Indications on the World Wide Web.

As mentioned several times throughout the work, and again at the beginning of this third paragraph, the just recalled *new frontiers* of GI infringements concern the digital sphere and the necessity to protect Geographical Indications online³⁹⁴. Indeed, the digitalisation process that has now taken hold in the agri-food sector³⁹⁵ also affects how protected designation of origin and protected geographical indications are commercialised, promoted, and advertised³⁹⁶, as in the case of online platforms for distance commerce, which, far from possibly being considered a novelty, have been around for some time now³⁹⁷.

This state of things – and the resulting possibility not only to sell PDO and PGI products online, but also that non-GI products are sold online with references (in their commercial names, labels, or information material) to protected designations – spontaneously raises some questions. First of all, what threats to Geographical Indications may arise in this scenario? Secondly, how can Geographical Indications be protected online?

Moving from these questions, it is inevitable to explore further whether Regulation (EU) No 2024/1143 introduces specific provisions and tools for this purpose, and, if so, whether these can be considered sufficient and effective³⁹⁸.

³⁹⁴ For some reflections on this topic, see M. FERRARI, *La protezione delle Indicazioni Geografiche nel contesto digitale*, in N. LUCIFERO (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, op. cit., pp. 237-250. See also, F. GUALTIERI, S. VACCARI, B. CATIZZONE, *La protezione delle indicazioni geografiche: La nozione di evocazione*, op. cit., pp. 26-31.

³⁹⁵ This aspect was deeply addressed in Chapter 1.

³⁹⁶ For an analysis of the impacts of digitalisation in the marketing of Geographic Indication products, see C. BARTOLI, E. BONETTI, A. MATTIACCI, *Marketing geographical indication products in the digital age: a holistic perspective*, in *British Food Journal*, 2022, 9, pp. 2857-2876.

³⁹⁷ In this regard, emblematic are the numbers showing the explosion of distance selling in Italy. According to the data published by the Netcomm Observatory, in 2024, the online market for food and groceries reached a total value of € 4.6 billion, an increase of 6,2% compared to the previous year. Also, in 2024, 27% of Italians purchased foodstuffs online.

³⁹⁸ In general terms, it is important to recall that the online protection of Geographical Indications is among the major novelties introduced by the 2024 EU quality schemes reform, and it is already visible in the recitals to the 2024 Regulation. Here, indeed, the legislator recognises that to strengthen GIs defence and to combat infringements more effectively, the protection of PDO and PGI should apply to all domain names that are accessible in the Union, irrespective of the place of establishment of the relevant registries (recital 33), including the need to acknowledge the legal value of GIs in disputes that may arise with domain names (recital 45). All of this is only possible by equipping the competent national authorities with the tools to react properly to any violation

To begin with, it should be premised that the subject that is about to be explored can be quite entwined, and this is due to different reasons. On the one hand, the topic can be complex because it is always ‘new’, meaning *not* that it is a recent or original one, but rather that it is constantly developing and changing. This evolution concerns both the challenges that may arise in relation to Geographical Indications and their online protection, and the tools that can be used to tackle them. On the other hand, the complexity of the topic also depends on the fact that, as it usually happens when technological innovation and digitalisation are observed through the lens of law, it is not easy to approach it from a legal perspective, especially in light of the fluidity of the rules that may (or may not) apply in these cases³⁹⁹.

That said, and moving from question number one, two main challenges may arise when considering the phenomenon of online protection of Geographical Indications.

The first involves, in general, any counterfeiting of PDO or PGI products and any GI infringement taking place on online marketplaces⁴⁰⁰. The second concern, instead, entails the

of GIs that may occur on the internet, not only to fight against the phenomenon of infringements in domain names, but also to prevent and combat any fraud and counterfeiting of PDO and PGI products that may take place on intermediary services, in particular online marketplaces (recitals 55 and 56). For these very reasons, the protection of Geographical Indications in virtual markets is already included among the objectives of Reg. (EU) No 2024/1143, set out in Article 4, in particular: ‘ensuring that consumers receive reliable information and necessary guarantee of the origin, authenticity, quality, reputation and other characteristics linked to the geographical origin or the geographical environment of such products and can readily identify them in the marketplace including in electronic commerce’ (lett. c); ‘ensuring effective controls, enforcement and placing on the market throughout the Union, including in electronic commerce, thereby ensuring the integrity of the internal market’ (lett. e).

³⁹⁹ This aspect is highlighted in M. FERRARI, *La protezione delle Indicazioni Geografiche nel contesto digitale*, op. cit., p. 238, which, in particular, mentions legal issues such as the difficulty of identifying the (national) judge competent for disputes that may arise from commercial practices taking place online, as well as the intertwining of public and private rules and provisions from different sources. In this regard, it is also interesting to recall the reflections provided in C. GALLI, *Agroalimentare e DOP/IGP: come le imprese possono tutelarsi dalla contraffazione sul web*, in *AgendaDigitale.eu*, 2022, available online at: <https://www.agendadigitale.eu/mercati-digitali/ecommerce/agroalimentare-e-dop-igp-come-le-imprese-possono-tutelarsi-dalla-contraffazione-sul-web/> (last accessed: 1.09.2025). Among other things, the A. emphasises the problem of the ‘pure players’, i.e., those actors that do not have a physical shop but only sell agricultural products and foodstuffs via the internet, thus making it extremely difficult to identify and locate them. As a consequence of this, serious concerns are raised as to the power of control and corresponding liability of Internet Service Providers (ISPs) over the contents published by these ‘pure players’.

⁴⁰⁰ On these aspects, see the comprehensive overview provided in ASSOCIATION OF EUROPEAN REGIONS FOR PRODUCTS OF ORIGIN, *The protection of Geographical Indications on the Internet. AREPO Practical Guide*, 2023, available online at the following link: https://www.arepoquality.eu/wp-content/uploads/2023/03/protection-of-gis-on-the-internet_arepo-practical-guide_en.pdf (last accessed: 1.09.2025), which observes: ‘Thus, in addition to traditional infringements such as the sale of counterfeit products or the unauthorised use of a name belonging to a third party on physical media, new methods of free riding using the so called immaterial media of the Internet have appeared’ (p. 12). Soon after, however, the document acknowledges that no strong protection for GIs in terms of online defence can still be found. Thus, the practical guide aims to provide clarified information on how the internet works in terms of intellectual property rights (IPR) and to present the concrete steps that need to be taken to protect one’s GI from infringement on the internet. For more general reflections on the problem of counterfeit products being sold online, see J. P. KENNEDY, *Counterfeit Products Online*, in T. J. HOLT, A. M.

possibility of registering domain names conflicting with commercial names registered as Geographical Indications and protected within the European Union⁴⁰¹. Although substantially different, indeed, both cases pose serious and alarming threats for Geographical Indications, both of them being equally difficult to detect and block, or to prevent, by producers and by producer groups in charge of governing and controlling their GI.

It is precisely for these reasons, however, that Reg. (EU) No 2024/1143 has provided specific measures for both of them.

As to the first point, reference should be made to any form of infringement of a name registered as a Geographical Indication, and to any counterfeiting of PDO and PGI products, taking place on online marketplaces. This hypothesis may occur both when sellers use online platforms to market agricultural products or foodstuffs that evoke, imitate, or usurp PDO and PGI⁴⁰², and when it is the platform itself that markets these products⁴⁰³.

Until recently, this problem was addressed individually by the Member States, adopting the measures deemed most appropriate to monitor and control the online panorama⁴⁰⁴.

BOSSLER (eds.), *The Palgrave Handbook of International Cybercrime and Cyberdeviance*, London, Palgrave Macmillan, 2020, pp. 1001-1024.

⁴⁰¹ The risks for Geographical Indications connected to domain name registration and use have been stressed for some years. See T. GEORGOPOULOS, *Cyberspace v. Territory: Domain Names and the Problem of Protection for Geographical Indications*, in T. E. SYNODINOU, P. JOUGLEUX, C. MARKOU, T. PRASTITOU (eds.), *EU Internet Law. Regulation and Enforcement*, Cham, Springer, 2017, pp. 315-335. For a more recent overview, see L. R. NAIR, *Domain Name Protection for Geographical Indications: A European Gamechanger*, in E. VANDECANDELAERE, D. MARIE-VIVIEN, E. THÉVENOD-MOTTET, M. BOUHADDANE, V. PIEPRZOWNIK, F. TARTANAC, I. PUZONE, *Worldwide Perspectives on Geographical Indications*, Cham, Springer, 2025, pp. 109-125.

⁴⁰² See, again, M. FERRARI, *La protezione delle Indicazioni Geografiche nel contesto digitale*, op. cit., pp. 240-242. This possibility automatically raises the question of whether, in this case, the online platform, working as a hosting provider, can be held liable for the goods that are sold by third parties on its virtual channels and, consequently, whether it can be attributed with the obligation to check and ensure that these products do not infringe any intellectual property rights belonging to others. The A. comes to a negative conclusion for both questions, excluding that these obligations can automatically be attributed to the online platform. Nevertheless, if the owner of the infringed IPR (in our case, the producers or producer groups managing and controlling the PDO or PGI) were to notify the hosting provider of the infringement, then the latter would be compelled to step in to suspend the illegitimate practice.

⁴⁰³ *Ibidem*. In this case, no particular doubt that the online platform is liable for the unfair commercial practice carried out against the interested Geographical Indication, not as a hosting provider but rather as a seller.

⁴⁰⁴ In Italy, for example, it is always the ICQRF that plays a key role in fighting against online infringements of Geographical Indications. To tackle the problem being discussed here, in recent years, the Ispettorato has entered into some agreements (*Memoranda of Understanding*) with some of the leading online platforms for distance selling, including eBay, Alibaba, and Amazon. Under these agreements, in particular, the ICQRF is authorized to monitor the platforms and, when needed, to inform and request them to hinder the unfair commercial practices taking place against PDO and PGI. For an overview of the activities carried out in the last year by the ICQRF to monitor and protect GIs on virtual markets, and for some additional data on these phenomena, see the ICQRF 2023 annual Report of activities, at <https://www.masaf.gov.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/21342> (last accessed 2.09.2025). On these aspects, see also O. GERINI, M. G. SAPORITO, *Controllo dei siti e repressione frodi*, in O. M. CALLIANO (ed.), *E-Wine, Aspetti giur-economici della comunicazione e distribuzione del vino online*, Torino, Giappichelli, 2018, pp. 113-118. Indeed, the importance of establishing forms of collaboration between institutions and e-commerce platforms is also underlined in the Report of Ministero delle Imprese e del

However, Reg. (EU) No 2024/1143 has taken a significant step forward in this direction, expressly establishing some obligations of providers on the online market⁴⁰⁵. In this sense, art. 43, par. 1, Reg. (EU) No 2024/1143, starts from stating that *'Any information related to the advertising, promotion, and sale of products that is accessible to persons established in the Union and that contravenes the protection of geographical indications provided for in Articles 26 and 27 of this Regulation shall be considered illegal content (...)'* and, by referencing the term 'illegal content', explicitly envisages the application of the Digital Service Act⁴⁰⁶. In addition to this, the provision further acknowledges that *any* individual or entity can notify providers of hosting services of the presence of content that breaches the legal protection established for GIs⁴⁰⁷. This provision, which can be read first and foremost as an encouragement for producers and producer groups to actively engage in the fight against online infringements, is also symptomatic of a more general opening to all those who might identify illegitimate behaviours, to report them.

Moving on to the second point, the question concerns the protection of Geographical Indications against domain names or, more precisely, those domain names that contain, evoke, or otherwise refer to names that are registered and protected as GIs within the EU⁴⁰⁸.

Made in Italy, *Prevenzione e contrasto della contraffazione online. L'impegno comune con le principali piattaforme web*, 2024, which emphasises the validity of this path to strengthen the anti-counterfeiting strategies and activities put in place by the Italian government. It is also interesting to note that the Report mentions some of the most common techniques used on the web, including: *hacking*, which consists of placing counterfeited goods into legal websites, intercepting searches by those who want to buy original products; *cybersquatting*, an activity based on the registration of domain names corresponding to existing GIs, trademarks, or other distinctive signs; *typosquatting*, which involves the registration of domain names that resemble existing GIs, trademarks, or other distinctive signs, in terms of graphic or sound, and which cause confusion among consumers; *cloaking* and other similar techniques aimed at unconsciously directing buyers to illegal websites through strings of code.

⁴⁰⁵ Art. 43, Reg. (EU) No 2024/1143.

⁴⁰⁶ Indeed, the definition of 'illegal content' is provided in Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market for Digital Services and amending Directive 2000/31/EC (Digital Service Act). Under Art. 3, par. 1, lett. h, an illegal content is *'(...) any information that, in itself or in relation to an activity, including the sale of products or the provision of services, is not in compliance with Union law or the law of any Member State which is in compliance with Union law, irrespective of the precise subject matter or nature of that law'*. The most relevant consequence of such an explicit reference to the Digital Service Act is that its full framework also applies to GI infringements happening online, including the liability rules. For example, under Art. 9, Reg. (EU) 2022/2065, judicial and administrative authorities of the Member States may order online service providers to take action against one or more illegal content and, upon receipt of such an order, online service providers must inform the demanding authority on how they have given effect to that order. For some reflections on the novelties introduced by the European legislator for the online protection of GIs, see A. MOERLAND, *Geographical Indications upgraded: an overview of the recent changes in EU legislation on GI protection*, in *Maastricht Law. Faculty of Law Research Paper series*, 2025, 1, pp. 3-5.

⁴⁰⁷ Art. 43, par. 3, Reg. (EU) No 2024/1143.

⁴⁰⁸ A domain name is a unique address on the internet that serves as a human-readable substitute for complex IP addresses, which computers use to locate websites and other resources. As it was said: *'...domain names indicate a place in cyberspace'* (see T. GEORGOPOULOS, *Cyberspace v. Territory: Domain Names and the Problem of Protection for Geographical Indications*, *op. cit.*, p. 315). Domain names consist of two elements (one, preceding

From this perspective, the issue of domain names reproducing or emulating all or part of a PDO or PGI is swiftly becoming a real *new face* of evocation. And, at the same time, the topic is quite thorny for Geographical Indications, especially because, until now, in the records of disputes between GIs and domain names, the former have mostly been outcast by the latter⁴⁰⁹.

It is precisely to address these criticalities that the 2024 Regulation has also taken action on this front, first of all by specifying that the protection provided for Geographical Indications under Art. 26, par. 1, Reg. (EU) No 2024/1143 also applies to all domain names accessible in the Union⁴¹⁰. In addition to this, the Regulation also introduces a specific provision for domain

the dot, and one, following the dot) and, with such a composition, they must be registered within the Internet Corporation for Assigned Names and Numbers (ICANN), the nonprofit organization that coordinates the technical functions of the internet's domain name system. Only after this registration, domain names can freely be used on the web. Today, domain names are a valuable economic resource, mostly because they allow a subject to be identified on the internet; it is also for this reason that scholars are increasingly considering domain names as new distinctive signs. In this sense, see G. GARGIULO, *L'ultimo nato tra i segni distintivi: il nome a dominio*, in *Il diritto industriale*, 2015, 3, pp. 300-325.

⁴⁰⁹ In the event of disputes arising from the request to register, as a domain name, a term that is already registered and protected as a trademark, a GI, or any other distinctive sign owned by another party, the system established by ICANN provides for resorting to an arbitration procedure handled by the World Intellectual Property Organization and based on the '*Uniform Domain Name Dispute Resolution Policy*' (UDRP), which contains the substantial rules applying in these disputes, and the '*Rules for Uniform Domain Name Dispute Resolution Policy*'. As far as it is mostly relevant here, these rules only consider trademarks and service marks to be relevant distinctive signs; all other signs, including the designations registered as Geographical Indications, can only be claimed for protection where it can be shown that, over time, they have acquired a *secondary meaning*, i.e., a meaning additional to the original one. This demonstration, of course, is far from easy or straightforward to provide. For a detailed overview of these points, see T. GEORGOPOULOS, *Cyberspace v. Territory: Domain Names and the Problem of Protection for Geographical Indications*, *op. cit.*, pp. 322-328, which, consequently, emphasises the need to identify a specific legal protection for GIs in this context, as well. See also S. GERIEN, C. PASSARELLI, *Challenges for Geographical Indications in the context of the ICANN new generic Top-Level Domains*, *OrigIn*, 2016, pp. 14-15. The insidious situation that this system creates for GIs is clearly highlighted in a case that concerned the Champagne PDO (see WIPO Mediation and Arbitration Centre, *Comité Interprofessionnel du vin de Champagne v. Steven Vickers*, case No DCO2011-0026, 11 June 2011). In this case, the *Comité* complained about the registration of some domain names containing the term 'Champagne' by part of a British company, requesting their cancellation on grounds of the infringement caused to their PDO. The Panel, noting that UDRP only offers protection against domain names for trademarks and service marks, excluded that the designation 'Champagne' could be defended in that scenario. More precisely: '*While every protected geographical indication may inevitably become distinctive of the reputation for particular style or quality which is associated with the relevant protected goods, it seems to this Panel that that is not the kind of acquired distinctiveness which will of itself be enough to confer trademark or service mark status for the purposes of paragraph 4(a)(i) of the Policy. As this Panel sees it, to hold otherwise would be to turn on its head the decision made by the framers of the Policy, that geographical indications as such would not be within the Policy's scope. Champagne may be among the world's most famous geographical indications, but that in itself is not enough for it to qualify as an unregistered trademark or service mark under the Policy. For a geographical indication to be found to have acquired such status, something more than potential eligibility to succeed in a passing off action would be required. In particular, it would be necessary to show distinctiveness as an identifier of an individual trade source. On the record in this proceeding, the Panel is not persuaded that the Complainant has proved that kind of distinctiveness under the Policy (...)*'. For some reflections on this case, see M. FERRARI, *La protezione delle Indicazioni Geografiche nel contesto digitale*, *op. cit.*, pp. 244-248.

⁴¹⁰ Art. 26, par. 2, Reg. (EU) No 2024/1143. That means that when an application is made for a PDO or PGI to be registered as a domain name, the registration must be rejected if it conveys any direct or indirect commercial use of the GI, any misuse, imitation or evocation, any false or misleading indications as to the provenance, origin, nature or essential qualities of the product, or any other misleading practice. It also implies that national authorities

names. Under Art. 35, the EU legislator provides that ‘*Country-code top-level domain name registries established in the Union shall ensure that alternative dispute resolution procedures for domain names recognise registered geographical indications as a right that can be invoked in those procedures*’, also in opposition to the dispute resolution system that was described before⁴¹¹. Furthermore, the possibility of developing a domain name information and alert system, established and managed by the EUIPO, is also introduced⁴¹².

The described provisions, and the trend emerging from Reg. (EU) No 2024/1143, certainly allow to recognise and appreciate the tangible interest and the efforts that the European legislator wishes to devote to the protection of Geographical Indications online. However, given that the measures introduced with the Regulation are, overall, rather broad, their validity and efficiency can only be assessed by checking how Member States will transpose them and, consequently, which tools will be adopted to practically implement these commitments, hopefully bearing in mind the contribution that new technologies can make in identifying possible infringements in the immense World Wide Web⁴¹³. It is also clear that, given the rapid pace of technological innovation, it will be necessary for European institutions not to rest on their laurels, but to keep an eye on the new threats that may arise for GIs.

3.2. *The hard path to sustainability.*

Another crucial new challenge that Geographical Indications face today is sustainability, or, more precisely, the path to enhancing the environmental, economic, and social sustainability

should take any appropriate action to disable access from their territory to domain names that have been registered in violation of a GI. See, again, A. MOERLAND, *Geographical Indications upgraded: an overview of the recent changes in EU legislation on GI protection*, *op. cit.*, p. 4.

⁴¹¹ Art. 35, par. 1, Reg. (EU) No 2024/1143.

⁴¹² Art. 35, par. 2 and 3, Reg. (EU) No 2024/1143. More precisely, the disposition opens up to the possibility for the European Commission to settle, through delegated acts, rules entrusting the EUIPO with the task of establishing and managing this information and alert system for domain names. The system, in particular, would aim to provide information about the availability of the Geographical Indication as a domain name and about the registration of a domain name identical to an existing PDO or PGI. Recently, the Commission presented a report in which it evaluated the necessity and feasibility of such a system. See EUROPEAN COMMISSION, Report from the Commission to the European Parliament and the Council, *Analysis of the necessity and feasibility of a domain name information and alert system for geographical indications pursuant to Article 35(3) of Regulation (EU) 2024/1143*, Brussels, 10.11.2025, COM(2025) 673 final.

⁴¹³ Consider, by way of example, the possibility of adopting digital solutions that make use of AI algorithms to detect on the internet products or domain names that breach the legal protection established for GIs under the European regime. For some reflections on the use of Artificial Intelligence in the field of Geographical Indications, see F. D. E. DE SILVO, *Brief Notes on the European Geographical Indication Law: Among Sustainability Implications and Artificial Intelligence Applications*, in *International Journal of Management, Knowledge and Learning*, 2024, 13, pp. 105-111.

of PDO and PGI products⁴¹⁴. As quality agri-food productions also share this battle, the new demands of sustainability point out the ineluctability of innovation⁴¹⁵, which, however, is not an end in itself, but is mostly expressed in terms of adaptation and adjustment to the former⁴¹⁶.

The leading question in this context is whether Geographical Indications are actually ready to embrace the demands of sustainability and, if so, how they can do that. Consequently, it is inevitable to further wonder whether the legal regime provided for this purpose under Reg. (EU) No 2024/1143 can be considered sufficient and effective. In this regard, indeed, it can already be anticipated that the 2024 EU quality schemes reform finally addressed the topic of sustainability, but probably did so in a much weaker way than was expected and, above all, than would have been necessary⁴¹⁷.

⁴¹⁴ For some preliminary remarks on the topic, see M. C. RIZZUTO, *Indicazioni geografiche e pratiche sostenibili: prime considerazioni alla luce del Regolamento (UE) 2024/1143*, in *Persona e Mercato*, 2024, 2, pp. 615-635.

⁴¹⁵ A. MOERLAND, *Geographical indications and innovation: what is the connection?*, in J. DREXL, A. K. SANDERS (eds.), *The Innovation Society and Intellectual Property*, Cheltenham, Edward Elgar Publishing Limited, 2019, pp. 59-85.

⁴¹⁶ In this sense, see A. GOCCI, C. LUETGE, *The Synergy of Tradition and Innovation Leading to Sustainable Geographical Indication Products: A Literature Review*, in *Journal of Management and Sustainability*, 2020, 1, pp. 152-161. These considerations are crystal clear when examining the environmental dimension of sustainability and the criticalities that PDO and PGI productions face as a result of climate change, rising temperatures, and increasingly extreme weather events. The elements that subsequently arise are numerous and include, among other things, the need to find new plant varieties or adapt existing ones, to identify new geographical areas of production or broaden established ones, to develop new criteria for managing climate risk, and many others. On these points, see A. DI LAURO, *Gli effetti dei cambiamenti climatici sulla disciplina delle indicazioni geografiche: criticità e prospettive*, in *Rivista di diritto alimentare*, 2022, 3, p. 30; ID., *Il “cibo della memoria” e lo sviluppo sostenibile: analisi critica della sostenibilità delle Denominazioni geografiche protette (DOP) e Indicazioni geografiche protette (IGP), anche alla luce dell'evoluzione dei segni del territorio*, in *Revista iberoamericana de derecho agrario*, 2020, 12. It is no coincidence, after all, that many scholars delved into the relation between Geographical Indications and climate change from a legal perspective. See, *ex multis*, L. F. CLARK, W. A. KERR, *Climate change and terroir: The challenge of adapting geographical indications*, in *The Journal of World Intellectual Property*, 2017, 3-4, pp. 88-102. For some recent reflections with specific reference to the wine sector, see S. CARMIGNANI, *La produzione vitivinicola di qualità alla prova della climate emergency*, in *Rivista di diritto alimentare*, 2023, 2, pp. 5-12; ID., *Cambiamenti climatici e conciliazione tra sviluppo sostenibile e produzione di vini di qualità*, in *Rivista di diritto alimentare*, 2024, 3, pp. 5-11. However, the need for such an adaptation can also be observed in relation to the social dimension of sustainability, as a consequence of growing social tensions, phenomena of rural migration, and the trends towards exploitation and illegality of agricultural work. For an in-depth analysis of these topics, see the research led by I. Canfora and V. Leccese. See, I. CANFORA, V. LECCESE, *Lavoro irregolare e agricoltura. Il Piano triennale per il contrasto allo sfruttamento lavorativo, tra diritto nazionale e regole di mercato della nuova PAC*, in *Diritto agroalimentare*, 2021, 1, pp. 39-80; ID., *Pratiche sleali, equilibrio del valore e legalità dei rapporti di lavoro nella filiera agroalimentare*, in *Giornale di diritto del lavoro e di relazioni industriali*, 2022, 1, pp. 135-150. Individually, see also, V. LECCESE, *Lavoro, sfruttamento e tutele nella filiera agroalimentare: un itinerario*, in *Giornale di diritto del lavoro e di relazioni industriali*, 2018, 2, pp. 245-257; I. CANFORA, *La filiera agroalimentare tra politiche europee e disciplina dei rapporti contrattuali: i riflessi sul lavoro in agricoltura*, *ivi*, pp. 259-287.

⁴¹⁷ While moving from this premise, it is nevertheless worth bearing in mind that sustainability, as a concept applied to quality agri-food productions, is not an utterly unprecedented idea of the 2024 EU quality schemes reform. On closer inspection, indeed, evidence in this sense can already be found in the 2008 Green Paper on agricultural product quality, which highlights how ‘...consumers increasingly pay attention to the contribution made by farming on sustainability, climate change, food security and development, biodiversity, animal welfare, and water scarcity’ (see p. 4). Consequently, in the section dedicated to the criteria for the registration of Geographical

The main point, indeed, is that Geographical Indications, *as such*, are not sustainable food production systems and should not be taken as sustainability standards⁴¹⁸. Nevertheless, the literature widely acknowledges that Geographical Indications do contribute to improving various elements of environmental, economic, and social sustainability⁴¹⁹, as also came to light when the multidimensional appearance of GIs was described⁴²⁰.

Acknowledging these potentialities⁴²¹, but aware of the enduring absence of mechanisms to implement them consistently, the European legislator eventually deals with GIs'

Indications, the Commission questions whether specific sustainability and other criteria should be included in product specifications, whether or not they are intrinsically linked to origin (see p. 13). These considerations, however, were not reflected in the following reform of the European GI *sui generis* regime. Reg. (EU) No 1151/2012, indeed, only envisages that product specifications should include specific requirements aimed at protecting the natural resources or landscape of the production area, or improving the welfare of farm animals, as can be read in Recital 23, without, however, formalizing these purposes in Article 7, '*product specification*'. The sustainability of Geographical Indications, at least in its environmental dimension, clearly remains in the background, while greater space is given to the economic sustainability of PDO and PGI productions, which is more evaluated and valued. Even among the amendments introduced with Reg. (EU) No 2021/2117 to the EU legal regime for GIs, nothing significant is to be reported as to the sustainability of PDO and PGI productions, even though, as is well known, the CAP 2023-2027 was tasked with adapting European policies for the agri-food sector to the sustainable development goals enshrined in the European Green Deal. Reg. (EU) No 2021/2117, in fact, merely introduces the possibility for producer groups to include, in product specifications, a (vague) description of the contribution their GI offers to sustainable development, without giving further specifications or requirements of any kind. This approach to sustainability, as one might understand, remains rather weak. On these last aspects, see A. DI LAURO, *Le denominazioni di origine protette e le indicazioni geografiche protette: strumenti per lo sviluppo sostenibile dell'impresa agricola?*, *op. cit.* For further reflections on these topics, see also A. SABA, *The Renewed Role of Producer Organisations in Enhancing Sustainable Agricultural and Food Systems under the EU Common Market Organisation*, in *Opinio Juris in Comparatione*, 2024, 2, pp. 1-14. Reg. (EU) No 2024/1143 seems now to propose a global and cross-cutting approach to sustainability, which is equally emphasised in its environmental, economic, and social dimensions, thereby taking a clear stand on the matter. However, as will also be observed below, several doubts arise as to the measures concretely deployed by the EU legislator to achieve these ambitious objectives.

⁴¹⁸ See E. VANDECANDELAERE, L. F. SAMPER, F. TARTANAC, M. VITTORI, *Sustainability Strategy for GIs: A Bottom-Up and Participatory Approach for GI Sustainability*, in E. VANDECANDELAERE, D. MARIE-VIVIEN, E. THÉVENOD-MOTTET, M. BOUHADDANE, V. PIEPRZOWNIK, F. TARTANAC, I. PUZONE (eds.), *Worldwide Perspectives on Geographical Indications*, *op. cit.*, p. 345. Similar reflections are proposed in A. DI LAURO, *Gli effetti dei cambiamenti climatici sulla disciplina delle indicazioni geografiche: criticità e prospettive*, *op. cit.*, pp. 22-23, who observes that sustainability did not belong to the original panorama of Geographical Indications, as the sector was not designed to be necessarily sustainable. This is mainly because, when PDO and PGI were regulated for the first time at the EU level, sustainability was not at the centre of the political debate. Although this perception has changed, today other obstacles hinder the sustainability of GI productions, such as the mistaken belief that GIs are already sustainable and that no further efforts or commitments are needed in that direction.

⁴¹⁹ On this point, see E. VANDECANDELAERE, L. F. SAMPER, A. REY, A. DAZA, P. MEJÍA, F. TARTANAC, M. VITTORI, *The Geographical Indication Pathway to Sustainability: A Framework to Assess and Monitor the Contributions of Geographical Indications to Sustainability through a Participatory Process*, in *Sustainability*, 2021, 13, p. 2-3, which, while introducing some examples, focuses on the ability of Geographical Indications to positively impact the preservation of cultural and natural resources as part of local capital, as well as territorial reputation, landscape, natural and food heritage, local culture and know-how, and so on. The mentioned contribution can also be referenced for further bibliography on the positive impacts of Geographical Indications on sustainability.

⁴²⁰ See *supra*, chapter II, par. 1.3.

⁴²¹ Recital 3, Reg. (EU) No 2024/1143: '*Geographical indications can play an important role in terms of sustainability, including in the circular economy, thereby enhancing their heritage value and thus strengthening*

sustainability in Reg. (EU) No 2024/1143 and introduces specific provisions to address it⁴²², which reveal a clear inclination to bestow the task of improving the sustainability of PDO and PGI productions directly to producer groups⁴²³, who are consequently given the opportunity (but also the responsibility) to develop their own bottom-up GIs sustainability strategies.

Indeed, as the Union's quality policy also aims to contribute to the transition to a sustainable food system⁴²⁴, Reg. (EU) No 2024/1143 establishes that producer groups, or recognised producer groups where they exist, may agree to adhere to *sustainable practices* in the making of their GI product, which go beyond mandatory standards and contribute to one or more environmental, social, or economic objectives, or to animal welfare⁴²⁵. These practices can also be included in the product specification of the PDO or PGI and, in this way, they become mandatory for all producers of the concerned Geographical Indication⁴²⁶. In addition, producer groups, or recognised producer groups where they exist, can voluntarily draw up and regularly update a sustainability report that provides verifiable information on the adopted sustainable practices. When prepared, the sustainability reports are published by the European Commission⁴²⁷. These provisions are then further reflected in Art. 32, par. 4, Reg. (EU) No

their role within the framework of national and regional policies with a view to meeting the objectives of the European Green Deal'.

⁴²² For an overview of the novelties introduced with the 2024 EU quality schemes reform on sustainability, see A. MOERLAND, *Geographical Indications upgraded: an overview of the recent changes in EU legislation on GI protection*, op. cit., pp. 5-7. For a more detailed study on the approach to sustainability adopted in Reg. (EU) No 2024/1143, see C. GERNONE, *Il ruolo dei soggetti collettivi nel sistema delle indicazioni geografiche. Profili di diritto europeo e nazionale*, Torino, Giappichelli, 2025, pp. 87-115.

⁴²³ This aspect is highlighted in recital 19, Reg. (EU) No 2024/1143, where the legislator acknowledges that producers acting collectively have more powers than individual producers, and always collectively they can work to respond to societal demands for products resulting from sustainable production. An interesting case study involving these aspects is presented in F. RUGGERI, C. LEROY, A. MAZÉ, *How Can Collective Action Support the Agroecological Transition in Geographical Indication Vineyards? Insights from the Loire Valley Wine Area*, in *Sustainability*, 2023, 15, pp. 1-19.

⁴²⁴ See recital 23 and recital 24, Reg. (EU) No 2024/1143.

⁴²⁵ Art. 7, par. 1, Reg. (EU) No 2024/1143. The objectives that these sustainable practices may contribute to achieving are listed in paragraph 2, and include: '(a) climate change mitigation and adaptation, the sustainable use and protection of landscapes, water and soil, the transition to a circular economy, including the reduction of food waste, pollution prevention and control, and the protection and restoration of biodiversity and ecosystems; (b) the production of agricultural products in ways that reduce the use of pesticides and manage risks resulting from such use, or that reduce the danger of antimicrobial resistance in agricultural production; (c) animal welfare; (d) a fair income for producers, diversification of activities, promotion of local agricultural production, and valorisation of the rural fabric and local development; (e) preservation of agricultural employment by attracting and sustaining young producers and new producers of products benefiting from a geographical indication; (f) improving working and safety conditions in agricultural and processing activities'.

⁴²⁶ Art. 7, par. 3, Reg. (EU) No 2024/1143.

⁴²⁷ Art. 8, Reg. (EU) No 2024/1143. The sustainability report should include '(...) a description of existing sustainable practices implemented in the production of the product, a description of how the method of obtaining the product impacts on sustainability, in terms of environmental, social, economic or animal welfare commitments, and information necessary to understand how sustainability affects the development, performance and position of the product'.

2024/1143, which, in outlining the tasks assigned to producer groups, includes that of agreeing on the recalled sustainable practices⁴²⁸ and taking action to improve the performance of their Geographical Indication, in terms of environmental, social, and economic sustainability⁴²⁹.

Apart from this brief framework, no other element of Reg. (EU) No 2024/1143 is to be pointed out as to the sustainability of Geographical Indications. Therefore, it comes as no surprise that many legal scholars have already underlined how *'the level of commitment remains rather low, making it difficult to judge the actual impact this addition may have for GI products'*⁴³⁰, a concept that is quite understandable also when considering whether the mild measures⁴³¹ introduced by the 2024 Regulation will actually foster the innovation that Geographical Indications need in this context.

In this regard, it can be expected that the main adjustments towards an increased sustainability of Geographical Indications will mostly come from amendments in product

⁴²⁸ Lett. d.

⁴²⁹ Lett. e.

⁴³⁰ See, again, A. MOERLAND, *Geographical Indications upgraded: an overview of the recent changes in EU legislation on GI protection*, op. cit., p. 5, who also notes that: *'It would have been a stronger commitment to sustainability if a binding obligation was introduced that required all producers of GI products to employ sustainable production practices'*. A similar opinion can be read in G. PISCIOTTA TOSINI, *Il difficile innesto della sostenibilità nei disciplinari DOP e IGP secondo le regole del nuovo regolamento 1143 del 2024: l'esperienza nell'ambito del progetto Prin Pnrr INWINE*, in *Rivista di diritto alimentare*, 2025, 1, pp. 15, who, while commenting on the provisions introduced by the 2024 Regulation in terms of sustainability of PDO and PGI productions, criticises the ways in which the rules therein expressed could be included into product specifications. According to the A., one tricky possibility is that producer groups introduce sustainability practices that do *not* relate to production but, for example, to packaging or labelling, thereby only partially meeting the pursued sustainability objectives, while still obtaining sustainability certifications for their GIs. Ultimately, this risks debasing and genericising the concept of sustainability itself. The same reflections can be found in A. DI LAURO, *Gli effetti dei cambiamenti climatici sulla disciplina delle indicazioni geografiche: criticità e prospettive*, op. cit., p. 27, which, commenting on the direction taken in the Proposal of Regulation, underlines how the approach to sustainability is much milder than what was announced, and amounts to an encouragement for producer groups to voluntarily include in the product specifications of their GIs requirements aimed at improving the environmental, economic, and social features of their PDO or PGI. See COM(2022) 134 final, p. 8: *'As regards the sustainability, the driving opinion was that sustainability should not be imposed on the GI producers, but encouraged and accompanied. The existing practices in relation to sustainability are to be acknowledged and promoted. Member States' experts stressed particularly the importance of a gradual integration of sustainability requirements. There is a need for more support (e.g., for sustainability certification, relevant investments) and other forms of incentives (e.g., priority in funding), as well as information and promotion actions'*.

⁴³¹ The major criticality to be raised to the approach to sustainability proposed in Reg. (EU) No 2024/1143 is, precisely, the lack of any cogency in the rules to enhance the sustainability of PDO and PGI productions, which, as emerged in the course of the analysis, remain voluntary and are entirely left to the discretion of producer groups. Ultimately, it can be argued that the will to integrate environmental, economic, and social sustainability into Geographical Indications, which results from the recitals and objectives of Reg. (EU) No 2024/1143, is then largely *not* reflected in the Regulation itself. On the contrary, the voluntary nature of the adopted measures risks undermining their effectiveness, or at least limiting it, while leading to inconsistencies and severe discrepancies between Member States.

specifications⁴³². Consequently, they will above all depend on the value that producer groups attribute to sustainability, as well as on the tools and strategies they will adopt in this direction, also welcoming the support that, in this scenario, as well, comes from the use of digital tools and technologically advanced solutions⁴³³.

This path – however uncertain and difficult to predict, given the substantial discretion of producer groups as to sustainability issues⁴³⁴ – is not necessarily destined to fail⁴³⁵. However,

⁴³² Some interesting insights in this sense can be read in the research that analyses the amendments to product specifications for PDO and PGI. See A. MARESCOTTI *et al.*, *Are Protected Geographical Indications Evolving Due to Environmentally Related Justifications? An Analysis of Amendments in the Fruit and Vegetable Sector in the European Union*, in *Sustainability*, 2020, 12, pp. 1-19, which, in particular, examines a series of major amendments to product specifications of PDO and PGI in the fruit and vegetable sector in different European countries and finds that the main innovations were determined, above all, to market requirements, the use of new technologies, and the enhancement of quality. Only a limited number of amendments, on the contrary, were due to environmental or climate concerns. For similar approaches, see X. F. RUIZ *et al.*, *How are food Geographical Indications evolving? An analysis of EU GI amendments*, in *British Food Journal*, 2018, 8, pp. 1876-1887; F. ARFINI, V. BELLASSEN (eds), *Sustainability of European Food Quality Schemes, Multi-Performance, Structure, and Governance of PDO, PGI, and Organic Agri-Food Systems*, Basilea, Springer Nature, 2019.

⁴³³ It is a fact that technological innovation provides tools that can be implemented in quality agri-food productions, as well, and put at the service of the demands of sustainability. This is what happens, for example, with the digitalised mechanisms that identify less impactful production techniques or methods that would make product specifications more consistent with environmental changes (e.g., via precision agriculture), or with those technologies, including data sharing technologies, that allow for the rapid interaction and exchange of information between actors involved, increasing their skills and know-how, and making them more active and aware of decision-making processes, or again, with those digital tools that simplify some passages within production chains, making them faster and more efficient, and addressing some causes of economic inefficiency, as in the case of the implementation of blockchain-based solutions. In this perspective, the relationship established between Geographical Indications, sustainability, and innovation (including technological innovation) is reciprocal. And this is because GIs are enablers for innovation and technological innovation, as well as an excellent field to implement their results. Indeed, given the need for innovation of Geographical Indications, to be understood as an adaptation or adjustment to the rising demands of sustainability, if technological innovation provides the means to take this call, through new tools, improved methods, and innovative techniques, then this aspect should not be ignored by the actors entitled to lead this change. For some evidence on this topic, see S. STRANIERI, L. ORSI, I. DE NONI, A. OLPER, *Geographical Indications and Innovation: Evidence from EU regions*, in *Food Policy*, 2023, 116, pp. 1-15, which investigates the relationship between the diffusion of GIs across EU regions and technological innovation, to understand how the former affects the latter.

⁴³⁴ Field studies and consultations with GI producers worldwide have indeed shown that, for many organisations, building a sustainability strategy for their Geographical Indication is still not an easy task. Frequently, GI producers are not sufficiently aware of the advantages and challenges of enhancing the sustainability of their productions, and require more information and tools to develop a sustainability strategy that is tailored to their local context and their resources. For an overview of these aspects, see FAO, EBRD, *Strengthening sustainable food systems through geographical indications. An analysis of economic impacts*, Roma, 2018.

⁴³⁵ Indeed, several works delving into the sustainability of Geographical Indications have already revealed that producer groups do play a key role in enhancing the needed innovation. Consider the reflections proposed in S. CARMIGNANI, *Cambiamenti climatici e conciliazione tra sviluppo sostenibile e produzione di vini di qualità*, *op. cit.*, p. 7, which emphasises the role of producer groups in strengthening and coordinating sustainability adaptation strategies and in enforcing their diffusion throughout the involved producers. In this context, producer groups have some golden functions: they promote amendments to product specifications with a view to sustainable productions; they work as channels for information and knowledge sharing; they provide consultancy and promote research, fostering processes of innovation. On the role producers and producer groups play in this scenario, see also E. VANDECANDELAERE, L. F. SAMPER, F. TARTANAC, M. VITTORI, *Sustainability Strategy for GIs: A Bottom-Up and Participatory Approach for GI Sustainability*, *op. cit.*, p. 345. At the institutional level, as well, the contribution producer groups can offer in this scenario has been placed at the centre of the debate for some time now. For

it is foretold that each group will take the call depending on its possibilities and resources, inevitably leading to unequal and nonuniform results among Member States and, within the same country, between bigger, more organised groups and the younger or smaller ones. In this framework, private and public systems for the certification of sustainability, implemented by Member States, may also find room for discussion⁴³⁶.

It is clear, however, that the expectations placed on producer groups, both by political institutions and academics, will inevitably be disappointed if the provisions introduced under Reg. (EU) No 2024/1143 are not flanked by adequate programs to set a framework and tools to embark on their journey towards sustainability.

example, FAO and Origin have taken steps in this direction already in 2016. The collaboration was aimed at supporting GI producers, defined as all value-chain actors involved in the production of the final GI product, in their efforts to create or strengthen sustainability strategies for their PDO or PGI. See FAO, *The Sustainability Strategy for Geographical Indication*, Roma, 2017. Recently, these joint efforts to develop the Sustainability Strategy for Geographical Indications (SSGI) resulted in the publication of a broad document including practical step-by-step guidelines for producer organisations to improve the sustainability of their GI systems. See FAO, ORIGIN, *Developing a roadmap towards increased sustainability in geographical indication systems*, Roma, 2024.

⁴³⁶ In general, the European legislator leaves considerable latitude to Member States to develop their own systems for the certification of sustainability. Up to this moment, this has led to the adoption of different schemes applicable to agricultural products and foodstuffs, in general, as well as to GI products, specifically, also catching the attention of legal scholars. For some examples, see A. DI LAURO, *Certificazioni sulla sostenibilità e sulla biodiversità*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea*, op. cit., pp. 733-745; G. TORRE, *La disciplina delle certificazioni di sostenibilità dei prodotti agroalimentari e la comunicazione "business to consumer"*, in *Rivista di diritto agrario*, 2023, 4, II, pp. 573-600; L. SALVI, *Le certificazioni private nel settore alimentare*, in *Compendio di diritto alimentare*, op. cit., pp. 349-354. In Italy, the best-known example of private certification for quality agri-food productions is the 'Equalitas' standard for the wine sector, which found great success as it gives the possibility to measure and certify not only the environmental sustainability of PDO and PGI productions, but also their economic and social sustainability. Nevertheless, it must be acknowledged that this sort of scheme, especially when private, involves considerable costs that individual operators, and sometimes producer groups, as well, may not be able to bear. The case can be different with public certifications (e.g., the Italian SQNPI standard), which are normally free, but whose adoption is often restricted to specific categories of products. An interesting and complete overview of these topics was offered during the Meeting '*Il nuovo Pacchetto Qualità. Innovazioni normative tra criticità e opportunità*', Accademia dei Georgofili, 11.02.2025, by E. POMARICI, *Sostenibilità e qualità multidimensionale nel nuovo "Pacchetto Qualità": strumenti e criticità*.

CHAPTER III

Taking a step forward. Applying blockchain to the realm of Geographical Indications

SUMMARY: 1. Merging blockchain technology and Geographical Indications: an introduction. - 1.1. Overview of blockchain's ancillary functions for Geographical Indications. - 2. Producer groups tasks and responsibilities under Reg. (EU) No 2024/1143. What room for blockchain? - 2.1. Establishing a new Geographical Indication. - 2.2. Ensuring compliance with product specifications. - 2.3. Protecting and enforcing the Geographical Indication. - 2.4. Enhancing, promoting, and improving the Geographical Indication. - 2.4.1. Verifying and communicating the sustainability of Geographical Indications through blockchain. - 2.5. Blockchain for democratic accountability. - 3. Wrapping it up with some conclusive thoughts. - 3.1. The flip side of the coin.

1. Merging blockchain technology and Geographical Indications: an introduction.

The second chapter, as evoked by its own title, has sought to frame the field of interest of the present research, that of Geographical Indications. There, an attempt was made to provide the essential information to enable the reader to approach and understand the context of Geographical Indications: their fundamental components and primary functions, how the European legislator regulates them within the EU quality policy framework, and some of the main challenges that Geographical Indications still face today. And, while recognising that such a reconstruction cannot but be partial and incomplete in light of the complexities of the subject and the multiple levels of discussion that come to the fore when addressing GIs, the overview was provided bearing in mind that the aim of the present work is not only, or primarily, to analyse the regulatory framework and the policies involving protected designations, but rather to understand which possible lines of intersection with technological innovation might be draw.

In this regard, in particular, the previous chapter ended with a discussion around the known and new hurdles that Geographical Indications meet, and which, nowadays, find in innovation, defined as a response to the need for *adaptation* and *adjustment* of PDO and PGI productions, a strategic tool, if not the only available weapon. This innovation, as mentioned,

is also a technological innovation, given that many scenarios can be highlighted where the adjustments required to PDO and PGI productions involve digitalisation⁴³⁷.

Building on this background, chapter three aims to take a step forward and delve deeper into the technology that, as seen in the first chapter, is a binding and central theme of this research and, therefore, is a key to understanding the present work: blockchain technology⁴³⁸. In doing so, the pursued purpose is to *apply blockchain technology to Geographical Indications*, to understand whether blockchain can find spaces in the realm of Geographical Indications and, thus, whether, and to what extent, this technology might contribute to addressing some of the challenges that GIs face today.

In this regard, it can already be anticipated that, after an overview of those that are to be identified as the ancillary functions of blockchain for GIs, the focus will quickly shift to the more specific context of the governance of Geographical Indications, which, as is known, is in the hands of producer groups⁴³⁹. Rolling through the different phases that can be identified in

⁴³⁷ Just to give some examples, one could consider the identification of innovative technological tools to protect GI products commercialised online and to detect and restrain infringements through the registration of conflicting domain names, or the adoption of new agricultural and production practices capable of bringing PDO and PGI productions into line with sustainability requirements, and many others.

⁴³⁸ See *supra*, chapter I, par. 2.

⁴³⁹ Introducing a profile that has not yet been explored in detail, it is paramount now to recall that producer groups are an intrinsic and essential component of the Geographical Indications system, as they represent the economic actors entitled to use the protected designation or indication. Understandably, countless legal scholars have addressed and studied the subject, and it would not be possible to refer to all of the existing literature. See, *ex multis*, L. PAOLONI, *Programmazione della produzione e lesione delle regole antimonopolistiche nei consorzi di tutela dei prodotti agro-alimentari tipici*, in *Diritto e giurisprudenza agraria e dell'ambiente*, 1998, 4, pp. 197-201; R. SCHIANO, *L'applicazione del diritto della concorrenza nel settore agricolo. Brevi note in margine al caso dei consorzi di tutela dei prodotti tipici*, in *Il Diritto dell'Unione Europea*, 2000, 4, pp. 835-849; L. PAOLONI, *I Consorzi di tutela ed i contratti per le politiche dell'offerta dopo il d.lgs. 61/2010*, in *Rivista di diritto alimentare*, 2012, 3, pp. 27-32. More recently, A. TOMMASINI, *Il ruolo polivalente dei consorzi: dalle funzioni socio-economiche e territoriali alla tutela e promozione delle produzioni di qualità*, in *Rivista di diritto agrario*, 2020, 3, I, pp. 644-672; A. GENOVESE, *Il ruolo dei consorzi di tutela delle produzioni di qualità nel prisma della sostenibilità. Quale futuro per la tradizione?*, in *Rivista di diritto agrario*, 2022, 4, I, pp. 687-710; C. GERNONE, *I consorzi di tutela: autonomia privata e compatibilità con le regole della concorrenza alla luce della nuova PAC*, in *Rivista di diritto alimentare*, 2023, 2, pp. 44-62. For the latest comprehensive work on this topic, see ID., *Il ruolo dei soggetti collettivi nel sistema delle indicazioni geografiche. Profili di diritto europeo e nazionale*, *op. cit.* With specific reference to the wine sector, E. GUADAGNO, *I Consorzi di tutela e gli organi di certificazione dei vini di qualità*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2012, 2, pp. 133-136; L. PAOLONI, *Contractual scope in the agri-food market: the case of protection consortia in the wine sector*, in G. MARTINO *et al.* (eds.), *It's a jungle out there – the strange animals of economic organization in agri-food value chains*, Wageningen, Wageningen Academic Publishers, 2017, pp. 197-211; N. LUCIFERO, *I Consorzi di tutela dei vini e le funzioni erga omnes*, in *Rivista di diritto alimentare*, 2019, 1, pp. 36-49. It is also for this reason that the European legislator, since the dawn of the EU *sui generis* regime for GIs in the early 1990s, has paid much attention to the role that these collective entities may have in this context, gradually strengthening and expanding, overtime, the tasks and responsibilities assigned to them. This intensification is crystal clear in the latest EU quality schemes reform and in Reg. (EU) No 2024/1143, which, as will be better highlighted in the following part of this chapter, has also increased the scope of the tasks and responsibilities falling on producer groups. For some preliminary reflections on these novel points, see A. TOMASSINI, *Il Reg. (UE) 2024/1143 ed il consolidamento dei gruppi di*

this context (establishing a new Geographical Indication; ensuring compliance with product specifications; protecting and enforcing the Geographical Indication; enhancing, improving, and promoting the Geographical Indication), the chapter will eventually seek to understand if blockchain technology can be a valuable tool in the hands of producer groups to maintain governance of their Geographical Indications.

produttori: evoluzione normativa o rivoluzione mancata?, in *Rivista di diritto alimentare*, 2025, 3, pp.55-69; N. LUCIFERO, *I gruppi dei produttori nel sistema europeo dei regimi dei prodotti agricoli di qualità*, in *Le nuove leggi civili commentate*, 2025, 2, pp. 328-361. Specifically, the provision addressing producer groups is Art. 32, Reg. (EU) No 2024/1143, whose paragraph 1 defines them as *any association of producers of the same product or products, irrespective of the chosen legal form, and which: performs at least one of the tasks specified in the Regulation; is set on the initiative of producers, and is composed of producers; is democratically organised and controlled by its own members*. In the Italian legal regime, for example, the European provisions led to the identification of consortia formed under Article 2602 of the Civil Code, as the chosen legal structure to which tasks and responsibilities concerning Geographical Indications are attributed (see Art. 14, par. 15, Law 21 December 1999, n. 525, *Disposizioni per l'adempimento di obblighi derivanti dall'appartenenza dell'Italia alle Comunità europee*, last updated 8 September 2018). Regarding the internal composition of producer groups, Regulation (EU) No 2024/1143 introduces significant novelties concerning the powers of Member States to which the group belongs. Under Art. 32, par. 1, *'Member States may restrict membership to certain categories of producers, taking into account the nature of the product covered by the producer group concerned'*. In addition to this, and oppositely, States may also decide to *enlarge* the borders of producer groups by allowing operators, representatives, and stakeholders of economic activities linked to one of the stages of the supply chain of GI products to enter it. This provision, set in paragraph 2, cannot be overlooked, as it legitimates Member States to authorise actors that are not primary producers or processors to become part of the group, if they have a specific interest in this sense; however, it also prevents these members from controlling the producer group. Finally, Member States are allowed to set additional rules with respect to the composition, organisation, and functioning of the groups, as provided in paragraph 3. It is then equally significant to consider the possibility referred to in Art. 32, par. 6, which allows Member States to take over in the implementation of the functions and responsibilities provided for in the EU legislation, if no producer group has been established for a specific PDO or PGI. In general, the role of producer groups surfaces in various stages of the 'life' of Geographical Indications. As highlighted by renowned doctrine, these functions are partially promotional and partially managerial, and they integrate the scheme of co-administration of Geographical Indications that also involves European institutions (mostly, the EU Commission) and the competent national authorities. See, V. RUBINO, *Il ruolo dei consorzi di tutela nella protezione della qualità*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea, op. cit.*, pp. 671-672. The macro-areas of interest for producer groups, as identified by the Regulation, are four: promotion and enhancement of PDO and PGI; market surveillance; governance of the protected designation; protection of the involved interests. The tasks attributed to producer groups under Reg. (EU) No 2024/1143 will be analysed soon after (see *infra*, chapter III, par. 2). Also, next to producer groups, special attention must be paid to *recognised* producer groups. Indeed, under Art. 33, par. 1 and par. 2, Reg. (EU) No 2024/1143, Member States may also apply a system of recognition of producer groups, upon request of the interested producers. The possibility of recognition is given when the producer group possesses a certain legal form and fulfils one of the following conditions: a minimum share of more than 50% of the producers of the product as members; a minimum share of members among the producers of the product, and a minimum share of more than 50% of the volume or value of marketable production. Member States may also provide for additional criteria, including having financial contributions from their members, rules on their admission, or written statutes. It is then important to remember that the tasks assigned to producer groups and recognised producer groups, mostly those concerning the surveillance of their GIs on the market, should not be confused with the control activities that are conferred to the competent national authorities, or to the delegated bodies. For an in-depth analysis on this point, see I. CANFORA, *Gruppi di produttori ed enti di certificazione: competenze e legittimazione in una regolazione mobile*, in *Rivista di diritto alimentare*, 2015, 2, pp. 4-12. For an overview, see also G. TASSONI, *Denominazioni di origine e compiti di vigilanza*, in *Il Diritto industriale*, 2023, 6, pp. 528-533.

1.1. Overview of blockchain's ancillary functions for Geographical Indications.

The first passages of this work have extensively highlighted how blockchain technology has long been finding fertile ground in the agri-food sector, revealing multiple possibilities for application throughout agri-food supply chains⁴⁴⁰. The technology has, in fact, been proposed as a valid tool to address some of the critical issues that globalised agri-food systems face today, with applications aimed, among other things, at ensuring food safety, managing supply chains, and enhancing the financial efficiency of the sector.

In particular, as seen, the effectiveness of blockchain technology as a solution applied to the agri-food sector mostly lies in the ability of the technology to improve the overall efficiency of the system, ensuring the integrity, immutability, and security of data and information relating to the different transactions.

A blockchain application for Geographical Indications can be considered as a logical extension of its implementation to food supply chains. In PDO and PGI productions, indeed, blockchain technology is said to be contributing to the strengthening of the functions performed by protected designation of origin and geographical indications, thereby further ensuring their protection and enforcement⁴⁴¹.

Without repeating aspects that have already been discussed in detail before, it is known that blockchain essentially allows information relating to different transactions to be recorded, stored, and transferred with an almost complete degree of certainty: this is because, once recorded, the data is tamper-proof and immutable⁴⁴². In this way, blockchain builds up transparency in supply chains.

These features entail that blockchain-based solutions could also be implemented in quality agri-food productions, specifically in PDO and PGI productions, for a wide range of purposes.

Among them, first and foremost, is blockchain's ability to prove the origin of GI products⁴⁴³. As was carefully described, in Geographical Indications, quality is indissolubly linked to the origin of the product, thus its geographical provenance. It is the direct consequence of the *origin link*, and, in fact, quality and origin were identified as the two core components of

⁴⁴⁰ *Supra*, chapter I, par. 3.1.

⁴⁴¹ In this sense, G. REMOTTI, *Blockchain Technologies per la filiera agroalimentare*, *op. cit.*, p. 494.

⁴⁴² Chapter I, par. 2.1.

⁴⁴³ See M. S. CADOGAN, *The Prospects and Limits of Blockchain Technologies in the Global Protection of Geographical Indications*, in *Canadian Intellectual Property Review*, 2020, 35, p. 32.

Geographical Indications⁴⁴⁴. In this regard, it is of great importance to stress blockchain's ability to verify the authenticity of agricultural products and foodstuffs by offering evidence that a PDO or PGI product truly originates from the geographical area from which it claims its quality, reputation, or other such characteristics. This feature appears to be of particular significance from the perspective of communication to consumers, who get a stronger association with the provenance of the GI product. Indeed, consumers are surely encouraged to choose and purchase agri-food products whose quality or other reputational characteristics can somehow be demonstrated, as happens when blockchain is used to convey and confirm the product's origin.

Secondly, the implementation of blockchain-based solutions in the realm of Geographical Indications shows promising results in terms of simplification and effectiveness of control activities, involving both external controls implemented by competent national authorities or delegated bodies⁴⁴⁵, and internal supervision activities carried out by producer groups to ensure compliance with product specifications by individual operators allowed to use the PDO or PGI⁴⁴⁶. As it is understandable, this all has a substantial impact on the validity and efficiency of the interests served by Geographical Indications⁴⁴⁷.

These last considerations also relate to another topic that should be further explored within this framework: namely, the contribution blockchain may offer to the detection and restriction of GI counterfeiting. Indeed, the mentioned improved ability to check and monitor PDO and PGI products throughout their 'lives', which can be achieved by implementing blockchain-based solutions, also allows the involved actors to observe the market (including both physical and virtual markets) in a much more accurate and timely manner. In this way, the solution enables the identification and detection of fraudulent behaviours or counterfeiting

⁴⁴⁴ Chapter II, par. 1.1 and 1.2.

⁴⁴⁵ A. SCUDERI, F. VERA, G. TIMPANARO, *The supply chain value of PDO and PGI food products through the application of blockchain*, in *Quality-Access to Success*, 2019, 2, p. 585.

⁴⁴⁶ See, again, M. S. CADOGAN, *The Prospects and Limits of Blockchain Technologies in the Global Protection of Geographical Indications*, *op. cit.*, p. 33, which recognises: 'There may be a role for blockchain technologies in the administration and monitoring of compliance procedures within GI producer groups. The technology can be useful in recording and tracking product specification compliance among GI producers'. However, for this possibility to be concretised, a specific provision would need to be added to product specifications, requiring each producer to complete a compliance checklist using an application on their mobile phone, or a different device, enabled to collect information and automatically record it on the blockchain platform used by the producer group. In this way, the blockchain-based solution would automatically and directly verify compliance with the product specification based on the information compulsorily provided by individual producers, thereby accelerating and facilitating the surveillance imposed on producer groups.

⁴⁴⁷ G. REMOTTI, *Blockchain Technologies per la filiera agroalimentare*, *op. cit.*, pp. 500-503.

placed by other operators in the supply chain⁴⁴⁸. Given that one of the major hurdles for GI producers and producer groups today is protecting their PDO and PGI on the internet and fighting against online infringements⁴⁴⁹, the use of blockchain-based solutions should be further considered in this scenario.

Additionally, the ability of the technology to immutably record any type of transaction also leads to two further results: on the one hand, it improves the accuracy and rapidity of communication and information flow between the actors involved in the production of the PDO or PGI; on the other hand, it fosters transparency and efficiency of the market due to the complete traceability of the production steps⁴⁵⁰.

These accomplishments appear to be pertinent to Geographical Indications, as well, especially in light of some major burdens GI products experience⁴⁵¹.

Blockchain-based solutions also enable the rapid and accurate tracking of all relevant events in the cycle of the Geographical Indication, with further simplification of evidence collection related to intellectual property rights. Based on this, some authors also suggested that blockchain could be adopted as a ‘differentiated platform’ to register IPRs stemming from Geographical Indications, taking as an example some case studies of companies using the

⁴⁴⁸ Ivi, pp. 504-505, who points out that blockchain’s impact in this sense does not only concern the relationship with other actors, but also pours out in the relationship with consumers, as it increases the credibility and reliability of commercial communication. The role that blockchain can effectively play in respect to GI counterfeiting is also taken into consideration in M. S. CADOGAN, *The Prospects and Limits of Blockchain Technologies in the Global Protection of Geographical Indications*, op. cit., p. 33, which, however, raises some objections in this regard, observing that: ‘How useful blockchain technology will be in effectively mitigating GI counterfeits depends on the GI law of the jurisdiction in which the infringement occurs’. Indeed, looking at the international framework for the protection of Geographical Indications, one of the main problems is the lack of uniformity in the treatment provided for names registered as GIs. And, when the legal regime applied in a jurisdiction differs from the protection offered by the country of origin of a given product, the use of a technological solution like blockchain cannot make a difference, as it will have little or no impact on the protection of the Geographical Indication abroad. Therefore, while it is true that blockchain can, in principle, be adopted to detect and avoid infringements, it is equally true that this contribute, as such, is not sufficient or decisive, and provides no extra benefits in terms of international protection of GIs, if the infringement is a consequence of the lack of uniformity between the regulations applicable in one State and another.

⁴⁴⁹ See chapter II, par. 3.1.2.

⁴⁵⁰ These aspects are highlighted in N. RAMPAZZO, *Geographical indications and European agricultural policies*, in J. A. VALLÉS, N. RAMPAZZO, J. KEPINSKI (eds.), *Intellectual Property in Agriculture. Plant breeders’ rights and geographical indications: towards a comprehensive approach to Intellectual Property in Agriculture*, Navarra, Editorial Aranzadi, 2022, p. 131.

⁴⁵¹ Ivi, p. 132. In this perspective, among other elements, the A. focuses on issues such as: excess of bureaucratic procedures coupled with high registration costs, implying significative investments from the beginning; intrinsic uncertainty of the market and of the marketing promotion, which is mostly a consequence of the limited perception consumers sometimes have of protected designation; increasing risks linked to counterfeiting and falsification and related difficulties to uniformly monitoring and implementing the execution measures.

discussed technology to offer trademark and copyright registration platforms to IP owners⁴⁵². This possibility, although hypothetically valid, is unlikely to be concretely implemented, at least on a large scale, mainly because it risks entangling the already complex dynamics for the registration, enforcement, and protection of GIs.

One last relevant aspect that should be recalled here, of no less significance than the previous ones, concerns the impacts that blockchain can have on the market for PDO and PGI agricultural and food products. More specifically, it involves blockchain contribution as a competitive asset for GI producers, given that the technology works as a lever to create or increase value on the market⁴⁵³. Several economic studies indeed delved into this topic, and they found that blockchain can be proposed as a solid marketing tool in the hands of producers with effects on five different fronts: product enhancement, brand positioning, relations with consumers, access to the market, and supply chain relations⁴⁵⁴.

The overview provided up to this point confirms that blockchain offers many possibilities to PDO and PGI productions, as well, and that there are several reasons why producers and companies might decide to take advantage of this tool in their daily activities. However, it cannot be denied that several obstacles of technological, institutional, and infrastructural nature come to light also in this particular context, and they deeply slow the

⁴⁵² M. S. CADOGAN, *How Blockchain Is Changing the Trademark Space*, in *UnscriPted: Views on Canadian Intellectual Property*, 2019, 2, pp. 25-38. A deeper reflection on the role that blockchain can play for intellectual property and IPRs will be provided soon after, together with some bibliographical references. See *infra*, fn. 456.

⁴⁵³ For a general overview of blockchain's contribution as a business and marketing tool, not limited to the agri-food sector, see P. GATOMATIS, N. BOGONIKOLOS, *Using blockchain for business and marketing improvement*, in *Journal of Marketing Development and Competitiveness*, 2021, 15, pp. 37-42. For a more precise reconstruction of the impacts of digitalisation in the marketing of GI products, see C. BARTOLI, E. BONETTI, A. MATTIACCI, *Marketing geographical indication products in the digital age: a holistic perspective*, *op. cit.*

⁴⁵⁴ See E. BONETTI, C. BARTOLI, A. MATTIACCI, *Applying blockchain to quality food products: a marketing perspective*, in *British Food Journal*, 2024, 5, pp. 2005-2026. This work looks closely at blockchain technology and its application to PDO and PGI products, providing insights into the marketing impacts, as well as the opportunities and challenges for producers and Italian consortia. In terms of product enhancement, blockchain increases the perceived quality through data collection, sharing, and transparency. Blockchain-based solutions also support PDO and PGI branding activities, integrating labels and reinforcing their meanings; in this way, this technology improves consumers' understanding of the diverse attributes of Geographical Indications, thereby increasing perceived value and willingness to pay more. Concerning producers' communication with consumers, blockchain provides for a new, dynamic point of contact between the former and the latter. Finally, as to the profile of relations within supply chains, blockchain certifies the credibility of producers and companies, on the one hand, and facilitates knowledge diffusion on GI productions, on the other, thus allowing producers to position themselves in niche markets. In addition to this, blockchain strengthens the links between actors in the supply chain, fostering the establishment of new relationships.

spread of the technology, casting further doubts on whether this outcome will ever be achieved⁴⁵⁵.

Bearing in mind the framework provided so far, it is now time to go beyond the observations and conclusions already provided by the doctrine on the implementation of blockchain technology in quality agri-food productions. As anticipated, indeed, this research aims to look at Geographical Indications as intellectual property rights ‘belonging’ to producers and, consequently, to producer groups; as agricultural and food products bearing a peculiar public nature. Thus, moving from the support that blockchain has been acknowledged to offer to intellectual property and IPRs⁴⁵⁶, the question is now to understand whether the technology can also be proposed as a valid tool in the hands of producer groups to improve the governance over their Geographical Indications.

⁴⁵⁵ These obstacles mostly reflect the *enduring limits* to the implementation of blockchain technology in the agri-food sector, which have been explored in depth in the general overview provided in the first chapter. See *supra*, chapter I, par. 3.2.

⁴⁵⁶ Blockchain’s potential for intellectual property rights has been extensively addressed by legal scholars, and many authors have already recognised the validity of the technology in the registration, enforcement, and evidence of intellectual property rights. In general, indeed, blockchain and blockchain-based applications, especially smart contracts, have been explored in their potentialities to handle a great number of transactions concerning IP law, contributing to enforce and protect IPRs due to the technology’s immutability, free accessibility, record-keeping, and prevention of fraud, all features that are further strengthened when IPRs transactions are implemented on smart contracts, with their automatic executions. The resulting scenarios are numerous: for example, blockchain-based solutions could be implemented to provide evidence of creatorship and authentication of provenance; to maintain IP registries and assess the concerning rights; to manage licensing and the permission of access to a specific IP right; to enforce IP agreements, licences and digital rights; to control and track (un)registered IPRs; to provide evidences of genuine and/or first use in trade or commerce, as well as to track the origin to detect counterfeit, stolen or parallel-imported goods. For an overview of the legal doctrine on these points, see, *ex multis*, B. CLARK, *Blockchain and IP Law: A Match made in Crypto Heaven?*, in *WIPO Magazine*, 2018, available online at: <https://www.wipo.int/en/web/wipo-magazine/articles/blockchain-and-ip-law-a-match-made-in-crypto-heaven-40267> (last accessed: 19.09.2025); J. M. RIVIÈRE, *Blockchain technology and IP – investigating benefits and acceptance in governments and legislations*, in *Junior Management Science*, 2018, 3, pp. 1-15; K. ITO, M. O’DAIR, *A Critical Examination of the Application of Blockchain Technology to Intellectual Property Management*, in H. TREIBLMAIER, R. BECK (eds.), *Business Transformation through Blockchain*, Cham, Springer Nature, 2019, pp. 317-335; N. BHOWMIK *et al.*, *Distributed Ledger Technologies in the realm of Intellectual Property Rights: Panacea or Puzzle?*, in *Asian Business Lawyer*, 2021, 28, pp. 15-51; E. TZOULIA, *The blockchain ecosystem in the light of intellectual property law*, in *Journal of Intellectual Property, Information Technology, and Electronic Commerce Law*, 2022, 3, pp. 290-301. With specific reference to Copyright Law, see G. NOTO LA DIEGA, J. STACEY, *Can Permissionless Blockchains be Regulated and Resolve Some of the Problems of Copyright Law?*, in M. RAGNEDDA, G. DE STEFANIS (eds.), *Blockchain & Web 3.0: Social, Economic, and Technological Challenges*, Londra, Routledge, 2020, pp. 30-47; M. FINCK, V. MOSCON, *Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0*, in *International Review of Intellectual Property and Competition Law*, 2019, 50, pp. 77-108. As a matter of fact, the possibilities offered by blockchain’s implementation towards intellectual property rights are also acknowledged by European institutions, as shown by the already cited European Parliament Resolution of 3 October 2018 (see *supra*, chapter I, fn. 147), which stresses the idea that ‘DLT can enable the tracking and management of intellectual property rights and facilitate copyright and patent protection’ (point 22), or by the following Resolution of 13 December 2018 (see *supra*, chapter I, fn. 151), where the European Parliament acknowledges that blockchain strengthens the intellectual property rights of goods ‘thereby reducing the risk of illicit goods, including fake and counterfeit goods, entering the supply chain’ (point 9, lett. a).

2. Producer groups tasks and responsibilities under Reg. (EU) No 2024/1143. What room for blockchain?

There is a preliminary step that seems proper and inevitable in attempting to answer the question asked above. In fact, to understand whether blockchain technology can be validly implemented by producer groups to endorse their governance functions over the GIs, it is first and foremost necessary to understand what is being referred to and what these functions actually are. Therefore, it is appropriate to begin by outlining the tasks and responsibilities related to the governance of Geographical Indications, and which, in the EU *sui generis* legal regime for GIs, fall on producer groups.

This passage is even more meaningful given that the 2024 EU quality schemes reform, among other things⁴⁵⁷, also stepped in on this front⁴⁵⁸.

The European legislator, indeed, explicitly bestows unprecedented emphasis on producer groups, which take on a position of absolute centrality in the 2024 Regulation⁴⁵⁹.

⁴⁵⁷ See *supra*, chapter II, par. 2.2.

⁴⁵⁸ In this regard, it should anyway be recalled that the 2023-2027 CAP, within the framework of the Common Market Organisation, already introduced instruments specifically destined to actors of quality agri-food productions. In this context, in particular, Regulation (EU) No 2021/2117 has broadly expanded the objectives that producer organisations can pursue, especially in relation to the sustainability of agri-food production, with consequent effects for PDO and PGI producer groups, as well. On these aspects, see C. GERNONE, *Il ruolo dei soggetti collettivi nel sistema delle indicazioni geografiche*, *op. cit.*, pp. 43-48. For an in-depth analysis of the effects brought by the CAP 2023-2027 to producer organisations, see A. JANNARELLI, *Mercato e concorrenza nella nuova PAC: un cantiere aperto su un futuro incerto*, in *Rivista di diritto agrario*, 2021, 4, I, pp. 453-504; I. CANFORA, *Rapporti tra imprese e ripartizione del valore nella filiera agroalimentare*, in *Rivista di diritto alimentare*, 2022, 2, pp. 5-17; ID., *Le Organizzazioni di produttori agricoli tra funzioni di mercato e composizione interna. Riflessioni a margine della sentenza della Corte di giustizia nel caso "Saint-Louis Sacre"*, in *Diritto agroalimentare*, 2023, 3, pp. 413-433, where the A. underlines that the market functions assigned to producer organisations have been further boosted with the CAP reform for the period 2023-2027. Reg. (EU) No 2024/1143, therefore, does not move away from the objectives therein established. And, on closer inspection, it stands in line with a tendency that was actually set with the previous Common Agricultural Policy, launched with Reg. (EU) No 1308/2013, which promoted the gradual strengthening of producer associations and the role of collective entities throughout agri-food production chains, especially for the regulation of the latter. On these last aspects, see L. RUSSO, *La riforma della PAC del 2013 e le relazioni contrattuali tra gli operatori del mercato*, in *Agricoltura, Istituzioni e Mercati*, 2013, 1-2, pp. 157-180; A. JANNARELLI, *Profili giuridici del sistema agro-alimentare e agro-industriale*, 2nd ed., Bari, Cacucci Editore, 2018, pp. 85-88.

⁴⁵⁹ In this sense, see F. ALBISINNI, *Il nuovo Pacchetto Qualità*, *op. cit.* These aspects are already highlighted in the opening passages of the new Regulation, as in Recital 19: '*Producers acting collectively have more powers than individual producers and take collective responsibilities to manage their geographical indications, including responding to societal demands for products resulting from sustainable production. Similarly, the collective organisation of the producers of a product designated by a geographical indication can better ensure a fair distribution of the value added amongst the actors in the supply chain, to provide a fair income to producers, which covers their costs and allows them to invest further in the quality and sustainability of their products (...)*'. See also Recital 42: '*As producers of products bearing geographical indications are mostly small or medium-sized enterprises, they face competition from other operators along the food supply chain, which can create unfair competition between local producers and those operating on a more extended scale. In this context, in the interest*

Consequently, Reg. (EU) No 2024/1143 confers producer groups, and recognised producer groups, with novel and increased tasks and responsibilities, which are precisely those that are deemed necessary to enable them to better manage their Geographical Indications and to meet not only the needs of producers and consumers, but also the demands of society as a whole⁴⁶⁰. The assignments traditionally attributed to producer groups – from submitting applications for registration of a new designation of origin or geographical indication, to amending product specifications, to the legitimacy to take administrative and judicial action to protect the PDO or PGI⁴⁶¹ – are now joined by the paramount task of governing GIs on the market, reflecting the legislator's glaring goal to make producers and producer groups central players in the European Union quality policy.

The just-described shift in paradigm can already be observed in the first Articles of Reg. (EU) No 2024/1143, ever since the provision establishing its '*objectives*'. Under Art. 4, lett. a, the first objective of the new Regulation is indeed: '*ensuring that producers acting collectively have the necessary powers and responsibilities to manage the geographical indication concerned, including in order to respond to societal demands, such as for animal health and welfare, for products resulting from sustainable production in its three dimensions of economic, environmental and social value, and to operate and be competitive in the market*'⁴⁶².

This ambition is then echoed by a series of norms, also intended for Member States, which confirm *old* assignments and provide *new* tasks and responsibilities of producer groups, thereby ensuring that the latter are in a position to achieve the described objective⁴⁶³.

of all the producers concerned, it is necessary to allow one single producer group to perform specific actions in the name of the producers'.

⁴⁶⁰ It should be noted that, at the outset of the European legislation on Geographical Indications, the role attributed to producer groups did not appear to be of particular substance. Of this opinion is V. RUBINO, *Il ruolo dei consorzi di tutela nella protezione della qualità*, op. cit., fn. 2. As a matter of fact, the attention paid by the EU institutions to producer associations in the GI sector has gradually grown over time, and last culminated in Reg. (EU) No 2024/1143, which marks a decisive step ahead in this direction.

⁴⁶¹ For an overview of the multifaceted role of producer groups before the 2024 EU quality schemes reform, with specific reference to Italian consortia, see A. TOMMASINI, *Il ruolo polivalente dei consorzi: dalle funzioni socio-economiche e territoriali alla tutela e promozione delle produzioni di qualità*, op. cit.

⁴⁶² One cannot help but share the reflection proposed in F. ALBISINNI, *Il nuovo Pacchetto Qualità*, op. cit., which observes that the idea resulting from the structure of the objectives is that of a legal framework that relies primarily on two pillars: the Geographical Indications' shared governance between the producers composing the group, and the self-governance ability of producer groups.

⁴⁶³ In general, producer groups play an essential regulatory function when product specifications are developed and when applying for registration, amendment, and cancellation, as well as a strategic role of supervision and control of compliance with product specifications by individual producers. They take action on sustainability practices to improve the performance of their GIs in terms of sustainability. They fight back against infringements and suspected fraudulent uses of PDO and PGI products on the market. Producer groups are also an element of guarantee for consumers, as they represent and certify the quality of the PDO or PGI product. In this sense, A. GENOVESE, *I consorzi tra produttori agricoli*, in L. COSTATO, F. ALBISINNI (eds.), *Trattato breve di diritto agrario*

Article 32, Reg. (EU) No 2024/1143, '*producer groups*', is indeed the first provision that comes to the floor in this framework. In addition to what was premised before, regarding the definition and composition of producer groups and the powers attributed to Member States in this regard,⁴⁶⁴ it is of great interest here to address the list of tasks provided under paragraph 4. The latter, as mentioned, not only recalls those functions and tasks that were already established by the preceding legal regime⁴⁶⁵, but also introduces other provisions that appear particularly worthy of attention, due to the element of novelty they bring about.

First of all, a producer group may '*represent its members in intellectual property enforcement networks and in relation to anti-counterfeiting bodies established at Union or national level*'⁴⁶⁶. The disposition further enhances the idea that producer groups work as a means of collectively representing single actors legitimately using the PDO or PGI, who, therefore, are entitled to resort to an additional, and likely more effective, channel to protect their interests, including in their relations with public authorities.

Of particular interest is also the provision introduced by lett. d and which attributes producer groups with the power to agree on the sustainable practices as referred to in Article 7⁴⁶⁷. This provision should additionally be read in conjunction with the following one, provided

italiano e dell'Unione europea, op. cit. p. 915. See also, R. RICCI CURBASTRO, *Il ruolo di garanzia dei consorzi di tutela*, in *Rivista di diritto alimentare*, 2012, 1, pp. 56-58.

⁴⁶⁴ See *supra*, chapter III, fn. 439.

⁴⁶⁵ Reference is, in particular, to the tasks described under Art. 32, par. 4, lett. a and b, as a result of which producer groups may develop product specifications, apply for registration, amendment, and cancellation, as well as carry out activities to verify and ensure compliance with the product specification, and also engage in any appropriate action to ensure protection of the Geographical Indication and the IPRs that are directly connected with it. Similarly, the dispositions provided under Art. 32, par. 4, lett. f and g, remain unaltered. Producer groups thus fight against infringements and suspected fraudulent uses on the markets of the GIs products that are non-compliant with the product specification, by monitoring and verifying the use of the Geographical Indication across the internal market and on third country markets, including on online interfaces; they take measures to enhance the value of products and, where necessary, to prevent or oppose any practice which is, or risks to be, detrimental to the image and value of their products. A glance at the respective former provision, offered by Art. 45, Reg. (EU) No 1151/2012, immediately reveals that the 2024 legislator did not deviate significantly from the path chased for these functions.

⁴⁶⁶ Art. 32, par. 4, lett. c, Reg. (EU) No 2024/1143.

⁴⁶⁷ Art. 32, par. 4, lett. d, Reg. (EU) No 2024/1143. Producer groups may '*agree sustainable practices as referred to in Article 7, whether included in the product specification or as a separate initiative, including arrangements for verification of compliance with those practices and assuring adequate publicity for them particularly in an information system provided by the Commission*'. This norm was already mentioned in a previous passage of this work, which addressed the 'mission' that the EU legislator has entrusted to producer groups and recognised producer groups in terms of improving the sustainability of their PDO and PGI productions. See *supra*, chapter II, par. 3.2. And one cannot help but go back to the perplexities already expressed in that passage, which fundamentally derive from the instruments adopted by the EU legislator to formalise the ambitious goals in terms of sustainability of PDO and PGI productions set out in the recitals and objectives of the 2024 Regulation. Indeed, a reading of the provisions here referred to, through which producer groups should be able to strengthen and enhance the sustainability of their Geographical Indications, suggests the limited strictness of the provided

under lett. e, officialising the contribution producer groups may offer in this context by further establishing that they can *‘take action to improve the performance of the geographical indication, in terms of environmental, social and economic sustainability...’*. The actions that are relevant and applicable in this perspective are many and diverse, and some of them are expressly described by the legislator, including: development and organisation of collective marketing and advertising campaigns that can enhance the visibility of the product; dissemination of information and promotion activities to communicate the quality and specific features of the GI products to consumers, including tourism services in the relevant geographical area; analysing the economic, social or environmental performance of the PDO and PGI production, as well as the nutritional and organoleptic profile; circulating information on the GI, the relevant Union symbol, and the abbreviation; sharing recommendations, training, and best practice guidelines to current and future producers, e.g. on sustainable practices, scientific-technical progress, digitalisation, gender mainstreaming and equality.

As anticipated before, producer groups are neared by recognised producer groups, whose recognition procedure is carried out by Member States, upon request of the former, when the European requirements relating to the internal composition of those groups, and potential additional conditions established by each State, are met. Recognised producer groups are regulated under Article 33, Reg. (EU) No 2024/1143, which lays important provisions and significant distinctions compared to non-recognised ones, mostly as to the functions attributed to each of them⁴⁶⁸.

To begin with, Art. 33, par. 3, Reg. (EU) No 2024/1143 establishes that whenever a recognised producer group exists, it is the only collective entity entitled to undertake a whole range of functions, including both the ‘ordinary’ tasks generally attributed to producer groups

measures, as both the sustainability practices they *may* agree to and the further actions they *can* take to improve the performance of their GI in terms of sustainability are to be established voluntarily.

⁴⁶⁸ The discrepancies in the structure and functioning of producer groups and recognised producer groups and, more in general, the regulatory asymmetry that surfaces when considering the different associative forms that GI producers may take, are scrutinised in detail in F. GUERRIERI, *Governing governance. Collective action and rulemaking in EU agricultural and non-agricultural geographical indications*, PhD Thesis, University of Amsterdam, 2023, pp. 28-31. The A. critically observes how the differences between these associative forms inevitably affect how groups operate, the spectrum of powers and responsibilities attributed to them, as well as the forms of control they are subjected to depending on the case, and therefore fuel divergencies and fragmentation not only between States, but also between recognised and non-recognised producer groups belonging to the same State. In Italy, for example, the specific legal rules applicable only to *protection* consortia lead to the development of a ‘two-speed system’, depending on the legal form producer groups acquire after the registration of the GI, and which hinders the harmonisation of the conditions necessary to manage the designation (*ivi*, p. 323).

– such as setting up product specification, applying for registration, amendment and cancellation, or agreeing on sustainable practices – as well as different and new tasks.

Focusing on the latter, attention must first be paid to the provision included in lett. b, according to which recognised producer groups receive the prior notification as to the inclusion of the GI in the name of the prepacked food where the PDO or PGI is used as an ingredient⁴⁶⁹.

Of equal interest are, then, the dispositions provided in the following parts of paragraph 3, which firmly underline the EU legislator's goal to strengthen producer groups' capabilities to influence market balances while managing their Geographical Indications.

In this perspective, in particular, lett. c establishes that recognised producer groups are entitled to request binding rules for the regulation of the supply of PDO and PGI products⁴⁷⁰.

⁴⁶⁹ See *supra*, chapter II, par. 2.2.2. Such a provision once again seems to confirm and validate the idea that producer groups are the privileged representatives in the governance and control of their designations of origin or geographical indications, as the provision confers them with an additional tool to check how their Geographical Indications are used on the market and to verify the correctness and legitimacy of such use even outside cases of direct marketing of the PDO or PGI, for instance, when GIs are used as ingredients.

⁴⁷⁰ The matter of the regulation of the supply of PDO and PGI products is highly articulated, and is made even more complex by the fact that the topic has evolved and developed over time, with different, often shifting, regulatory passages. Indeed, the opportunity to confer GI producer groups with tools to regulate the production had also emerged in the preparatory works of Reg. (EU) No 1151/2012, as can be observed in the Opinion of the Committee of the Regions *'Towards an ambitious European policy for agricultural quality schemes'* (2011/C 192/06), where it can be read that the Committee *'is of the view that developing and maintaining quality schemes form part and parcel of a concerted supply control policy (...)'* (point 62). In particular, it was believed that such a tool in the hands of producer groups could serve the main purpose of ensuring product quality while increasing competitiveness among producers. Nevertheless, this program saw the light of day only in a fragmented manner, as at the European level, regardless of the solid experiences of some Member States in this regard, the achievement of models to regulate the supply of PDO and PGI productions initially only involved PDO and PGI cheeses and hams, as respectively provided under Art. 150 and Art. 172, Reg. (EU) No 1308/2013. For an in-depth analysis on these norms, see F. PRETE, *Piani di Regolazione dell'offerta di formaggi DOP e IGP e limiti alla concorrenza in agricoltura*, in *Rivista di diritto agrario*, 2015, 3, I, pp. 322-360. A decisive step forward in this direction was only taken with Reg. (EU) No 2021/2117, which, in the framework of the Common Agricultural Policy for the period 2023-2027, replaced the aforementioned norms with a single new provision, established under Art. 166a, which broadens the possibility of resorting to binding rules for the regulation of the supply to all PDO and PGI products. According to Art. 166a, indeed, Member States may lay down binding rules for the regulation of the supply of agricultural products and foodstuffs benefiting from a PDO or PGI, for a limited period of time, at the request of producer organisations or associations of producer organisations, interbranch organisations, groups of operators, and groups of producers. Despite the progressive extension of this regulatory function, however, the requirements of access remain quite strict and tight to avoid any form of unfair distortion to competition. For a detailed and comprehensive overview of the subject, see, *ex multis*, L. RUSSO, *La regolazione dell'offerta dei prodotti di qualità e i consorzi di tutela*, in *Trattato di diritto alimentare Italiano e dell'Unione Europea*, *op. cit.*, pp. 259-266, who interestingly opens the analysis with a critical remark on the legislator's intentions underneath the regulation of the supply. According to the A., indeed, it is not clear how and why GI productions would necessitate the regulation of the supply to maintain their quality or added value, given that the latter should instead be conveyed by the peculiar characteristics of the products themselves, and by their link with the geographical territory of origin. On the matter, see also the detailed reconstruction offered in C. GERNONE, *Il ruolo dei soggetti collettivi nel sistema delle indicazioni geografiche*, *op. cit.*, pp. 43-68.

At the same time, and on the other hand, recognised producer groups can establish standard value sharing clauses (lett. d)⁴⁷¹.

Finally, an additional element for reflection comes from the novelty introduced with Article 34, Reg. (EU) No 2024/1143, which enables the constitution of *associations* of producer groups, on initiative of the latter and, according to a reading of the provision, regardless of whether these associations involve non-recognised or recognised producer groups. The tasks the associations of producer groups can exercise are listed in paragraph 2, and, in general, they relate to the promotion of the Geographical Indications and their representation, to interaction with public authorities, and to the dissemination of good practices among the involved producers⁴⁷².

The disposition, which therefore appears quite broad in its formulation, allows for flexible forms of cooperation between producer groups, while formally acknowledging the contribution these structures can offer to enhance the governance of Geographical Indications.

The picture that was drawn so far frames the (wide) range of tasks and functions, powers and responsibilities, respectively entrusted to producer groups, recognised producer groups, and associations of producer groups, in the EU *sui generis* regime for GIs.

In doing so, one purpose was to complete the analysis of the main novelties and amendments introduced with the 2024 EU quality schemes reform, proposed in chapter II. Above all, however, this preliminary passage was deemed necessary to understand what the governance of Geographical Indication actually involves.

⁴⁷¹ The tool enshrined by standard value sharing clauses, in the peculiar framework of PDO and PGI productions, plays a role that is far from trivial, as recognised producer groups could decide to adopt these clauses to boost and fortify the contractual power of farmers and primary producers, securing that a significant part of the added value of quality agri-food productions remains in the hand of local actors, and thus of the territory and local community. Standard value sharing clauses, from this perspective, can be perceived as a tool to reverse the imbalances afflicting contractual relations in the supply chains of PDO and PGI products. In this sense, in fact, it is pivotal to remember that the European policy for Geographical Indications also aims to ‘...ensure a fair distribution of the value added amongst the actors in the supply chain, to provide a fair income to producers, which covers their costs and allows them to invest further in the quality and sustainability of their products. The use of geographical indications rewards producers fairly for their efforts in producing a diverse range of quality products’. See recital 19, Reg. (EU) No 2024/1143.

⁴⁷² Under Art. 34, par. 2, Reg. (EU) No 2024/1143, an association of producer groups may exercise the following tasks: ‘(a) participating in consultative bodies; (b) exchanging information with public authorities on geographical indication policy-related topics; (c) making recommendations to improve the development of geographical indication policies, in particular with regard to sustainability, the fight against fraud and counterfeiting, the creation of value among operators, competition rules and rural development; (d) promoting and disseminating best practices among producers on geographical indication policies; (e) taking part in promotion measures within the meaning of Regulation (EU) No 1144/2014’.

Bearing this framework in mind, it is now possible to slide back to the question that opened this third chapter and understand whether blockchain technology can also play a role in this scenario – assuming that, generally speaking, the technology’s potential towards quality agri-food productions has already been recognised and illustrated.

In a nutshell, can blockchain be proposed as a valid tool in the hands of producer groups to make some of their functions more immediate and effective, ultimately enhancing the governance of their Geographical Indication? Such a question is grounded on the fact that, as seen, GIs’ governance is a complex and multifaceted matter, which results from a wide range of different tasks, and requires not only coordination, unity, and synergy among these collective entities, but also tools and resources to address it feasibly.

In such a scenario, it therefore seems reasonable to reflect on the implementation of blockchain-based solutions in the governance of Geographical Indications, particularly when considering the main features and the functioning of the technology. Blockchain’s potential to serve as a transparent and immutable ledger of information and data, shared among the network’s components (i.e., the nodes), may also be applicable in this context and lend itself efficiently to the activities composing the governance of the GI. This assumption, however, must be considered and validated on a case-by-case basis, referring to the single tasks and responsibilities producer groups are attributed with; indeed, the adoption of the technology could have greater or lesser effectiveness, and determine more or less plausible implications, in each of them.

To facilitate this next step, it is possible to isolate the activities described above and to trace them back to some different categories or moments, which can be outlined by looking at the main functions producer groups embed: establishing a new Geographical Indication; ensuring compliance with product specifications; protecting and enforcing the Geographical Indication; enhancing, improving, and promoting the Geographical Indication⁴⁷³.

⁴⁷³ For an overview of the implementation of blockchain technology by PDO and PGI producers, see S. ARONZON, *Blockchain and geographical indications: A natural fit?*, in *Journal of Intellectual Property Law & Practice*, 2020, 15, pp. 913-925, which delves into the application of blockchain to the realm of Geographical Indications by adopting a comparative perspective between the European legal regime, under Reg. (EU) No 1151/2012, and the US legislation.

2.1. Establishing a new Geographical Indication.

One of the first functions that the European legislator confers on producer groups is dealing with the procedures to establish a new Geographical Indication or, more precisely, to establish the legal protection over a new Geographical Indication. At the European level, the involved tasks are specified in Art. 32, par. 4, lett. a, Reg. (EU) No 2024/1143, which, in its first part, suggests that producer groups develop product specifications and apply for the registration of a PDO and PGI, they handle any necessary amendments, as well as the eventual cancellation of the registered GI.

The analysis of the mentioned procedures has already been presented in a previous passage⁴⁷⁴, which aimed to highlight the novelties introduced with the EU quality schemes reform of 2024 on these points. Therefore, it does not seem necessary to return now punctiliously to the matter, avoiding a repetition that would probably be redundant and pointless. What *does* seem important, on the other hand, is to highlight the key profiles that are prominent in the procedures undertaken by producer groups to establish a new Geographical Indication, to understand whether, and how, blockchain technology could be integrated into them.

As it was said, these procedures are mostly and normally left to producer groups⁴⁷⁵. Shortly, as is well known, the registration procedure comprises two stages: the first is held at the national level, where the competent national authority of each Member State examines the proposed applications to verify they meet the applicable legal requirements; the second is held at the European level, where the European Commission oversees that the applications contain

⁴⁷⁴ Chapter II, par. 2.2.3.

⁴⁷⁵ On this point, it should actually be recalled that the EU legislator also allows single producers to act as applicants in the national stage of the procedure for the registration of a GI. Under Art. 9, par. 3, Reg. (EU) No 2024/1143, indeed: ‘...a single producer may be deemed to be an applicant producer group, where it is shown that all of the following conditions are fulfilled: (a) that producer is the only producer willing to submit an application for the registration of a geographical indication; (b) the geographical area concerned is defined on the basis of the link referred to in Article 49(1), point (f), of this Regulation, Article 94(1), point (i), of Regulation (EU) No 1308/2013 and Article 22(1), point (f), of Regulation (EU) 2019/787 and not on the basis of property boundaries; and (c) the geographical area concerned has characteristics which differ appreciably from those of neighbouring areas or the characteristics of the product are different from those produced in neighbouring areas or, with respect to geographical indications of a spirit drink, the spirit drink has a specific quality, reputation, or other characteristic which is clearly attributable to its geographical origin’. Nevertheless, this possibility is in reality rather remote and infrequent. On the one hand, this is because the requirements established for single producers to be authorised to individually apply for the registration of a GI are quite stringent. Of no less significance are, then, the factual hurdles that a single producer would meet in bearing the related bureaucratic and economic burdens on its own.

the required information and that they do not contain manifest errors, mostly complying with the outcomes of the national stage of examination.

This reconstruction spontaneously brings to mind an initial reflection involving blockchain's main features. In the passages leading to the establishment of a new Geographical Indication and, in particular, in the registration procedure that was mentioned just above, blockchain could first of all prove to be useful simply by operating as a *distributed ledger technology*. The technology could indeed work as a tool to record all data and information that is relevant for the registration of a new Geographical Indication and to automatically share it within the actors involved: producer groups, Member States that are in charge of the procedure's first stage, and the European Commission that is entitled to the second one. In this context, in addition to a considerable reduction in the time needed to circulate the relevant information among the parties involved, blockchain would also allow for a significant lightening in the bureaucratic burdens for these actors.

That said, it should also be pointed out that the advantages offered by a blockchain platform in this context do not seem to particularly differ from those that could be obtained by using other digital records, especially distributed ones. As a consequence of this, the described application in the field of Geographical Indications does not appear overwhelming.

Notwithstanding this, a second reflection is possible. The legal protection attributed to Geographical Indications within the EU *sui generis* regime, and therefore the related request for application, requires the identification of an agricultural product or foodstuff and the designation of a specific geographical area, as well as the demonstration that the former has acquired a degree of notoriety among consumers due to its quality, its peculiar characteristics, or its reputation. All of this must be set out in the product specification.

In fact, the latter should at least include⁴⁷⁶ the name to be registered, a description of the product, the definition of the interested geographical area and evidences that the product

⁴⁷⁶ Art. 49, par. 1, Reg. (EU) No 2024/1143. More precisely: '1. A product specification shall include at least: (a) the name to be registered as a designation of origin or geographical indication, as it is used in trade or in common language to describe the specific product in the defined geographical area; (b) a description of the product, including, where relevant, the raw materials, plant varieties and animal breeds concerned, including the commercial designation of the species and its scientific name, as well as the principal physical, chemical, microbiological or organoleptic characteristics of the product; (c) the definition of the geographical area delimited with regard to the link referred to in point (f)(i) or (ii) of this paragraph, and, where appropriate, details indicating compliance with the requirements of Article 46(3); (d) evidence that the product originates in the defined geographical area specified in accordance with Article 46(1), point (c), or Article 46(2), point (c); (e) a description of the method of obtaining the product and, where appropriate, the authentic and unvarying local methods; as well as information concerning packaging, if the applicant producer group so determines and gives sufficient product-specific justification as to why the packaging must take place in the defined geographical area to safeguard quality;

originates in the defined geographical area, a description of the methods to obtain the product, and any information concerning packaging, when it is sufficiently proven that these are needed to safeguard quality, or to ensure the origin or controls. Additionally, and above all, product specifications should include details establishing the link between the quality or characteristics of the product and the geographical environment (including human factors), for protected designation of origin; and the link between a given quality, the reputation or other characteristic of the product and the geographical origin referred to, for protected geographical indication.

What follows is the possibility to claim that the key profile that arises in this context, as it underlies the registration of a PDO or PGI, and thus the establishment of a new Geographical Indication, is precisely the need to establish and prove the link between the geographical area of origin of the agri-food product and its quality, peculiar features, or reputation. And, keeping in mind the main purpose of this analysis, the resulting question is: can blockchain technology emerge and show some utility in this sense? Two plausible alternatives, in part opposed to each other, seem to emerge.

The factors that shape the quality and the other peculiar characteristics of a PDO or PGI agricultural product or foodstuffs are, above all, ‘objective’ factors, sometimes of a scientific nature, or having historical grounds. As mentioned above⁴⁷⁷, origin, that is the *condicio sine qua non* of Geographical Indications’ quality, is indeed expressed in a whole series of factors – pedoclimate conditions involving climate, soil, territory, and agricultural influences, but also local and traditional methods of production, consolidated know-how, and many others – which give life to the key notion of *terroir*⁴⁷⁸. These are the factors that determine and demonstrate the *quid pluris* of agri-food products, and entail the *sui generis* regime of protection attributed

to ensure the origin or to ensure control, taking into account Union law, in particular Union law relating to the free movement of goods and the free provision of services; (f) details establishing the following: (i) as regards a protected designation of origin, the link between the quality or characteristics of the product and the geographical environment referred to in Article 46(1), point (b). The details concerning human factors of that geographical environment may, where relevant, be limited to a description of the soil and landscape management, cultivation practices or any other relevant human contribution to the maintenance of the natural factors of the geographical environment referred to in that provision; (ii) as regards a protected geographical indication, the link between a given quality, the reputation or other characteristic of the product and the geographical origin referred to in Article 46(2), point (b)’. According to the following paragraph, product specifications can also include references to sustainability practices, specific labelling rules, and other applicable requirements provided for by Member States or by a producer group.

⁴⁷⁷ Chapter II, par. 1.2, where an attempt was made to outline and address the concept of origin as a core component of Geographical Indications.

⁴⁷⁸ See D. GIOVANNUCCI, T. JOSLING, W. KERR, B. O’CONNOR, M. T. YEUNG, *Guide to Geographical Indications: Linking Products and Their Origins*, 2009, available at: <http://www.intracen.org/publications/> (last accessed: 20.09.2025).

to GI. And these are precisely the factors that producer groups need to include in product specifications to express and illustrate the link between the geographical area of origin of the agri-food product and its quality or peculiar characteristics.

It does not seem that blockchain could have potentially disruptive applications in this framework, or at least have a function that goes beyond its mere implementation as a digital ledger to record data concerning these factors, but as other existing digital solutions would do. As it is clear that producer groups might sufficiently obtain this sort of information in different ways, it is unlikely that implementing blockchain-based solutions in this scenario would offer striking advantages or add any particular value.

A partially different solution comes ahead when the same question is addressed from the viewpoint of reputation or, more precisely, of the reputational link. Establishing the link between the geographical area of origin of the agri-food product and its reputation might more significantly benefit from blockchain's typical features, as the latter could contribute to building the reputation of agricultural products and foodstuffs, or at least to proving it.

Indeed, despite the described difficulties in framing the reputational link⁴⁷⁹, when considering in particular what has been defined as '*contemporary reputation*' or '*market reputation*'⁴⁸⁰, this can be gauged by resorting to familiar categories of evidence, such as consumer surveys, sales figures, trade opinion, as well as by considering sales and consumption volumes, and thereby weighting the evaluation and appreciation consumers have of the product. From this perspective, the implementation of blockchain-based solutions would enable producer groups to obtain a detailed and reliable record of every sale made by individual producers within the group, starting from a specific date onwards, based on the time-stamping of the collected data. In this way, producer groups would have access to accurate and trustworthy information, attested by the implementation of a blockchain, which could be used to build or demonstrate the reputation of a product by looking at consumers' purchasing choices. In this context, furthermore, making use of a blockchain-based solution would also have an additional advantage, that is, to collect and record commercial data and confidential information (e.g., consumers' preferences, trade opinions, sales volumes, etc.) without necessarily

⁴⁷⁹ See *supra*, chapter II, par. 1.1.

⁴⁸⁰ The first term is used in D. S. GANGJEE, *From Geography to History: Geographical Indications and the Reputational Link*, *op. cit.*, pp. 19-20, while the second is adopted by A. ZAPPALAGLIO, *The Transformation of the EU Geographical Indications Law. The Present, Past and Future of the Origin Link*, *op. cit.*, p. 79. From a reading of the two works, it is nevertheless clear that the two expressions are essentially interchangeable, as they express similar concepts.

disclosing it to the other GIs producers participating in the network, as they all compete on the same market and with the same products. This possibility is provided by the pseudonymisation ensured by blockchain platforms⁴⁸¹.

That said, it is also clear that resorting to a solution of this kind solely to achieve the described result, however plausible and remarkable in theory, would probably be too onerous, cumbersome, and unnecessary to be made real. These considerations, moreover, would in any case only apply to protected geographical indications, and not to protected designation of origin, as only in the former the reputational link is of any relevance in terms of establishing the legal protection over the Geographical Indication.

Bearing the presented insights in mind, it is then possible to conclude that in the described *preliminary* phase aimed at *establishing* a new Geographical Indication, where it is necessary to settle the protectability of a commercial name as a PDO or PGI, and therefore to assess whether the requirements exist for that name to be protected as a Geographical Indication in the EU *sui generis* regime, blockchain technology does not seem to find breakthrough uses, as no sensible benefits to its implementation surface. As a matter of fact, while there is no hesitation in acknowledging that blockchain could validly be adopted to prove that an agricultural product or foodstuff originates from a specific geographical area⁴⁸², is it not equally certain that the technology could also be used in the steps leading to the establishment of a new Geographical Indication.

2.2. Ensuring compliance with product specifications.

Under Art. 32, par. 4, lett. Reg. (EU) No 2024/1143, producer groups are also required to develop activities to verify and ensure compliance with the relevant product specifications, including supporting their members with their own control systems. The tasks that are deemed necessary to guarantee compliance with product specification – i.e., to make sure that each PDO

⁴⁸¹ As discussed in the first chapter, one of the main features of blockchain technology is its security. This characteristic is essentially derived from the cryptographic techniques implemented for the functioning of blockchain networks and, more specifically, from the double symmetric key system adopted to encrypt messages and transactions. As a matter of fact, blockchain platforms typically store information by only recording the hashes, thereby ensuring security and confidentiality of registered data. See *supra*, chapter I, par. 2.1.

⁴⁸² However, this is more of a burden that falls on individual producers wishing to adopt the Geographical Indication in their agri-food products or, at most, an activity that can be traced back to the tasks and responsibilities of producer groups, but not at this stage, rather when assessing the compliance with product specifications. This second phase will be analysed immediately afterwards.

or PGI product that is placed on physical and virtual, on domestic and foreign markets, has fully observed the dispositions included in the relevant product specification – are therefore also assigned to producer groups, who thereby take the lead in this primary step to maintain the protection over their Geographical Indication, once it has been registered and established.

In this regard, it should immediately be clarified that the control systems implemented by producer groups are additional to the official ones, carried out by public authorities and, in many cases (including Italy), by independent certification bodies⁴⁸³. This distribution of powers and responsibilities brings an additional element to the table, that is, how to enhance the desirable cooperation between the different subjects involved in control activities.

In general, the importance of ensuring compliance with the provisions contained in product specifications is paramount to securing that all products designated by a PDO or PGI

⁴⁸³ In the European *sui generis* regime for GIs, the control system for protected designation of origin and protected geographical indications foresees a collaboration between individual producers, producer groups, the authority or body thereto designated in each Member State, and Member States themselves. The relevant provisions are to be found in Chapter 4, *Controls and enforcement*, Reg. (EU) No 2024/1143. Here, the activities for the effective control and enforcement of Geographical Indications are conferred to competent authorities, delegated bodies, and natural persons to whom these functions have been delegated. Art. 38 starts by defining the scope of these activities: ‘control’ extends both to the verification that a product designated by a Geographical Indication has been produced in compliance with the corresponding product specification, and to the verification of the use of Geographical Indications in the market, including on online interfaces; ‘enforcement’, on the other hand, refers to any activity that aims to ensure that the protection of GIs is achieved. The subjects in charge of carrying out these functions are ‘competent authorities, delegated bodies and natural persons’, which shall comply with the requirements laid down in Regulation (EU) 2017/625. Unlike producer groups, these subjects do not act as private entities representing the interests of their members (beyond the tasks of governance of the Geographical Indication conferred to them by the EU legislator), but rather are delegated with the control functions that are given to public authorities, and must therefore preserve their impartiality and independence from the other economic operators placed on the market. In this sense, see I. CANFORA, *Gruppi di produttori ed enti di certificazione: competenze e legittimazione in una regolazione mobile*, op. cit., pp. 10-11. As anticipated, the control system also envisages the strong and direct involvement of PDO and PGI producers. Indeed, the operators willing to participate in any activity covered by the product specification of a GI should notify their intention to the competent national authority, and they are the first subjects responsible for their own controls to ensure compliance with the product specification *before* the product is placed on the market (Art. 39, par. 1 and 2). On closer inspection, the direct involvement of individual operators can also be caught from a reading of Art. 39, par. 7, which states that the costs of verification of compliance with the product specification may be borne by the operators which are subject to those controls, even though Member States may collect fees or charges to cover them, wholly or partially. In addition to this, specific norms are also established for the verification of the use of Geographical Indications in the market and their enforcement. In this sense, under Art. 42, par. 1, Member States must designate one or more competent authorities that are responsible for the verification of the use of the Geographical Indication *after* a product designated by a GI has been placed on the market, considering operations such as storage, transit, distribution, and sale, including electronic commerce, and take on the needed enforcement actions. These authorities must act regularly and with appropriate frequency, based on a risk analysis and notifications received, including those from producer groups (par. 2). Similar rules also apply to the control and enforcement of Geographical Indications that designate products originating from a third country. Lastly, the control and enforcement system provided for in Reg. (EU) No 2024/1143 is further boosted by solid and strong cooperation between Member States. Under art. 44, indeed, Member States shall assist each other while carrying out the described functions and, to this end, the EU Commission may also lay down detailed rules on the nature and the type of information to be exchanged, as well as on the methods for exchanging that information, by means of implementing acts.

that are placed on the market are truly suitable to reflect the quality that is inherent in the GI itself, while communicating this element to consumers. From this perspective, the central position of product specifications and their observance in *maintaining* and *expressing* GI quality is immediately shown by the fact that Member States are called upon to establish the legal effects applicable in the case of violation of one or more provisions included in a product specification⁴⁸⁴. Equally emblematic is the provision enabling the European Commission to cancel a registered Geographical Indication when compliance with the requirements for the product specification can no longer be ensured⁴⁸⁵.

In the described framework, blockchain seems to find relevant spaces for its implementation, as the main features of the technology allow for the efficient, timely, transparent, and immutable collection, processing, and managing of all information necessary to ensure that each producer is compliant with the product specification, as well as to openly and promptly circulating it within single producers, producer groups, existing associations of producer groups, and eventually with the competent national authorities⁴⁸⁶. Since, as seen, the system designed to ensure compliance with product specifications is a composite one, where the tasks of producer groups are complemented by those of public or private authorities appointed by each Member State, and vice versa, the introduction of a blockchain network could facilitate this composition and foster cooperation between all subjects involved. Indeed, the development of a blockchain platform – hypothetically a private and permissioned one – managed by the producer group and shared among all GI producers, the national authorities

⁴⁸⁴ In the Italian legal system, for example, any detected violation of one or more provisions included in a product specification results in the application of administrative pecuniary sanctions, varying in their amounts, as well as in the accessory sanction hindering the use of the protected designation, without prejudice to the potential application of any criminal law in force. The relevant regulations are to be found in the d. lgs. 19 November 2004, n. 297, *Disposizioni sanzionatorie in applicazione del Regolamento (CEE) N. 2081/92, relativo alla protezione delle indicazioni geografiche e delle denominazioni di origine dei prodotti agricoli e alimentari*, which entered into force on 30 December 2004, and was last updated on 13 July 2024.

⁴⁸⁵ Art. 25, par. 1, lett. a, Reg. (EU) No 2024/1143. The mentioned hypothesis is one of the only two cases in which the European Commission is allowed to proceed, even on its own initiative, to the cancellation of the registration of a Geographical Indication. The second hypothesis is provided in the same paragraph, lett b., and refers to the case where ‘...no product has been placed on the market under the geographical indication for at least the preceding seven consecutive years’.

⁴⁸⁶ By way of example, it is first of all possible to recall here blockchain’s ability to detect and register information concerning the precise place of origin of an agricultural or food product, which was also mentioned in the previous paragraph. Or, additionally, the possibility of implementing blockchain-based solutions to collect detailed information of each stage of the production chain (a passage that is rather meaningful especially for transformed and processed PDO and PGI products), as well as accurate data on packaging, slicing, grating, and any other form of conditioning of the product, which might be requested to be carried out exclusively in the defined geographical area. Ultimately, every passage that GI products have to make *before* being placed on the market could, in this way, be controlled by producer groups, who would easily access all relevant information as these are recorded on a blockchain.

responsible for the controls referred to in chapter IV, Reg. (EU) No 2024/1143, and producer groups themselves, would enable to settle a network opened to the direct participation of all the involved actors. The latter would thereby be able to record and share all relevant information promptly and transparently, avoiding delays or additional burdens, and increasing reciprocal trust and cooperation. In other words, the adoption of blockchain-based solutions would foster and simplify immediate awareness of each stage in the production process of a GI product, as not to ignore that the recording of the relevant data on a blockchain platform would make it accessible to producer groups and control authorities with considerable savings in terms of bureaucracy and procedures, time, and costs.

Considering blockchain's implementation to check and verify compliance with product specifications even allows for a more immediate execution of the control activities discussed here. That would be possible when not only information gathering and sharing were supported by the implementation of blockchain-based solutions, but also in the case that producer groups adopted a system for the *automatic* control and validation of this data through smart contracts. Via smart contracts, in fact, these controls would no longer be taking place exclusively after the producer groups or competent authorities have accessed the relevant data and information, but rather *simultaneously*. And this is because, if the information relating to the production does not perfectly match what is established in the product specification of the interested GI, the smart contract performing the function of verifying the compliance would not be activated⁴⁸⁷. Producers would be prevented from making use of a PDO or PGI in the marketing of the agri-food products subject to control when the relevant product specification was not fully observed and complied with.

An example may be useful at this point to better explain how blockchain adoption can have positive impacts on the verification of compliance with product specifications.

Pecorino Toscano PDO is a soft or semi-hard cheese made exclusively from whole sheep's milk originating from the production area, which covers the entire Tuscany, some

⁴⁸⁷ The thesis delved into the topic of smart contracts in chapter I, par. 2.2. For the purposes of the ongoing analysis, and to understand how this blockchain application could contribute to performing control activities over Geographical Indications, it is sufficient here to reiterate that a smart contract is a computer protocol designed to execute contractual duties once the established conditions are met, responding to the logic 'if this, then that'. It is a code that can be programmed to conclude, verify, and carry out contractual agreements, or their performance, automatically, being designed to immediately execute when the predetermined conditions occur.

municipalities in Umbria, and other municipalities in Lazio⁴⁸⁸. The product specification includes, among other things, provisions establishing sheep's basic diet, or that the milk obtained from these animals must be coagulated at a temperature of 33° to 38° within 20-25 minutes, or again that the milk can be used raw or pasteurised by heat treatment, and that, for aged cheese, the curd may also be heat-treated at 40° to 42° for 10-15 minutes (see Art. 5). These, as well as the other information required in the product specification, can clearly be recorded by individual producers on a blockchain platform and thus be immediately made available to the producer group and the control authority – for the Pecorino Toscano PDO, the control body 'Dipartimento qualità agroalimentare' (DQA). But that is not all. Considering, for instance, the mentioned requirements on temperatures, these could automatically be measured and registered on the blockchain platform by using sensors or other digital tools. Once the information is entered into the blockchain, the smart contract programmed to check the compliance would only activate if the retrieved data matches the provisions of the product specification, based on which it has been programmed to self-execute. This would ultimately enable the automatic performance of the control activities described thus far.

In conclusion, it can be claimed that the possibilities and concrete advantages that blockchain seems to provide in terms of 'internal' controls – that means, the controls carried out within the producers of the Geographical Indication and relating to the compliance with product specifications – are not insignificant or dull. Nor are they irrelevant when considering the possibility of saving time and resources from all sides involved, as well as of making these functions more secure, timely, trustworthy, and widespread⁴⁸⁹.

2.3. Protecting and enforcing the Geographical Indication.

As it has been highlighted above⁴⁹⁰, PDO and PGI infringements represent one of the leading challenges in the system of Geographical Indication, constantly pushing European

⁴⁸⁸ The product specification that is being considered here is available on the Pecorino Toscano PDO website at: <https://www.pecorinoscanodop.it/wp-content/uploads/2017/08/DisciplinarePecorinoToscano.pdf> (last accessed: 30.09.2025).

⁴⁸⁹ In this perspective, an additional step can be hypothesized. If the recording on the blockchain platform of any information relating to the PDO or PGI product was made mandatory through a specific provision included in the product specification, no individual producer intending to use the Geographical Indication could exempt themselves from following it. The positive outcome is that none of them would possibly avoid or elude the controls put in place by producer groups and the competent national authorities.

⁴⁹⁰ Chapter II, par. 3.1.

Institutions and national legislators, but also courts, practitioners, and interpreters, to search for possible remedies and effective countermeasures. Today, this acknowledgement is even more accurate when looking at what were defined as the ‘*new frontiers*’ of GI infringements: the protection of Geographical Indications on virtual markets and online interfaces.

It is thus no coincidence that producer groups, among other things, are further called upon to identify and adopt the most appropriate measures to effectively protect and enforce their Geographical Indications. Looking at the text of Art. 32, par. 4, Reg. (EU) No 2024/1143, these preliminary considerations translate into a whole series of tasks and responsibilities that the European legislator places on producer groups.

In this perspective, indeed, producer groups are called upon to take any appropriate step to ensure the protection of their Geographical Indications and the intellectual property rights stemming from them. This includes, among other things, taking legal action and submitting requests for action to customs authorities⁴⁹¹, but also preventing or countering any measure or marketing practice that is, or risks being, detrimental to the reputation or value of the Geographical Indication⁴⁹². Producer groups can also act on behalf of their members within intellectual property enforcement networks and work with anti-counterfeiting bodies established both at the European and national levels⁴⁹³. At the same time, producer groups are expected to combat infringements and suspected fraudulent uses on the markets of GI products that are not in compliance with the product specification. To this end, they must monitor and verify the use of their Geographical Indication across physical and virtual markets within the EU, and on third country markets in which the GI is protected. When necessary, producer

⁴⁹¹ Reference is expressly made to the customs authorities as identified in Regulation (EU) No 608/2013 of the European Parliament and of the Council of 12 June 2013 concerning customs enforcement of intellectual property rights and repealing Council Regulation (EC) No 1383/2003.

⁴⁹² Under art. 32, par. 4, lett. b, Reg. (EU) No 2024/1143, a producer group may: ‘*engage in appropriate action to ensure protection of the geographical indication and of the intellectual property rights that are directly connected with it, including legal actions and filing applications for actions with customs authorities in accordance with Regulation (EU) No 608/2013 and preventing or countering any measures or marketing practices which are, or risk being, detrimental to the reputation or value of the geographical indication concerned*’.

⁴⁹³ Art. 32, par. 4, lett. c, Reg. (EU) No 2024/1143. The significance of this article, however brief and concise, should not be overlooked, especially in view of the message it conveys. Indeed, it translates a pivotal novelty introduced with the EU quality schemes reform of 2024, where the EU legislator has definitely acknowledged the weight of collective entities for the governance of Geographical Indications, and that ‘*Producers acting collectively have more powers than individual producers and take collective responsibilities to manage their geographical indications...*’ (in this sense, see recital 19 of the 2024 Regulation). Consequently, the provision analysed here aims at ensuring that producer groups can speak and act collectively for their individual members in the fight against counterfeiting, GI violations, and infringements. By taking part in the mentioned enforcement networks and by engaging with anti-counterfeiting bodies, these groups can indeed share information and coordinate actions, advocate for the most appropriate measures of protection, and protect and enforce the intellectual property rights of their individual producers. Ultimately, this allows a stronger and more unified protection against infringements.

groups are also allowed to directly report to enforcement authorities⁴⁹⁴. Finally, producer groups can also act to enhance the value of GI products and, when necessary, intervene to prevent or take action against any measure or commercial practice (such as devaluing marketing practices and lowering prices) that might harm the image and value of their Geographical Indication and related PDO or PGI products⁴⁹⁵.

The recalled activities are hence aimed at protecting and enforcing a Geographical Indication once it has been registered, and the designated products placed on the market, against any form of infringement, fraudulent use, detrimental practices, and so on. It is therefore rather clear that the greatest commitment and major efforts of producer groups are precisely projected in this paramount function, which, however, are not always adequately performed, especially when it comes to the younger or smaller groups.

In the described framework, delving into the contribution that blockchain technology might offer for the functions of protection and enforcement of the Geographical Indication is not illogical, especially given the difficulties that producer groups actually face in keeping a widespread and comprehensive surveillance in domestic and foreign physical markets where PDO and PGI products are sold, as well as in online interfaces, which often escape the scrutiny of producer groups and the other competent national authorities, as these lack sufficiently adequate tools to act promptly and efficiently on the internet.

With respect to the hurdles arising in this scenario, it is of major importance to explore the support that technological innovation and related digital instruments may offer, not only theoretically, but also in practice. And this is where blockchain comes in, as the main features and the functioning of the technology provide spaces to reflect on its implementation in this third framework, as well.

To simplify the following reconstruction, there are basically two cases that can be considered and observed in this context, and, in both cases, the implementation of blockchain-based solutions could effectively ease and boost producer groups' protection and enforcement

⁴⁹⁴ Art. 32, par. 4, lett. f, Reg. (EU) No 2024/1143. Producer groups '*combat infringements and suspected fraudulent uses on the markets of products designated by geographical indications that are not in compliance with the product specification, by monitoring and verifying the use of the geographical indication across the internal market and on third country markets where the geographical indications are protected, including on online interfaces, and, as necessary, inform enforcement authorities using confidential systems where available*'.

⁴⁹⁵ Art. 32, par. 4, lett. g, Reg. (EU) No 2024/1143. Producer groups also '*take measures to enhance the value of products and, where necessary, take steps to prevent or counter any measures or commercial practices which are, or risk being, detrimental to the image and value of their products, including devaluing marketing practices and lowering prices*'.

of their Geographical Indications. On the one hand, the first hypothesis concerns agricultural products and foodstuffs that actually originate from the defined geographical area, but whose production procedure fails to comply with one or more provisions of the product specifications, and are nevertheless placed on the market referencing the PDO or PGI⁴⁹⁶. The second scenario, on the other hand, refers to the infringements carried out by operators that are located outside the defined geographical area, and thus have no possibility of legitimately adopting the PDO or PGI for their products.

In both cases, if it were made mandatory to record the information relating to the different stages of the GI production chain on a blockchain platform to be compliant with the product specification⁴⁹⁷, any product that is placed on the market as a PDO or PGI, but has not been validated by the blockchain network, would immediately be detected as infringing. This identification, moreover, would *not exclusively* be in the hands of producer groups and the competent national authorities, but also be accessible and possible for each subject involved, including the different actors of the production chain (distributors, suppliers, retailers, etc.) and consumers themselves. This is because it would be sufficient to scan the lot number or other identification code stamped on the product designated as a PDO or PGI to verify and establish that it is compatible with the lots previously validated by the blockchain platform managed by the producer group⁴⁹⁸. Blockchain technology would, in this activity, be fully autonomous.

In other words, the implementation of blockchain technology in the described framework would ensure that any agricultural product or foodstuff that is placed on the market as a PDO or PGI, without a previous approval from the blockchain system, is instantly identified and detected as non-compliant or infringing. Furthermore, every subject involved would be able

⁴⁹⁶ The reflections that have already been presented in the previous paragraph, when proposing the implementation of blockchain-based solutions to perform the tasks aimed at ensuring compliance with product specifications, may also be extended to apply to this first hypothesis.

⁴⁹⁷ However, it is evident that this possibility would necessitate considerable involvement and additional efforts on the part of the interested producer group, which would first of all need to plan (and finance) the development of a blockchain platform that is specifically suited for its Geographical Indication, more likely a private and permissioned one to be managed by the group itself. Secondly, the producer group would also have to amend its product specification to include a provision expressly requesting that each producer wishing to make use of the protected designation of origin or protected geographical indication shall adopt the blockchain platform to record and share their information.

⁴⁹⁸ The fact that the implementation of blockchain-based solutions for the described purposes could also enable other subjects in the production chain of a GI product to be involved in the monitoring of the Geographical Indication is quite an interesting factor and should not be overestimated, as it would make controls aimed at protecting and enforcing PDO and PGI much more widespread and accurate, and therefore more effective. By way of example, it is possible to think about distribution channels and retail companies, which hypothetically could decide to sell products designated as PDO or PGI only after verifying that the lots entirely correspond to those validated by the blockchain. This would, in principle, prevent counterfeit products from entering shops.

to notice possible infringements, as scanning the questioned product would immediately show whether it matches the information and data already validated by the blockchain platform. Going back to the example of our Pecorino Toscano PDO, if each cheese wheel presented a QR code or other identification code on the label, or even in its rind⁴⁹⁹, linking to the blockchain explorer⁵⁰⁰ referencing the lots previously validated by the blockchain platform of the Consorzio Tutela del Pecorino Toscano DOP, it would then be possible for anyone to access and verify the authenticity of the information on the production of the PDO, for example, that the milk used is exclusively whole sheep's milk originating from the territories included within the designated geographical area.

Another specific scenario where blockchain technology could support the protection and enforcement of Geographical Indications is offered by the case of PDO or PGI products used as ingredients. As highlighted before⁵⁰¹, Art. 27 of Reg. (EU) No 2024/1143 regulates this profile and introduces a system of prior written notification falling on the producer who intends to use the PDO or PGI product as an ingredient in a processed, transformed, or prepacked product. The notification is intended to communicate all the necessary information to prove that the conditions set for the use of a GI as an ingredient are complied with, and specifically: that the processed product does not contain any other comparable ingredient; that the GI product is used in sufficient quantities to confer its essential characteristics or quality to the processed product; that the percentage of the used GI product is clearly indicated on the label (Art. 27, par. 1).

In this case, as well, the adoption of a blockchain-based solution to record all the information relating to the processed, transformed, or prepacked product would enable a higher

⁴⁹⁹ Consider, by way of example, the possibility of developing a new smart label for cheese products from casein plates, special labels already quite widespread in the cheese industry, which can be applied directly to the rind because they are made of a natural and edible material, derived from casein. Combining casein plates with scannable tags could provide a completely innovative solution to identify, certify, and trace back PDO and PGI (cheese) products. For a general overview of the latest technical and technological advancements in this sense, see G. K. DESHWAL, N. R. PANJARI, *Active and Intelligent Packaging of Cheese: Developments and Future Scope*, in M. A. PRIETO, P. OTERO (eds.), *Natural Food Additives*, IntechOpen, 2022, pp. 225-248.

⁵⁰⁰ As this term has not been used before, it should be clarified that a blockchain explorer (also known as blockchain browser or block explorer) is an online tool that can be used to search, explore, and analyse all the information related to a blockchain, including its component blocks, the registered transactions, the addresses, network metrics, and related statistics. In other words, it is a web-based application that allows users to interact with the data stored in a blockchain. With such content, its main purpose is to disclose the principles of transparency and accessibility to data that are pivotal in blockchain-based solutions. For more information, see M. LEGGE, *Blockchain Explorer*, in *Crypto Glossary*, 2023, available online at the following link: <https://koinly.io/crypto-glossary/blockchain-explorer/> (last accessed: 5.10.2025).

⁵⁰¹ See *supra*, chapter II, par. 2.2.2.

degree of protection and enforcement of the involved Geographical Indication, extended to cases where it is not the PDO or PGI product itself to be placed on the market, but rather a non-designated one containing the PDO or PGI product as an ingredient. The described validation system could also apply to this scenario, allowing producer groups (in this case, recognised producer groups) to verify not only that the requirements laid down for the use of a GI as an ingredient are fulfilled, but also that the product intended to be used is really complying with the relevant product specification. That said, it is not possible to underestimate the complexities this particular case entails. Indeed, for the described system to function, the blockchain platform managed by the producer group would have to be used not only by GI producers, who may already be part of the group and easy to reach, but also by any other food business operator potentially interested in using the GI product as an ingredient. Such a system, already difficult to implement in theory, could also have adverse economic and reputational consequences for the Geographical Indication itself, whereby the additional burden of resorting to a blockchain platform to provide this information would discourage any interested actor from using that PDO or PGI product as an ingredient. At the same time, it would probably require a more complex and distributed blockchain, leading to higher costs and duties for the producer group and, consequently, for the GI producers themselves.

In general, it is nevertheless rather clear that the adoption of blockchain-based solutions to support the activities of protection and enforcement of the Geographical Indication performed by producer groups can have positive impacts, affecting their timing and effectiveness⁵⁰². Considerable improvements can also be achieved in terms of transparency,

⁵⁰² In this regard, supplementary information can be useful to get a better understanding of the contribution that the recourse to blockchain technology could offer here. In Italy, producer groups (or, more precisely, protection consortia) rely on the ‘manual’ work of some Supervisory Agents (in Italian, *Agenti vigilatori*) to perform the functions of protection and enforcement of their Geographical Indications. The activities carried out by these agents involve every stage of the production, processing, and marketing of the GI product and, in general, mostly consist in checks to verify that the products designated by a GI comply with the requirements set out in the product specification, after registration, as well as the monitoring of any similar product that is made or commercialised in the European Union and which, due to information on the origin, nature, features, or presumed quality, might mislead the consumer or damage the PDO or PGI. The relevant legislation is to be found in d. lgs. 19 November 2004, n. 297, that, under Art. 8, entitles these agents to ascertain and detect the specified irregularities (as set out in Articles 1, 2, and 5 of the Decree). In exercising the mentioned functions, Supervisory Agents may also be assigned the status of Agents of public security. And, while Supervisory Agents are normally private citizens carrying out the assigned duties, Supervisory Agents of public security are, to all intents and purposes, public officials. As a consequence of this, when the latter detect GI products that do not comply with the relevant product specification, or other products evoking or infringing registered PDO or PGI, they are allowed to directly confiscate and/or establish pecuniary sanctions. For a comprehensive overview of this topic, see A. GENNARI, *L'agente vigilatore con qualifica di pubblica sicurezza nei consorzi di tutela*, in *Infowine.com*, 2012. Under d.m. 27 December 2012, *Istituzione dell'albo nazionale degli agenti vigilatori e degli agenti vigilatori con qualifica di pubblica sicurezza, ai sensi dell'articolo 5 del decreto 6 novembre 2012*, a national register for Supervisory Agents

further contributing to enhancing the levels of trust not only among individual producers, producer groups, and the national competent authorities, but also with final consumers, who, in fact, dispose of a trustworthy tool to ascertain that the PDO or PGI product they are purchasing is actually reflecting the additional quality embedded in the Geographical Indication, and that effective and clear controls have been carried out in this regard. Ultimately, it is also in terms of ‘external’ controls that the enhancements brought by blockchain technology seem to be striking, to the point that they leave room for some serious reflections on its implementation.

Mention apart should then be made to the relation that can be established between blockchain technology and intellectual property, given that producer groups are also responsible for ensuring protection of the intellectual property rights stemming from their Geographical Indications, as well as for taking part in the intellectual property enforcement networks and anti-counterfeiting bodies on behalf of the individual producers.

As it was previously observed, blockchain technology finds multiple perspectives of implementation in the realm of IPR. As far as it is mostly relevant here, blockchain-based applications can indeed be adopted, among other things, to provide authentication of provenance, to control and track (un)registered IPRs, to provide evidence of genuine and/or first use in trade or commerce, as well as to track the origin to detect counterfeit, stolen, or parallel-imported goods. However, the functions for which blockchain seems to be interesting in the field of IP mostly concern the *initial* moment of creation of the intellectual property right. For Geographical Indications, this means the moment when a new protected designation of origin or geographical indication is established⁵⁰³. In this context, in other words, blockchain seems to apply not so much to the protection of the intellectual property rights stemming from Geographical Indications, as understood in the words adopted by the European legislator, but rather to the establishment of the related intellectual property, without, however, differentiating that much from the contribution that other distributed registers would provide.

and Supervisory Agents of public security is established, consisting of two separate sections. Up to October 2025, the national register counts about 160 Supervisory Agents and 176 Supervisory Agents of public security. It is not trivial to wonder whether the workload that this limited number of agents has to bear to keep track of all the Italian GIs sold in Europe and in third countries, on physical markets and online interfaces, still allows producer groups to adequately and sufficiently protect and enforce their Geographical Indications. Nor is it superfluous to understand whether the adoption of more or less advanced digital tools may, on the contrary, allow for significant improvement in this direction (reference here is not only to blockchain technology but, more in general, to any other digital solution that could prove to be strategic, such as with the adoption of AI algorithms).

⁵⁰³ Consequently, the reflections already raised and presented above, while attempting to outline and describe the contribution that blockchain technology could provide when producer groups establish a new Geographical Indication, apply. See *supra*, chapter III, par. 2.1.

2.4. Enhancing, improving, and promoting the Geographical Indication.

Finally, producer groups are further entrusted with functions aimed at enhancing, improving, and promoting their Geographical Indication. In the wording adopted by the European legislator, these tasks seem to be mostly directed at boosting the sustainability of PDO and PGI production, but, as it will appear in the following pages, they are also prone to reach other objectives.

Under Reg. (EU) No 2024/1143, indeed, producer groups may first of all agree on the sustainable practices, in the form of both provisions included in the product specification and separate initiatives, they establish how to verify that individual producers comply with these practices, and, interestingly, find the best means to ensure adequate publicity of the established measures⁵⁰⁴. In addition to this, producer groups can take any action that is deemed necessary or suitable to improve the performance of their Geographical Indication, in terms of environmental, social, and economic sustainability⁵⁰⁵. From a literal interpretation of these provisions, it therefore seems that enhancing, improving, and promoting Geographical Indications means, first and foremost, enhancing, improving, and promoting the *sustainability* of Geographical Indications, prompting these collective subjects to take an active role in the process by entrusting them with specific tasks and precise responsibilities⁵⁰⁶.

However, sustainability is *not* the only element that comes to the fore in this perspective. In fact, in its following passages, Art. 32, par. 4, lett. e, Reg. (EU) No 2024/1143, lists a whole series of actions and activities that producer groups can implement and which, despite being literally destined to ‘...improve the performance of the geographical indication in terms of environmental, social and economic sustainability’, seem to have a much broader and promising scope, as they more widely contribute to promoting Geographical Indications on the market⁵⁰⁷.

⁵⁰⁴ Under art. 32, par. 4, lett. d, Reg. (EU) No 2024/1143, producer groups may: ‘agree sustainable practices as referred to in Article 7, whether included in the product specification or as a separate initiative, including arrangements for verification of compliance with those practices and assuring adequate publicity for them particularly in an information system provided by the Commission’.

⁵⁰⁵ Art. 32, par. 4, lett. e, Reg. (EU) No 2024/1143.

⁵⁰⁶ After all, this aspect further reflects the architecture of the choices made by the European legislator in the context of the 2024 EU quality schemes reform to address the topic of the sustainability of GI productions, as was illustrated and discussed above (see *supra*, chapter II, par. 3.2).

⁵⁰⁷ When addressing the tasks directed at enhancing, improving, and promoting Geographical Indications, it is also important to recall the more collective role that associations of producer groups play in this regard, even though these will not be specifically considered in this section. As it was already observed, indeed, these organisations do contribute, among other things, to establishing appropriate promotion measures for Geographical Indications, as

In this sense, producer groups can arrange and conduct collective marketing and advertising campaigns, share information and promotion activities, including tourism services in the interested geographical area, to communicate the features of the PDO or PGI product to consumers, and inform them about the EU quality schemes' symbols and abbreviations. At the same time, producer groups can analyse the environmental, economic, and social performances of their GI production, as well as the nutritional and organoleptic profile of the related PDO or PGI product. Furthermore, they provide advice and training, and share guidelines for current and future producers, including on the undertaken sustainable practices, scientific and technical progress, digitalisation, gender mainstreaming, and equality.

Even for these last functions of enhancement, improvement, and promotion of the Geographical Indication, as it was for the previous ones, it is interesting to focus on the leading question of this third chapter and understand whether, and to what extent, blockchain technology can be proposed and presented as a valid tool in the hands of producer groups to more efficiently accomplish the described tasks.

It was observed that one of the major outcomes of blockchain's implementation in the agri-food sector is linked to the fact that the technology acts as a tool to foster and simplify *communication* with the consumer⁵⁰⁸, as it allows the consumer to directly access all relevant information concerning the production chain of the chosen agricultural product or foodstuff. The adoption of blockchain-based solutions, therefore, enables some key results in the relationship between producers and final consumers, as it strengthens the level of trust between them while allowing the former to convey messages to the latter⁵⁰⁹.

well as to set and disseminate recommendations and best practices to help shape GIs' policies and their governance at the national and European levels, by focusing on topics such as sustainability, the fight against food fraud and counterfeiting, value creation, competition rules, and rural development. In this sense, the functions attributed to associations of producer groups mostly focus on Geographical Indications as a collective phenomenon that is a pivotal component of the European policy for quality.

⁵⁰⁸ On this point, S. ØLNES, J. UBACHT, M. JANSSEN, *Blockchain in government: benefits and implications of distributed ledger technology for information sharing*, in *Government Information Quarterly*, 2017, 3, pp. 355-364.

⁵⁰⁹ Abundant scientific literature has indeed already highlighted how the adoption of blockchain-based solutions by economic operators and industries in the agri-food sector can significantly affect consumer behaviour and purchasing choices, ultimately improving companies' marketing performance. In this sense, see H. WANG, M. ZHANG, H. YING, *The impact of blockchain technology on consumer behavior: a multimethod study*, in *Journal of Management Analytics Online*, 2021, 3, pp. 371-390, whose findings reveal that, among the firms that were observed within the empirical study, those that adopted the blockchain tracing system had an increase in product sales and a decrease in product returns compared to those that did not. More generally, on the potential of digitalisation and digital solutions in this context, see also S. BRESCIANI *et al.*, *Digital transformation as a springboard for product, process and business model innovation*, in *Journal of Business Research*, 2021, 128, pp. 204-210.

Analogous results can certainly be witnessed in the realm of Geographical Indications, where blockchain technology can ultimately be presented as a valuable tool to enhance, improve, and promote PDO and PGI products. As a matter of fact, access to precise, clear, and complete information on GI productions increases both the trust and the quality perceived by consumers⁵¹⁰, as it raises their awareness and understanding of the peculiar features of the Geographical Indication, consequently upholding their willingness to pay more for this *quid pluris* that is truly understood as added value⁵¹¹.

Blockchain's potential to foster and support the functions discussed here is thus linked to the technology's ability to establish a connection with consumers, as it enables and strengthens communication between them and PDO and PGI producers (and producer groups, as well). Therefore, the main implication is that blockchain allows not only producers but also producer groups to convey a message to consumers, consequently improving the understanding of PDO and PGI products, in particular, and of the protected designation in general, thereby further promoting the Geographical Indication⁵¹². As a consequence of this, producer groups could resort to this innovative tool to develop marketing and advertising campaigns, but also to share information and communicate the features of the PDO or PGI product to consumers.

As blockchain serves as a valid marketing tool to present PDO and PGI products on the market, especially foreign ones, it ultimately also expresses its validity to fulfil the activities through which producer groups can enhance, improve, and promote their Geographical Indications.

It is hardly the case to recall that the importance of communication between GI producers and consumers, mostly concerning the geographical origin, authenticity, quality, reputation, and additional characteristics of the PDO or PGI product, is already prioritised in the opening passages of the 2024 Regulation on Geographical Indications, which, among the

⁵¹⁰ Some interesting reflections on this point can be found in M. FERNANDEZ ZARZA, S. AMAYA, G. BELLETTI, E. CRIADO, *Trust and food quality in the valorisation of geographical indication initiatives*, in *Sustainability*, 2021, 6, pp. 1-22, which acknowledges that food quality categories may also be guided by logics including trust and proximity between producers and consumers.

⁵¹¹ See E. BONETTI, C. BARTOLI, A. MATTIACCI, *Applying blockchain to quality food products: a marketing perspective*, *op. cit.* p. 2008.

⁵¹² To get some practical feedback on these aspects, it is interesting to recall the outcomes of the empirical study proposed in S. VIOLINO *et al.*, *Are the innovative electronic labels for extra virgin olive oil sustainable, traceable, and accepted by consumers?*, in *Foods*, 2019, 8, pp. 1-14. The research delved into consumers' acceptability of different digital systems supporting traceability and capable of providing electronic labels for Italian PDO and PGI Extra Virgin olive oil, further estimating consumers' willingness to pay additional premium prices to access them. Among the considered digital solutions, blockchain technology takes the lead, as the results show that 94% of the consumer respondents are interested in the implementation of such technologies, and, among them, 45% chose blockchain info tracing platforms.

objectives of the European legal regime, expressly addresses the need to ensure that ‘...consumers receive reliable information and necessary guarantee of the origin, authenticity, quality, reputation and other characteristics linked to the geographical origin or the geographical environment of such products and can readily identify them in the marketplace including in electronic commerce’⁵¹³. And, while the use of Geographical Indication is in itself already sufficient to convey the message of the high(er) standards required for the production of the PDO or PGI product⁵¹⁴, the adoption of blockchain-based solutions would allow, as seen, a much stronger, more transparent, and engaging communication with the final consumer on these profiles.

Considering the advantages that blockchain offers for increasing communication between GI producers and consumers, it can be agreed that the technology provides interesting grounds for reflecting on its implementation to enhance, improve, and promote Geographical Indications. And, while these conclusions might not be as striking as the results that can be achieved when adopting blockchain-based solutions to ensure compliance with product specifications or to protect and enforce the GI, they still cannot be neglected insofar as the adoption of such an innovative solution could effectively support and foster producer groups to convey and share the values of their Geographical Indications.

2.4.1. Verifying and communicating the sustainability of Geographical Indications through blockchain.

As mentioned in the opening passages of this section, the actions that producer groups can take to enhance, improve, and promote their Geographical Indications are, in the vision of the EU legislator, closely linked to enhancing, improving, and promoting the *sustainability* of GIs. Thus, taking a step back, it is interesting to understand whether blockchain can play a role in this framework.

⁵¹³ Art. 4, lett. c., Reg. (EU) No 2024/1143.

⁵¹⁴ PICK B., *Intellectual Property and Development. Geographical Indications in Practice*, op. cit., pp. 140-141.

It seems that the answer to this question is only partially affirmative, mostly because quite a few doubts arise when considering the relationship between blockchain and sustainability⁵¹⁵, both in the agri-food sector⁵¹⁶ and beyond⁵¹⁷.

Under Art. 32, par. 4, lett. d, Reg. (EU) No 2024/1143, recalled above⁵¹⁸, producer groups establish and adopt sustainable practices, check that these are complied with by individual producers, and identify the most appropriate means to publicise them.

In this framework, the implementation of blockchain-based solutions can certainly be envisaged for the steps that *follow* the introduction of more sustainable production practices, i.e., monitoring their compliance and disseminating them. In this sense, it seems undeniable that blockchain could contribute to making producer groups' efforts simpler, more immediate, and more efficient when it comes to these two passages that are ancillary to increasing PDO and PGI production's sustainability.

The reflections that were presented in the previous sections, referring, on the one hand, to blockchain implementation to ascertain compliance with product specifications and, on the other hand, to the contribution blockchain makes in terms of communication with consumers, also extend and apply to the tasks under discussion here. In other words, if blockchain can be

⁵¹⁵ On these aspects, see, *ex multis*, C. MULLIGAN *et al.*, *Blockchain for sustainability: A systematic literature review for policy impact*, in *Telecommunications Policy*, 2024, 2, pp. 1-18. On closer inspection, however, such a statement is not limited to blockchain technology, as it can be extended to any other innovative, disruptive technology that is changing human life and ordinary activities. Consider, by way of example, the wide scientific debate assessing whether Artificial Intelligence can be considered an enabler or inhibitor of sustainability. For a comprehensive overview of this topic, see A. VAN WYNSBERGHE, *Sustainable AI: AI for sustainability and the sustainability of AI*, in *AI and Ethics*, 2021, 1, pp. 213-218. For some additional considerations on the impacts of digitalisation on the sustainability of the agri-food sector, see G. SECUNDO, R. SCHENA, A. RUSSO, F. SCHIAVONE, *The impact of digital technologies on the achievement of the Sustainable Development Goals: evidence from the agri-food sector*, in *Quality Management & Business Excellence*, 2022, pp. 1-17; A. MYSHKO *et al.*, *Towards the twin transition in the agri-food sector? Framing the current debate on sustainability and digitalisation*, in *Journal of Cleaner Production*, 2024, 452, pp. 1-16.

⁵¹⁶ S. L. BAGER *et al.*, *Blockchain is not a silver bullet for agro-food supply chain sustainability*, *op. cit.* See also L. CHING-FU, *Blockchainizing Food Law: Promises and Perils of Incorporating Distributed Ledger Technologies to Food Safety, Traceability, and Sustainability Governance*, in *Food and Drug Law Journal*, 2019, 4, pp. 586-612.

⁵¹⁷ After all, it is no coincidence that considerable scientific literature delved into the relationship between blockchain technology and sustainability. In any economic and industrial sector where the adoption of blockchain-based solutions is addressed, it is automatic to further question how sustainable the implementation of such solutions can be considered, from an environmental point of view, but also economically and socially. In this sense, many examples can be mentioned, affecting supply chain management or Industry 4.0, but also specific sectors such as the energy sector, manufacturing, the fashion industry, water management, and so on. For some general reflections on these aspects, see R. L. RANA, P. GIUNGATO, A. TARABELLA, C. TRICASE, *Blockchain Applications and Sustainability Issues*, in *Amfiteatru Economic*, 2019, 13, pp. 861-870; C. SCHINCKUS, *The good, the bad and the ugly: An overview of the sustainability of blockchain technology*, in *Energy Research & Social Science*, 2020, 6, pp. 1-23.

⁵¹⁸ *Supra*, chapter III, fn. 504.

proposed as a valid tool in the hands of producer groups to efficiently ensure compliance with product specifications, it can certainly also be adopted to verify that all GI producers are also compliant with the sustainable practices included in the product specification, as the technology eases the collection, organisation, and recording of all relevant information on this point⁵¹⁹. Furthermore, in this case, the implementation of a blockchain network would enhance the desirable cooperation between producer groups and the public authorities or independent certification bodies appointed in each Member State for the official controls, enabling the dissemination and circulation of information gathered by each of them. At the same time, if blockchain can be used by producer groups to convey and share the values of their Geographical Indications, it can also adjust to communicate the commitments taken in terms of sustainability⁵²⁰, thereby enabling producer groups to publicise and share these measures among consumers⁵²¹.

On the contrary, it does not seem that the recourse to blockchain could favourably affect the *preceding* passage, as it is not clear how the adoption of a blockchain-based solution could integrate or lead to one of the sustainability practices described under Article 7, or analogous ones, and therefore significantly contribute to enhancing and improving the sustainability of GI productions.

This state of things, after all, further reflects a preliminary and more general issue, already anticipated in the opening passages of this section, namely, whether blockchain itself can be considered as a truly sustainable solution from the environmental, economic, and social viewpoint. Addressing such a question is even more compelling when considering blockchain's implementation in the agri-food sector, which, as seen, is constantly called upon to come to terms with the demands of sustainability⁵²².

⁵¹⁹ See J. P. OURY, *Blockchain: A Strong Link to Rebuild Confidence in the Agriculture of the Future?*, in *European Scientist*, 2018, available at the link <https://www.europeanscientist.com/en/editors-corner/blockchain-a-strong-link-to-rebuild-confidence-in-the-agriculture-of-the-future/> (accessed: 15.10.2025).

⁵²⁰ A. J. SULKOWSKI, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers?*, in *Delaware Journal of Corporate Law*, 2018, 43, pp. 303-328.

⁵²¹ In this way, producer groups additionally get access to a tool that is capable of conveying more strongly and directly a message that, to date, is mostly left to the Sustainability reports referred to in Art. 8, Reg. (EU) No 2024/1143, prepared and regularly updated by producer groups and then published by the EU Commission. Blockchain thus proposes itself as a valid parallel or additional instrument, rather than an alternative one, through which producer groups can disseminate the implemented sustainable practices, explain how these measures impact sustainability, and provide any other information that is deemed necessary to share with consumers their commitments in terms of sustainability.

⁵²² As a matter of fact, this aspect is often scrutinised by legal scholars delving into the implementation of blockchain technology in the agri-food sector, and is also the core of many interesting empirical studies. Consider S. KÖHLER, S. BAGER, M. PIZZOL, *Sustainability standards and blockchain in agri-food supply chains: Synergies*

While the environmental challenges descending from blockchain's implementation, mostly related to the high levels of computational energy that blockchain platforms require to function, and therefore to its massive energy consumption, are widely acknowledged⁵²³, serious concerns also involve the economic and social sustainability of the technology, largely depending on what have been defined as its 'infrastructural and capacity development' challenges⁵²⁴.

In conclusion, while the implementation of blockchain-based solutions does not seem to make any difference in the adoption of practices that increase the sustainability of PDO and PGI productions – if not, in fact, risking to entail the opposite result – there is no question that producer groups might resort to blockchain to verify that all GI producers comply with the sustainability measures undertaken collectively, as well as to publicise and communicate the

and conflicts, in *Technological Forecasting and Social Change*, 2022, 185, pp. 1-11; P. GIGANTI, M. BORRELLO, P. M. FALCONE, L. CEMBALO, *The impact of blockchain technology on enhancing sustainability in the agri-food sector: A scoping review*, in *Journal of Cleaner Production*, 2024, pp. 1-26.

⁵²³ See A. PARMENTOLA, A. PETRILLO, I. TUTORE, F. DE FELICE, *Is blockchain able to enhance environmental sustainability? A systematic review and research agenda from the perspective of Sustainable Development Goals (SDGs)*, in *Business Strategy and the Environment*, 2021, 1, pp. 194-217. Blockchain's decentralised structure and the shared mechanisms that allow blockchain platforms to function, including the energy-intensive Proof-of-Work, are among the factors that determine the high energy consumption of the technology. To get a clearer idea of the scale of the problem, it suffices to say that, a few years ago, it was estimated that the yearly energy consumption of Bitcoin mining was similar to the yearly energy consumption of 200.000 to 1.2 million households in the EU (see J. BACON, J. D. MICHELS, C. MILLARD, J. SINGH, *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, in *Richmond Journal of Law and Technology*, 2018, 1, pp. 25-26). Faced with these criticalities, and in response to them, scientific literature has long been questioning how to improve the sustainability of blockchains and distributed ledger technologies, especially from an environmental perspective. In fact, it is clear that, to be feasible and sustainable in the long run, each blockchain solution must find more environmentally friendly mechanisms to work. And it is precisely in this direction that research and studies on the so-called *green* blockchain have been pointing. A green blockchain is an environmentally wise blockchain designed to minimise energy consumption by using energy-efficient consensus mechanisms (for example, Proof-of-Stake instead of Proof-of-Work), incorporating renewable energy sources, and adopting other sustainable practices. These solutions are crucial to increase the environmental sustainability of blockchain platforms and indeed many blockchain networks and systems, such as Cardano, Tezos, and Bitgreen, assert to be environmentally friendly as they have adopted mechanisms that allow them to produce the least amount of carbon emissions. For a comprehensive overview of green blockchains, see Y. I. ALZOUBI, A. MISHRA, *Green blockchain. A move towards sustainability*, in *Journal of Cleaner Production*, 2023, pp. 1-13. For some reflections and a case study on the adoption of green blockchains in the agri-food sector, see G. VARAVALLO, G. CARAGNANO, F. BERTONE, L. VERNETTI-PROT, O. TERZO, *Traceability Platform Based on Green Blockchain: An Application Case Study in Dairy Supply Chain*, in *Sustainability*, 2022, 6, pp. 2-14.

⁵²⁴ See *supra*, chapter I, par. 3.2. In this regard, it is impossible to neglect issues such as the everlasting lack of infrastructures that are suitable and sufficient to support the adoption of digital solutions of this kind, like a stable and trustworthy internet connection, but also the additional costs related to the adoption, first, and maintenance and upgrade, then, of the devices necessary for each operator to interact with the blockchain platform. These aspects must be taken into account while addressing the economic and social sustainability of blockchain-based solutions, because they risk creating or exacerbating inequalities and differences between producer groups, which can be larger or smaller, more or less structured, and have greater or lesser resources. At the same time, they might turn into further burdens on the resources of producer groups and, consequently, on the economies of individual producers.

adopted commitments to their consumers. In a broader scenario in which producer groups can resort to blockchain-based solutions to more generically enhance, improve, and promote their Geographical Indications, the profile of sustainability of GI productions takes on an interesting dimension, too.

2.5. Blockchain for democratic accountability.

As said, Reg. (EU) No 2024/1143 introduces novel tasks and responsibilities for GI producer groups. Consequently, the previous pages explored the possibility of proposing blockchain technology as a tool to facilitate and support the uptake of some of these functions, making them more effective.

However, this initial statement leads to an additional point of reflection, whose perspective of observation is ‘reversed’. It moves from the acknowledgement that GI producer groups are democratic bodies set up voluntarily on the initiative of PDO and PGI producers and which do not operate autonomously, but rather are controlled and scrutinised by their members. This monitoring activity is primarily aimed at ensuring democratic accountability within the group – that means, that the governance of the Geographical Indication is displayed by producer groups in such a way as to exclusively mirror the interests of local communities and producers, ensuring them fair incomes and a just distribution of the added value – as well as to guarantee that the resources allocated by individual producers to the group are used in the full interest of GI producers themselves and in the best possible way to protect and enforce the Geographical Indication. In this regard, as producer groups are indeed entrusted with greater tasks and responsibilities under the new European legal regime, the need for a more extensive and enhanced control by individual producers on the activities and tasks carried out by the producer groups they belong to is even more severe, and so is the need to look for appropriate means to ensure this surveillance.

Resorting to digital solutions might appear promising and leave room for reflection from this perspective, as well. For instance, the implementation of a blockchain platform, where the prompt and open circulation of all relevant information between the involved actors is allowed, could also make internal procedures of GI producer groups more transparent, thereby addressing the described need for democratic accountability perceived within the groups⁵²⁵.

⁵²⁵ In this regard, it is important to highlight that the use of blockchain-based solutions in democratic processes is a well-investigated area of research. For an in-depth analysis, see, *ex multis*, the contributions in O. POLLICINO, G.

Indeed, while the model described so far has seen blockchain technology serving the functions attributed to producer groups (in some cases together with the national authorities responsible for official controls), thanks to the recording of any information relating to the production of PDO or PGI products by individual producers, the same model also enables GI producer groups to participate in the blockchain network as nodes and record data and information relating to the performed tasks, thereby allowing GI producers to access this information (e.g., workflows, management procedures, relevant documentation, etc.) and exercise an *a contrario* control on the attributed functions.

Considering blockchain implementation from the viewpoint of individual GI producers induces positive effects that can *also* be perceived from the perspective of democratic accountability. The higher levels of transparency and the greater openness in the flow of information that the technology allows ultimately lead to improved organisational responsiveness while raising trust and legitimacy in the composition and functioning of these democratic bodies, enhancing control on how resources are allocated and safeguarding the rights and interests of GI producers and local communities to a fair and transparent governance of their Geographical Indications.

3. Wrapping it up with some conclusive thoughts.

The framework that was provided in the previous sections has attempted to understand what room blockchain technology can achieve in the realm of Geographical Indications or, more specifically, in the *governance* of Geographical Indications. Indeed, in a scenario where GIs find in technological innovation an ally to address old and new challenges, producer groups

DE GREGORIO (eds.), *Blockchain and Public Law. Global Challenges in the Era of Decentralisation*, Cheltenham, Edward Elgar Publishing Limited, 2021, and particularly J. GOOSSENS, *Blockchain and democracy: Challenges and opportunities of blockchain and smart contracts for democracy in the distributed, algorithmic state*, *ivi*, pp. 77-89. See also F. BOLICI, A. CASTELLI, A. HINNA, *Embedding Distributed Systems into Organizations. How Blockchain Reinforces Transparency and Accountability in PA's New Governance Models*, in A. STACHOWICZ-STANUSCH, L. MERCURIO (eds.), *The Social Issue in Contemporary Society. Relations between Companies, Public Administrations and People*, Leeds, Emerald Publishing, 2019. As to democracy in government systems, in fact, many tangible ways have been identified for blockchain to support citizens holding their governments accountable, leading to healthier democracies. Indeed, shared consensus mechanisms and the security of distributed ledgers pave the way towards more inclusive ways of collective decision-making. However, the same principles apply to different and more vertical governance frameworks, including accountability in NGOs or corporate accountability in business practices and reporting, thereby offering grounded rationales to delve into the possibility of resorting to blockchain platforms to foster democratic accountability within GI producer groups.

are called upon to learn about and evaluate the support that digital solutions can provide in the pursuit of the tasks and responsibilities that the European and national legislations pose to them.

These reflections also include blockchain, and this has become even clearer from a reading of the role this technology can play in relation to the different functions that shape GIs' governance. And in fact, the overview proposed throughout this third chapter ultimately allows to assert that blockchain technology offers promising and valid reasons to acknowledge its implementation for the execution of the different tasks leading up to the governance of GIs. As a consequence of this, it appears that producer groups could seriously consider adopting blockchain-based solutions to facilitate their performance and achieve results that, overall, are more accurate and thus more reliable.

Exception made for the establishment of a new Geographical Indication⁵²⁶, the other responsibilities entrusted to producer groups provide fertile ground for the implementation of blockchain-based solutions, as the latter seem capable of making their achievement much more efficient, leading to significantly better results and reducing the burdens, costs, and time needed from all the actors involved.

This is immediate, for example, for the measures aimed at ensuring compliance with product specifications, as well as in the actions undertaken by producer groups to protect and enforce their Geographical Indications on physical and virtual markets, and the intellectual property rights stemming from them. In this regard, blockchain can be proposed as a strategic, innovative tool capable of improving these tasks, especially when compared to the systems and mechanisms currently adopted by producer groups, which are perhaps still too reliant on human intervention alone. As it was seen, these passages reflect above all blockchain's ability to allow for the efficient, timely, transparent, and immutable recording of all relevant information, as well as to promptly process and circulate it within all the subjects involved. In addition to this, it is also worth recalling the possibility of automatising all the steps necessary to perform these tasks through the integration of smart contracts specifically programmed for this purpose, thereby improving the relevant activities and enhancing their reliability.

At the same time, positive conclusions can also be pictured when considering the functions of enhancement, improvement, and promotion of the Geographical Indication, in

⁵²⁶ Here, as seen, the added value of resorting to blockchain-based solutions is null or very limited, possibly confined to the sole establishment or demonstration of the *reputational link*, i.e., the connection between the geographical area of origin of the agri-food product and its reputation. In any case, this added value does not seem to go much beyond the contribution that blockchain might offer as a digital ledger of information, thereby not particularly differing from the contribution that *other* digital records might provide.

which, as mentioned before, the validity and advantages of resorting to blockchain-based solutions are to be found on the side of relations with consumers, and mostly rely on the ability of the technology to foster and simplify communication with consumers, thereby increasing both the trust and quality perceived by the latter.

It cannot be denied, in conclusion, that blockchain offers several different advantages for the governance of Geographical Indications, showing beneficial patterns that go far beyond the *individual* dimension of the single producer resorting to blockchain-based solutions to differentiate its production and boost its position on the market, but rather display a *collective* dimension⁵²⁷. And, on closer view, this approach also addresses some concerns raised by the legal doctrine on this topic⁵²⁸ acknowledging that, given the well-known unique public nature of Geographical Indications as intellectual property rights belonging to the community of producers located in the designed geographical area and complying with the product specification, a strong and trusted intermediary is probably indispensable for a blockchain platform to be successfully implemented in the realm of protected designation of origin and protected geographical indications.

From this perspective, there is no question that producer groups are well-suited to respond to this understandable consideration, acting as the necessary trusted intermediary in charge of governing and controlling the private and permissioned blockchain platform, which is mostly adequate for the purposes described so far.

3.1. The flip side of the coin.

That said, it should also be stressed that several hurdles still hinder the comprehensive or large-scale implementation of the proposed model.

⁵²⁷ This collective dimension, after all, also reflects the very own structure and architecture of blockchain systems, as they were described in the opening chapter of this work. In this regard, indeed, it should not be forgotten that blockchain technology was originally theorised and proposed precisely to provide a solution that could allow for a decentralised, distributed, and collective management of specific situations and phenomena. In Satoshi Nakamoto's White Paper, for example, Bitcoin was presented as an innovative tool to be adopted so that currency exchanges could occur autonomously and independently from central authorities, in response to the global financial crisis of 2008. The project, in other words, wanted to develop an innovative tool capable of managing monetary transactions in a distributed and collective manner among all nodes belonging to the blockchain network. Some interesting reflections on the collective dimension of blockchain technology are presented in J. RANTALA, *Blockchain as a medium for transindividual collective*, in *Culture, Theory and Critique*, 2019, 3, pp. 250-263.

⁵²⁸ On this point, see S. ARONZON, *Blockchain and geographical indications: A natural fit?*, *op. cit.*, p. 924. See also J. BACON, J. D. MICHELS, C. MILLARD, J. SINGH, *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, *op. cit.*, p. 29.

Indeed, alongside the obstacles that generally hamper the widespread adoption of blockchain technology in the agri-food sector⁵²⁹, some critical profiles also arise when looking at the specific framework that is being considered here, i.e., producer groups' recourse to blockchain-based solutions to foster and simplify the governance of their Geographical Indications.

A first critical remark is more of a *technical* nature, and it springs precisely from the fact that, as seen, the type of blockchain that appears more suitable for the purposes and uses considered so far is a private and permissioned blockchain platform, managed and controlled by the producer group acting as the trusted intermediary for individual PDO and PGI producers.

In this regard, it is worth noting that the literature has raised several objections to the notion that private and permissioned platforms can fully be considered as blockchain solutions⁵³⁰. Additionally, one could also wonder whether the use of blockchain can genuinely be deemed necessary, where some of the essential and qualifying features of the technology, including its complete decentralisation, must be sacrificed⁵³¹. This consideration is of no small importance, as it substantially calls into question whether the use of blockchain-based solutions is truly necessary (or, likewise, whether it makes sense) when the latter are structured and programmed in such a way as not to replicate the typical canons of the technology. This, however, is the case in the vast majority of blockchain uses in industry⁵³².

In other words, what is critically emphasised is that, if the solutions that are mostly appropriate in a specific context are solutions that essentially do not require blockchain's main characteristics, then the use of this technology itself may be unnecessary, overly complex, and perhaps even excessively demanding, as different digital solutions might work as well. These considerations could also extend to the adoption of blockchain-based solutions for the

⁵²⁹ As these aspects have already been illustrated and sufficiently delved into above, it is believed that there is no need to bring them up again here. See *supra*, chapter I, par. 3.2.

⁵³⁰ Private and permissioned blockchain networks are sometimes considered something different from the original blockchain concept, mostly because they lack the full decentralisation that is typical of (permissionless) blockchain platforms. Thus, while the former still present some blockchain core features, like cryptographic hashes and distributed ledgers, their controlled nature (given by the fact that a central authority or consortium restricts participation and can override or delete entries) contrasts with the public, open, and decentralised nature of public and permissionless blockchain networks. As a consequence of this, some scholars refer to these systems as a 'subclass' of distributed ledger technologies, rather than a true blockchain. In this sense, see, *ex multis*, O. KONASHEVYCH, *Why 'Permissioned' and 'Private' are not Blockchains*, 2019, electronic copy available at: <https://ssrn.com/abstract=3496468> (last accessed: 15.10.2025).

⁵³¹ In this regard, see the reflections proposed in R. BURSTALL, B. CLARK, *Blockchain, IP and the Fashion Industry*, in *Managing IP*, 2017, available at: <https://www.managingip.com/article/2a5bqo2drut0bwufew5r/blockchain-ip-and-the-fashion-industry> (last accessed: 15.10.2025) with specific reference to the fashion sector.

⁵³² See E. STREHLE, *Public Versus Private Blockchain*, *op. cit.*, p. 1.

governance of Geographical Indications and conceptually undermine the robustness of the outcomes reached for the different tasks and responsibilities falling on producer groups.

Other critical remarks come to light when considering the reality and functioning of GI producer groups more closely. In fact, the adoption of a blockchain platform to handle the governance of Geographical Indications is a choice that demands significant commitment from producer groups, on the one hand, and from all the PDO and PGI producers, on the other. This includes, among other things, efforts in terms of the administration and management of the chosen solution⁵³³, but also substantial economic investments⁵³⁴. The main consequence is that it still seems difficult or exceptional for producer groups to be *willing* or to be *able* to make blockchain adoption a priority, among many other needs and demands to which the group's resources must be allocated, even when they acknowledge and understand the advantages that blockchain could bring to many of the tasks and responsibilities entrusted to them.

⁵³³ If, as said, it is the producer group that must act as a trustworthy intermediary in the administration and control of the blockchain platform, someone within the group will have to take charge of this function, even if solely by resorting to a service provider or some other internal form of specialist assistance. In any case, the administration of the blockchain platform will entail additional specific training on the subject.

⁵³⁴ The parentheses that can be opened in this regard are quite broad. Consider, by way of example, the costs that a producer group would have to bear for the purchase of the blockchain solution from the service provider, as well as for its management, maintenance, and periodic updates. Similarly, to make blockchain use truly effective, at some point, it will be necessary to make its adoption a 'structural' choice for the whole group, i.e., to require all PDO and PGI producers to resort to the blockchain platform. Consequently, the producer group will first need to cover the expenses associated with the amendment of the product specification to include a provision that compels all involved producers to register the information relating to the production of the PDO or PGI product on the blockchain. Additional efforts should also be made to inform and train individual producers on the use of the technology and the achievable results, as well as to publicise and circulate information and advertising material among involved producers and consumers. Individual producers, for their part, would have to directly bear the costs to purchase the digital devices needed to interact with the blockchain. All of this already translates into a substantial financial investment to adopt a blockchain platform for the governance of the Geographical Indication, to which one must further add the costs for running the platform itself. On this last point, see the explanation provided in C. BIONDI SANTI, V. VESPRI, *Solving Cryptographic Puzzles: How to Mine?*, in B. CAPPIELLO, G. CARULLO (eds.), *Blockchain, Law, and Governance*, 1st ed., Cham, Springer, 2021, pp. 75-76. As it is known, in fact, every transaction that is registered on a blockchain entails the payment of a commission for the piece of information to be sent to the network, validated by other nodes, and finally recorded. Overall, this mechanism serves to ensure that transactions are processed efficiently, but also to prevent any illegitimate use of the platform, as interacting with the blockchain abusively would be economically inconvenient. However, the commission, which is ultimately used to reward miners who validate the new block, is paid by the participant willing to add a block to the chain. And this aspect is not much different in private and permissioned blockchains. In fact, while one might think that resorting to these types of systems sensibly reduces the costs necessary for the platform to function, at least because the value of the currency used to pay the commission is established by the central intermediary considering the needs of the system itself, some scholars have actually underlined how cost savings are not among the reasons to choose a permissioned or hybrid blockchain solution. This conclusion is reached in J. S. GANS, N. GANDAL, *More (or less) economic limits of the blockchain*, in *National Bureau of Economic Research*, Working Paper 26534, 2019, p. 14. In any case, in fact, nodes still have to make a starting investment each time they wish to register a new transaction on the platform. Going back to our scenario, these burdens would be sustained by individual PDO and PGI producers when they have to register all the information relating to the production on the blockchain.

This is believed to be the case for at least two main reasons. On the one hand, considering the efforts involved in the management of the blockchain platform, producer groups may take a step back and show reluctance, especially in view of the heavy constraints and extensive duties that the European legal regime and national regulations already impose on them. On the other hand, from a purely economic point of view, producer groups may not have sufficient financial resources to steadily and consistently pursue the adoption of blockchain-based solutions in the absence of specific external private or public funding⁵³⁵. On this last point, since the difficulty of bearing additional costs represents a real barrier, one alternative to consider would be to collectively implement a blockchain-based solution to be used for the described purposes, resulting from the union of different producer groups into associations or other collective bodies⁵³⁶. In this way, the relative burden would not be borne by a single group, but shared among more. However, such a possibility imposes to consider which organisation and which management mechanisms would be most appropriate to the newly adopted platform. That means, more specifically, to understand whether a private and permissioned blockchain – which, as seen, is the most suitable type of blockchain for the use in question – is still appropriate for ensuring the full participation of a much broader number of nodes (i.e., more producers of different GIs, more GI producer groups, different national authorities competent for the official controls, etc.). In case of an affirmative answer, then the subject responsible for managing the platform would have to be identified. Conversely, if a public and permissionless blockchain appeared more adequate, its implementation would raise a series of sensitive questions regarding data sharing by producers, which could also act as a further deterrent to the willing adoption of the proposed solution. Furthermore, implementing a ‘collective’ blockchain

⁵³⁵ This aspect, moreover, can easily translate into a different chance of accessing digital tools between larger or more structured and developed producer groups and smaller or younger ones. As it can be imagined, the former, having bigger human and financial resources, certainly have more possibilities to invest in experimenting or adopting innovative technologies, such as blockchain technology, in the governance of their Geographical Indications. The latter, on the other hand, may ultimately have to renounce or postpone such choices and redirect their resources to address other priorities. Eventually, all of these risks further widen the disparities between producer groups, which are already crystal clear in different areas. On these profiles, see F. GUERRIERI, *Governing governance. Collective action and rulemaking in EU agricultural and non-agricultural geographical indications*, *op. cit.* For some interesting reflections on the impacts of the spatial distribution of Geographical Indications, see also L. CEI, *The distribution of geographical indications across Europe. Reflecting spatial patterns and the role of policy*, in *European Planning Studies*, 2025, 2, pp. 281-300.

⁵³⁶ Consider, for instance, the case of the associations of producer groups referred to in Art. 34, Reg. (EU) No 2024/1143, mentioned above (see *supra*, chapter III, par. 2). Since the tasks attributed to these associations are aimed, among other things, at enhancing and representing Geographical Indications, as well as at promoting and disseminating best practices among the producers involved, it is possible to imagine the constitution of an association of this type to facilitate the uptake of technological solutions, including blockchain technology, to support the governance of Geographical Indications.

solution, shared by multiple GI producer groups, would require a larger, more complex and distributed platform, whose management cost would likely be higher: this risks undermining the effect pursued through a collective action.

Again, as argued many times before, blockchain cannot work at its best in isolation. In fact, the ideal functioning of the technology postulates a broader digital context (in our case, digitalised agri-food supply chains) in which blockchain can operate efficiently by interacting with other digital solutions, such as sensors, machines, applications, etc., in a non-stop creation and exchange of data⁵³⁷. From this perspective, considering a more extensive digitalisation of quality agri-food productions broadens the mentioned concerns on inequalities between the involved individual and collective entities and the possibilities of using available resources.

In addition to this, the critical remarks linked to the internal functioning of producer groups risk being further exacerbated by the fact that even GI producers, who effectively make up the groups and are therefore directly affected by the groups' decisions, may still not be fully aware of what blockchain is and what advantages the technology could bring in terms of governance, control, and protection of their intellectual property rights over the Geographical Indication. Held back by the perceived excessive complexity of the technology⁵³⁸, as well as by the idea of sharing information that can never be modified or deleted and is accessible to all participants in the blockchain network⁵³⁹, PDO and PGI producers might resist the idea of a collective use of this solution for the governance of their Geographical Indication. From this perspective, it is clear that if individual producers do not initially see and understand the inherent value of resorting to blockchain, they will be less likely to invest in and rely on the

⁵³⁷ In this sense, see S. KÖHLER, M. PIZZOL, *Technology Assessment of Blockchain-Based Technologies in the Food Supply Chain*, in *Journal of Cleaner Production*, 2020, 269, pp. 1-16.

⁵³⁸ See F. SANDER, J. SEMEIJN, D. MAHR, *The Acceptance of Blockchain Technology in Meat Traceability and Transparency*, in *British Food Journal*, 2018, 1, pp. 2075-2077.

⁵³⁹ See M. ARISI, *Coltivare la fiducia? Una prospettiva giuridica su dati, blockchain e tracciabilità lungo la filiera agroalimentare*, op. cit., p. 66. The first chapter already emphasised the importance of topics such as data ownership, data control, and digital dispossession, as legal obstacles hindering blockchain's widespread diffusion in the agri-food sector (see *supra*, chapter I, par. 3.2). And these aspects cannot but be mentioned in the framework that is now under discussion, as well. Nevertheless, a paramount distinction that comes to light here is that, in the case of PDO and PGI productions, the information that would be uploaded on the blockchain platform, and therefore shared with the network, is the same information that PDO and PGI producers are already compelled to provide to enable controls on the compliance with product specifications and the protection of their Geographical Indication. Thus, it would not be strategic or confidential information that these producers might not be willing to share. What also differs is the type of platform that is most likely to be used in these cases, a private and permissioned blockchain, whose access would only be allowed to PDO and PGI producers, producer groups, and the national control authorities, at most. As a consequence of this, it is believed that, exception made for a more general, biased scepticism in resorting to advanced digital solutions to record the information relating to their own productions, the issue of data sharing is perhaps less acute for PDO and PGI producers in the specific context of GI's governance.

technology; at the same time, without a strong and stable acceptance from the bottom, it is unlikely to impose such operational decisions at the collective level⁵⁴⁰.

Blockchain systemic implementation for the governance of Geographical Indications strongly relies on the voluntary participation of individual producers. Indeed, it does not seem possible for producer groups to impose on GI producers the mandatory adoption of a digital solution in the production process of the PDO or PGI product, for instance, via an amendment in the product specification – a solution that has been suggested in some cases before. A decision of this nature is, in fact, excessively divisive, as it could never be embraced and adopted by each GI producer, with the crucial effect of excluding those who are unable to comply from the use of the protected designation.

In conclusion, it seems that even in the governance of Geographical Indications, the path leading to a complete and genuine implementation of blockchain technology is still uphill and slippery. This is because the many aspects that make the application of these solutions appealing for the execution of the recalled tasks are still flanked by serious doubts and criticalities that, ultimately, result in wondering whether blockchain technology is truly a viable, valuable, and vital solution for producer groups⁵⁴¹. Indeed, there is no doubt that any suggestion proposed in the described scenario is eventually only acceptable when its implementation is feasible and sustainable in the long run, as otherwise any promise would amount to nothing.

The risk, under these circumstances, is for blockchain to remain a '*solution in search of a problem*'⁵⁴² in the realm of Geographical Indications, as well.

At present, however, what still seems more likely is for blockchain's adoption to be fundamentally left to the discretion and possibilities of different producer groups. Aware of the

⁵⁴⁰ This observation echoes the broader theme of the validity and relevance of bottom-up, producer-driven approaches to GI's governance, as compared to top-down, state-driven approaches, especially in those countries having an established tradition for quality agri-food productions and their protection, such as European ones. For an overview of these aspects, see B. PICK, *Intellectual Property and Development. Geographical Indications in Practice*, op. cit., pp. 98-120, who observes that top-down approaches, though useful in countries with little awareness of the concept of Geographical Indications, carry the risk of being too, or solely, administrative, leaving little or no space to local producers' contributions to the decision-making and protection processes of their GIs. For some further reflections in the same direction, see also D. MARIE-VIVIEN *et al.*, *Controversies around geographical indications: Are democracy and representativeness the solution?*, in *British Food Journal*, 2019, 12, pp. 2995-3010; B. PICK, D. MARIE-VIVIEN, *Representativeness in Geographical Indications: A Comparison between the State-Driven and Producer-Driven Systems in Vietnam and France*, in *Sustainability*, 2021, 13, pp. 1-16.

⁵⁴¹ On this aspect, see J. GIEGLING, *In blockchain we trust? Certificates of Origin as a case for distributed-ledger technologies*, in *Journal of Law, Market & Innovation*, 2022, 1, pp. 70-103.

⁵⁴² In this sense, see A. J. SULKOWSKI, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers?*, op. cit., p. 304.

advantages that resorting to these solutions can bring to the achievement of their tasks and responsibilities, but also of the higher efforts and commitments that are needed in this sense, producer groups may decide to steer their energies and resources to its implementation even beyond experimentation, case studies, and field test, developing and enforcing strategies to steadily integrate this digital tool into their GIs' governance choices.

CHAPTER IV

Outcomes from the outside. Cases and questions for Italian producer groups

SUMMARY: 1. Introduction and methodological indications. - 2. Applying blockchain to the governance of Geographical Indications. Through the eyes of GI producer groups. - 2.1. Consorzio Arancia Rossa di Sicilia PGI. - 2.2. Consorzio Tutela del Pecorino Toscano PDO. - 2.3. Consorzio Cioccolato di Modica PGI. - 2.4. No result is a bad result. - 3. Applying blockchain to the governance of Geographical Indications. Through the eyes of Origin Italia. - 4. Final remarks.

1. Introduction and methodological indications.

The previous chapter concluded by acknowledging that, to date, the decision to use blockchain-based solutions to fulfil the tasks and responsibilities entrusted to producer groups by the European legislation remains entirely at their discretion. In other words, it is essentially a matter of their free choices, which primarily depend on the capabilities of the groups themselves.

Nevertheless, such a conclusion still seems too summary and hasty to be sufficient. In fact, presenting these final remarks without investigating the role of blockchain technology in the vision of producer groups more closely does not feel quite exhaustive. As a consequence of this, the following logical step is to delve into the setting of PDO and PGI producer groups and try to understand, at present, where blockchain fits, i.e., how many of these collective entities are willing to, or can, make the recourse to this innovative solution a priority towards which allocate their time, means, and human resources.

And that is precisely the step forward that is taken in this fourth chapter. In an attempt to corroborate the preliminary results reached through the study of the relevant literature and the interpretation of the concerned legislation, and gradually presented throughout the whole work, this chapter searches for a dialogue with the outside, or, more simply and precisely, with producer groups, which, as emerged especially in the third chapter, are the selected observation point of the present research.

All of this resulted in the effort to conduct an *empirical legal research* where the normative investigation that is typical of legal research is matched with different empirical

methods⁵⁴³. In doing so, the following sections set aside the tools that are proper to legal research and which have driven the previous three chapters (that is, analysis of primary sources, case law, academic papers, textbooks from legal scholars, and so on)⁵⁴⁴ to be instead based on a more purely empirical approach, making use of qualitative research methods.

The described shift is primarily due to the need for greater completeness and thoroughness in the research and its results, with the purpose of genuinely understanding the field of interest and getting feedback from the collective entities that were taken as viewpoints in the work. To achieve this result, a picture of the implementation of blockchain-based solutions by part of different producer groups is needed, and was taken in this fourth chapter.

Data collection entailed two methods⁵⁴⁵, adopted one after the other, which considerably narrowed the selected framework to conduct the empirical research, and also influenced the form chosen to report the results in this fourth chapter, namely, that of case studies⁵⁴⁶.

These two methods are: observation of the field of interest; individual, face-to-face, semi-structured interviews with selected GI producer groups⁵⁴⁷.

⁵⁴³ The match between legal research questions and empirical methods, albeit not systematically investigated, has been the target of close attention for several decades, as the use of empirical data and empirical methods in legal research has extensively increased over time. Consequently, the literature addressing these topics from various perspectives is also quite broad. See, *ex multis*, F. L. LEEUW, *Empirical Legal Research: The Gap between Facts and Values and Legal Academic Training*, in *Utrecht Law Review*, 2015, 2, pp. 19-33; T. R. TYLER, *Methodology in Legal Research*, in *Utrecht Law Review*, 2017, 3, pp. 130-141. More recently, M. MALSCH, *Empirical Legal Research*, in J. J. GARCIA BLESÁ (ed.), *Contemporary Methods in International Legal Research. Between Legal Interpretivism and Empirical Inquiry*, Cham, Springer, 2024, pp. 167-192. As conveniently pointed out, the contribution of empirical methods to legal research is pivotal because, as laws are designed and proposed to produce certain results, it is of major interest to understand if they achieve the expected results or different ones. In this sense, L. E. TEITELBAUM, *An Overview of the Law and Social Research*, in *Journal of Legal Education*, 1985, 35.

⁵⁴⁴ The term that is usually adopted to qualify this methodology is 'library-based'. See, W. HONG CHUI, *Quantitative Legal Research*, in M. MCCONVILLE, W. HONG CHUI (eds.), *Research Methods for Law*, 2nd ed., Edinburgh, Edinburgh University Press, 2017, pp. 47-48.

⁵⁴⁵ See L. B. NIELSEN, *The need for Multi-method approaches in Empirical Legal Research*, in P. CANE, H. KRITZER (eds.), *The Oxford Handbook of Empirical Legal Research*, Oxford, Oxford University Press, 2010, p. 953.

⁵⁴⁶ The methodological category of case studies has been described as 'an empirical study that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident'. In this sense, see R. K. YIN, *Case Study Research Design and Methods*, 2nd ed., London, Sage Publications, 2003, p. 13. In general, a case study is an umbrella strategy in empirical research that can also be adopted to present a range of data (including interview data, as in our case) and is best suited to answering *how* and *why* questions that refer to single and specific situations. Even though they also present their set of complexities, the present work makes use of case studies to present the outcomes of the empirical research because the former are deemed to be the most appropriate empirical tool whenever the researcher wishes to focus on a given circumstance, rather than to provide generalisable findings, while still being allowed to get some conclusive remarks.

⁵⁴⁷ As highlighted in L. WEBLEY, *Qualitative Approaches to Empirical Legal Research*, in P. CANE, H. KRITZER (eds.), *The Oxford Handbook of Empirical Legal Research*, *op. cit.*, p. 927, interviews are among the three main methods for collecting data, along with direct observation and document analysis, and they are frequently used in empirical legal research because they prove to be quite efficient and reliable. Indeed, individual interviews tend to be much more personal and in-depth than other methods, such as questionnaires or surveys, and they allow the

The first step in the empirical research was therefore to observe the field of interest, which, as mentioned several times, is that of GI producer groups, with the view of identifying and selecting the experiences that were actually relevant to the research objectives.

When setting up the empirical work, it soon became clear that looking at the entirety of producer groups would risk leading astray from the questions being addressed, as well as inevitably resulting in the handling of an excessive amount of information. This different approach would have probably best suited a different type of empirical research, likely quantitative rather than qualitative, but falling outside the scope of the present work. Therefore, though aware that this first step would considerably shrink the amount of data available, i.e., the number of experiences to delve into, it was also understood that in the analysed framework, a smaller set of data sources would be sufficient⁵⁴⁸.

Through preliminary research that made use of online search engines, participation in conferences and other events, and the reading of cases and projects already presented in different ways, the field of interest was first limited to include only producer groups who adopt, or have adopted in the past, blockchain-based solutions to manage and control the production chain of their protected designation of origin or protected geographical indication, or the activities of individual PDO or PGI producers. In this passage, attention was paid to experiences that took the form of experiments or other projects, as well as to more structured production choices. Furthermore, the implementation of blockchain-based solutions was considered both as such and as part of broader digitalisation processes in the PDO or PGI production, including, for example, the employment of sensors or other devices to collect data, and resorting to AI algorithms to analyse it.

researcher to access richer and more detailed information. One of the main advantages of the described tool, which is also one of the reasons why it was chosen in the present research, is that interviews allow for gathering precisely the information that the researcher is looking for. The researcher can indeed stimulate the *right* information by posing the *right* questions and steering the data collection in the needed direction. On these aspects, see H. BECKER, B. GEER, *Participant Observation and Interviewing: A Comparison*, in W. J. FILSTEAD (ed.), *Qualitative Methodology: Firsthand Involvement with the Social World*, Chicago, Markham Publishing, 1970, pp. 133-142. On the contribution of interviews in empirical legal research, see also A. IYOH, *The Importance of Interview for Data Collection in Legal Research*, in *International Journal of Law and Clinical Legal Education*, 2020, 1, pp. 135-148. In the case of the present research, in particular, resorting to individual, face-to-face, semi-structured interviews, which are not set in the phrasing and order of the questions, and to open-ended questions rather than closed ‘yes/no’ ones, made it possible to gather precisely the searched information, while allowing interviewees to broadly and spontaneously express their point on the addressed topics. To this end, and to allow interviewees to reflect sufficiently on the presented issues, questions were anticipated via email.

⁵⁴⁸ It is consequently understandable that the collected information is not statistically representative. However, this is not believed to be a shortcoming, as the purpose of this empirical work is not to collect general data or provide statistical findings, but rather to offer insights into the chosen point of observation.

Having thus framed the selected field, the research then moved on to the second step. As premised, this phase consisted of taking individual, face-to-face, semi-structured interviews with selected producer groups, in the persons of their Presidents and Directors, to get access to interviewees' experiences, understanding, and perceptions of blockchain's implementation for the governance of their Geographical Indications.

As to this second step, some methodological guidelines are appropriate and necessary to fully understand the work that has been done, which will be presented in the following sections.

A first indication concerns the interviewees. In this regard, it should be noted that the groups identified and selected after the first step of the empirical research, which were reached by email to arrange the interview, are ten. Of these ten, only three expressed their availability and agreed to participate in the interviews.

These numbers lead to two further points.

A first observation is purely mathematical: most of the producer groups approached in the first place were then not interviewed, either because they did not respond to the request for initial contact or because, despite replying to the email, they decided not to continue with the interview. In this second case, the refusals were mostly motivated by the fact that: the experiences with blockchain were terminated after an initial experimental phase; the experiences were deemed discontinued; or the experiences were not successfully brought to an end. In these cases, in other words, the interested producer groups did not perceive that they could positively contribute to the research. Far from being considered a failure, even this outcome is, on the contrary, worth of attention, as it still suggests some reflections that will be explored later⁵⁴⁹.

In addition to this, since the producer groups eventually interviewed were three, it was decided to present the collected data in the form of case studies to give them the best exposure possible. As a matter of fact, notwithstanding the small sample size, it is strongly believed that the yielded data is still worthy of in-depth investigation and further analysis. In any case, indeed, these results provide insights into producer groups' evaluation of blockchain implementation for the governance of their Geographical Indications, and they still offer the possibility to draw some preliminary conclusions through a bottom-up approach. And this is precisely the main goal pursued by this empirical research.

⁵⁴⁹ See *infra*, chapter IV, par. 2.4.

A second indication involves the content of the interviews⁵⁵⁰. In this regard, it should be specified that the questions proposed during the interview were tailored to the topics that surfaced and were addressed throughout the entire research, as the objective of the empirical work was precisely to gather evidence on them from producer groups. Consequently, interviews revolved around two macro-areas: one, more general, relating to the digitalisation of PDO and PGI production chains; one, more specific, delving into each group's experience with blockchain technology to manage their Geographical Indication and to tackle the main hurdles in pursuing the attributed functions.

Hence, an effort was made to simultaneously understand, on the one hand, what the main difficulties are that the interviewed producer groups face in the daily governance of their Geographical Indication and what challenges are perceived as most compelling; and, on the other hand, how the idea of resorting to blockchain-based solutions came about, whether it arose to address these difficulties, and whether their expectations in terms of achievable and achieved results were met or disappointed. Finally, the interviews tried to grasp the overall assessment towards blockchain technology and its implementation as an effective tool to support and ease GI producer groups in the governance of their Geographical Indications.

However, it is also important to note that producer groups were not the only recipients of the described empirical research. In fact, to broaden the scope of the investigation, getting access to a different and more *collective* overview of the explored topics, it was decided to gather the point of view of an associative reality, as well. And, to this end, it was natural to hear the testimony of Origin Italia, the Italian Association of Geographical Indications' Protection

⁵⁵⁰ For the sake of completeness, the questions posed during the interviews are listed below. 1) *General context*. What are the main challenges and criticalities that your producer group meets in the daily governance of the Geographical Indication? 2) *Origin of the initiative*. How did the idea of adopting a blockchain-based solution come about in your group? Which necessities prompted your group to consider resorting to blockchain in the governance of the Geographical Indication? 3) *Starting goals and achieved results*. When you decided to embark on this experience, what were your objectives? And, in concrete terms, have these objectives been achieved? Have you noticed tangible benefits in terms of easing the governance of the Geographical Indication? 4) *Effectiveness of the solution*. In light of your experience, do you believe that blockchain has proven to be a valuable tool to tackle (some of) the challenges mentioned before? In which of the tasks related to the governance of the Geographical Indication has blockchain proven to be most effective? Do you then believe that blockchain could be proposed as a valid tool for GI producer groups to take charge of the 'new' tasks and responsibilities posed on them under Reg. (EU) No 2024/1143? 5) *Overall assessment*. Altogether, how did your group evaluate the experience? In case of a positive assessment, have you decided to maintain the solution, and do you still use blockchain technology? In case of a negative or not entirely positive assessment, what are the main critiques you can raise? Please note that all of the interviews were taken in Italian. The questions listed here, as well as the information drawn from the offered answers, which will be presented in the following sections, are translated from Italian to English by the Author. Any change in the wording originally used is exclusively due to clarity reasons or to the ease of translation.

Consortia, which is currently the main and largest association of producer groups for PDO and PGI agri-food products in Italy⁵⁵¹.

The interview with Origin Italia, in the person of its General Director, Mauro Rosati, was designed in a slightly different way than those proposed to the other interviewees: this was simply because, in this case, the purpose of the interview was not to listen to a direct experience in blockchain adoption, but rather to get an overview and external impressions of the extent and intensity of the phenomenon in the realm of Geographical Indications and among Italian protection consortia. Nevertheless, the raised questions covered the same macro-areas⁵⁵².

Finally, another consideration that needs to be addressed concerns the territorial scope of the empirical research, which is limited to the experiences of Italian producer groups. This choice, which certainly had the consequence of further narrowing the field of observation and, inevitably, omitting equally interesting and relevant cases falling outside the borders of the national territory, was not random or accidental. On the contrary, it stemmed from two different reasons.

The first reason is merely technical and was prompted by the greater logistical difficulties in establishing an initial link and setting up interviews with non-Italian producer groups of Geographical Indications. The second reason, perhaps more strategic, was instead driven by the intention to leave some room to integrate and broaden the preliminary outcomes of this first empirical research on blockchain implementation for the governance of

⁵⁵¹ Origin Italia currently brings together almost 90 PDO and PGI Italian protection consortia and two associations of consortia, AFIDOP (Association of Italian PDO and PGI Cheeses) and Salumitalia. It therefore represents over 95% of Italian PDO and PGI agri-food products. The main role of Origin Italia is thus to act as a representative and spokesperson of the collective needs of protection consortia, pursuing the mission of promoting the development of Italian Geographical Indications and their producer groups through a network of cooperation and coordination between all actors involved. Further information is available on the website, accessible online at the following link: <https://www.origin-italia.it/> (last accessed: 2.11.2025).

⁵⁵² These are the questions posed during the interview with Origin Italia. 1) *General context*. What are the main challenges and criticalities that the associated protection consortia face in the daily governance of their Geographical Indications? 2) *Perception of technological innovation*. How do associated protection consortia perceive the use of technological solutions in the governance of their Geographical Indications? In your opinion, is this technological transformation already underway, or is it an opportunity still waiting to bloom? 3) *Barriers*. If applicable, which do you consider to be the main hurdles still hindering or slowing down the adoption of technological solutions by associated protection consortia? 4) *Experiences and perspectives on blockchain*. In the framework of innovative technologies and digital solutions applied to the governance of Geographical Indications, do you believe that blockchain finds room for application? If so, for which tasks do you believe it could prove to be most useful or effective? Have any associated protection consortia had experiences with blockchain-based solutions? If so, what results emerged from them? 5) *Overall evaluation*. At the associative level, and in light of the experiences of associated consortia, what is the opinion of Origin Italia on blockchain adoption for the governance of Geographical Indications? Do you believe that blockchain could be proposed as a tool for protection consortia to meet new and old tasks and responsibilities established under Reg. (EU) No 2024/1143? Again, as above, questions and answers were given in Italian and then translated into English by the Author.

Geographical Indications, also by seeking out other experiences and case studies of GI producer groups from European (and, maybe, non-European) countries.

Given these necessary methodological premises, it is now possible to delve into the heart of this empirical research and its key findings. To this end, the following paragraph will first report, in the form of case studies, the experiences of the three producer groups who agreed to the interview. These are: Consorzio Arancia Rossa di Sicilia PGI; Consorzio Tutela del Pecorino Toscano PDO; Consorzio Cioccolato di Modica PGI. A separate section will instead be dedicated to presenting some reflections on the suggestions derived from the fact that most of the consortia that were approached in the first place did not respond or accept the invitation for the interview.

In paragraph three, then, the points of view that emerged during the interview with Origin Italian will be presented and illustrated.

Finally, the concluding paragraph will summarise the discussion. By bringing together the different positions, reflections, and suggestions that the empirical research brought to light, an attempt will be made to provide some general and comprehensive remarks on the perception that the interviewees have of blockchain technology and its systemic implementation for GIs' governance, thus performing the many tasks and functions linked to the governance of their Geographical Indications.

2. Applying blockchain to the governance of Geographical Indications. Through the eyes of GI producer groups.

It was anticipated that the methodological approach of case studies is an umbrella strategy of great validity when the researcher wishes to reach an in-depth understanding and assessment of an issue, event, or phenomenon of interest, in a natural and real-life context⁵⁵³.

It is precisely with these reasons in mind that it was decided to take this empirical tool to report on the history and experiences of the three interviewed producer groups. In this context, indeed, the pursued goal was to explore a complex issue, the adoption of blockchain-based solutions for the governance of Geographical Indications, in its real-life settings, i.e., producer groups' governance of *their* Geographical Indications. The aim, as pointed out by the

⁵⁵³ In this sense, S. CROWE *et al.*, *The case study approach*, in *Medical Research Methodology*, 2011, 11, p. 1.

relevant literature on the topic, was to ‘*explain, describe or explore events or phenomena in the everyday context in which they occur*’⁵⁵⁴.

In doing so, this fourth chapter tried to follow and comply with what is usually the structure of a case study⁵⁵⁵, covering the trinomial ‘challenge – solution – result’, while also remembering that, when reporting a case study, it is necessary to provide the reader with enough contextual information to understand the process and its conclusions properly⁵⁵⁶.

The following pages will therefore report the case studies of the three GI producer groups that were interviewed in the course of the research: Consorzio Arancia Rossa di Sicilia PGI; Consorzio Tutela del Pecorino Toscano PDO; Consorzio Cioccolato di Modica PGI.

Each section consists of an initial, general presentation of the context of interest, delving into the observed GI product, its history, its territory, and the relevant Consorzio, followed by a more specific description of the elements that emerged during these conversations. The sections then culminate with more precise references to the experience with blockchain technology and lessons learned from it.

As will be noticed by the reading of the following pages, the order followed to propose and present the interviews is not random; it mirrors a gradation in the assessment of the technology under discussion. Blockchain will first be pictured as a non-disruptive solution for GI’s governance, then as a more than valid solution when operating in a broader panorama of digitalisation of the production chains, and finally as a ‘game-changer’ in the performance of some of the functions of producer groups. Nevertheless, all interviews are equally relevant for this research, and each yielded result has been weighted equally, as will also be highlighted in the closing section dedicated to conclusions.

2.1. Consorzio Arancia Rossa di Sicilia PGI.

Arancia Rossa di Sicilia PGI⁵⁵⁷ is a protected geographical indication that is produced in its three varieties: ‘moro’, medium-sized and ovoid in shape; ‘tarocco’, the most popular and

⁵⁵⁴ See R. K. YIN, *Case Study Research Design and Methods*, op. cit., p. 18.

⁵⁵⁵ On this point, M. HALIZAHARI, *Designing a Case Study Template for Theory Building*, in *International Journal of Academic Research in Business & Social Sciences*, 2018, 12, pp. 2240-2249.

⁵⁵⁶ S. CROWE et al., *The case study approach*, op. cit., p. 7.

⁵⁵⁷ The Arancia Rossa di Sicilia was registered as a PGI under the Commission Regulation (EC) No 1107/96 of 12 June 1996 on the registration of geographical indications and designations of origin under the procedure laid down in Article 17 of Council Regulation (EEC) No 2081/92. The product specification, which, among other things, defines the relevant geographical area, establishes the different allowed varieties and production and packaging

renowned variety of red orange; ‘sanguinello’, taking the name from the bright ruby red of its peel⁵⁵⁸.

In its three varieties, the Arancia Rossa di Sicilia is a seasonal product, available from mid-December to mid-June. More precisely, the oranges grown within the territory defined in the product specification ripen in a period that spans from mid-December to April, with maturation times and harvesting periods that naturally differ depending on the variety.

As it always happens with Geographical Indications, the pedoclimate of the geographical area of origin influences the quality and typical features of these PGI products, which are grown in the eastern part of the island, in 33 municipalities located between the provinces of Catania, Enna, and Siracusa. In these areas surrounding Etna, the climate, the sun, and the significant temperature excursion influence decisively the characteristics of the oranges. In particular, the marked variation in temperature detected in the production area, from day to night and throughout the seasons, results in a considerable accumulation of sugars and anthocyanins, which confer the PGI product its typical sweet flavour and its distinctive red colour⁵⁵⁹.

The cultivation of the Arancia Rossa di Sicilia PGI in the involved geographical areas has an ancient history, whose first traces date back to the Arab domination in the region. Nevertheless, the story of the Geographical Indication and its protection consortium is instead much more recent.

The Consorzio Arancia Rossa di Sicilia PGI was founded in 1994, on the initiative of local producers wanting to establish a collective structure that could promote and protect the

methods for cultivating the Arancia Rossa di Sicilia PGI, thus representing the very essence of the producer group, is available at the following link: <https://www.tutelaaranciarossa.it/i-documenti/> (last accessed: 10.11.2025).

⁵⁵⁸ See art. 2 of the product specification.

⁵⁵⁹ These external and organoleptic aspects reflect, in particular, the close connection between the factors relating to soil and climate, and the quality and specific characteristics of the Sicilian red orange PGI, which are not found in the same varieties of fruits grown in different geographical areas and territories around the country. As a matter of fact, on these points, and on the *origin link*, the product specification underlines that: *‘Legame geografico: La coltivazione degli agrumi in Sicilia è antichissima e ne abbiamo notizia fin dal dominio arabo. In particolare, la zona collinare e la pianura circostante il rilievo vulcanico dell'Etna si è andata caratterizzando e specializzando in una coltivazione del tutto particolare. Infatti, per effetto delle notevoli escursioni termiche presenti nella zona, si determina negli esperidi un accumulo zuccherino e di pigmenti antociani di notevole rilevanza che conferiscono alle arance un aspetto colorito visibilmente assai piacevole ed al frutto un sapore dolce, caratteristico e di accentuata intensità cromatica dell'epicarpo. Esistono varietà che nel corso dei secoli hanno acquisito una forte interazione con l'ambiente di coltivazione; esse sono: Sanguinello, Tarocco e Moro. L' “Arancia Rossa di Sicilia” rappresenta quindi un evidentissimo esempio di stretto legame dei fattori climatici con le caratteristiche del prodotto. Infatti, le stesse varietà di arancia coltivate in altri climi non presentano il particolare colore e le specifiche caratteristiche organolettiche che le ha rese famose nel mondo’* (see art. 8).

three varieties of Sicilian red orange in Italy and around the world. In 2015, furthermore, the producer group was recognised by the Italian Ministry of Agriculture⁵⁶⁰.

Despite being quite young, the Consorzio has come a long way in these 30 years: today, it brings together around 500 producers, 70 packagers, and over 50 companies allowed to use the protected geographical indication in processed and transformed products, mostly juices, for a total of 200 labels authorised to be placed on the market hosting the PGI name and symbol.

Equally remarkable are the producer group's efforts to protect the designation, which is now registered and enforced not only in the European Union, but also outside (e.g., in the United States, and it is currently under registration in China). In this perspective, the primary objectives pursued by the Consorzio are in fact connected to the need to promote and enhance, but above all to protect and safeguard⁵⁶¹, the products and the registered designation throughout the world.

Not by coincidence, the protection of the Arancia Rossa di Sicilia PGI from infringements is still perceived as an extremely tricky question for the Consorzio, which considers evocation to be one of the main challenges in the daily governance of its Geographical Indication. Alongside the threat of *external* evocation, i.e., due to producers operating outside the designated geographical area and making unlawful use of the PGI's name or symbol on the market, a different compelling issue that the group must face is the improper use that the PGI producers themselves sometimes still make of the indication. That is, an infringement from the *inside*. According to the Consorzio, these behaviours are mostly due to a general lack of awareness or knowledge of the rules applicable in the European Union and in Italy to protected designation of origin and protected geographical indications. In other words, involved producers do not always have a clear idea of what they can and cannot do in the production, packaging, and selling of a GI product.

⁵⁶⁰ D. m. 24 June 2015, *Riconoscimento del consorzio di tutela della Arancia Rossa di Sicilia IGP e attribuzione dell'incarico di svolgere le funzioni di cui all'articolo 14, comma 15, della legge 21 dicembre 1999, n. 526 per la IGP «Arancia Rossa di Sicilia»*.

⁵⁶¹ As to the protection of the PGI, which extends to unjust commercial practices, unfair competition, counterfeiting, and illegitimate use of the registered designation, even when the Sicilian red orange is used as an ingredient in processed products, the Consorzio makes use of Supervisory Agents (in Italian, *Agenti vigilatori*. For further details on these subjects, see *supra*, chapter III, fn. 502), in addition to the collaboration with ICQRF. The activities of monitoring and surveillance, as described under Art. 2, d. m. 12 October 2000, *Collaborazione dei consorzi di tutela delle DOP e IGP con l'Ispettorato centrale repressione frodi nell'attività di vigilanza, tutela e salvaguardia delle DOP e IGP*, are mostly intended to: verify that the products that are placed on the market with the Arancia Rossa di Sicilia PGI comply with the provisions established in the product specification; control similar products, made or sold in the EU, which could create confusion among consumers or harm the reputation of the protected geographical indication due to false indications on the origin, species, nature, or specific qualities.

In this regard, it is still particularly important for the GI producer group to communicate and impress on individual PGI producers the meaning, principles, and real value lying behind the PGI, sometimes even before and more than to consumers. Although young, indeed, the Arancia Rossa di Sicilia PGI is a seed that is quickly sprouting⁵⁶²: without these precautions, however, the plant would not be growing healthy and robust.

These critical profiles further intertwine with another question, which poses serious concerns for the Consorzio: to proactively address and adjust to the need for innovation as a response to the many economic and social⁵⁶³, but mostly environmental and climatic changes⁵⁶⁴, that the PGI is facing. In this framework, the need to adapt production methods and practices and marketing models to the *new* requirements of environmental, economic, and social sustainability is already well understood⁵⁶⁵.

Albeit acknowledging that this innovation is also a *technological* innovation, the experience of the Consorzio Arancia Rossa di Sicilia PGI with blockchain technology, which certainly fits into this scenario of changes and adaptation, is not among its milestones.

⁵⁶² In 2024, the total sales volume from Arancia Rossa da Sicilia PGI products was € 40 million.

⁵⁶³ In this regard, the interview held with the Consorzio Arancia Rossa di Sicilia PGI highlighted, in the first place, issues related to *social* innovation, which has become an imperative point to ensure the turnover in farmers and other operators in the PGI supply chain, while accessing trained and qualified workers, on the one hand, and complying with the applicable national legislation to avoid dangerous, but still frequent, dynamics of irregular labour. On this point, it is interesting to recall that the same concerns are also acknowledged and addressed by the Italian legislator, which recently approved the Law Decree 3 October 2025, n. 146, *Disposizioni urgenti in materia di ingresso regolare di lavoratori e cittadini stranieri, nonché di gestione del fenomeno migratorio*, which, among other things, recognises the extraordinary urgency and necessity of stepping up the efforts to combat illegal work and labour exploitation in agriculture, as far as it mostly concerns the illegal recruitment of foreign workers.

⁵⁶⁴ Environmental and climate emergencies are indeed a major concern for the Consorzio. It was said that the external characteristics and organoleptic profiles of the Sicilian red orange depend heavily on the soil, climate, and, above all, on the marked temperature range that is typical of the designed geographical area. The anthocyanins that give the fruit its distinctive red colour, for example, are only activated with significant temperature variations from day to night. As a matter of fact, the more these elements are at stake (and they already are, given the manifest climate crisis currently underway), the more the PGI producer group may be called upon to amend the product specification as necessary, for instance by changing the representation and symbols associated with the Sicilian red orange in the PGI logo, and therefore the very image that consumers have of the product, established through time and use.

⁵⁶⁵ It is also of great interest to mention the project 'NovArancia. Innovazioni tecnologiche per la valorizzazione e la tracciabilità dell'Arancia Rossa di Sicilia', to which the Consorzio participates as a partner. The project, launched at the beginning of 2022 and lasting 41 months, aims to experiment with innovative technologies to promote sustainable practices for the production of the Sicilian red orange, with the main objective of obtaining plants with a defined and traceable genetic and phytosanitary profile, and a more plastic and efficient root system, to ensure faster development and better yields in terms of quality and quantity. Further information, including technical and informative material, is available on the project website: <https://novarancia.it/> (last accessed: 10.11.2025).

The ROUGE project (Red Orange upgrading green economy)⁵⁶⁶, launched in 2019, which focused on the implementation of a blockchain platform to protect the Sicilian red orange PGI from counterfeiting, was in fact a temporary initiative that the Consorzio decided not to bring forth. From the suggestions received during the interview, this decision seems to have been due, in particular, to two circumstances.

The first reason is a factual one, which rather stands on the surface. It is linked to the group's perception that, following an initial moment in which research, stakeholders, and institutions were all strongly pushing for the adoption of blockchain technology in the agri-food sector, mostly as a consequence of large-scale distribution's concerns on the traceability of agricultural products and foodstuffs, the attention for the topic has gradually waned in recent years and, with it, the incentives to keep experimenting with this digital solution. However, without external stimulation, and in the absence of economic incentives or other forms of funding, both public and private, it is not for granted that producer groups are up to invest in and make use of blockchain.

Added to this first reason, there is a second and more structural aspect to take into account, associated with the fact that, in the opinion of the Consorzio, resorting to blockchain-based solutions for monitoring the PGI production chain does not appear to be completely necessary, as these systems fundamentally duplicate the traceability systems already provided for in the product specification and implemented through the certification body, before the products are placed on the market, and the Supervisory Agents, after.

Of great interest, in this regard, is a reflection that emerged in the final stages of the interview, and which further confirms this last element. The idea of the Consorzio is that, for the generality of consumers, seeing the registered designation and the PGI logo is, as such, sufficient to fully express the quality of the Sicilian red orange PGI. In other words, except for small niches of consumers (e.g., younger consumers, more sensitive consumers, and so on), blockchain-based solutions in this context are useful but ultimately unnecessary. The still-limited percentages of consumers actually getting the message conveyed by the adoption of

⁵⁶⁶ The project, born from the collaboration between Almayviva and the Consorzio, was running from the 2019-2020 harvest. The underlying idea was to delegate to a blockchain platform the recording and storage of all information relating to the production chain of the PGI, including, among other things, humidity levels, temperatures, and the fruits' general conditions during transport, storage, and up to commerce, collected directly through sensors where possible, to ensure the highest traceability in all passages of the production. In addition, an app monitoring the fields through geolocation systems and maps also allowed for data relating to the 'first mile' to be accessible. All this culminated in a digital stamp placed on fruit boxes, which, when scanned, entered consumers and other interested actors with all the information recorded on the blockchain platform.

blockchain do not justify the related efforts, as, according to the Consorzio, the main guarantee of the PGI product is still represented by the PGI itself and its producers.

All of these factors ultimately culminated in the Consorzio's decision not to bring forward the blockchain project, which can therefore be considered a flash in the pan in the history of the Arancia Rossa di Sicilia PGI. As a matter of fact, no major updates or further developments on the ROUGE project are to be found since its launch⁵⁶⁷.

2.2. Consorzio Tutela del Pecorino Toscano PDO

Pecorino Toscano PDO is among the finest enogastronomic products of Tuscany⁵⁶⁸. It has been produced since 1996 in its two varieties: Pecorino Toscano PDO Fresco (soft cheese), white or light yellow in colour, characterised by a more delicate flavour, and aged for a minimum of 20 days, normally extended to 45 or 60 days; and Pecorino Toscano PDO Stagionato (semi-hard cheese), distinguished by a light straw-yellow colour, by a strong but smooth flavour, and by a prolonged aging period ranging from a minimum to 120 days to one year⁵⁶⁹.

In both of its varieties, Pecorino Toscano PDO is produced exclusively with sheep's milk from the pastures of the territories defined in the product specification, including the whole of Tuscany and some neighbouring municipalities in the Umbria and Lazio regions (respectively 2 for the former and 11 for the latter)⁵⁷⁰. Here, the typical characteristics of the areas allocated to sheep farming, almost exclusively free-range and using natural pastures rich in wild herbs, confer the milk distinctive features and an exceptional quality. As for human factors, then, the production of Pecorino Toscano PDO also has economic and sociological

⁵⁶⁷ On this point, it should also be noted that, during the interview, the ROUGE project was only addressed in passing by the interviewees, while much more emphasis and focus were placed on the other elements mentioned in the previous parts of the section. This aspect, partly due to the fact that the two people who were listened to (the President of the Consorzio and one of the Supervisory Agents) did not hold these roles during the project itself, is nevertheless still emblematic, for this research, of the position of the producer group on the adoption of blockchain technology for the governance of their GI.

⁵⁶⁸ The protected designation of origin for the Pecorino Toscano was registered under the Commission Regulation (EC) No 1263/96 of 1 July 1996 supplementing the Annex to Regulation (EC) No 1107/96 on the registration of geographical indications and designations of origin under the procedure laid down in Article 17 of Regulation (EEC) No 2081/92. The product specification, which specifies the established requirements in terms of production, aging, packaging, and distribution of the PDO, is available at: <https://www.pecorinotoscanodop.it/consorzio/il-disciplinare/> (last accessed: 10.11.2025).

⁵⁶⁹ See art. 2 of the product specification.

⁵⁷⁰ See art. 6 of the product specification.

positive impacts, due to the use of marginal lands, which would otherwise be progressively abandoned and depleted in natural resources.

As in all protected designations of origin, all stages of production (from sheep livestock to milking, from production of raw materials to transformation into cheese, right up to the aging process) must take place within this designated area. In this perspective, indeed, Pecorino Toscano PDO symbolises the dairy tradition of these territories, while reflecting in its features and quality the close link with the geographical area, its history, and centuries of sheep farming and dairy traditions characterising it⁵⁷¹.

The connection with the territory of origin and the established tradition is still reflected in the producer group of the PDO, namely in its composition and in the functions it performs. Today, the Consorzio Tutela del Pecorino Toscano PDO, founded in 1985⁵⁷², brings together almost 900 farmers and 17 cheese factories, all united by the joint mission of passing on and safeguarding the centuries-old tradition of Pecorino Toscano PDO and strengthening its identity at the national and international levels.

To these ends, the Consorzio takes on several tasks and responsibilities. It protects and monitors the production and marketing of the PDO cheese, as well as the adoption and use of the protected designation, working hand in hand with the Ministry of Agriculture, control bodies, and other competent authorities, through its Supervisory Agents. At the same time, the Consorzio works to enhance and improve the PDO itself, promoting any initiative that might be useful to preserve its typical features and distinctive quality from any act of unfair competition, counterfeiting, improper use of the registered designation, and other commercial practices forbidden by the law, while supporting its members and individual producers in updating and self-monitoring the production chain. It also promotes the consumption of the Pecorino Toscano PDO both in Italy and abroad. Furthermore, over the years, the Consorzio has launched many initiatives and partnerships to foster scientific research.

This last profile, in particular, highlights the interest of the Consorzio in research and innovation. In this perspective, scientific research and innovation are not only dependent on

⁵⁷¹ Pecorino Toscano PDO sets its roots in centuries of history and sheep farming, an activity that was already practised by the Etruscans and Romans in the same territories included in today's geographical designation. This centuries-old tradition is also testified by Pliny the Elder, who, in his work *'Naturalis Historia'*, references a high-quality cheese (Lunense), arriving in Rome from an Etruscan city (Luni, now Lunigiana).

⁵⁷² It is interesting to note that the Consorzio was established *before* the registration of Pecorino Toscano as a protected designation of origin. One of the original scopes behind the set of the producer group was for their cheese to achieve the strong legal protection entrusted to Geographical Indications under the EU *sui generis* regime.

each other, but they also intertwine with sustainability. Indeed, innovation is perceived and proposed as a response to the acquired awareness that the issues related to sustainable development have created a new sensibility in consumers and must be addressed. Embracing these reflections, the Consorzio has embarked on some initiatives to boost the sustainability of the Pecorino Toscano PDO, focusing on the environmental and climate impacts of the production chain and, consequently, on the identification of mitigation and compensation actions⁵⁷³.

Overall, the described close emphasis on research also emerged during the interview, given that the Consorzio appears to widely rely on scientific research, technological innovation, and collaboration with universities and research centres, especially to address two challenges that are among the main obstacles faced in the governance of their protected designation of origin.

The first challenge involves producers' turnover and the need to foster young people's access to agriculture by taking care of their training and qualifications.

The second challenge concerns the traceability of raw materials used for the production of the Pecorino Toscano PDO, and becomes even more complex when considering that the production chain of the designation must also deal with the scarce availability of sheep's milk in Tuscany⁵⁷⁴. It is precisely this second challenge that encouraged the Consorzio to experiment with blockchain functionality in this context, finding considerable advantages in the essential features of the technology as a distributed digital ledger of data and information.

⁵⁷³ In this regard, it is interesting to recall the project 'SOFIG. La sostenibilità delle filiere dei prodotti DOP e IGP della Toscana: condivisione di buone pratiche e accountability', partnering the Consorzio Tutela Pecorino Toscano PDO. The main objective of the project is to support PDO and PGI producers of the region, together with their groups and associations, to identify the most adequate sustainability practices, monitor their implementation, and disseminate them to consumers and interested stakeholders. Further information can be found on the website of the project, accessible at the following link: <https://www.pin.unifi.it/progetto-sofig> (last accessed: 10.11.2025).

⁵⁷⁴ As the limited availability of sheep's milk has forced many cheese producers in the region to use raw materials from elsewhere, even though only in the production of non-PDO products, it is immediately clear why this circumstance widens the need for higher levels of traceability of the milk, making it imperative for the producer group to resort to tools that are actually capable of monitoring the origin and the itinerary of the materials used for the production of the Pecorino Toscano PDO, ensuring that it exclusively originates from the territories included in the product specification. This aspect is also closely connected to another major challenge faced by the Consorzio in the governance of the Geographical Indication: that is, to protect the PDO from any form of infringement, not only forms of evocation, but also misuse. On this last point, the Consorzio also highlights that most of the misuses actually take place *within* the region, where cheese products are often sold on the market as Pecorino Toscano PDO simply because they come from Tuscany, and are made from sheep's milk, irrespective of whether they comply with the product specification or not. In this case, as well, it was noted that these mistakes are often the consequence of producers' ignorance of the European and national rules governing PDO and PGI, and of what they are and are not allowed to do.

In reality, the adoption of a blockchain-based solution is part of a broader project aimed at digitalising the production chain of the Pecorino Toscano PDO, which also involved other highly innovative digital techniques⁵⁷⁵ to achieve higher standards of traceability, transparency, and quality for the GI product, as well as to strengthen communication within the chain.

Indeed, the primary goal behind blockchain implementation was precisely to find a mechanism that could assist the Consorzio in its tasks, especially in monitoring and controlling the production chain and individual producers of the PDO, as well as in assessing the compliance with the product specification. In other words, it was the possibility of being supported and simplified in the activities to control the production of Pecorino Toscano PDO that first pushed the Consorzio to embark on this experience, making use of blockchain technology as a ‘technical’ tool⁵⁷⁶.

Nevertheless, this first goal went at the same speed as that of providing consumers with higher guarantees as to the origin of raw materials, ultimately fostering the perceived quality. In this perspective, the Consorzio also acknowledges the positive impacts that blockchain can have as a marketing tool, improving communication with final consumers. Therefore, to emphasise this second profile, and allow blockchain adoption to surface *not only* as a ‘technical’ tool in the hands of the producer groups, but *also* as a marketing tool for individual PDO producers, the platform adopted by the Consorzio Tutela del Pecorino Toscano PDO also generates a smart label that can be downloaded and stamped, so that individual producers can communicate to consumers the higher efforts made in terms of traceability, thereby taking direct advantage of the implemented solution.

Taking a look at the pursued purposes, the results that the Consorzio claims to have been achieving through the experience with blockchain are more than gratifying, to the point that it has decided to broaden the scope of the project by requesting additional funding⁵⁷⁷. In fact, to

⁵⁷⁵ More precisely, the information is collected via a bio fingerprint, that is, a biochemical fingerprint digitalised through the implementation of artificial intelligence and detected through a portable device that tracks and recognises, using infrared spectrometry, the different molecules making up the product. In a nutshell, this technology allows a food passport to be generated for each agricultural product and foodstuff: the product becomes its own label, as it directly contains all the information that would be on the label and even more, while also allowing the final consumer to fully access this information. This and other information can be found in the official press release of the project, available at: <https://www.pecorinotoscanodop.it/blog/2023/04/importanti-passi-avanti-sul-sentiero-tracciabilita/> (last accessed: 10.11.2025).

⁵⁷⁶ As a matter of fact, this experience was also presented as an attempt to react to the severe lack of specialised workers perceived within the Consorzio, which makes it opportune to resort to a broader and more intensive automation of production processes.

⁵⁷⁷ The short-term goal is to continue experimenting with the use of blockchain technology to record data collected through vehicles, to switch from the first experimental stage to a second operational stage. The project will keep developing voluntarily, as today, Pecorino Toscano PDO’s operators voluntarily decide whether to join and

precisely detect the geographical area and the farmer from which the raw milk comes, to control its quantity and quality, thereby calculating in advance the steps that will be taken during the production, and, even before that, the practices and methods that can improve the farmer's activity⁵⁷⁸, is a huge advantage for all the actors involved in the PDO production chain, from the individual farmers and producers, to the Consorzio that brings them together.

For the Consorzio, in particular, all of this translates into the possibility of having access to a digital tool enabling it to better and more easily fulfil the tasks and responsibilities that the European legislation confers on GI producer groups. At the same time, the positive outcomes reached with the blockchain experience have gradually won over individual PDO producers: the sharp mistrust and scepticism generally perceived at the beginning of the project have quickly been replaced by curiosity, interest, and engagement, especially since no extra effort is required of them.

Nonetheless, the experience of the Consorzio Tutela del Pecorino Toscano PDO also imparts a lesson to consider. For the efforts in research, technological innovation, and digitalisation to be effective, it is indispensable to also focus and invest in infrastructure. In the very specific scenario that is being observed here, this means focusing and investing in the connectivity of small and medium-sized companies of the agricultural and food sector.

Without infrastructure, a complete, comprehensive, and effective digitalisation process cannot take place, and this would be a loss on all fronts. For the Consorzio, technological innovation is indeed a paramount tool that should not be exploited only in the private sector, but also from a collective perspective, and producer groups can be a driving force in this direction.

participate in it, or not. Nevertheless, the Consorzio hopes to extend the scope of the experience to include as many producers as possible.

⁵⁷⁸ To this end, however, the interaction with other technologies or digital solutions, automatically collecting and analysing the data registered in the blockchain platform, is fundamental. Indeed, as it was acknowledged many times before, blockchain works at its best when combined with other technologies.

2.3. Consorzio Cioccolato di Modica PGI.

In the narrower panorama of Italian Geographical Indications for sweet products, the Cioccolato di Modica PGI stands out, a young protected geographical indication registered in the European Union since 2018⁵⁷⁹.

The unique characteristics of this PGI product are revealed both in the adopted ingredients⁵⁸⁰ and in the specific production method, which together result in the distinctive texture and flavour of the final product. In fact, the organoleptic features of the product are the outcome of practices that do not involve any addition of cocoa butter or other vegetable fats, nor the ‘concaggio’, that is, a long process of mixing and heating the mass at high temperatures to increase its fluidity. On the contrary, in Cioccolato di Modica PGI’s production, the ingredients are worked ‘cold’, which prevents the sugar from completely dissolving into the cocoa mass and results in the grainy, sandy consistency that is typical of this Geographical Indication⁵⁸¹.

These features distinguish Cioccolato di Modica PGI from other kinds of chocolate that can be found on the market. At the same time, however, the involved practices demand specific skills and expertise (in measuring and blending the ingredients, controlling the temperatures, and so on). As a matter of fact, Cioccolato di Modica PGI’s methods of production reflect the long tradition of practices established over time in the territory from which the chocolate originates⁵⁸², Modica, a town located in the south-eastern part of Sicily, which gives its name

⁵⁷⁹ The Commission Implementing Regulation (EU) 2018/1529 of 8 October 2018 entering a name in the register of protected designations of origin and protected geographical indications [‘Cioccolato di Modica’ (PGI)], introduced the Cioccolato di Modica PGI in the European Union register of Protected Geographical Indications. The product specification sets, among other things, the features, the methods of production, the area of origin, the link with the area of origin, controls, and dispositions for packaging and labelling of Cioccolato di Modica PGI. It can be found at the following link: https://www.cioccolatodimodica.it/doc/disciplinare_cioccolato_di_modica.pdf (last accessed: 11.11.2025).

⁵⁸⁰ As provided for in the product specification, the only two mandatory ingredients for Cioccolato di Modica PGI are bitter cocoa paste (from 50% to 99% of the total weight) and sugar (from 50% down to 1% of the total weight, depending on optional ingredients). The product specification further allows for the use of optional ingredients or additives, including spices (cinnamon, vanilla, chilli, etc.), natural flavourings, dried or dehydrated fruits (citrus peel, pistachios, hazelnuts and almonds, etc.), salt, and others, specifying the admitted percentages. On the contrary, the use of artificial colours, preservatives, vegetable fats, vanillin, and milk is specifically prohibited (see art. 5 of the product specification).

⁵⁸¹ Again, see art. 5, which establishes that the cocoa mass must be gently heated so that the raw materials never go above the temperature of 50°, to preserve the features and quality of a cold-worked product. After this first step, the chocolate is portioned into traditional moulds, air residues are eliminated, it is brought to the temperature of 5 to 15°, and demoulded within a maximum of 12 hours to maintain the integrity.

⁵⁸² The product specification mentions traces of production and consumption of Cioccolato di Modica among the noble families as early as the 18th century (see art. 6, *Legame con la zona geografica*).

to the PGI product. The entire municipality of Modica, but only the municipality of Modica, is included in the geographical area defined by the product specification: this aspect significantly narrows the areas in which it is allowed to produce the chocolate, but also makes the production even more typical.

Also, this territory is more than just a place of production; rather, it is a place of *origin* that affects the identity of the product itself. Indeed, Modica's uneven pedoclimatic conditions influence how the chocolate cools and crystallises, contributing to its distinctive structure and flavour; at the same time, the production methods that are adopted today reflect traditional practices and old-style tools, further mirroring a strong connection with the heritage and craftsmanship of the territory⁵⁸³.

The values and principles lying behind the protected geographical indication are nowadays still conveyed by the Consorzio Cioccolato di Modica PGI, which brings together the small, and nevertheless meaningful, number of Cioccolato di Modica PGI's producers⁵⁸⁴.

Established in 2003 to safeguard the traditional production methods while defining the dispositions embedding the product specification and pursuing the recognition of the designation at the EU level as a protected geographical indication, the Consorzio is now responsible for controlling, protecting, promoting, and enhancing the Geographical Indication, as well as improving the relationship and communication with final consumers. To these ends, the producer group was recently also recognised by the Italian Ministry of Agriculture⁵⁸⁵.

Since the registration as a protected geographical indication, the Consorzio has actively worked to strengthen the product's reputation at the national and international levels, in particular by addressing the need to identify effective systems that could protect the registered designation from possible infringements, as well as the PGI product against any form of counterfeiting taking place on the market. In fact, given that the production techniques are still

⁵⁸³ On this point, the product specification reads that: *‘La produzione del Cioccolato di Modica ha sempre rappresentato un'importante occasione di lavoro per la popolazione locale e ancora oggi essa costituisce una significativa attività economica ed una delle più importanti fonti di occupazione del comune siciliano. Negli ultimi trenta anni la fioritura di una serie di piccole aziende ha determinato la nascita di un vero e proprio Distretto del Cioccolato di Modica, che si caratterizza per la particolare vitalità degli operatori, alcuni dei quali hanno avviato una significativa attività di export del prodotto. Questa connotazione del sistema produttivo ha consentito negli anni lo sviluppo e il mantenimento di conoscenze e abilità che si sono tramandate di generazione in generazione e che non sono riscontrabili in altre zone (...)’* (see art. 6).

⁵⁸⁴ The Consorzio involves today 14 member companies producing Cioccolato di Modica PGI.

⁵⁸⁵ D. m. 5 December 2024, *Riconoscimento del Consorzio di tutela del Cioccolato di Modica IGP e attribuzione dell'incarico di svolgere le funzioni di cui all'articolo 53, comma 15, della legge 24 aprile 1998, n. 128, come modificato dall'articolo 14, della legge 21 dicembre 1999, n. 526, di promozione, valorizzazione, vigilanza, tutela, informazione del consumatore e cura generale degli interessi della IGP «Cioccolato di Modica».*

traditional, and therefore extremely basic, the chances for the Cioccolato di Modica PGI to be counterfeited are still rather high.

It is also for this reason that, despite being registered as a PGI in 2018, the production of the ‘new’ Cioccolato di Modica PGI only began one year later. In the meantime, the Consorzio, collaborating with the Poligrafico dello Stato, Fondazione Qualivita, and CSQA as control body, was involved in a project aimed at developing an anti-counterfeiting tool for agricultural products and foodstuffs, which culminated in the launch of the Digital Passport⁵⁸⁶ for Cioccolato di Modica PGI.

The Consorzio’s experience with blockchain technology openly reflects the efforts of producer groups in the governance of their Geographical Indications. As was carefully underlined in the previous chapters, this activity is anything but simple in light of the demanding European regulation, which defines self-control models for GI producers and strict inspections by control bodies. In fact, it was above all the desire to discover a tool that could simultaneously protect PGI producers and consumers by combating counterfeiting attempts of Cioccolato di Modica PGI that led the Consorzio to test the contribution that blockchain technology could provide in this regard.

Through an integrated digital systems, which combines physical security components and innovative digital solutions, including the IBSI blockchain platform⁵⁸⁷ connected to an App that gives access the data recorded on the blockchain simply by scanning a QR code⁵⁸⁸, the Consorzio and its partners have succeeded in developing a solution that enables to verify the origin and authenticity of the data put on the label, fostering the exchange of information

⁵⁸⁶The Digital Passport is a solution developed in partnership between Poligrafico di Stato, Fondazione Qualivita, and CSQA, integrating a digital system for the traceability of GI products. Indeed, the Digital Passport for PDO and PGI products develops personalised tags connected to any information made available by certifying bodies, control authorities, producers, and all operators involved in the production chain of the Geographical Indication. Such information is made accessible via an App (Trust Your Food®), which, among other things, allows direct contact between producers and consumers. This innovative label offers a solution that combines anti-counterfeiting and traceability solutions, such as blockchain technology, with tools to communicate quality, thereby establishing concrete control and communication services for GIs’ producers, producer groups, designated authorities, and consumers.

⁵⁸⁷ Chapter one addressed the European Blockchain Service Infrastructure (EBSI), which was presented as the first public sector blockchain infrastructure in Europe (see *supra*, chapter I, par. 2.3.1). Italy has developed a mirrored project, which indeed takes the name of Italian Blockchain Service Infrastructure (IBSI), created with the intention of aligning with EBSI to ensure interoperability and extensibility of the services hosted at the European Union and European Blockchain Partnership levels. While maintaining its autonomy and being country-oriented, the IBSI leverages experiences learned in the EU framework to promote the development of public utility services through the use of blockchain. The IBSI works via case studies that bring innovation in ‘critical’ processes such as the exchange of digital certificates, the tracking of productions, and the protection of Made in Italy products.

⁵⁸⁸ The tags consist of a physical label featuring advanced printing technologies, security graphics, special inks, unique identification numbers, and a non-cloneable QR code that collects the information.

between all actors involved in the production chain of the Cioccolato di Modica PGI, up to the final consumer⁵⁸⁹.

The Consorzio is still quite satisfied and confident about its decision to implement this technological solution, which is deemed to have sensibly reduced counterfeiting. The Digital Passport, indeed, enables the producer group to anytime access the data and information submitted by PGI producers to the control body and recorded on the blockchain platform⁵⁹⁰, thereby constantly monitoring the production and marketing of Cioccolato di Modica PGI. Positive outcomes in terms of communication between producers and consumers are also reported.

Faced with a system that generates value for both producers and consumers, the Consorzio has welcomed the adoption of the described solution with great enthusiasm and positivity, employing it in a stable way in the governance of their protected geographical indication. In fact, the producer group still makes use of the Digital Passport to distinguish Cioccolato di Modica PGI products, and has no intention of giving it up, especially in light of the diffusion that the solution is having with other Italian Geographical Indications⁵⁹¹ and specific product categories, including the Italian wine sector.

The idea of the Consorzio is to have found an innovative solution that, also because of the decisive contribution made by the use of a blockchain platform, can be proposed as a strategic tool to meet the renowned responsibilities brought about by Regulation (EU) No

⁵⁸⁹ Accessing the App that is linked to the blockchain platform enables the user to enter four different sections, each dedicated to a specific function. They are: traceability, where the user can query the Poligrafico database to verify the correspondence between the codes shown by the App and those printed on the tags attached to the Cioccolato di Modica PGI's bars; production, a section that displays product data; producer, a space dedicated to communication between producers and consumers; producer group, a section showing information about the Consorzio Cioccolato di Modica PGI.

⁵⁹⁰ For a chocolate product to be marked as Cioccolato di Modica PGI, producers must ensure to comply with the product specification, both through company documentation and by filling in the portal that is connected to the blockchain platform. In particular, they must provide all the information that is needed to verify data, such as: mandatory ingredients used and their quantities; optional ingredients used and their quantities; any added natural flavouring accompanied by the relevant technical data; the origin of used sugar; the origin of used bitter cocoa paste; and others. A very interesting aspect of the experience is also given by the fact that sharing their data was not an obstacle for the producers of the Cioccolato di Modica PGI, who were the first to acknowledge the value of the Digital Passport and made themselves available, after a training provided by the Poligrafico di Stato and CSQA, to use the portal and register their data on the blockchain platform.

⁵⁹¹ After the experience of the Consorzio Cioccolato di Modica PGI, other GI producer groups have also started using the Digital Passport of the Poligrafico di Stato for managing and controlling their Geographical Indications, as was the case with the Consorzio Tutela Aceto Balsamico di Modena PGI. Unfortunately, it was not possible to contact the producer group during the research to gather their opinions on these topics and learn more about the progress of the blockchain technology project.

2024/1143 for GI producer groups, to the extent that the adoption of similar platforms may be made mandatory for all PDO and PGI products, not only in Italy, through specific regulations.

2.4 No result is a bad result.

The previous sections have introduced the case studies for the three interviewed producer groups and presented the results that emerged during these conversations, thereby setting some points from which to draw some closing reflections on the opinions and positions of PDO and PGI producer groups as to the implementation of blockchain-based solutions to support the governance of their Geographical Indications.

Nevertheless, there is a second significant finding that emerges from this empirical research, albeit indirectly. This finding is to be seen in the fact that, of the ten consortia identified after the first stage of the research and reached out for the interview, only three agreed to take it. And, although this outcome is objective and apparently negative, it is believed that *no result is a bad result*, as even the outcomes that differ from the desired, searched, or expected ones suggest some insights and should be taken into consideration for the information they may communicate.

In the case of our interviews, in particular, the question was raised as to what suggestions could be drawn from the fact that, essentially, most of the producer groups that were approached to narrate their experience with blockchain technology and their impressions on the topic did not want to do so, or at least did not feel like doing so. What do these reactions convey about the opinion that *these* producer groups may have of blockchain and its implementation as a tool for the governance of Geographical Indications?

Taking a step further in this direction, it is first of all important to clarify that, for the consortia that decided not to go further with the interview, different behaviours could actually be identified.

For example, only a few consortia did not respond to the initial email. It is rather obvious that these silences suggest a lack of interest in delving into the topic, even when assuming that they might have been due to negligence, lack of time, or the email being missed.

Notwithstanding this, most of the reached groups replied to the email by declining the invitation and explaining the reasons why they did not wish to proceed with the interview. And, as already mentioned at the beginning of this fourth chapter, these refusals were mostly due to

the belief they would not (positively) contribute to the empirical research, for different reasons. The answers included sentences such as ‘we no longer use blockchain technology’, ‘our project did not exactly involve the use of blockchain’, or ‘the testing with blockchain was a short interlude’. Therefore, denials to participate in the interviews in this second case suggest much more than might appear at first glance.

In some cases, the experience with blockchain technology began as a project in which the producer group was involved as a partner, but was midway interrupted due to the loss of public or private funding supporting the pilot, which could not be continued. In other cases, the experience with blockchain, again conducted in the form of a project or case study, was performed in an excessively fragmented or discontinuous manner, or too few producers were involved⁵⁹², to the point that the approached producer groups considered they would not be able to answer the submitted questions or give data that were relevant to the purposes of the research. In other cases, again, the refusal was motivated by the fact that the Consorzio decided not to bring the experience to an end, either because it did not perceive the real validity of blockchain-based solutions, or because these tools were seen as too challenging, complex, and costly, if compared to the advantages they could bring.

On closer inspection, then, even these *non-answers* are valid responses, and suggest some ways to observe and interpret the blockchain phenomenon as applied to the governance of Geographical Indications.

To begin with, even the producer groups that did not agree to be interviewed, as already surfaced from the case studies of the consortia that were interviewed and presented in the previous sections, reveal a rather heterogeneous landscape in how producer groups assess the potential of blockchain technologies. If, on the one hand, it is true that such an evaluation is not always positive, neither can it be said to be always negative: and indeed, even among those

⁵⁹² As to the engagement of individual PDO and PGI producers, one gold element that emerges from the research is that, in projects aiming to implement blockchain-based solutions in the production chains of GI products and for the governance of the Geographical Indications, as in the experiences that are being considered here, the inclusion, involvement, and active participation of individual producers is essential. In fact, especially in the initial stages of these experiences, it seems possible to move forward only when the individual producers of the involved Geographical Indication contribute actively to the experimentation, by voluntarily providing the information relating to their production, so that the producer group can test what happens when this data is registered on the blockchain platform. This preliminary step through individual PDO and PGI producers is therefore necessary. It is clear, indeed, that it would be very unwise to impose (for example, through an amendment in product specifications) the adoption of certain technologies or digital tools whose effectiveness, validity, and impact on the governance of the Geographical Indication have yet to be seen and evaluated. At the same time, however, it is very unlikely that these experiences will succeed if individual producers themselves do not get involved in the first place.

consortia that declined to participate the empirical research, several implicitly recognised the advantages of blockchain-based solutions, acknowledging that the decision to give up or shelve the idea of resorting to blockchain was not related to the perceived usefulness of the technology.

To a certain extent, the insights inspired by the refusals to participate in the interviews suggest the idea that sometimes individual PDO and PGI producers are the real tough nuts to crack, more reluctant to get carried away by the interest of their producer group. However, this impression clashes with the findings of some of the interviews conducted with the other consortia as to the involvement and receptiveness of individual producers⁵⁹³.

All of this, anyway, highlights a dependence on external funding, both public and private, which ultimately appears decisive for producer groups to engage with blockchain for the governance of their Geographical Indications. This aspect will be further addressed later on; for the moment, it is sufficient to point out that it seems unlikely that a producer group would deny the possibility of implementing a blockchain-based solution capable of supporting the activities for the governance of its Geographical Indication, if it were given access to the necessary resources to do so.

Ultimately, these are the clues that can be pieced together when looking at the possibility of applying blockchain technology for the governance of Geographical Indications *through the eyes of GI producer groups*. After framing the experiences, impressions, and opinions of interviewed consortia, as well as getting insights from those who declined to be listened to, it is now interesting to step aside and have a look at a different viewpoint: and, as anticipated in the opening passages of this fourth chapter, this second *collective* perspective is that of Origin Italia.

3. Applying blockchain to the governance of Geographical Indications. Through the eyes of Origin Italia.

As it was anticipated in the opening passages of this chapter, the decision to approach Origin Italia to arrange another interview on the topics of blockchain technology and its implementation for the governance of Geographical Indications arose from the wish to provide greater depth and breadth to the empirical research that is being described here, particularly by

⁵⁹³ The words used to describe the experience of the Consorzio Tutela Pecorino Toscano PDO, for instance, suggest the deep enthusiasm and involvement of individual PDO producers, who are voluntarily an integral part of the project that is digitalising the production chain of the Pecorino Toscano PDO.

looking for an interviewee who would be able not to describe direct experiences in the use of the technology, but rather to provide an external and comprehensive overview of the extent and intensity of the phenomenon in the realm of Geographical Indications and among Italian protection consortia.

Moving from this point, it was natural and almost inevitable to reach for Origin Italia, the Italian Association of Geographical Indications' Protection Consortia, to gather a *collective* and *associative* viewpoint based on the impressions assembled from the observation of the many realities composing it.

Founded in 2006⁵⁹⁴, Origin Italia is currently the main and largest umbrella association of Italian producer groups for PDO and PGI agricultural products and foodstuffs, bringing together more than 80 PDO and PGI protection consortia⁵⁹⁵ and two producer groups' associations⁵⁹⁶ and behaving as a collective voice for their common interests. With such an extensive representation on the national panorama, Origin Italia is likely the leading representative body of the Italian Geographical Indications' system, both at the national and international levels, a role that is further strengthened by its partnership with Origin Europe and Origin Mondo, respectively coordinating producer groups at the European and international levels⁵⁹⁷.

Origin Italia's strategic role in the representation of Italian producer groups is further mirrored in the association's stated mission, which is to promote the growth of the Italian framework for quality agri-food productions by fostering a culture of quality, certification, and sustainable development of territories⁵⁹⁸.

⁵⁹⁴ Despite being still quite young, Origin Italia has played a leading role in many paramount events for the development of the Italian system for Geographical Indications. The association was indeed funded in the early 2000s under the name of 'Associazione Italiana Consorzi Indicazioni Geografiche' (AICIG) and only rebranded and reorganised in 2018, to adopt a more international perspective and to align under the broader 'Origin' umbrella alongside other associations for Geographical Indication both in Europe and worldwide.

⁵⁹⁵ The diversity of the membership is another remarkable element, suggesting Origin Italia's broad representativeness, given that the associated protection consortia cover all food sectors under Geographical Indication. The list of members, which is accessible via the website, shows an equal participation of producer groups belonging to quality productions in the sectors of cheese and dairy products, meats, processed meats, cured meats, olive oils, fruit and vegetables, cereals, both fresh or processed, and other transformed products. This characteristic gives Origin Italia a strongly representative and cross-sectoral legitimacy as an interlocutor of both national and European institutions and international bodies.

⁵⁹⁶ They are the Association of Italian PDO and PGI Cheeses (AFIDOP) and Salumitalia.

⁵⁹⁷ Origin Europe is the organisation handling relations with European institutions and stakeholders at the EU level. Origin Mondo, on the other hand, is the global alliance of Geographical Indications, covering a large variety of sectors, and representing some 600 associations of GIs' producers and other GI-related institutions from 40 countries.

⁵⁹⁸ This, and all the information presented above, can be found on Origin Italia's official webpage, accessible at the following link: <https://www.origin-italia.it/> (last accessed: 12.11.2025).

To this end, Origin Italia currently carries out a wide array of activities aimed at supporting its members, promoting Italian protected designation of origin and protected geographical indications and related products, fostering cooperation between involved public actors and private stakeholders, as well as engaging dialogues with public institutions and involved authorities to steer national policies and political guidelines on the regulation of Italian Geographical Indications and their enforcement on the market. In this perspective, the key function Origin Italia displays is that of representation, as it reflects the collective interests of its members before national and European institutions, engaging in debates on the national policies for the regulation and governance of PDO and PGI. Consequently, Origin Italia also advocates on current policy issues, taking positions on the most compelling matters for the regulation of Italian GIs and issuing position papers⁵⁹⁹.

Other valuable functions that can be taken into account include supporting activities for their members, mainly as to the procedural steps for the governance of their Geographical Indications, training and informational activities, as well as enhancing dialogue, interaction, and consensus-building among protection consortia.

Nonetheless, Origin Italia's main role is certainly to act as a representative and spokesperson of the collective needs of its members, pursuing the mission of promoting the development of Italian Geographical Indications and their producer groups through a network of cooperation and coordination between all actors involved. And, as said, it was precisely in this representative position that the interview was conducted.

The conversation with Origin Italia started with a question aimed at identifying the main criticalities member groups face in the governance of their Geographical Indication. The scenario that surfaced is actually more complex than expected, as it seems that Italian producer

⁵⁹⁹ In this regard, it is of major interest to look at the Strategic Plan for the triennium 2024-2027, outlined by Origin Italia for the inauguration of the first board of directors and the strategic committee of the association. In this extensive and ambitious plan, special emphasis is placed on some of the issues that most risk impacting the Italian system for GIs. These include, in particular: the need to strengthen the development of the GI system worldwide, working jointly with Origin Mondo and Origin Europe to fight against counterfeiting and curb the threats of US duties; facilitating and supporting protection consortia in the application of the new Regulation (EU) No 2024/1143; promoting the GIs' sustainability and the adoption of a shared model for the sustainability of Italian PDO and PGI by 2030; addressing the uncontrolled proliferation of local or 'evocative' marks not corresponding to real Geographical Indications, which are often misleading for consumers and detrimental for PDO and PGI; opposing the diffusion of the Nutriscore, considered deceptive for consumers and penalising for many GI products, and expressing concern about the potential negative impacts of this labelling system on PDO and PGI products. Some additional information on the main policy guidelines shared by Origin Italia can be read on the official press release presenting the 2024-2027 Strategic Plan, accessible at the following link: <https://www.origin-italia.it/comunicatostampa/dazi-riforma-ue-nutriscore-e-marchi-locali-le-priorita-di-origin-italia/> (last accessed: 12.11.2025).

groups meet quite a number of challenges in performing their tasks and responsibilities for Geographical Indications. While some of these challenges are well known, because they have always been within the Italian GIs' system⁶⁰⁰, others are instead brand new.

For instance, there are *new* difficulties associated with the implementation of Reg. (EU) No 2024/1143. As it was observed, the Regulation offers many opportunities to producer groups, as it introduces the crucial, wide concept of GIs' governance, thereby expanding boundaries that were previously much more stringent⁶⁰¹. At the same time, however, governance is a broad and complex idea, which needs to be further specified at the national level: indeed, it embraces great values, but also bestows major responsibilities to producer groups. All of this is mostly concerning for the smaller ones, which lack a solid structure and often miss the necessary resources to fully and efficiently comply with the functions they are in charge of.

No less hindering is the control and protection of Geographical Indications in domain names, a topic that is deeply highlighted in Reg. (EU) No 2024/1143, which, as observed before⁶⁰², entrusts GI producer groups with the task of defending GIs on the web. For the moment, however, this topic is still a major source of confusion for these subjects, with producer groups struggling to understand which direction to undertake and which tools to adopt.

In such a complex and intertwined landscape, where the challenges producer groups deal with are many and varied, digitalisation seems to take a back seat in the collective vision proposed by Origin Italia.

In general, indeed, digitalisation is not systemically perceived by producer groups. This means, in different words, that protection consortia have never had the fever to promote technological innovation as a means of governance of their Geographical Indications, unlike

⁶⁰⁰ For instance, it is possible to consider the well-known topic of protecting GIs from infringements and, above all, from evocative practices. In this regard, although evocation has always existed and it is nothing new for producer groups to deal with this sort of commercial practice, while navigating the interpretative guidelines provided by the Court of Justice of the European Union and by national courts, an interesting aspect that came to light during the interview concerns what was defined as an 'entrepreneur dualism'. Indeed, there are very few producers who infringe a PDO or PGI without knowing they are doing so – an aspect that, instead, appeared during the interviews with the three protection consortia; and, if this happens, it is almost exclusively a matter that concerns the smallest groups. What should be underlined, on the contrary, is this dualistic tendency of producers who, on the one hand, want to convey the idea of quality to consumers but, on the other hand, often look for shortcuts to avoid investing in this quality. It is mostly this behaviour that producer groups must deal with when it comes to protecting and enforcing their Geographical Indications.

⁶⁰¹ See *supra*, chapter III, par. 2.

⁶⁰² See *supra*, chapter II, par. 3.1.2.

with other topics such as the sustainability of production chains or the promotion of tourism in interested territories.

Looking at the phenomenon from the viewpoint of producers, operators, and companies in the Italian GI system, resorting to innovative technology is already a thing. Actually, innovation is in their DNA, as they must innovate to remain competitive in the market. However, the opposite is true when adopting the perspective of producer groups: despite being aware of the value of technological innovation and of the advantages that digitalisation can bring in performing many tasks, producer groups do not make a battle out of digitalisation, simply because this matter falls outside the many tasks and functions they already need to take care of.

In Origin Italia's view, in other words, pursuing the mission of digitalisation in PDO and PGI production chains is *not* among producer groups' tasks. Therefore, while the protection consortia can certainly steer their own members and support them in the initial steps, fostering projects and research, it is then only up to the PDO or PGI producer to put everything into practice.

That said, for Origin Italia, blockchain implementation is still an aspect that may catch the interest of producer groups because, among other things, they are indeed responsible for ensuring the protection and enforcement of their Geographical Indications and PDO and PGI products on the market⁶⁰³. As a consequence, a discussion on the use of this digital solution can, in principle, be tabled, as blockchain possesses features that actually facilitate producer groups in performing functions that, in any case, would fall to them.

However, it is also perceived that numerous significant obstacles stand in the way of the practical implementation of this theoretical statement. To begin with, it should be acknowledged that digitising entire production chains is still a challenging practice. This is clear, for instance, when considering the production chain of a transformed PGI product, whose production phases, as is known, might also take place in a different geographical area, and even in a different Country. Consequently, despite the interest that may arise in the adoption of this technological solution, such a comprehensive decision is then rather difficult to implement. As has been said many times before, blockchain works at its best when delved into a more widely digitalised

⁶⁰³ This is, in fact, one of the functions that were examined in the previous chapter, and for which the possibility of resorting to a blockchain-based solution was investigated and discussed, leading to promising results. See *supra*, chapter III, par. 2.3.

framework and in combination with other technologies; such a scenario, however, still seems a utopia in the current system of Italian GIs.

For Origin Italia, this state of things is further mirrored in the attitude of Italian protection consortia towards the topic. Indeed, while in the past years blockchain has been the core of many projects, case studies, and experiences involving producer groups, this early interest has mostly not been materialised, enduring in time as a chimaera. This outcome is due to many reasons, which certainly go beyond the mere failure to perceive the advantages that blockchain implementation can bring to the governance of Geographical Indications⁶⁰⁴, but in any case, do not change the final result.

At the same time, and considering the other insights gained from the empirical research, it cannot be denied that these facts are partly confirmed by the small number of protection consortia that agreed to illustrate their experience with blockchain during these interviews.

What seems to emerge from the interview with Origin Italia is that, at present and perhaps definitively, in the Italian GIs system, the conditions do not exist to implement production chains that require each member to adopt a blockchain-based solution.

This step forward would indeed be way too challenging and costly to be taken by each actor that is involved in a Geographical Indication. However, this is the *conditio sine qua non* for the advantages of using blockchain in the different functions making up GI governance to really emerge, as shown in the previous chapter. In fact, while some producers will certainly be in a position (including financial position) to welcome the exhortation to make use of blockchain to record information relating to the production of their GI product, others will not be able to invest in such an initiative, given that there may be different investments to prioritise to remain competitive on the market⁶⁰⁵.

At the same time, Origin Italia firmly believes that a GI producer group is not allowed to force or compel its members to digitalise or, more specifically, to adopt a digital technology as disruptive as blockchain technology is, for instance, by amending the product specification

⁶⁰⁴ When asked what, in his opinion, were the main inhibiting factors in this context, the interviewee agreeably pointed out that, a few years ago, blockchain attracted a great deal of attention both from institutions and stakeholders, but that interest has gradually waned over time. This has likely led to a decline in external funding that allowed various public and private entities, including producer groups, to embark on projects to experiment with the implementation of this technology for different purposes.

⁶⁰⁵ In other words, for a protection consortia, investing money and resources in this mission may not be as important as investing in other paramount aspects for the management of its Geographical Indication, such as the marketing of PDO and PGI products.

to make it mandatory for each PDO or PGI producer to resort to the blockchain platform managed by the producer group itself to record their information.

According to Origin Italia, all of these factors ultimately make it impossible to imagine a systemic implementation of blockchain-based solutions in the Italian system for Geographical Indications.

The conclusions that can be drawn from the interview with Origin Italia are manifold and certainly interesting to frame. To begin with, it must be recognised that, at the associative level, producer groups are involved in everything that relates to ensuring the safety, quality, and origin of their Geographical Indications, as well as any other value that is conveyed by a GI. And, from this perspective, blockchain technology is undoubtedly a valid tool to strengthen these aspects, fitting into a broader scheme of technological innovation that concerns the agri-food sector, in general, and the realm of Geographical Indications, in particular⁶⁰⁶. However, once again, this discussion seems to involve more individual producers and companies, who are the real drivers for the digitalisation process in their own realities, rather than producer groups. The latter, while acknowledging the contribution that digital tools and technological solutions can make to the performance of tasks and responsibilities aimed at governing Geographical Indications, can at best encourage and support technological innovation but cannot replace individual PDO and PGI producers in implementing these changes.

4. Final remarks.

In the previous paragraphs, the content of the empirical study carried out throughout the research was reported, in an attempt to convey the most interesting points that emerged during the four interviews, together with the lessons learned from the interviews that were not conducted.

⁶⁰⁶ In this regard, an interesting point that emerged during the interview concerns the opportunity to focus on Artificial Intelligence, deepening the possibility of promoting GI products via the use of AI-based solutions. More in general, as to the topic of digitalisation in the realm of Geographical Indications and PDO and PGI productions, it is also interesting to recall a recent report issued by Origin Italia on the Italian GIs web market. See ORIGIN ITALIA, *Rapporto E-Food DOP IGP Italia. E-commerce e food delivery DOP IGP in Italia*, 2024. The report is the result of research carried out by Origin Italia, in partnership with Fondazione Qualivita and the contribution of MASAF, aimed at observing and delving into the online sales system for Italian PDO and PGI products, with a specific focus on e-commerce and food delivery platforms operating in Italy. The main objective of the work is to understand the incidence of GI products in online markets, both quantitatively (i.e., to measure the phenomenon) and qualitatively. As to this last element, the research tried to understand how PDO and PGI products are promoted on these platforms, while looking for the presence of counterfeiting or infringing commercial practices that could exist due to legislative gaps.

Hopefully, the preceding pages have succeeded in shedding light on the recurring question of the work (can blockchain technology be proposed as a valid tool in the hands of producer groups for the governance of Geographical Indications?), while gathering the viewpoints, impressions, and opinions of the real protagonists of the question, to find practical feedbacks to the reflections and conclusions reached in chapter III, by collecting these *outcomes from the outside*.

Indeed, much food for thought has emerged, with some points even going well beyond the parameters that were set at the beginning, when structuring the questions to be submitted to the interviewees⁶⁰⁷. To close this fourth chapter, the following pages will thus attempt to bring together the main points collected during the empirical research, to outline and present some final remarks.

To begin with, it was highlighted how GI producer groups face numerous challenges in the daily governance of their Geographical Indications. And, while some of these challenges had already been acknowledged and addressed in the course of the work and confirmed in the words of interviewed consortia and Origin Italia (such as the hurdles related to the evocation of protected designations⁶⁰⁸, or issues depending on the need to increase the sustainability of PDO and PGI productions⁶⁰⁹), others emerged unexpectedly (ad in the case of infringements committed by PDO or PGI producers themselves).

All these criticalities require an innovation, which, as already assumed in other passages of the work, is confirmed to be synonymous with adaptation and adjustment. This innovation is also technological, and while, on the one hand, it primarily concerns GIs' businesses and producers, as Origin Italia agreeably pointed out, on the other hand, it also affects and involves producer groups, which can be a driving force in encouraging and promoting technological innovation, albeit with different capacities and results.

In this regard, it has in fact emerged that the involvement of producer groups in the mission of digitalisation depends on many factors, often going beyond the mere assessment of the usefulness of the digital solutions considered, or the validity and extent of the advantages these can bring. These reasons may also stem from the dimension of the producer group itself, its structure, the resources it disposes of, and so on; all factors that inevitably also influence the

⁶⁰⁷ An aspect that, additionally, confirms the validity of the choice to carry out individual, face-to-face, semi-structured interviews for this work, as this decision allowed interviewees to speak openly and propose profiles and topics that had not been identified during the preparation phase.

⁶⁰⁸ See *supra*, chapter II, par. 3.1.1.

⁶⁰⁹ See *supra*, chapter II, par. 3.2.

scale of priorities of protection consortia. In other words, faced with many other urgent issues, needs, and challenges to consider and address, a producer group may not be in the position to put the ‘digitalisation’ mission at the forefront.

Moreover, although Reg. (EU) No 2024/1143 indeed entrusts GI producer groups with the function of enhancing, promoting, and improving their Geographical Indications, which, as seen, can also be interpreted in terms of innovation and technological innovation⁶¹⁰, a proper responsibility for the digitalisation of their PDO or PGI is not to be attributed to GI producer groups under the new European legislation.

These considerations are further confirmed when viewed with specific reference to blockchain technology and its generalised adoption for the governance of Geographical Indications. Indeed, when the interviews moved on to address experiences with blockchain, the interviewees’ accounts confirmed the paradigm: every producer group does what it can and how it can. In this perspective, the empirical research conducted on protection consortia (both interviewed and not interviewed ones) showed a rather heterogeneous landscape, with different positions surfacing as to the final assessment of the observed technology. Nevertheless, three comprehensive scenarios ultimately seem to emerge.

As to the first scenario, some protection consortia put aside their experiences with blockchain technology, after an initial attempt to test the tool, as they were not persuaded, or entirely persuaded, with the usefulness and validity of resorting to this digital solution in the governance of their Geographical Indication⁶¹¹. In other words, in this first scenario, the decision to quit resorting to a blockchain-based solution seems to be connected to the belief that blockchain is an excessively complex and burdensome tool, also in economic terms, compared to the advantages it can bring. In addition to this, the results achievable via blockchain are being sufficiently obtained with the means already at the disposal of producer groups for this switch to be undeniable.

The second scenario is instead composed of those protection consortia that decided to close the blockchain ‘chapter’, but did so for reasons that go beyond the mere assessment of the exploitability, validity, and efficiency of the solution. More often than not, these reasons seemed to be dependent on the lack or loss of the resources necessary to make blockchain

⁶¹⁰ See *supra*, chapter III, par. 2.4.

⁶¹¹ For instance, this is the idea that emerged during the interview with the Consorzio Arancia Rossa di Sicilia PGI. See *supra*, chapter IV, par. 2.1.

adoption a priority at the associative level⁶¹². These are the examples that most mirror what was recalled above, about the struggles and limitations faced by producer groups in prioritising digitalisation, in this case expressed through blockchain, as they must manage available resources among the multiple needs and demands of the Geographical Indication.

Anyway, and regardless of the underlying reasons, the outcome remains the same in the first and second scenarios: blockchain technology is not conceived as a practically applicable option for the governance of Geographical Indications.

The outcome reached in the third scenario is instead different, as it is composed of those producer groups that continue progressing in the use of blockchain technology, either in the form of experimentations or in more structured manners. The insight emerging from these experiences primarily concerns the positive assessment of the impacts that blockchain-based solutions can have on the accomplishment of one or more tasks attributed to producer groups. However, a generic and comprehensive vision of blockchain adoption for the governance of Geographical Indications, to be intended as the whole range of tasks and responsibilities entrusted to producer groups under Reg. (EU) No 2024/1143, such as that conceived and described in chapter III, is still lacking. The interviews, indeed, revealed a perception of the technology that is still confined to one or more specific functions, while a convincing awareness of the more comprehensive use that could be made of this solution is not to be found.

Another finding that emerges from the observation of the third scenario is, once again, connected to the need to resort to forms of external support to continue making use of blockchain technology⁶¹³. The point of external support, whether public or private, is a constant that, in one way or another, has always seeped into the different experiences that were considered throughout the empirical research, suggesting an additional, more general, well-known but not obvious fact: digitalisation, innovation, and research require financial support. And the sudden lack of incentives and financial support has certainly taken its toll on blockchain technology. It is no secret that, after initially generating considerable enthusiasm and interest, both from public institutions and private stakeholders, blockchain has gradually gained a more

⁶¹² In particular, this is the position that sometimes emerged in the answers of those producer groups that were reached out but did not agree to be interviewed (see *supra*, par. 2.4). On closer inspection, however, the insights that emerged during the interview with Origin Italia, mentioned just above, suggest analogous conclusions.

⁶¹³ This aspect can be identified in the case of the Consorzio Tutela del Pecorino Toscano PDO, which stated that it had requested additional funding to move further and expand the experimentation with blockchain. The nature of this funding, however, was not specified (see *supra*, par. 2.2). The same observation can be made for the Consorzio Cioccolato di Modica PGI, which relies on the partnership with other entities, including the Poligrafico di Stato, to continue using the Digital Passport for the PGI products. See *supra*, par. 2.3.

marginal position – even compared to other technologies and digital tools – with an inevitable but drastic decline in the disposal and access to funding available for research, innovation, and design of original solutions.

The description of the three scenarios spontaneously brings to light another variable to be taken into account in assessing the propensity of GI producer groups in resorting to a blockchain-based solution for the governance of their Geographical Indications: that is, the unprocessed or processed nature of the product protected by a PDO or PGI. Indeed, since traceability is a trickier matter in the case of transformed or processed GI products, as it can be more complicated to control and ensure that the product specification has been complied with in every step of the production process and by every involved actor, producer groups might be more inclined to resort to digital solutions that enable effective controls and ease the related tasks, thereby allocating their resources on this front, as well. This observation emerged, for instance, in the words of the Consorzio Tutela del Pecorino Toscano PDO, where traceability was a predominant topic. On the other hand, the picture may be different for unprocessed GI products (e.g., fruit and vegetables, as in the case of the Arancia Rossa di Sicilia PGI), given the lesser difficulty of tracking and controlling the steps and the actors involved in the production process. As a result, the use of advanced digital solutions, including blockchain technology, may in this second case appear overly complex, expensive, and unnecessary in light of the actual needs of the Geographical Indication.

In conclusion, the insights collected throughout the empirical research, as presented in the course of this fourth chapter, highlight how blockchain technology is perceived as a highly valuable tool to be implemented in the field of Geographical Indications, as well, both from the perspective of GI producer groups, and from the viewpoint of PDO and PGI companies and individual producers. For these subjects, in particular, sharing the information relating to the different stages of the GI production chain⁶¹⁴ by recording it on the blockchain platform managed and controlled by the producer group does not seem to represent too much of an obstacle, as illustrated by the Consorzio Tutela del Pecorino Toscano PDO and the Consorzio Cioccolato di Modica PGI. However, the same insights also suggest that the moment does not seem to be ripe for a systemic implementation of blockchain technology in the realm of PDO and PGI, and especially for a comprehensive governance of Geographical Indications. Whether

⁶¹⁴ This is, after all, the same information that individual PDO and PGI producers are already required to share with the producer group and, above all, to put at the disposal of competent national authorities, to ensure compliance with product specifications.

the time is *not yet* ripe, or *no longer* ripe, is a different matter, one that can perhaps only be answered by continuing to observe the phenomenon and these outcomes from the outside, over time.

CONCLUSION

The present work has tried to understand what role blockchain technology could play today in the realm of Geographical Indications. More specifically, looking at the phenomenon from the perspective of GI producer groups, rather than from the viewpoint of PDO and PGI individual producers and companies, an attempt was made to understand whether blockchain could contribute to the governance of Geographical Indications, ultimately answering one main research question, i.e., whether blockchain could be presented and proposed as a valid tool in the hands of producer groups to facilitate the uptake of the different functions leading to the governance of Geographical Indications.

As highlighted throughout the work, this research question is rooted in a broader context, namely, that of an agri-food sector now relentlessly characterised by demands for digitalisation and technological innovation. The extensive digitalisation process that is currently underway – and which, as was also noted, takes different forms and responds to various needs and functions – involves blockchain technology and the wider category of distributed ledger technologies, as well, which indeed find promising areas of application in agri-food supply chains.

These statements also apply to the specific field of Geographical Indications, a well-established and solid system in the EU framework that, however, is currently undergoing profound changes. These changes entail original needs for adjustment and adaptation in the GI system, connected not only to the entry into force of the new European regulatory regime for GIs, but also to known issues and new challenges that the GI system and its actors are called upon to address. It is precisely in response to the described needs that the system of Geographical Indications must also consider innovation, which, although not exclusively technological, surely involves digitalisation.

For blockchain technology, the central topic of this work, the described scenario of adjustment and adaptation paves the way for novel and original perspectives on implementing blockchain-based solutions, which seem to go far beyond the already known uses in relation to quality agri-food production chains. These horizons extend to include the still uncharted concept of GI governance, entrusted to producer groups under Reg. (EU) No 2024/1143 through the attribution of larger tasks and greater responsibilities affecting the establishment of a new

Geographical Indication, its protection and enforcement, its improvement and enhancement, and much more.

Having summarised the above, it is now appropriate to draw some concluding reflections that can set the present research straight.

To begin with, it must be acknowledged that this work is partially in line with the prevalent scientific literature addressing these topics, both legal and otherwise, which recognises blockchain technology's potentialities and advantages, including for the specific realm of Geographical Indications. As seen in chapter III, indeed, the features that differentiate the observed solution from other existing digital registers also surface in the governance of Geographical Indications, especially for all of those tasks that require producer groups to have a bird's eye on their GI and the GI products, to follow their movements at all times and in all 'places' – inside and outside national lines, but also inside and outside physical borders. Looking back at some of the functions that producer groups must take care of (without the need to recall them again, as they were in-depth scrutinised above), and the methods and tools implemented to achieve them, it is undeniable that resorting to blockchain-based solutions would mark a significant step forward in terms of efficiency and efficacy.

Nevertheless, the research also revealed a discrepancy between what is acknowledged scientifically, i.e., what primarily resulted from legal research and reflection in this work, and what is assessed practically, i.e., what mainly emerged from empirical research. Indeed, while legal research framed a picture where blockchain implementation entails substantial advantages in the performance of many of the tasks entrusted to producer groups, as just recalled, empirical analysis revealed a scenario that is not opposite, but neither perfectly coinciding.

It has appeared quite clearly that blockchain has not obtained the spaces it could have achieved for the governance of Geographical Indications, but neither do the conditions seem suitable to envisage such a systemic implementation in the future. Setting aside a few 'virtuous' cases – which, however, ultimately appear to be exceptional – empirical research has demonstrated that for GI producer groups, at least in Italy, blockchain is not an implemented or feasible priority, despite a deep-rooted and shared awareness of the potential this technological solution provides.

Wishing, then, to identify the reasons behind the missed comprehensive implementation of blockchain technology for the governance of Geographical Indications, the range of causes is plural. The opened parenthesis further leads to a second finding, connected to the fact that

many of the rationales that can be outlined in this context, as factors preventing blockchain's systemic application for the governance of Geographical Indications by producer groups, already emerged in other passages of the work, and mostly in the first chapter, when the main challenges hindering the advent of digitalisation in the agri-food sector were highlighted. Consequently, it can be observed that the *blockchain phenomenon* mostly mirrors the broader *digitalisation phenomenon* in the agri-food sector, as many of the causes preventing the systemic application of blockchain in the realm of Geographical Indications, and for the purposes here under discussion, are the same that still hamper a wider digitalisation of the agri-food sector today.

This is true, for instance, for the manifested lack of resources available for investment in blockchain or, more generally, in digital solutions and technological innovation by PDO and PGI producers, in the first place, and producer groups, subsequently. In this perspective, chapter I already highlighted the economic obstacles to a straightforward and functional digitalisation of the sector, although the CAP 2023-2027 conceives modernisation of agriculture as a fundamental scope to be achieved through innovation and digitalisation, as well. However, these economic obstacles need to be stressed again, as all of the experiences gathered during the empirical research emphasised the need for access to external funding, both private and, above all, public, to continue resorting to these digital solutions.

In the same direction, another aspect, intrinsically linked to the previous one, should be addressed. It concerns the ongoing absence of fully or more profoundly digitalised production chains in the agri-food sector, a condition that is essential to envisage the systemic use of blockchain, including in the field of Geographical Indications, but which is still an unattainable goal at present. On closer inspection, this profile can once again be traced back to the obstacles already mentioned in the work as barriers hindering the digitalisation of the agri-food sector, and in particular to the paramount infrastructural obstacles setting the digital divide, which, in the peculiar GI system, risks becoming even more acute due to the inner differences between producer groups.

These reflections, far from being relevant only in their 'concluding' capacity, are also noteworthy in a *de iure condendo* perspective and with a look to the future, as they leave room to investigate possible changes of course connected to the CAP post-2027⁶¹⁵.

⁶¹⁵ During the writing of this work, the European Commission presented its proposal for the Multiannual Financial Framework 2028-2034, which also includes resources for the future Common Agricultural Policy. See EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the European Council, the

Speaking of producer groups, another concluding remark can be proposed, which concerns the decision-making power that each group can exert, or, in other words, the type and scope of decisions they can make. A more detailed explanation may help to grasp the crux.

This issue also appears as a crucial one, and it derives from the fact that, as seen in chapter III, achieving a systemic implementation of blockchain technology to manage the activities falling within the broader governance of a Geographical Indication implies, in concrete terms, developing and implementing a blockchain platform, most likely a private and permissioned one, managed by the producer group itself. Every GI producer would have to be a member of this platform (as a node), accessing it to directly record information on the blockchain and share it with the network, thus making it available to other members, i.e., the other PDO or PGI producers, the producer group itself, and the national authorities in charge of control activities.

The heart of the matter stems from the fact that, to date, such a system can only be implemented voluntarily and with the spontaneous involvement of GI producers.

In fact, there is no such possibility for a producer group to impose on GI producers to adopt a digital solution of the type of blockchain, for instance, by amending the product specification – a solution that was, in some cases, imagined and proposed in the third chapter. It should not be forgotten that the producer group is not a separate entity, something *other* than the Geographical Indication. On the contrary, a producer group is set up voluntarily on the initiative of producers, it is composed of them, organised democratically, and controlled and scrutinised by its members. If the producer group is the spokesperson for the Geographical Indication and its producers, then it must necessarily take decisions that are sustainable and feasible for each of them, especially when these decisions involve a change in the product specification, whose effect is to exclude from the use of the Geographical Indication all those who are unable to adapt to the introduced amendments.

Council, the European Economic and Social Committee and the Committee of the Regions, *A dynamic EU Budget for the priorities of the future – The Multiannual Financial Framework 2028-2034*, Brussels, 16.7.2025, COM(2025) 570final. Despite being only a proposal, whose content might be drastically modified in the course of months of debate and voting between Member States and the European Parliament, the Communication still anticipates the EU Commission's new vision for the CAP that will come. In the same vein, the Commission's *Vision for Agriculture and Food* can be read. See, EUROPEAN COMMISSION, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A Vision for Agriculture and Food. Shaping together an attractive farming and agri-food sector for future generation*, Brussels, 19.2.2025, COM(2025) 75final. Among other things, the Communication is committed to promoting and ensuring innovation and digitalisation in agriculture, and a sector that is attractive to young people.

Consequently, although seen as a means to improve the governance of Geographical Indications, imposing the use of a specific digital solution on GI producers is excessively divisive, as it could never be equally welcomed and adopted by all the producers involved.

However reasonable and understandable, this last reflection poses a severe obstacle to blockchain implementation for the governance of Geographical Indications in the ways and extent described so far. This is because the producer group may, at most, involve GI producers in projects related to blockchain adoption, as in the case of the experiences gathered via interviews, or it may recommend and suggest the use of the technology to its producers in light of the advantages it offers to the governance of the Geographical Indication. However, it cannot bind GI producers in this regard.

That stated, it is then interesting to reflect on the strategies that GI producer groups may develop to promote blockchain adoption among producers, i.e., the incentives that could be put in place to incentivise such adoption on a voluntary basis.

In their functions of enhancement, promotion, and improvement of the PDO or PGI, producer groups could, for instance, present advertising campaigns and marketing proposals specifically dedicated to publicising the use of blockchain-based solutions within the group, or shed light on those producers who resort to this technology by organising dedicated events or public conferences, thereby allowing them to recoup their investment and commitment in terms of publicity and consumer awareness. In this regard, one could also imagine the introduction of a logo, issued by the producer group, indicating blockchain's voluntary adoption by the interested GI producers and suitable to communicate in a direct, immediate, and large-scale manner the greater efforts made by the latter as to the protection of the Geographical Indication.

A paramount incentive could also be proposed in relation to the control activities on the use of the GI and on compliance with the product specification. As the implementation of a blockchain platform in this context would already facilitate the desirable cooperation between GI producer groups and the national authorities competent for official controls, a potential strategy that producer groups could follow to further encourage blockchain's voluntary use is to reach an agreement with the latter to lessen controls on those GI producers who agree to record production information on the blockchain platform managed by the producer group, and open to the national authority itself. As seen, this step would indeed significantly enhance compliance control and protection and enforcement functions, thus favouring all subjects

involved in these phases. At the same time, the promise of a reduction in the bureaucratic burden associated with the described controls appears as a powerful incentive for GI producers.

Finally, partnership with universities and research centres in the framework of research activities financed by national or European public funds or private sources is undoubtedly a winning strategy for accelerating innovation while circumventing the obstacles associated with excessive investment. In this perspective, achieving positive results in pilot projects involving the most motivated producers is probably the best way to trigger a domino effect among other GI producers.

Notwithstanding this, and even though the empirical research revealed an interest of PDO and PGI individual producers in the digitalisation of the production chains⁶¹⁶, it is not for granted that the producer group can recruit all GI producers to voluntarily make use of a blockchain platform to record their information, as not all of them might be willing or able to cope with the commitment and costs associated with such a change. Additionally, while the exercised appeal may be stronger and more successful with the producers who are members of the group, the outcomes could also be rather different with those who are not.

All of this can easily result in a fragmented adoption of the technology and hinder the enhanced outcomes for the governance of the Geographical Indications, which is indeed intrinsically tied to its systemic and comprehensive implementation in the whole group.

Still on producer groups, a further closing remark should be stressed here, intertwined with the idea that they still seem to have of blockchain. The insights gathered with the empirical research indeed suggest a ‘vertical’ perception of blockchain technology, whose application is still anchored to specific tasks of the producer group. On the contrary, the understanding of a broader systemic implementation of blockchain-based solutions for the governance of Geographical Indications is still evanescent. This second concept, theorised in the work and especially in chapter III, did not find much support in empirical research, which instead

⁶¹⁶ It is interesting to observe that this finding from the empirical research has partly dispelled some of the concerns raised in chapter I and connected to the reluctance and scepticism of farmers and producers to embrace new digital solutions, mostly due to their unwillingness to share the generated data. In this regard, however, it should also be noted that the thorny issue of data sharing in agriculture arises only partially in the scenario that is under observation here. Indeed, as mentioned above, the blockchain platform that is being considered here is a private and permissioned one, with the main consequence that the information registered on the platform by GI producers would not be accessible to anyone, but only to those authorised to access the platform by the producer group managing it. Furthermore, it should also be noted that the data entered in the blockchain would not convey confidential or secret information, but rather information that producers are already required to make available to verify their compliance with product specifications.

provided a perception of the technology that is still confined to one or more specific functions of the group.

The whys of this situation are not easy to identify. A first and more spontaneous attempt at explanation leads to the belief that this outcome may be the effect of a still missing full awareness of blockchain, primarily in technical terms, and what this solution can achieve. However, there is also an additional explanation appearing in the background, connected to the fact that producer groups, as also suggested during the interview with Origin Italia, are still becoming familiar with the concept of GIs' governance introduced under Reg. (EU) No 2024/1143, and with the new opportunities it entails. Therefore, it is also possible that producer groups will be able to identify the means and tools available to manage this comprehensive responsibility only after having understood the concept and how to approach it. At the same time, since the focus on blockchain technology has in fact already decreased greatly, if compared to a few years ago, it can already be assumed that the chances that producer groups might resort to it, having gained a greater awareness of the concept, are remote.

There is then another aspect which should be addressed here, as, despite being overlooked in some parts of the work, it has permeated the entire research and is certainly relevant in closing terms. It relates to the sustainability (or unsustainability) of the decision to resort to blockchain-based solutions.

As it is well known, and as it often happens when a technological phenomenon is observed from a legal perspective, it is not easy to discuss blockchain in terms of sustainability without being deceiving or hypocritical. Even though scientific literature has long been researching and studying ways to improve the sustainability of blockchains and distributed ledger technologies, especially from an environmental perspective with the so-called green blockchains, it is rather clear that blockchain, as such, cannot be considered a sustainable technology. This statement can be made both from the environmental viewpoint, where it is mostly the effect of the huge amounts of computational energy needed to make blockchain mechanisms work, but also from the economic and social perspectives, largely depending on infrastructural hurdles and capacity development challenges identified in the course of the work, and once again addressed a few lines above.

Acknowledging the poor sustainability of blockchain, *per se*, is not too much of a dilemma, as the reflections on the environmental, economic, and social impacts of new technologies very rarely have the effect of hampering their advance or slowing down their

generalised use, as is happening today with Artificial Intelligence. In the scenario that is under observation here, however, the rub lies in the fact that the described state is juxtaposed to a new ‘condition’ imposed under Reg. (EU) No 2024/1143, whereby, as is well known, producer groups are required, among other things, to take decisions to increase and improve the performance of their Geographical Indications in terms of sustainability.

The derived questions are not meaningless. How could a producer group state its sustainability commitments if it decided to resort to blockchain, after all unsustainable technology, to manage and control its GI? Or, again, does the implementation of a blockchain system for the governance of a GI compromise, or at least diminish, the results in terms of sustainability achieved via other measures or practices? On the contrary, could the advantages that this digital solution offers for producer groups’ functions somehow be interpreted in a sustainability-oriented way, for instance, as a means to ensure fair income to producers or a valorisation of local development through a better control of the GI on the market? This last implication, although less spontaneous, is nevertheless to be taken into account.

The ideological contrast between these profiles is crystal clear and, understandably, it poses an additional obstacle to the systemic implementation of blockchain for the governance of Geographical Indications, especially by those producer groups working towards higher sustainability levels for their GIs.

Taken together, all of the elements gathered throughout the work suggest the impression that the uptake of blockchain-based solutions for the governance of Geographical Indications by producer groups depends not really, or not only, on the intrinsic value of the technology, which is undeniable in this framework, as well, given its ability to provide innovative solutions to concrete problems and issues that GI producer groups must face. Nor does it seem to depend on producer groups’ perception and assessment of blockchain as a solution that can, in principle, be implemented to support and simplify the tasks and responsibilities leading to the governance of the GI, and falling on producer groups themselves. Also, and perhaps primarily, blockchain’s success in the field that has been observed in this work relies on the availability of adequate resources and on the ability of producer groups, acting as a collective voice, to mobilise GI producers around shared innovation pathways.

BIBLIOGRAPHY

- AA. VV., *Rivista di diritto alimentare*, Quaderno n. 1, 2023.
- AA. VV., *Rivista di diritto agrario*, 2022, 2.
- AA. VV., *Rivista di diritto agrario*, 2020, 1.
- AA. VV., *Rivista di diritto alimentare*, 2009, 1.
- ADORNATO F., *Contratti e mercati di prossimità e di territorio dei prodotti agroalimentari*, in *Rivista di diritto alimentare*, 2013, 1.
- ADORNATO F., *Le “declinazioni della qualità”: una nota introduttiva*, in *Rivista di diritto alimentare*, 2009, 3.
- AGDOMAR M., *Removing the Greek From Feta and Adding Korbelt to Champagne: The Paradox of Geographical Indications in International Law*, in *Ford. Intellectual Property, Media & Entertainment Law Journal*, 2007, 18.
- AGOSTINI C., *I prodotti di montagna*, in BORGHINI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell’Unione europea*, 2nd ed., Milano, Giuffrè, 2024.
- ALABRESE M., *Politiche climatiche, politiche agricole e il bisogno di coordinamento*, in *Rivista di diritto agrario*, 2020, 1, I.
- ALABRESE M., *“Toscana” batte “toscoro”: un nuovo match nella competizione tra marchi e indicazioni geografiche*, in *Rivista di diritto agrario*, 2014, 2, I.
- ALABRESE M., SABA A., *Digitalising Agricultural and Food Systems: policy challenges and actions for the sustainable transition in the EU*, in *Perspectives on Federalism*, 2022, 3.
- ALABRESE M., SABA A., *Sistema agroalimentare e Blockchain. Opportunità, punti di debolezza e prospettive*, in *Economia Trentina*, 2021, 3.
- ALBISINNI F., *Il nuovo Pacchetto Qualità*, in *GeorgofiliINFO. Notiziario di informazione a cura dell’Accademia dei Georgofili*, 8.05.2024.
- ALBISINNI F., *Indicazioni geografiche e tutela internazionale e transfrontaliera: nuovi scenari, tra condivisione e contaminazione*, in LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.
- ALBISINNI F., *Strumentario di diritto alimentare europeo*, 5th ed., Milano, Wolters Kluwer, 2023.
- ALBISINNI F., *Agricoltura e digitalizzazione: l’impresa agricola nel tempo presente*, in *Rivista di diritto alimentare*, Quaderno 1, 2023.
- ALBISINNI F., *La direttiva 2019/633 tra PAC e mercati*, in *Rivista di diritto alimentare*, 2021, 4.
- ALBISINNI F., *Trasparenza e scienze della vita nella codificazione europea*, in *Rivista di diritto alimentare*, 2019, 3.
- ALBISINNI F., *Le declinazioni della qualità agroalimentare. Regole e prospettive*, in SAIJA R., FABBIO P. (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, Milano, Wolters Kluwer, 2019.
- ALBISINNI F., *Il Regolamento (UE) 2017/625: controlli ufficiali, ciclo della vita, impresa e globalizzazione*, in *Rivista di diritto alimentare*, 2018, 1.

ALBISINNI F., *Marchi e indicazioni geografiche: una coesistenza difficile*, in *Rivista di diritto agrario*, 2015, 2, I.

ALBISINNI F., *La comunicazione al consumatore di alimenti, le disposizioni nazionali e l'origine dei prodotti*, in *Rivista di diritto agrario*, 2012, 1, I

ALBISINNI F., *La qualità in agricoltura e nell'alimentazione*, in ADORNATO F., ALBISINNI F., GERMANO' A. (eds.), *Agricoltura e alimentazione. Principi e regole della qualità. Disciplina internazionale, comunitaria, nazionale*, Atti del Convegno di Macerata del 9-10 ottobre 2009, Milano, Giuffrè, 2010.

ALBISINNI F., *Prodotti alimentari e tutela transfrontaliera*, in *Rivista di diritto alimentare*, 2009, 2.

ALBISINNI F., *Un Libro Verde sulla comunicazione, verso il 2013*, in *Rivista di diritto alimentare*, 2009, 1

ALBISINNI F., *Nomi geografici e marchi commerciali: regole del mercato e sistemi locali*, in *Economia & Diritto Agroalimentare*, 2007, 2.

ALBISINNI F., *L'origine dei prodotti alimentari*, in GERMANO' A., ROOK BASILE E. (eds.), *Il diritto alimentare tra comunicazione e sicurezza dei prodotti*, Torino, Giappichelli, 2005.

ALBISINNI F., *Luoghi e regole del diritto alimentare: il territorio tra competizione e sicurezza*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2004, 4.

ALBISINNI F., *L'Aceto balsamico di Modena, il Torrone di Alicante e la Birra di Warstein (Denominazioni geografiche e regole del commercio alimentare)*, in *Rivista di diritto agrario*, 2001, 1, II.

ALBISINNI F., *L'origine dei prodotti agro-alimentari e la qualità territoriale*, in *Rivista di diritto agrario*, 2000, 2, I.

ALESSANDRINI M., *Regulating Short Food Supply Chains in the EU*, Cham, Springer, 2024.

ALLAIRE G., CASABIANCA F., THÉVENOD-MOTTET E., *Geographical origin: a complex feature of agro-food products*, in BARHAM E., SYLVANDER B. (eds.), *Labels of origin for food: local development, global recognition*, CABI Digital Library, 2011.

ALZOUBI Y. I., MISHRA A., *Green blockchain. A move towards sustainability*, in *Journal of Cleaner Production*, 2023.

AMMANATI L., *Information in agri-food market: the role of digital technologies*, in *Rivista di diritto alimentare*, 2020, 1.

ANTONUCCI F., FIGORILLI S., COSTA C., *A review on blockchain applications in the agri-food sector*, in *Journal of the Science of Food and Agriculture*, 2019, 14.

ANZALONE R., *IBM Blockchain is growing in the Food Industry during Covid-19*, in *Forbes*, 2020.

ARFINI F., BELLASSEN V. (eds), *Sustainability of European Food Quality Schemes, Multi-Performance, Structure, and Governance of PDO, PGI, and Organic Agri-Food Systems*, Cham, Springer, 2019.

ARISTEI L., *L'Accordo di Parigi: obiettivi e disciplina*, in *Rivista quadrimestrale di diritto dell'ambiente*, 2017, 3.

ARONZON S., *Blockchain and geographical indications: A natural fit?*, in *Journal of Intellectual Property Law & Practice*, 2020, 15.

ASCARELLI T., *Nota a Corte d'appello di Roma, 13 agosto 1924*, in *Foro Italiano*, 1924, 1.

ASSOCIATION OF EUROPEAN REGIONS FOR PRODUCTS OF ORIGIN, *The protection of Geographical Indications on the Internet. AREPO Practical Guide*, 2023.

ASTILL J. et al., *Transparency in food supply chains: A review of enabling technology solutions*, in *Trends in Food Science & Technology*, 2019, 91.

BABICH V., GILLES H., *Distributed Ledgers and Operations: What Operations Management Researchers Should Know about Blockchain Technology*, in *Forthcoming in Manufacturing & Service Operations Management*, Georgetown McDonough School of Business Research Paper, 2018, 3131250.

BACH L.M., MIHALJEVIC B., ZAGAR M., *Comparative analysis of blockchain consensus algorithms*, 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), IEEE, 2018.

BACON J., MICHELS J. D., MILLARD C., SINGH J., *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers*, in *Richmond Journal of Law and Technology*, 2018, 1.

BAGERS S. L. et al., *Blockchain is not a silver bullet for agro-food supply chain sustainability: Insights from a coffee case study*, in *Current Research in Environmental Sustainability*, 2022, 4.

BAKOS Y., HALABURDA H., *Permissioned vs Permissionless Blockchain Platforms: Tradeoffs in Trust and Performance*, in *NYU Stern School of Business working paper*, 2023.

BALDUCCI F., IMPEDOVO D., PIRLO G., *Machine Learning Applications on Agricultural Datasets for Smart Farm Enhancement*, in *Machines*, 2018, 6.

BARALLA G., IBBA S., MARCHESI M., TONELLI R., MASSINEO S., *A blockchain based system to ensure transparency and reliability in food supply chain*, *Lecture notes in computer science*, LNCS, 2019, 11339.

BARDI A., *La Tutela della Proprietà Intellettuale Agroalimentare nel mercato Nazionale, Europeo e Internazionale*, PhD Thesis, Università di Foggia, 2022-2023.

BARDI A., *La tutela delle DOP e IGP contro il maquillage parassitario dei prodotti generici alla luce del caso «Morbier»*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2021, 2.

BARJOLLE D., *Geographical Indications and protected designations of origin: intellectual property tools for rural development objectives*, in GANGJEE D. (ed.), *Research handbook on Intellectual Property and Geographical Indications*, Cheltenham, Edward Elgar Publishing Limited, 2016.

BARRETT H., ROSE D. C., *Perceptions of the fourth agricultural revolution: what's in, what's out, and what consequences are anticipated*, in *Sociologia Ruralis*, 2022, 62.

BARTOLI C., BONETTIE., MATTIACCI A., *Marketing geographical indication products in the digital age: a holistic perspective*, in *British Food Journal*, 2022, 9.

BASTARD A., CHAILLET A., *Blockchain: No pain, no gain? An examination of blockchain technology in the vitivinicultural sector*, in *BIO Web of Conferences. 44th World Congress of Vine and Wine*, 2023, 68.

BATTAGLINI R., *La normativa italiana sugli smart contracts*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

BATTELLI E., *Innovazione tecnologica e gestione della filiera agroalimentare*, in *Diritto agroalimentare*, 2024, 3.

BECKER H., GEER B., *Participant Observation and Interviewing: A Comparison*, in FILSTEAD W. J. (ed.), *Qualitative Methodology: Firsthand Involvement with the Social World*, Chicago, Markham Publishing, 1970.

BELARDI T., *Smart Contract: storia e definizione di un ibrido contratto/software*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

BELLETTI G., MARESCOTTI A., *Origin products, geographical indications and rural development*, in BARHAM E., SYLVANDER B. (eds.), *Labels of origin for food: local development, global recognition*, CABI Digital Library, 2011.

BENATTI C., *Il revirement della Corte di giustizia sul caso «Feta»*, in *Rivista di diritto agrario* 2006, 2, II.

BÉRARD L., *Terroir and the sense of place*, in GANGJEE D. (ed.), *Research handbook on Intellectual Property and Geographical Indications*, Cheltenham, Edward Elgar Publishing Limited, 2016.

BEZOVSKI Z. et al., *The Impacts and the Potential Disruption of the Blockchain Technology on Marketing*, in *Journal of Economics*, 2021, 6, 1.

BHOWMIK N. et al., *Distributed Ledger Technologies in the realm of Intellectual Property Rights: Panacea or Puzzle?*, in *Asian Business Lawyer*, 2021, 28.

BIEDAR., BLECHOVÁ A., LÓPEZ E. F., POTENZANO R. (eds.), *Legal Challenges of Disruptive Technologies*, 1st ed., Baden, Nomos, 2025.

BIONDI SANTI C., VESPRI V., *Solving Cryptographic Puzzles: How to Mine?*, in CAPPIELLO B., CARULLO G. (eds.), *Blockchain, Law, and Governance*, 1st ed., Cham, Springer, 2021.

BISWAS K. et al., *Blockchain-based wine supply chain traceability system*, in *Future Technologies Conference*, 2017.

BLAKENEY M., *The protection of geographical indications. Law and practice*, 2nd ed., Cheltenham, Edward Elgar Publishing Limited, 2019.

BLAKENEY M., *Geographical Indications and Environmental Protection*, in *Frontiers of Law in China*, 2017, 2.

BLAKENEY M., *Geographical Indications and TRIPs*, in *UWA Faculty of Law Research Paper*, 2012, 9.

BLASETTI R., *Geographical Indications: A Major Challenge for MERCOSUR*, in *GRUR International*, 2020, 11.

BOLICI F., CASTELLI A., HINNA A., *Embedding Distributed Systems into Organizations. How Blockchain Reinforces Transparency and Accountability in PA's New Governance Models*, in STACHOWICZ-STANUSCH A., MERCURIO L. (eds.), *The Social Issue in Contemporary Society. Relations between Companies, Public Administrations and People*, Leeds, Emerald Publishing, 2019.

BOLOGNINI S., *Disciplinari di sostenibilità e digitalizzazione*, in *Rivista di diritto agrario*, 2024, 1, I.

BOLOGNINI S., *E-Commerce e comunicazione*, in COSTATO L., ALBISINNI F. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed, Padova, Cedam, 2023.

BOLOGNINI S., *La giurisprudenza della Corte di Giustizia nella definizione del Sistema di tutela delle Indicazioni Geografiche*, in LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.

BOLOGNINI S., *La vendita a distanza dei prodotti alimentari fra innovazione del mercato agroalimentare e regime delle tutele*, in *Rivista di diritto agrario*, 2020, 4, I.

BOLOGNINI S., *Il consumatore nel mercato agro-alimentare europeo fra scelte di acquisto consapevoli e scelte di acquisto sostenibili*, in *Rivista di diritto agrario*, 2019, 4, I.

BOLOGNINI S., *Contrattazione a distanza e tutela del consumatore*, Torino, Giappichelli, 2018.

BOLOGNINI S., *La IGP "Aceto Balsamico di Modena" e le denominazioni "Balsamico" e "Aceto Balsamico": un legame indissolubile (anche in Germania)*, in *Rivista di diritto agrario*, 2015, 2, I.

BOLOGNINI S., *Il reg. (UE) n. 1151/2012 sui regimi di qualità dei prodotti agricoli e alimentari: cinquanta sfumature di valore aggiunto*, in *Agricoltura, Istituzioni, Mercati*, 2014, 2.

BOLOGNINI S., *La disciplina della comunicazione business to consumer nel mercato agro-alimentare europeo*, Torino, Giappichelli, 2012.

BOLOGNINI S., *La legislazione europea per la valorizzazione delle tipicità enogastronomiche*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2011, 12.

BONADONNA A., *I diversi significati del termine "qualità" nel settore agroalimentare*, in PEIRA G., BONADONNA A., ARNOLDI S. (eds.), *La qualità nel settore agroalimentare. Sistemi di qualità e strumenti innovativi*, Torino, Celid Edizioni, 2014.

BONETTI E., BARTOLI C., MATTIACCI A., *Applying blockchain to quality food products: a marketing perspective*, in *British Food Journal*, 2024, 5.

BONFIGLIO A., *La digitalizzazione nel Piano Strategico Nazionale della PAC 2023-2027*, in *PianetaPSR*, 2023, 120.

BONNEAU J., MILLER A., CLARK J., NARAYANAN A., KROLL J.A., FELTEN E.W., *SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies*, in *IEEE Symposium on Security and Privacy*, 2015.

BORGHI P., *Il reg. (UE) 2024/1143: norme verticali per i vini*, in COSTATO L., BORGHI P., RIZZIOLI S., PAGANIZZA V., SALVI L. (eds.), *Compendio di diritto alimentare*, 11th ed., Milano, Wolters Kluwer, 2025.

BORGHI P., *L'agricoltura 4.0: il futuro del settore agroalimentare e il filo rosso che lo lega alle origini della PAC*, in *Rivista di diritto alimentare*, 2023, Quaderno 1.

BORGHI P., *L'Accordo TRIPS*, in COSTATO L., ALBISINNI F. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed., Padova, Cedam, 2023.

BORGHI P., *Le informazioni volontarie nella disciplina della etichettatura degli alimenti*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

BORGHI P., *Le indicazioni geografiche dei vini: i vini DOP e IGP*, in COSTATO L., BORGHI P., RIZZIOLI S., PAGANIZZA V., SALVI L. (eds.), *Compendio di diritto alimentare*, 9th ed., Milano, Wolters Kluwer, 2019.

BORGHI P., *La giurisprudenza della Corte di Giustizia sul condizionamento dei prodotti a indicazione geografica e il Regolamento (UE) N. 1151/2012*, in COSTATO L., BORGHI P., RIZZIOLI S., PAGANIZZA V., SALVI L. (eds.), *Compendio di diritto alimentare*, 9th ed., Milano, Wolters Kluwer, 2019.

BORGHI P., *Qualità alimentare e controlli*, in SAIJA R., FABBIO P. (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, Milano, Wolters Kluwer, 2019.

BORGHI P., *L'insostenibile leggerezza delle versioni linguistiche: condizionamento e confezionamento dei prodotti DOP e IGP nel recente regolamento UE n. 1151/2012*, in *Rivista di diritto alimentare*, 2013, 3.

BORGHI P., *Risk-related Communication and Food-related Communication: what Information to Consumers?*, in *Rivista di diritto alimentare*, 2011, 2.

BORGHI P., *I requisiti di tutela dei prodotti di qualità*, in *Rivista di diritto alimentare*, 2009, 2.

BORRACCETTI M., *Trasformazione di un prodotto e suo confezionamento nel rispetto delle denominazioni d'origine*, in *Rivista di diritto agrario*, 2003, 4, II.

BORRACCETTI M., *La tutela del vino di qualità può ammettere una deroga al divieto di misure di effetto equivalente: il caso Rioja*, in *Rivista di diritto agrario*, 2000, 1, II.

BOUCHER P., NASCIMENTO S., KRITIKOS M., *How blockchain technology could change our lives. In-depth analyses*, EPRS – European Parliamentary Research Service, 2017.

BOWEN S., ZAPATA A., *Geographical indications, terroir, and socioeconomic and ecological sustainability: The case of tequila*, in *Journal of Rural Studies*, 2009, 25.

BRANDONISIO A., *Il fenomeno dell'Italian Sounding e la tutela dell'agroalimentare italiano*, in *Cultura e diritti*, 2019, 1.

BRANLARD J. P., *La reconnaissance et la protection par le Droit des mentions d'origine géographique comme élément de qualité des produits alimentaires*, in *Revue de droit rural*, 1995.

BRESCIANI S. et al., *Digital transformation as a springboard for product, process and business model innovation*, in *Journal of Business Research*, 2021, 128.

BREY P., *The strategic role of technology in a good society*, in *Technology in society*, 2018, 52.

BRICOLA F., *Tipologia delle frodi nella normativa penale sugli alimenti* in ID., *Scritti di diritto penale*, 2nd ed., Milano, Giuffrè, 1997.

BROUDE T., *Taking "Trade and Culture" Seriously: Geographical Indications and Cultural Protection in WTO Law*, in *University of Pennsylvania Journal of International Law*, 2005, 26.

BRUNORI G., *Agriculture and rural areas facing the "twin transition": principles for a sustainable rural digitalisation*, in *Italian Review of Agricultural Economics*, 2022, 3.

BUDILEANU C., *European Union Geographical Indications for Craft and Industrial Products. A Comparative Look at Geographical Indications for other types of products*, in *Lex et Scientia International Journal*, 2024, 1.

BURSTALL R., CLARK B., *Blockchain, IP and the Fashion Industry*, in *Managing IP*, 2017.

BUTERIN V., *Ethereum: Platform Review. Opportunities and Challenges for Private and Consortium Blockchains*, 2016.

BUTERIN V., *On Public and Private Blockchains*, in *Ethereum Foundation Blog*, 2015.

BUTERIN V., *Ethereum White Paper. A next-generation smart contract and decentralized application platform*, 2014.

CADOGAN M. S., *The Prospects and Limits of Blockchain Technologies in the Global Protection of Geographical Indications*, in *Canadian Intellectual Property Review*, 2020, 35.

CADOGAN M. S., *How Blockchain Is Changing the Trademark Space*, in *UnscriPted: Views on Canadian Intellectual Property*, 2019, 2.

CALABRESE B., *La Corte di giustizia dell'Unione europea si pronuncia sulla protezione delle indicazioni geografiche relative alle bevande spiritose: il caso Verlados*, in *Diritto comunitario e degli scambi internazionali*, 2016, 2-3.

CALBOLI I., *Geographical Indications of Origin, Economic Development, and Cultural Heritage: Good Match or Mismatch?*, in *Indian Journal of Intellectual Property Law*, 2020, 11.

CALBOLI I., *Of Markets, Culture, and Terroir: The Unique Economic and Culture-Related Benefits of Geographical Indications of Origin*, in Gervais D. J. (ed.), *International Intellectual Property: A Handbook of Contemporary Research*, Cheltenham, Edward Elgar Publishing Limited, 2015.

CALBOLI I., *Time to Say Local Cheese and Smile at Geographical Indications?*, in *Huston Law Review*, 2015, 2.

CALBOLLI., *Geographical Indications of Origin at the Crossroads of Local Development, Consumer Protection, and Marketing Strategies*, in *International Review of Intellectual Property and Competition Law*, 2005, 7.

CANFORA I., *La politica della qualità dei prodotti agroalimentari dell'UE*, in BORGHINI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

CANFORA I., *Politica Agricola Comune e digitalizzazione del comparto agroalimentare*, in *Rivista di diritto alimentare*, 2023, Quaderno 1.

CANFORA I., *Le Organizzazioni di produttori agricoli tra funzioni di mercato e composizione interna. Riflessioni a margine della sentenza della Corte di giustizia nel caso "Saint-Louis Sacre"*, in *Diritto agroalimentare*, 2023, 3.

CANFORA I., *Rapporti tra imprese e ripartizione del valore nella filiera agroalimentare*, in *Rivista di diritto alimentare*, 2022, 2.

CANFORA I., *L'evoluzione delle regole europee sulla trasparenza: verso un sistema di "Sicurezza alimentare 2.0"*, in *Rivista di diritto alimentare*, 2020, 3.

CANFORA I., *La tutela delle denominazioni di origine composte, tra termini divenuti generici, nomi comuni ed evocazione del prodotto: il caso dell'aceto balsamico*, in *Rivista di diritto agrario*, 2020, 4, I.

CANFORA I., *La filiera agroalimentare tra politiche europee e disciplina dei rapporti contrattuali: i riflessi sul lavoro in agricoltura*, in *Giornale di diritto del lavoro e di relazioni industriali*, 2018, 2.

CANFORA I., *La valorizzazione dei prodotti agricoli regionali tra politiche territoriali e vincoli europei*, in *I diritti della terra e del mercato agroalimentare*. Liber Amicorum Alberto Germanò, II, Torino, Utet Giuridica, 2017.

CANFORA I., *Gruppi di produttori ed enti di certificazione: competenze e legittimazione in una regolazione mobile*, in *Rivista di diritto alimentare*, 2015, 2.

CANFORA I., *Informazioni a tutela della salute e conformazione del contenuto negoziale tra diritto europeo e diritti nazionali*, in *Rivista di diritto agrario*, 2014, 2, I.

CANFORA I., *Il carattere evocativo della traduzione per le menzioni tradizionali dei vini. Il ruolo della Corte di giustizia nell'uniformazione dei principi del settore alimentare*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2009.

CANFORA I., *Il caso «Parmigiano Reggiano»: denominazioni di origine composte e strumenti di tutela tra competenze nazionali e diritto comunitario*, in *Rivista di diritto agrario*, 2008, 3, II.

CANFORA I., LECCESE V., *Pratiche sleali, equilibrio del valore e legalità dei rapporti di lavoro nella filiera agroalimentare*, in *Giornale di diritto del lavoro e di relazioni industriali*, 2022, 1.

CANFORA I., LECCESE V., *Lavoro irregolare e agricoltura. Il Piano triennale per il contrasto allo sfruttamento lavorativo, tra diritto nazionale e regole di mercato della nuova PAC*, in *Diritto agroalimentare*, 2021, 1.

CAPELLI F., *Il Regolamento (UE) n. 1151/2012 sui regimi di qualità dei prodotti agro-alimentari: luci ed ombre*, in *Rivista di diritto alimentare*, 2014, 1.

CAPELLI F., *Tutela della qualità dei prodotti agroalimentari sotto il profilo giuridico: riflessioni sulla riforma della disciplina dell'Unione europea*, in COSTATO L., BORGHINI P., RUSSO L., MANSERVISI S. (eds.), *Dalla riforma del 2003 alla PAC dopo Lisbona. I riflessi sul diritto agrario, alimentare e ambientale*, Napoli, Jovene, 2011.

CAPELLI F., *La sentenza Parmesan della Corte di giustizia: una decisione sbagliata (Nota a Sentenza del 26 febbraio 2008 in causa n. C-132/05)* in *Diritto comunitario e degli scambi internazionali*, 2008, 1.

CAPELLI F., *Tutela delle denominazioni d'origine e delle indicazioni geografiche dei prodotti agroalimentari nel nuovo regolamento comunitario n. 510/2006 e nel decreto italiano 19 novembre 2004 n. 297*, in *Diritto comunitario e degli scambi internazionali*, 2006, 1.

CAPELLI F., *Corte di giustizia tra «Feta» e «Cambozola»*, in *Diritto comunitario e degli scambi internazionali*, 1999, 1.

CAPELLI F., KLAUS B., *Protection of Geographic Indications and Designations of Origin in the Queso Manchego Case*, in *European Food and Feed Law Review*, 2019, 5.

CARBONI D., *Le tecnologie alla base della blockchain*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

CARBONI D., *Smart Contract – Caratteristiche tecniche e tecnologiche*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

CARMIGNANI S., *La nuova disciplina delle indicazioni geografiche. Profili di qualificazione e tutela*, in *Rivista di diritto alimentare*, 2025, 2.

CARMIGNANI S., *Pacchetto qualità e diritti: una diversa prospettiva*, in *Persona e Mercato*, 2025, 2.

CARMIGNANI S., *Cambiamenti climatici e conciliazione tra sviluppo sostenibile e produzione di vini di qualità*, in *Rivista di diritto alimentare*, 2024, 3.

CARMIGNANI S., *La produzione vitivinicola di qualità alla prova della climate emergency*, in *Rivista di diritto alimentare*, 2023, 2.

CARMIGNANI S., *SDGs e agricoltura. Una breve riflessione*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

CARMIGNANI S., *Agricoltura e pluridimensionalità dello sviluppo sostenibile*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2016, 1.

CARMIGNANI S., *La tutela delle indicazioni geografiche nell'accordo TRIPs. Localizzazione geografica del prodotto e mercato globale*, in GERMANÒ A., ROOK BASILE E. (eds.), *Agricoltura e alimentazione tra diritto, comunicazione e mercato*, Atti del Convegno "Gian Gastone Bolla" di Firenze del 9-10 novembre 2001, Milano, Giuffrè, 2003.

CARRARA L., *Dal Regolamento (UE) 2017/625 alle misure applicative unionali e nazionali: un percorso innovativo ma non concluso*, in *Rivista di diritto alimentare*, 2020, 4.

CAVICCHI A., *Qualità alimentare e percezione del consumatore*, in *Agriregionieuropa*, 2008, 15.

CAZZINI F., *Corte di Giustizia e denominazioni composte: il caso «Aceto Balsamico di Modena»*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2020, 3.

CEI L., *The distribution of geographical indications across Europe. Reflecting spatial patterns and the role of policy*, in *European Planning Studies*, 2025, 2.

CERRATO S.A., *Contratti tradizionali, diritto dei contratti e smart contract*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

CHAYKO M., *Techno-social Life: The Internet, Digital Technology, and Social Connectedness*, in *Sociology Compass*, 2014, 8.

CHING-FU L., *Blockchainizing Food Law: Promises and Perils of Incorporating Distributed Ledger Technologies to Food Safety, Traceability, and Sustainability Governance*, in *Food and Drug Law Journal*, 2019, 4.

CICIRIELLO M. C., *Dal principio del patrimonio comune al concetto di sviluppo sostenibile*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 1996.

CLACK C., BAKSHI V.A., BRAINE L., *Smart Contract Templates: foundations, design landscape and research directions*, in *ArXiv*, 2016.

CLARK B., *Blockchain and IP Law: A Match made in Crypto Heaven?*, in *WIPO Magazine*, 2018.

CLARK L. F., KERR W. A., *Climate change and terroir: The challenge of adapting geographical indications*, in *Journal of World Intellectual Property*, 2017, 20.

COCCO G., *Filiera corta e farmers' markets*, in *Rivista giuridica dell'ambiente*, 2015, 2.

COLI F., *L'Agricoltura sostenibile nel Pnrr e la sfida della complessità*, in *Euractive Italia*, 2022.

COLI F., MANZONI A., *Green revolution e agri-food: la strategia del PNRR tra esigenze europee e nazionali*, in *Pandora Rivista*, 2021, 2.

COLLINGRIDGE D., *The Social Control of Technology*, New York, St. Martin's Press, 1982.

COLOMBO R. J., *Bitcoin: Hype or Harbinger?*, in *Journal of International Business and Law*, 2016, 16, 1.

COMPAGNUCCI L. et al., *Uncovering the potential of blockchain in the agri-food supply chain: An interdisciplinary case study*, in *Journal of Engineering and Technology Management*, Elsevier, 2022, 65.

COPA-COGECA, *Principi essenziali per la raccolta, l'utilizzo e lo scambio dei dati agricoli*, 2016.

COPPOLA N., *Viiniverla: too much 'ado' about nothing*, in *Journal of Intellectual Property Law & Practice*, 2016, 6.

COSTANTINO L., *Le alterne vicende della piadina romagnola tra competenze amministrative e giurisdizionali nazionali, ruolo della Commissione e legame con il territorio*, in *Giustiziacivile.com*, 2018, 11.

COSTATO L., *L'ennesima riforma della PAC: alla ricerca di modelli tuttora incerti, tra piani strategici, competenze concorrenti e mercato*, in *Rivista di diritto alimentare*, 2021, 3.

COSTATO L., *L'origine conta: nell'alimentare e in agricoltura*, in *Rivista di diritto alimentare*, 2020, 1.

COSTATO L., *Il regolamento n. 1151/2012 del Parlamento europeo e del Consiglio sui regimi di qualità dei prodotti agricoli e alimentari*, in *Rivista di diritto agrario*, 2012, 2, I.

COSTATO L., *DOP, IGP, e STG, nei regolamenti del 2006 adottati anche in relazione ai negoziati WTO*, in *Rivista di diritto agrario*, 2006, 3, I.

COSTATO L., *Tracciabilità e territorio: il confezionamento delle DOP e IGP in loco*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2003, 5.

COSTATO L., *Brevi note a proposito di tre sentenze su circolazione dei prodotti, marchi e protezione dei consumatori*, in *Rivista di diritto agrario*, 1999, II.

COSTATO L., *La protezione delle indicazioni geografiche e delle denominazioni d'origine e le attestazioni di specificità*, in *Rivista di diritto agrario*, 1995, I.

COSTATO L., RUSSO L., *Corso di diritto agrario italiano e dell'Unione europea*, 4 ed., Milano, Giuffrè, 2019.

- CREYDT M., FISCHER M., *Blockchain and more – Algorithm driven food traceability*, in *Food Control*, 2019, 105.
- CRICELLI L., MAURIELLO R., STRAZULLOS., *Technological innovation in agri-food supply chains*, in *British Food Journal*, 2024, 5.
- CRISTIANI E., *La sostenibilità ambientale delle filiere agro-alimentari*, in *Rivista di diritto agrario*, 2021, 1, I.
- CRISTIANI E., *Modelli di agricoltura “sostenibile” con particolare attenzione al diritto vitivinicolo*, in *Przegląd prawa rolnego (Agricultural Law Review)*, 2018, 1.
- CROWE S. et al., *The case study approach*, in *Medical Research Methodology*, 2011, 11,
- CUCCURU P., *Blockchain e automazione contrattuale. Riflessioni sugli smart contract*, in *La Nuova Giurisprudenza Civile Commentata*, 2017, 1.
- D’ADDEZIO M., *Vendita a distanza e altre modalità di vendita diretta di prodotti agricoli e alimentari: molteplicità di questioni giuridiche e di interessi coinvolti*, in *Diritto agroalimentare*, 2020, 1.
- D’ADDEZIO M., MACCIONI G., BOLOGNINI S., “Nota” al Libro verde sulla qualità, in *Rivista di diritto alimentare*, 2009, 1.
- D’AVANZO W., *Smart Farming. La quarta rivoluzione industriale e la digitalizzazione del settore agricolo*, in *Diritto agroalimentare*, 2022, 2.
- D’AVANZO W., *Blockchain e smart contracts per la gestione della filiera agroalimentare, Potenzialità, progetti e problemi dell’internet del valore*, in *Diritto agroalimentare*, 2021, 1.
- DAMVAKERAKI T., *EU Blockchain Strategy*, EU Blockchain Observatory and Forum.
- DESHWAL G. K., PANJARI N. R., *Active and Intelligent Packaging of Cheese: Developments and Future Scope*, in PRIETO M. A., OTERO P. (eds.), *Natural Food Additives*, IntechOpen, 2022.
- DE FILIPPI P., MANNAN M., REIJERS W., *Blockchain as a confidence machine: the problem of trust and challenges of governance*, in *Technology in Society*, 2020, 62.
- DE FILIPPI P., WRIGHT A., *Blockchain and the law. Rule of code*, Cambridge, Harvard University Press, 2018.
- DE LUCA G., *I regimi delle DOP, delle IGP, delle STG e delle indicazioni facoltative di qualità nel Reg. UE 2024/1143*, in *Le nuove leggi civili commentate*, 2025, 2.
- DE LUCA G., *La tutela della denominazione composta «Aceto Balsamico di Modena» (IGP) in alcune recenti pronunce della giurisprudenza di merito italiana*, in *Rivista di diritto alimentare*, 2025, 1.
- DE LUCA G., *La Strategia “Dal produttore al consumatore” e la questione della sostenibilità economica del Green Deal per i produttori primari*, in *Rivista di diritto agrario*, 2022, 4, I.
- DE MAURO A., GRECO M., GRIMALDI M., *A formal definition of Big Data based on its essential features*, in *Library Review*, 2016, 3.
- DE SILVO F. D. E., *Brief Notes on the European Geographical Indication Law: Among Sustainability Implications and Artificial Intelligence Applications*, in *International Journal of Management, Knowledge and Learning*, 2024, 13.
- DI LAURO A., *Norme sensoriali incitative e norme sperimentali. Il caso Rémunérascoré*, in *Rivista di diritto alimentare*, 2024, 1.

DI LAURO A., *Le denominazioni d'origine protette (DOP) e le Indicazioni geografiche protette (IGP)*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

DI LAURO A., *Certificazioni sulla sostenibilità e sulla biodiversità*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

DI LAURO A., *Informazioni e scelte*, in ALBISINNI F., COSTATO L. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea*, Padova, Cedam, 2023.

DI LAURO A., *Gli effetti dei cambiamenti climatici sulla disciplina delle indicazioni geografiche: criticità e prospettive*, in *Rivista di diritto alimentare*, 2022, 3.

DI LAURO A., *Blockchain nel settore agroalimentare come discorso e come dispositivo*, in NAVARRETTA E., RICCI L., VALLINI A. (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di Blockchain*, Vol. II, Torino, Giappichelli, 2021.

DI LAURO A., *Il "cibo della memoria" e lo sviluppo sostenibile: analisi critica della sostenibilità delle Denominazioni geografiche protette (DOP) e Indicazioni geografiche protette (IGP), anche alla luce dell'evoluzione dei segni del territorio*, in *Revista iberoamericana de derecho agrario*, 2020, 12.

DI LAURO A., *Le denominazioni di origine protette e le indicazioni geografiche protette: strumenti per lo sviluppo sostenibile dell'impresa agricola?*, in *Rivista di diritto agrario*, 2019, 2, I.

DI LAURO A., *Le denominazioni di origine protette e le indicazioni geografiche protette di fronte alla sfida dello sviluppo sostenibile*, in *Rivista di diritto agrario*, 2018, 3, I.

DI LAURO A., *Comunicazione pubblicitaria ed informazione nel settore agro-alimentare*, Milano, Giuffrè, 2005.

DI LAURO A., *Denominazione di origine protetta e nozione di dominazione generica: il caso «FETA»*, in *Rivista di diritto agrario*, 1999, II.

DOWNES L., *The Laws of Disruption: Harnessing the New Forces That Govern Life and Business in the Digital Age*, New York, Basic Books, 2009.

EASTWOOD C., KLERKX L., AYRE M., *Managing Socio-Ethical Challenges in the Development of Smart Farming: from a Fragmented to a Comprehensive Approach for Responsible Research and Innovation*, in *Journal of Agricultural and Environmental Ethics*, 2019, 32.

ECHOLS A. M., *Geographical Indications For Food Products*, 2nd ed., New York, Kluwer Law International, 2016.

EUIPO, *Guidelines for the examination of European Union Trademarks*, 1.05.2025.

FAINI F., *Il diritto nella tecnica: tecnologie emergenti e nuove forme di regolazione*, in *Federalismi.it*, 2020, 16.

FALKON S., *The Story of the DAO – Its History and Consequences*, in *Medium*, 2017.

FAO, ORIGIN, *Developing a roadmap towards increased sustainability in geographical indication systems*, Roma, 2024.

FAO, EBRD, *Strengthening sustainable food systems through geographical indications. An analysis of economic impacts*, Roma, 2018.

FAO, *The Sustainability Strategy for Geographical Indication*, Roma, 2017.

FEENBERG, A. *Questioning Technology*, 1st ed., Londra, Routledge, 1999.

FELOUTZIS N., LEKAKOS G., *Is Blockchain a Disruptive Innovation? A Systematic Literature Review*, in DE LA IGLESIA D. H., DE PAZ SANTANA J.F., LOPEZ RIVERO A. J. (eds.), *New Trends in Disruptive Technologies, Tech Ethics and Artificial Intelligence*, Cham, Springer, 2023.

FERNANDEZ ZARZA M., AMAYA S., BELLETTI G., CRIADO E., *Trust and food quality in the valorisation of geographical indication initiatives*, in *Sustainability*, 2021, 6.

FERRARI M., *Le imprese alimentari e la digitalizzazione*, in BORGHI B., CANFORAI., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

FERRARI M., *Digitalizzazione e innovazione nell'attività delle imprese agricole*, in MAURO M. (ed.) *Start-up e PMI innovative in agricoltura. Imprese agricole tra innovazione e sostenibilità*, Padova, Cedam, 2024.

FERRARI M., *Fattori di produzione, innovazione e distribuzione di valore nella filiera agroalimentare*, Milano, Ledizioni, 2023.

FERRARI M., *La protezione delle Indicazioni Geografiche nel contesto digitale*, in LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.

FERRARI M., *De gustibus non disputandum est?: il ruolo del sapore nella disciplina degli alimenti*, in *Rivista di diritto agrario*, 2020, 2, II.

FERRARI M., *La dimensione proprietaria delle Indicazioni Geografiche. Uno studio di diritto comparato*, Trento, Editoriale Scientifica, 2015.

FERRARI M., *Il territorio nelle denominazioni geografiche: spunti comparatistici*, in *Il foro italiano*, 2015, 3.

FERRARI M., *The narratives of geographical indications*, in *International Journal of Law in Context*, 2014, 2.

FERRARI M., *Il nesso fra origine geografica e qualità dei prodotti agroalimentari: i diversi modelli di tutela europei e nordamericani*, in *Rivista di diritto agrario*, 2014, 2, I.

FERRARI M., *Risk Perception, Culture, and Legal Change. A Comparative Study on Food Safety in the Wake of the Mad Cow Crisis*, Londra, Routledge, 2009.

FERRELL S. L., *Legal Issues on the Farm Data Frontier, Part I: Managing First-Degree Relationships in Farm Data Transfers*, in *Drake Journal of Agricultural Law*, 2016, 21.

FINCK M., *Blockchain regulation and governance in Europe*, Cambridge, Cambridge University Press, 2019.

FINCK M., *Blockchains and Data Protection in the EU*, in *European Data Protection Law Review*, 2018, 4, 1.

FINCK M., MOSCON V., *Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0*, in *International Review of Intellectual Property and Competition Law*, 2019, 50.

FINOCCHIARO G., *Riflessioni su diritto e tecnica*, in *Il diritto dell'informazione e dell'informatica*, 2012, 4-5.

FRIZZO-BARKER J. et al., *Blockchain as a disruptive technology for business: a systematic review*, in *International Journal of Information Management*, 2020, 51.

GABRIELLI E., *La nozione di contratto e la sua funzione. Appunti sulla prospettiva di una nuova definizione di contratto*, in *Giustizia civile: rivista giuridica trimestrale*, 2019, 2.

GALATOLO F. A., *Blockchain: come funziona davvero?*, in NAVARRETTA E., RICCI L., VALLINI A. (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di Blockchain*, Vol. I, Torino, Giappichelli, 2021.

GALLI C., *Agroalimentare e DOP/IGP: come le imprese possono tutelarsi dalla contraffazione sul web*, in *AgendaDigitale.eu*, 2022.

GALVEZ J. F. *et al.*, *Future challenges on the use of blockchain for food traceability analysis*, in *Trends in Analytical Chemistry*, 2018, 107.

GANGJEE D. S., *Proving Provenance? Geographical Indications Certification and its Ambiguities*, in *World Development*, 2017, 98.

GANGJEE D. S., *From Geography to History: Geographical Indications and the Reputational Link*, in CALBOLI I., NG-LOY W. L. (eds.), *Geographical Indications at the Crossroads of Trade, Development, and Culture*, Cambridge, Cambridge University Press, 2017.

GANGJEE D. S. (ed.), *Research Handbook on Intellectual Property and Geographical Indications*, Cheltenham, Edward Elgar Publishing Limited, 2016.

GANGJEE D. S., *Relocating the Law of Geographical Indications*, Cambridge, Cambridge University Press, 2012.

GANGJEE D. S., *Geographical Indications and Cultural Heritage*, in *WIPO Journal*, 2012, 4.

GANGJEE D. S., *Quibbling Siblings: Conflicts Between Trademarks and Geographical Indications*, in *Chicago-Kent Law Review*, 2007, 82.

GANS J. S., GANDAL N., *More (or less) economic limits of the blockchain*, in *National Bureau of Economic Research*, Working Paper 26534, 2019.

GARGIULO G., *L'ultimo nato tra i segni distintivi: il nome a dominio*, in *Il diritto industriale*, 2015, 3.

GASCHI A., PORTALE V., *La definizione di blockchain e distributed ledger*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

GATOMATIS P., BOGONIKOLOS N., *Using blockchain for business and marketing improvement*, in *Journal of Marketing Development and Competitiveness*, 2021, 15.

GE L., BREWSTER C., SMEENK A., SPEK J., TOP J., *Blockchain for Agriculture and Food, findings from a pilot study*, Wageningen, Wur, 2017.

GENNARI A., *L'agente vigilatore con qualifica di pubblica sicurezza nei consorzi di tutela*, in *Infowine.com*, 2012.

GENOVESE A., *Le pratiche commerciali sleali nella filiera agricola e alimentare*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

GENOVESE A., *I consorzi tra produttori agricoli*, in COSTATO L., ALBISINNI F. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed, Padova, Cedam, 2023.

GENOVESE A., *Il ruolo dei consorzi di tutela delle produzioni di qualità nel prisma della sostenibilità. Quale futuro per la tradizione?*, in *Rivista di diritto agrario*, 2022, 4, I.

GEORGOPOULOS T., *'Selling GIs by the Pound'? Geographical Indications as Ingredients under Article 27 of Regulation (EU) 2024/1143*, in *European Food and Feed Law Review*, 2024, 19.

GEORGOPOULOS T., *Cyberspace v. Territory: Domain Names and the Problem of Protection for Geographical Indications*, in SYNODINOU T. E., JOUGLEUX P., MARKOU C., PRASTITOU T. (eds.), *EU Internet Law. Regulation and Enforcement*, Cham, Springer, 2017.

GERIEN S., PASSARELLI C., *Challenges for Geographical Indications in the context of the ICANN new generic Top-Level Domains*, OrlGin, 2016.

GERINI O., SAPORITO M. G., *Controllo dei siti e repressione frodi*, in CALLIANO O. M. (ed.), *E-Wine, Aspetti giuridici e economici della comunicazione e distribuzione del vino online*, Torino, Giappichelli, 2018.

GERMANÒ A., *Sulla titolarità dei segni DOP e IGP*, in *Diritto agroalimentare*, 2017, 2.

GERMANÒ A., *Protezione europea delle DOP e delle IGP da marchi simili e protezione nazionale delle denominazioni geografiche protette da simili denominazioni sociali*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2012, 1.

GERMANÒ A., *Le politiche europee della qualità alimentare*, in *Rivista di diritto alimentare*, 2009, 3.

GERMANÒ A., *Qualità alimentare: un'Europa, due sistemi*, in *Rivista di diritto alimentare*, 2009, 1.

GERMANÒ A., *La qualità dei prodotti agro-alimentari secondo la Comunità europea*, in *Rivista di diritto agrario*, 2009, 3, I.

GERMANÒ A., *Gli Stati membri hanno l'obbligo di difendere d'ufficio le denominazioni geografiche protette?*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2008.

GERMANÒ A., *Il Libro verde della Commissione europea del 15 ottobre 2008: alla ricerca di una definizione di alimenti di qualità*, in *Rivista di diritto agrario*, 2008, 4, I.

GERMANÒ A., *Il panel WTO sulla compatibilità del regolamento comunitario sulle indicazioni geografiche con l'accordo Trips*, in *Agricoltura, Istituzioni e Mercati*, 2005, 2.

GERMANÒ A., *Le indicazioni geografiche nell'Accordo TRIPS*, in *Rivista di diritto agrario*, 2000, 3, I.

GERMANÒ A., RAGIONIERI M. P., ROOK BASILE E., *Diritto agroalimentare. Le regole del mercato degli alimenti e dell'informazione alimentare*, Torino, Giappichelli, 2014.

GERMANÒ A., RUBINO V. (eds.), *La tutela dell'origine dei prodotti alimentari in Italia, nell'Unione europea e nel commercio internazionale*, Atti del Convegno di Alessandria del 21-25 maggio 2015, Milano, Giuffrè, 2015.

GERNONE C., *Il ruolo dei soggetti collettivi nel sistema delle indicazioni geografiche. Profili di diritto europeo e nazionale*, Torino, Giappichelli, 2025.

GERNONE C., *I consorzi di tutela: autonomia privata e compatibilità con le regole della concorrenza alla luce della nuova PAC*, in *Rivista di diritto alimentare*, 2023, 2.

GERNONE C., *Il caso «Morbier» e la protezione contro l'evocazione di DOP e IGP nella giurisprudenza della Corte di Giustizia dell'Unione europea*, in *Rivista di diritto agrario*, 2021, 1, II.

GIEGLING J., *In blockchain we trust? Certificates of Origin as a case for distributed-ledger technologies*, in *Journal of Law, Market & Innovation*, 2022, 1.

GIGANTI P., BORRELLO M., FALCONE P. M., CEMBALO L., *The impact of blockchain technology on enhancing sustainability in the agri-food sector: A scoping review*, in *Journal of Cleaner Production*, 2024.

GIOIA M., *Prime note sul regolamento n. 625/2017*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2017, 4.

GIORDANO A., *Blockchain per l'agrifood. Scenari, applicazioni, impatti*, in *I quaderni di RuralHack, Societing4.0 – Accademia di Management Mediterraneo*.

GIORDANO M. T., *Il problema degli oracoli*, in BATTAGLIN R., GIORDANO M. T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

GIOVANNUCCI D., JOSLING T., KERR W., O'CONNOR B., YEUNG M. T., *Guide to Geographical Indications: Linking Products and Their Origins*, 2009.

GIUFFRIDAM., *I prodotti a qualità certificata: DOP, IGP e STG*, COSTATO L., ALBISINNI F. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed, Padova, Cedam, 2023.

GIUFFRIDAM., *Declinazioni della qualità alimentare nelle regole europee*, in SAIJA R., FABBIO P. (eds.), *La qualità e le qualità dei prodotti alimentari tra regole e mercato*, Milano, Wolters Kluwer, 2019.

GIUFFRIDAM., *Innovazione tecnologica e responsabilità dell'operatore del settore alimentare*, in *Rivista di diritto alimentare*, 2018, 4.

GIUFFRIDAM., voce *Segni degli alimenti: DOP, IGP e STG*, in *Digesto delle Discipline Privatistiche*, Sez. Civile, XI, Torino, Utet Giuridica, 2018.

GIUFFRIDA M., *Pratiche leali di informazione e informazioni volontarie*, in *Rivista di diritto agrario*, 2012, 1, I.

GOCCI A., LUETGE C., *The Synergy of Tradition and Innovation Leading to Sustainable Geographical Indication Products: A Literature Review*, in *Journal of Management and Sustainability*, 2020, 1.

GUADAGNO E., *I Consorzi di tutela e gli organi di certificazione dei vini di qualità*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2012, 2.

GUALTIERI F., VACCARI S., CATIZZONE B., *La protezione delle indicazioni geografiche: La nozione di evocazione*, in *Rivista di diritto alimentare*, 2017, 2.

GUERRIERI F., *Governing governance. Collective action and rulemaking in EU agricultural and non-agricultural geographical indications*, PhD Thesis, University of Amsterdam, 2023.

HABER S., STORNETTA W. S., *How to time-stamp a digital document*, in *Journal of Cryptology*, 1991, 3, 2.

HADDON L., *Information and Communication Technologies in Everyday Life: A Concise Introduction and Research Guide*, Oxford, Bloomsbury Publishing, 2010.

HAGENMEYER M., *Food Information Regulation, Commentary on Regulation (EU) No. 1169/2011 on the Provision of Food Information to Consumers*, Berlin, Lexxion, 2012.

HALIZAHARI M., *Designing a Case Study Template for Theory Building*, in *International Journal of Academic Research in Business & Social Sciences*, 2018, 12.

HERNANDEZ I., *The Blockchain Technology and the Regulation of Traceability: The Digitization of Food Quality and Safety*, in *European Food and Feed Law*, 2020, 6.

HOFMANN F., WURSTER S., RON E., BÖHMECKE-SCHWAFERT M., *The Immutability Concept of Blockchains and Benefits of Early Standardization*, in *ITU Kaleidoscope: Challenges for a Data-Driven Society*, 2017.

HONG CHUI W., *Quantitative Legal Research*, in MCCONVILLE M., HONG CHUI W. (eds.), *Research Methods for Law*, 2nd ed., Edinburgh, Edinburgh University Press, 2017.

HUGHES J., *Champagne, Feta, and Bourbon: The Spirited Debate About Geographical Indications*, in *Hastings Law Journal*, 2006, 58.

INGRASSIA M., BACARELLA S., COLUMBA P., ALTAMORE L., CHIRONI S., *Traceability and Labelling of Food Products from the Consumer Perspective*, in *Chemical Engineering Transactions*, 2017, 58.

ISIDORI A., *When Blockchain Technology and Intellectual Property Meet: Perspectives and Limits in the Protection of Geographical Indications*, in BIEDAR., BLECHOVÁ A., LÓPEZ E. F., POTENZANO R. (eds.) *Legal Challenges of Disruptive Technologies*, 1st ed., Baden, Nomos, 2025.

ITO K., O'DAIR M., *A Critical Examination of the Application of Blockchain Technology to Intellectual Property Management*, in TREIBLMAIER H., BECK R. (eds.), *Business Transformation through Blockchain*, Cham, Springer, 2019.

IYOHA A., *The Importance of Interview for Data Collection in Legal Research*, in *International Journal of Law and Clinical Legal Education*, 2020, 1.

JANNARELLI A., *Mercato e concorrenza nella nuova PAC: un cantiere aperto su un futuro incerto*, in *Rivista di diritto agrario*, 2021, 4, I.

JANNARELLI A., *La tutela dei produttori agricoli nella filiera agro-alimentare alla luce della direttiva sulle pratiche commerciali sleali business to business*, in *Rivista di diritto agrario*, 2019, 1, I.

JANNARELLI A., *Profili giuridici del sistema agro-alimentare e agro-industriale*, 2nd ed., Bari, Cacucci Editore, 2018.

JANNARELLI A., *Il diritto agrario del nuovo millennio tra food security, food safety e sustainable agriculture*, in *Rivista di diritto agrario*, 2018, 4, I.

JANNARELLI A., *I rapporti contrattuali nella filiera agro-alimentare*, in A. GERMANÒ, E. ROOK BASILE (eds.) *I contratti agrari (collana Trattato nei contratti)*, Torino, Utet Giuridica, 2015.

JANNARELLI A., *La qualità dei prodotti agricoli: considerazioni introduttive ad un approccio sistemico*, in *Diritto e Giurisprudenza agraria, alimentare e dell'ambiente*, 2004, 1.

JIMÉNEZ J. I., *Wine NFT cryptoassets: EU regulatory issues and market challenges*, in *BIO Web of Conferences. 44th World Congress of Vine and Wine*, 2023, 68.

KAMPERMAN SANDERS A., *Incentives for and Protection of Cultural Expression: Art, Trade and Geographical Indications*, in *The Journal of World Intellectual Property*, 2010, 13.

KENNEDY J. P., *Counterfeit Products Online*, in HOLT T. J., BOSSLER A. M. (eds.), *The Palgrave Handbook of International Cybercrime and Cyberdeviance*, Londra, Palgrave Macmillan, 2020.

KLAUS B., *Scope of Protection of the Protected Geographical Indication 'Aceto Balsamico di Modena': The Ghosts of the Past Return*, in *European Food and Feed Law Review*, 2019, 2,

KLERKX L., JAKKU E., LABARTHE P., *A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda*, in *NJAS - Wageningen Journal of Life Science*, 2019, 90.

KODAN R. et al., *Internet of things for food sector: Status quo and projected potential*, in *Food Reviews International*, 2020, 6.

KONASHEVYCH O., *Why 'Permissioned' and 'Private' are not Blockchains*, 2019.

KONFO T. R. C. et al., *Recent advances in the use of digital technologies in agri-food processing: a short review*, in *Applied Food Research*, 2023, 3.

KONO T. (ed.), *Intangible cultural heritage and intellectual property: communities, cultural diversity and sustainable development*, Anversa, Intersentia Publishing, 2009.

KÖHLER S., BAGERS., PIZZOL M., *Sustainability standards and blockchain in agri-food supply chains: Synergies and conflicts*, in *Technological Forecasting and Social Change*, 2022, 185.

- KÖHLER S., PIZZOL M., *Technology Assessment of Blockchain-Based Technologies in the Food Supply Chain*, in *Journal of Cleaner Production*, 2020, 269.
- KRAGL I., *Failure to Deliver the Transparency Promised by European Law*, in *European Food and Feed Law Review*, 2025, 2.
- KRITIKOS M., *Precision Agriculture in Europe. Legal, Social, and Ethical Considerations*, European Parliament Research Service, Bruxelles, 2017.
- KYRYLENKO A., *Sprechen Sie Cambozola? On the Lessons from the Early Years of 'Evocation'*, in BOSHER H., ROSATI E. (eds.), *Developments and Directions in Intellectual Property Law*, Oxford, Oxford University Press, 2023.
- LA MORGIA M., *Il caso Champanillo: protezione ad ampio raggio per le DOP*, in *Diritto & Giustizia*, 2022, 101.
- LA PORTA B., *Contributo per una visione contemporanea dell'azienda agricola: tra sostenibilità e sfide del mondo digitale*, Torino, Giappichelli, 2023.
- LA PORTA B., *Riflessioni per una definizione di «prodotto alimentare sostenibile»*, in *Rivista di diritto agrario*, 2021, 2, I.
- LANGE S., POHL J., SANTARIUS T., *Digitalization and energy consumption. Does ICT reduce energy demand?*, in *Ecological Economics*, 2020, 176
- LARSON J., *Relevance of geographical indications and designations of origin for the sustainable use of genetic resources*. Study prepared for the Global Facilitation Unit for Underutilized Species, FAO, 2007.
- LATTANZI P., ISIDORI A., *Il complesso cammino delle agroenergie verso la sostenibilità. Quale ruolo per le comunità energetiche rinnovabili?*, in *Przegląd prawa rolnego (Agricultural Law Review)*, 2024, 2.
- LATTANZI P., *L'agricoltura di precisione: fisionomia, quadro strategico di riferimento e implicazioni giuridiche*, in *Rivista di diritto alimentare*, 2024, 2.
- LATTANZI P., *La transizione verso un sistema alimentare sostenibile nel Green Deal*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.
- LATTANZI P., MARIANI S., *Blockchain and the food supply chain, the future of food traceability*, in CALIGIURI A. (ed.) *Legal technology transformation. A practical assessment*, Napoli, Editoriale Scientifica, 2020.
- LATTANZI P., *L'agricoltura di precisione. Una sfida anche per il diritto*, in *Agriregionieuropa*, 2018, 53.
- LATTANZI P., *L'agricoltura di fronte alla sfida della digitalizzazione: opportunità e rischi di una nuova rivoluzione*, in *Rivista di diritto agrario*, 2017, 4, I.
- LECCESE V., *Lavoro, sfruttamento e tutele nella filiera agroalimentare: un itinerario*, in *Giornale di diritto del lavoro e di relazioni industriali*, 2018, 2.
- LECZYKIEWICZ D., WEATHERHILL S. (eds.), *The Images of the Consumer in EU Law*, Oxford, Hart Publishing, 2016.
- LEEUEW F. L., *Empirical Legal Research: The Gap between Facts and Values and Legal Academic Training*, in *Utrecht Law Review*, 2015, 2.
- LEGGE M., *Blockchain Explorer*, in *Crypto Glossary*, 2023.
- LEMLEY M. A., VOLOKHE., *Law, virtual reality and augmented reality*, in *University of Pennsylvania Law Review*, 2018, 166.

LEONE L., *Big data e intelligenza artificiale nell'agricoltura europea 4.0: una lettura etico-giuridica*, in *Diritto agroalimentare*, 2024, 3.

LIGHTBOURNE M., *What's in a Name? The Journey of Geographical Indications from Paris 1883 to Geneva 2015*, in *GRUR International*, 2021, 10.

LYCETT M., *'Datafication': Making sense of (big) data in a complex world*, in *European Journal of Information Systems*, 2013, 4.

LUCIFERO N., *I gruppi dei produttori nel sistema europeo dei regimi dei prodotti agricoli di qualità*, in *Le nuove leggi civili commentate*, 2025, 2.

LUCIFERO N., *International Protection of Geographical Indications*, in A.A. V.V., *European and Global Food Law*, Milano, Wolters Kluwer, 2025.

LUCIFERO N., *Imprese agricole e start-up tra innovazione e ricambio generazionale*, in MAURO M. (ed.) *Start-up e PMI innovative in agricoltura. Imprese agricole tra innovazione e sostenibilità*, Padova, Cedam, 2024.

LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.

LUCIFERO N., *Il modello europeo sulle indicazioni geografiche a seguito dell'adesione dell'Unione europea all'Atto di Ginevra dell'Accordo di Lisbona per la protezione e la registrazione internazionale delle indicazioni geografiche*, in *Rivista di diritto alimentare*, 2022, 4.

LUCIFERO N., *I Consorzi di tutela dei vini e le funzioni erga omnes*, in *Rivista di diritto alimentare*, 2019, 1.

LUCIFERO N., *Denominazioni composte, denominazioni generiche e la tutela delle denominazioni di origine protette. Il caso "parmesan"*, in *Giurisprudenza italiana*, 2009.

MACCIONI G., *Qualità delle produzioni e "sostegno specifico"*, in *Rivista di diritto alimentare*, 2009, 3.

MACCIONI G., *L'ambiguità della qualità*, in *Rivista di diritto alimentare*, 2009, 1.

MAGNUSON W., *Blockchain Democracy: Technology, Law and the Rule of the Crowd*, Cambridge, Cambridge University Press, 2020.

MAHY A., D'ATH F., *The Case of the "Champagner Sorbet" - Unlawful Exploitation or Legitimate Use of the Protected Name "Champagne"?*, in *European Food and Feed Law Review*, 2017, 12.

MALSCH M., *Empirical Legal Research*, in GARCIA BLES AJ. J. (ed.), *Contemporary Methods in International Legal Research. Between Legal Interpretivism and Empirical Inquiry*, Cham, Springer, 2024.

MANSERVISI S., *Il ruolo emergente del diritto agroalimentare tra economia circolare e SDGs di Agenda 2030*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

MANSERVISI S., *Nuovi profili del diritto ambientale dell'Unione europea. Tra evoluzione scientifica e sviluppo sostenibile*, Roma, Aracne, 2018.

MANSERVISI S., *Verso un uso sostenibile dell'energia, il miglioramento dell'efficienza energetica e la creazione di modelli di produzione di consumo sostenibili anche nel settore alimentare*, in *Rivista di diritto agrario*, 2017, 2, I.

MANSERVISI S., *Le Convenzioni internazionali sul clima e il ruolo dell'agricoltura*, in *Agricoltura, Istituzioni, Mercati*, 2016, 2.

MANTROV V., *Do you Prefer Scotch or German Whisky? CJEU Judgment in the Scotch Whisky and Glen Buchenbach Dispute*, in *European Journal of Risk Regulation*, 2018, 4.

MARCHI B. et al., *The disruptive potential of blockchain technologies in the energy sector*, in *ECEEE Summery Study Proceedings*, 2019.

MARESCOTTI A. et al., *Are Protected Geographical Indications Evolving Due to Environmentally Related Justifications? An Analysis of Amendments in the Fruit and Vegetable Sector in the European Union*, in *Sustainability*, 2020, 12.

MARIE-VIVIEN D. et al., *Controversies around geographical indications: Are democracy and representativeness the solution?*, in *British Food Journal*, 2019, 12.

MASINI S., *Informazioni e scelte del consumatore*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

MASINI S., *Italian sounding: la pirateria commerciale ostacolo allo sviluppo dell'agroalimentare*, in *Geopolitica*, 2023, 2.

MASINI S., *Piattaforme online e motori di ricerca: sul rischio di accesso del consumatore digitale di alimenti*, in *Diritto agroalimentare*, 2023, 3.

MASINI S., *Le indicazioni geografiche*, in *Diritto agroalimentare*, 2019, 3.

MASINI S., *Sull'imbottigliamento in zona di origine: conflitto di filiera e modello di sviluppo territoriale*, in *Rivista di diritto alimentare*, 2012, 1.

MASINI S., *Corso di diritto alimentare*, Milano, Giuffrè, 2011.

MASINI S., *Territorio di origine, nomen e mercato: il caso Feta ancora alla ribalta*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2006.

MASINI S., *Sulla funzione delle specialità tradizionali garantite: una nomenclatura tra tradizione e delocalizzazione*, in *Diritto e giurisprudenza agraria alimentare e dell'ambiente*, 2006, 9.

MASINI S., *Dal «mistero» dell'origine al diritto all'informazione nella presentazione dei prodotti agro-alimentari*, in *Diritto e Giurisprudenza agraria, alimentare e dell'ambiente*, 2003, 2.

MASINI S., RUBINO V. (eds.), *La sostenibilità in agricoltura e la riforma della PAC*, Bari, Cacucci Editore, 2021.

MAURO M., *La legittimazione a proporre opposizione alle richieste di registrazione di una DOP o IGP e modifica del disciplinare: la nozione europea di interesse legittimo*, in *Rivista di diritto alimentare*, 2022, 4.

MAURO M., *La provenienza geografica dei prodotti agroalimentari tra marchi di certificazione, collettivi e denominazione di origine. Prime riflessioni a margine dell'art. 11 bis del Codice della proprietà industriale*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

MAY T. C., *The Crypto Anarchist Manifesto*, 1988.

MAZZANTI E., *La disciplina sanzionatoria penale nella produzione degli alimenti*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

MCKINSEY GLOBAL INSTITUTE, *Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy*, Washington DC, 2013.

MILLER A., *Permissioned and Permissionless Blockchains*, in SHETTY S. S., KAMHOUA C. A., NJILLA L. (eds.), *Blockchain for Distributed Systems Security*, Wiley-IEEE Press, 2019.

MIRANDA J., PONCE P., MOLINA A., WRIGHT P., *Sensing, smart and sustainable technologies for Agri-Food 4.0*, in *Computers in Industry*, 2019, 108.

MIK E., *Smart contracts: terminology, technical limitations and real world complexity*, in *Law, Innovation and Technology*, 2017, 9, 2.

MOERLAND A., *Geographical Indications upgraded: an overview of the recent changes in EU legislation on GI protection*, in *Maastricht Law. Faculty of Law Research Paper series*, 2025, 1.

MOERLAND A., *Geographical indications and innovation: what is the connection?*, in DREXL J., SANDERS A. K. (eds.), *The Innovation Society and Intellectual Property*, Cheltenham, Edward Elgar Publishing Limited, 2019.

MONTELIONE E., *Alcune considerazioni di tipo economico e giuridico a margine del «caso Rioja»*, in *Giurisprudenza italiana*, 2000.

MONTINI M., *L'interazione tra gli SDGs ed il principio dello sviluppo sostenibile per l'attuazione del diritto internazionale dell'ambiente*, in *www.federalismi.it*, 2019, 9.

MONTINI M., *Riflessioni critiche sull'Accordo di Parigi sui cambiamenti climatici*, in *Rivista di diritto internazionale*, 2017, 3.

MONTINI M., VOLPE F., *Sustainable Development Goals: "molto rumore per nulla?"*, in *Rivista giuridica dell'ambiente*, 2015, 3.

MORETTI G., *Evocazione e tutela di indicazioni geografiche composte: le scelte della giurisprudenza in tema di Aceto Balsamico*, in *Rivista di diritto alimentare*, 2021, 2.

MULLIGAN C. et al., *Blockchain for sustainability: A systematic literature review for policy impact*, in *Telecommunications Policy*, 2024, 2.

MURPHY C. N., YATES J., *The International Organization for Standardization (ISO): Global Governance through Voluntary Consensus*, Londra, Routledge, 2009.

MYSHKO A. et al., *Towards the twin transition in the agri-food sector? Framing the current debate on sustainability and digitalisation*, in *Journal of Cleaner Production*, 2024, 452.

NAIR L. R., *Domain Name Protection for Geographical Indications: A European Gamechanger*, in VANDECANDELAERE E., MARIE-VIVIEN D., THÉVENOD-MOTTET E., BOUHADDANE M., PIEPRZOWNIK V., TARTANAC F., PUZONE I., *Worldwide Perspectives on Geographical Indications*, Cham, Springer, 2025.

NICOLINI J., MONDIN D., *IG come ingredienti di prodotti trasformati: per fama o per qualità?*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2025, 1.

NIELSEN L. B., *The need for Multi-method approaches in Empirical Legal Research*, in CANE P., KRITZER H. (eds.), *The Oxford Handbook of Empirical Legal Research*, Oxford, Oxford University Press, 2010.

NOTO LA DIEGA G., STACEY J., *Can Permissionless Blockchains be Regulated and Resolve Some of the Problems of Copyright Law?*, in RAGNEDDA M., DE STEFANIS G. (eds.), *Blockchain & Web 3.0: Social, Economic, and Technological Challenges*, Londra, Routledge, 2020.

OECD, *How's Life in the Digital Age? Opportunities and Risks of the Digital Transformation for People's Well-being*, Paris, OECD Publishing, 2019.

OECD, *Farm Management Practices to Foster Green Growth*, Paris, OECD Publishing, 2017.

- OECD, *Data-Driven Innovation: Big Data for Growth and Well-Being*, Paris, OECD Publishing, 2016.
- ØLNES S., UBACHT J., JANSSEN M., *Blockchain in government: benefits and implications of distributed ledger technology for information sharing*, in *Government Information Quarterly*, 2017, 3.
- ORIGIN ITALIA, *Rapporto E-Food DOP IGP Italia. E-commerce e food delivery DOP IGP in Italia*, 2024.
- OURY J. P., *Blockchain: A Strong Link to Rebuild Confidence in the Agriculture of the Future?*, in *European Scientist*, 2018.
- PAGANIZZA V., *More Holes than Cheese: PDOs, Evocation and a Possible Solution*, in *European Food and Feed Law Review*, 2015, 3.
- PAGANIZZA V., *Informazioni volontarie sugli alimenti*, in RUBINO V. (ed.), *Le informazioni sugli alimenti ai consumatori. Il Regolamento (UE) n. 1169/2011*, Roma, Aracne, 2015.
- PAGANIZZA V., *Dalla padella alla brace: la Piadina Romagnola IGP, dal “testo” al Consiglio di Stato*, in *Rivista di diritto alimentare*, 2014, 3.
- PALMETER D., MAVROIDIS P. C., MEAGHER N., *Dispute Settlement in the World Trade Organization*, 3rd ed., Cambridge, Cambridge University Press, 2022.
- PANDEY V., PANT M., SNASEL V., *Blockchain technology in food supply chains: review and bibliometric analysis*, in *Technology in society*, Elsevier, 2022, 69.
- PAOLONI L., *Sostenibilità e innovazione in agricoltura. Dilemma o opportunità?*, in *Diritto agroalimentare*, 2024, 3.
- PAOLONI L., *La sostenibilità “etica” della filiera agroalimentare*, in *Rivista di diritto alimentare*, 2020, 4.
- PAOLONI L., *Contractual scope in the agri-food market: the case of protection consortia in the wine sector*, in MARTINO G. et al. (eds.), *It's a jungle out there – the strange animals of economic organization in agri-food value chains*, Wageningen, Wageningen Academic Publishers, 2017.
- PAOLONI L., *I Consorzi di tutela ed i contratti per le politiche dell'offerta dopo il d.lgs. 61/2010*, in *Rivista di diritto alimentare*, 2012, 3.
- PAOLONI L., *L'uso sostenibile della terra*, in *Agricoltura, Istituzioni, Mercati*, 2011, 2.
- PAOLONI L., *Programmazione della produzione e lesione delle regole antimonopolistiche nei consorzi di tutela dei prodotti agro-alimentari tipici*, in *Diritto e giurisprudenza agraria e dell'ambiente*, 1998, 4.
- PARMENTOLA A., PETRILLO A., TUTORE I., DE FELICE F., *Is blockchain able to enhance environmental sustainability? A systematic review and research agenda from the perspective of Sustainable Development Goals (SDGs)*, in *Business Strategy and the Environment*, 2021, 1.
- PAROLA L., MERATI P., GAVOTTI G., *Blockchain e smart contract: questioni giuridiche aperte*, in *Contratti*, 2018, 6.
- PASTORINO L. F., *Gli accordi bilaterali in materia di IG e il loro legame con il WTO come chiave di lettura*, in *Rivista di diritto alimentare*, 2022, 3.
- PASTORINO L. F., *Indicazioni geografiche tra UE e Mercosur*, in TROIANO S., SCHMIDT-KESSEL M. (eds.), *Diritto, cambiamenti e tecnologie nel dialogo italo-tedesco*, Napoli, Edizioni Scientifiche Italiane, 2022.
- PEARSON S. et al., *Are Distributed Ledger Technologies the panacea for food traceability?*, in *Global Food Security*, 2019, 20.

PERNA A., *Le origini della blockchain*, in BATTAGLINI R., GIORDANO M. T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

PETRELLI L., *I regimi di qualità nel diritto alimentare dell'Unione europea. Prodotti DOP, IGP, STG, biologici e delle regioni ultraperiferiche*, Napoli, Editoriale Scientifica, 2012.

PETRELLI L., *Prodotti DOP (denominazione di origine protetta), IGP (indicazione geografica protetta) e certificazione*, in *Rivista di diritto agrario*, 1999, 1, I.

PETRELLI L., *Qualità, politiche di qualità dei prodotti agricoli e principio di libera circolazione delle merci nel mercato comunitario*, in CAPIZZANO E. (ed.), *Diritti fondamentali qualità dei prodotti agricoli e tutela del consumatore*, Camerino, Università di Camerino, 1993.

PICK B., *Intellectual Property and Development. Geographical Indications in Practice*, Londra, Routledge, 2022.

PICK B., MARIE-VIVIEN D., *Representativeness in Geographical Indications: A Comparison between the State-Driven and Producer-Driven Systems in Vietnam and France*, in *Sustainability*, 2021, 13.

PIERCE F. J., NOWAK P., *Aspects of Precision Agriculture*, in *Advances in Agronomy*, 1999, 67.

PISCIOTTA TOSINI G., *Il difficile innesto della sostenibilità nei disciplinari DOP e IGP secondo le regole del nuovo regolamento 1143 del 2024: l'esperienza nell'ambito del progetto Prin Pnrr INWINE*, in *Rivista di diritto alimentare*, 2025, 1.

PISCIOTTA TOSINI G., *Contratti tecnologici per l'effettività del diritto a una libertà alimentare informata*, in *Rivista di diritto alimentare*, 2024, 4.

PISCIOTTA TOSINI G. (ed.), *La rilevanza della digitalizzazione per un mercato agroalimentare sostenibile*, Atti del Convegno, Palermo, Palermo University Press, 2023.

PISCIOTTA TOSINI G. (ed.), *Comunicazioni di sostenibilità e Blockchain. Strumenti giuridici e prospettive tecnologiche per il settore vitivinicolo*. Atti del Convegno, Palermo, Palermo University Press, 2022.

POLITOU E., CASINO F., ALEPIS E., PATSAKIS C., *Blockchain Mutability: Challenges and Proposed Solutions*, in *IEEE Transactions on Emerging Topics in Computing*, 2021, 9, 4.

POLLICINO O., DE GREGORIO G. (eds.), *Blockchain and Public Law. Global Challenges in the Era of Decentralisation*, Cheltenham, Edward Elgar Publishing Limited, 2021.

POMARICI E., *Sostenibilità e qualità multidimensionale nel nuovo "Pacchetto Qualità": strumenti e criticità*, in *'Il nuovo Pacchetto Qualità'. Innovazioni normative tra criticità e opportunità*, Accademia dei Georgofili, 11.02.2025.

PRETE F., *La Tracciabilità*, in BORGHI P., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare Italiano e dell'Unione Europea*, Milano, Giuffrè, 2024.

PRETE F., *Le nuove frontiere della protezione delle indicazioni geografiche tra evocazione suggestiva dei luoghi legati ad una Dop e vera origine del prodotto*, in *Rivista di diritto agrario*, 2019, 3, II.

PRETE F., *Evocazione di indicazione geografica di bevande spiritose: la nozione eurocomunitaria di consumatore e il ruolo della Corte di giustizia nel processo di uniformazione dei principi del settore alimentare*, in *Rivista di diritto agrario*, 2016, 2, II.

PRETE F., *Piani di Regolazione dell'offerta di formaggi DOP e IGP e limiti alla concorrenza in agricoltura*, in *Rivista di diritto agrario*, 2015, 3, I.

RAINONE A., *La disciplina della blockchain e le sue implicazioni pratico-applicative: il caso del diritto d'autore*, Master Degree Thesis, Università degli Studi di Torino, 2020-2021.

RAMPAZZO N., *Geographical indications and European agricultural policies*, in VALLÈS J.A., RAMPAZZO N., KEPINSKI J. (eds.), *Intellectual Property in Agriculture. Plant breeders' rights and geographical indications: towards a comprehensive approach to Intellectual Property in Agriculture*, Navarra, Editorial Aranzadi, 2022.

RAMPONE F., *Smart contracts: né smart, né contracts*, in *Rivista di diritto privato*, 2020, 2.

RANAR.L., TRICASE C., DE CESARE L., *Blockchain technology for a sustainable agri-food supply chain*, in *British Food Journal*, 2021, 123, 11.

RANA R. L., GIUNGATO P., TARABELLA A., TRICASE C., *Blockchain Applications and Sustainability Issues*, in *Amfiteatru Economic*, 2019, 13.

RANCHORDAS S., VINCI V., *Regulatory sandboxes and innovation-friendly regulation: between collaboration and capture*, in *Italian Journal of Public Law*, 2024, 1

RANTALA J., *Blockchain as a medium for transindividual collective*, in *Culture, Theory and Critique*, 2019, 3.

RASMUSSEN N., *From Precision Agriculture to Market Manipulation: A New Frontier in the Legal Community*, in *Minnesota Journal of Law Science & Technology*, 2016.

RAUCHS M. et al., *Distributed Ledger Technology Systems: A Conceptual Framework*, Cambridge, Cambridge Centre for Alternative Finance, 2018.

RAUSTIALA K., MUNZER S. R., *The Global Struggle over Geographical Indications*, in *European Journal of International Law*, 2007, 2.

REJEB A. et al., *The Interplay between the Internet of Things and agriculture: A bibliometric analysis and research agenda*, in *Internet of Things*, 2022, 19.

REMOTTI G., *Possibili funzioni ausiliarie delle tecnologie blockchain per marchi e indicazioni di origine: tracciabilità della filiera agroalimentare, dinamica competitiva e meccanica mercantile*, in *Media Laws Rivista del diritto dei media*, 2021, 3.

REMOTTI G., *Blockchain Technologies per la filiera agroalimentare*, in *Alimenta*, 2021, 3-4.

REMOTTI G., *Blockchain smart contracts. Un primo inquadramento*, in *Osservatorio del diritto civile e commerciale*, 2020.

RICCI L., *La tecnologia delle Blockchain: concetti di base*, in NAVARRETTA E., RICCI L., VALLINI A. (eds.), *Il potere della tecnica e la funzione del diritto: un'analisi interdisciplinare di Blockchain*, Vol. I, Torino, Giappichelli, 2021.

RICCI CURBASTRO R., *Il ruolo di garanzia dei consorzi di tutela*, in *Rivista di diritto alimentare*, 2012, 1.

RIVIÈRE J. M., *Blockchain technology and IP – investigating benefits and acceptance in governments and legislations*, in *Junior Management Science*, 2018, 3.

RIZZIOLI S., *Il condizionamento dei prodotti con denominazione d'origine*, in *Rivista di diritto agrario*, 2003, 4, II.

RIZZUTO M. C., *L'uso del termine "Balsamico" è generico e non crea "confusione per evocazione" con la IGP Aceto Balsamico di Modena*, in *Rivista di diritto alimentare*, 2025, 3.

RIZZUTO M. C., *Indicazioni geografiche e pratiche sostenibili: prime considerazioni alla luce del Regolamento (UE) 2024/1143*, in *Persona e Mercato*, 2024, 2.

RIZZUTO M. C., *Filiere corte tra sostenibilità e valorizzazione del territorio*, in *Rivista di diritto alimentare*, 2023, 1.

ROLANDI S., *Food E-commerce and the Law. A Legal Analysis of the Role of Food Information in Strengthening Trust in EU Business-to-Consumers Food E-Commerce*, Torino, Giappichelli, 2025.

ROLANDI S., *La Blockchain nei sistemi agroalimentari*, in COSTATO L., ALBISINNI F., PAGANIZZA V. (eds.), *Trattato breve di diritto agrario Italiano e dell'Unione europea*, Padova, Cedam, 2023.

ROLANDI S., *Il ruolo attribuito alla digitalizzazione nella Strategia Farm to Fork dell'Unione Europea, tra riferimenti espliciti e nascosti. Quali interventi legislativi in quattro anni?*, in *Rivista di diritto agrario*, 2023, 4, I.

ROLANDI S., BRUNORI G., BACCO M., SCOTTI I., *The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts*, in *Sustainability*, 2021, 13.

ROLANDI S., *Food E-commerce as a New Tool for the Growth of the Economy. European Legal Framework for Information of Prepacked Food Sold Online*, in ALABRESE M. G., BRUNORI M., ROLANDI S., SABA A. (eds.) *Agricultural Law. Current Issues from a Global Perspective*, Cham, Springer, 2017.

RONCIN F., *Appellation d'origine et usages locaux: de la nécessité de l'innovation*, Presentation at the Conference in Les Mans, 28-30 October 1999, 67 EAAE Seminar.

ROOK BASILE E., *Attestazioni di specificità e prodotti tipici*, in COSTATO L. (ed.), *Trattato breve di diritto agrario italiano e comunitario*, Padova, Cedam, 2003.

ROSE D. C., CHILVERS J., *Agriculture 4.0: Broadening Responsible Innovation in an Era of Smart Farming*, in *Frontiers in Sustainable Food Systems*, 2018, 2.

ROSENFELD M., *Analyses of Bitcoin Pooled Mining Reward Systems*, in *Arxiv*, 2011.

ROSS E.S., *Nobody Puts Blockchain in a Corner: the Disruptive Role of Blockchain Technology in the Financial Services Industry and Current Regulatory Issues*, in *Catholic University Journal of Law and Technology*, 2017, 25, 2.

RUBINO V., *Il ruolo dei consorzi di tutela nella protezione della qualità*, in BORGHI B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

RUBINO V., *Accordi preferenziali di nuova generazione e fragilità nella cooperazione fra unione europea e stati membri: alcune riflessioni sul caso "CETA" e la tutela delle indicazioni geografiche dei prodotti alimentari*, in LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.

RUBINO V., *Sulle ragioni dell'incoerenza fra il dire e il fare: l'indicazione dell'origine degli alimenti, il mercato interno e il regolamento di esecuzione della Commissione (UE) n. 2018/775*, in *Diritto agroalimentare*, 2019, 2.

RUBINO V., *The "indirect" or "conceptual" evocation of a protected designation of origin and its practical and juridical effect after ECJ case Queso Manchego*, in *Revesta de derecho comunitario europeo*, 2019, 64.

RUBINO V., *La Corte di giustizia chiarisce i criteri per l'uso legittimo di una DOP – IGP come ingredienti caratterizzanti nell'etichettatura degli alimenti trasformati o composti*, in *Alimenta*, 2018, 9.

RUBINO V., *L'evoluzione della nozione di consumatore nel processo di integrazione europea*, in *Il diritto dell'Unione europea*, 2017, 2.

RUBINO V., *L'evoluzione della nozione di "consumatore" fra tutela dei diritti della persona, economia collaborativa e futuro del mercato interno dell'Unione europea*, in TRIGGIANI E., CHERUBINI F., INGRAVALLO I., NALIN E., VIRZO R. (eds.), *Dialoghi con Ugo Villani*, Bari, Cacucci Editore, 2017.

RUBINO V., *From “Cambozola” to “Toscorno”: The Difficult Distinction between “Evocation” of a Protected Geographical Indication, “Product Affinity” and Misleading Commercial Practices*, in *European Food and Feed Law Review*, 2017, 4.

RUBINO V., *L'evocazione di una denominazione geografica protetta ed il “consumatore medio dell'Unione europea”*, in *Il diritto dell'economia*, 2016, 2.

RUBINO V., *La protezione delle denominazioni geografiche dei prodotti alimentari nell'Unione europea dopo il regolamento 1151/2012 UE*, in *Rivista di diritto alimentare*, 2013, 4.

RUGGERI F., LEROY C., MAZÉ A., *How Can Collective Action Support the Agroecological Transition in Geographical Indication Vineyards? Insights from the Loire Valley Wine Area*, in *Sustainability*, 2023, 15.

RUIZ X.F. *et al.*, *How are food Geographical Indications evolving? An analysis of EU GI amendments*, in *British Food Journal*, 2018, 8.

RUIZ-REAL J.L. *et al.*, *A look at the past, present and future research trends of artificial intelligence in agriculture*, in *Agronomy*, 2020, 10.

RUSSO L., *La contrattazione digitale nella filiera agroalimentare: verso la scomparsa dell'umano?*, in DI LAURO A., LEONE L., STRAMBI G. (eds.), *Normatività contemporanea. Norme sensoriali e norme sperimentali nel settore alimentare*, Pisa, Edizioni ETS, 2025.

RUSSO L., *Le nuove sfide della digitalizzazione nei contratti della filiera agroalimentare*, in *Rivista di diritto alimentare*, 2025, 3.

RUSSO L., *La regolazione dell'offerta dei prodotti di qualità e i consorzi di tutela*, in BORGHI P., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare Italiano e dell'Unione Europea*, Milano, Giuffrè, 2024.

RUSSO L., *Blockchain e smart contracts nei contratti della filiera agroalimentare*, in BORGHI P., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare Italiano e dell'Unione Europea*, Milano, Giuffrè, 2024.

RUSSO L., *Il diritto agrario fra innovazione e sostenibilità*, in *Rivista di diritto agrario*, 2023, 3, I.

RUSSO L., *L'uso della blockchain nella lotta alle p.c.s. nei contratti di cessione nella filiera agroalimentare*, in PISCIOTTA TOSINI G. (ed.), *La rilevanza della digitalizzazione per un mercato agroalimentare sostenibile*, Atti del Convegno, Palermo, Palermo University Press, 2023.

RUSSO L., *Communication of the origin of food products: legal aspects*, in *Agricultural Law Review (Przegląd prawa rolnego)*, 2021, 29.

RUSSO L., *Le pratiche commerciali scorrette nella filiera agroalimentare tra diritto UE e diritto interno*, in *Diritto agroalimentare*, 2020, 2.

RUSSO L., *La riforma della PAC del 2013 e le relazioni contrattuali tra gli operatori del mercato*, in *Agricoltura, Istituzioni e Mercati*, 2013, 1-2.

SABA A., *The Renewed Role of Producer Organisations in Enhancing Sustainable Agricultural and Food Systems under the EU Common Market Organisation*, in *Opinio Juris in Comparatione*, 2024, 2.

SABA A., *The EU policy framework on the digital transition of farming and food systems*, in ALABRESE M., SABA A. (eds.), *EU law on sustainable and climate resilient agriculture after the European Green Deal*, Pula, Rurinnova, 2023.

SABA A., *Blockchain e vino: una nuova frontiera*, in *Diritto agroalimentare*, 2019, 3.

SAIJA R., *L'innovazione tra diritto dell'agricoltura e regole del cibo. Paradigmi consolidati e nuovi scenari*, Padova, Cedam, 2024.

SAIJA R., *La tutela delle denominazioni composte e la peculiarità in tema di evocazione. Nuovi percorsi della giurisprudenza di merito*, in *Rivista di diritto alimentare*, 2023, 2.

SAIJAR., *La qualità alimentare nel diritto europeo dal 1992 a oggi*, in AMBROSIO G., SAIJA R., CARRARA L. (eds.), *Prodotti alimentari di qualità. Regole. Casi. Questioni*, Padova, Cedam, 2022.

SALVI L., *Le certificazioni private nel settore alimentare*, in COSTATO L., BORGHİ P., RIZZIOLI S., PAGANIZZA V., SALVI L. (eds.), *Compendio di diritto alimentare*, 9th ed., Milano, Wolters Kluwer, 2019

SALVI L., *Traceability and Hygiene Package*, in COSTATO L., ALBISINNI F. (eds.) *European and Global Food Law*, Milano, Wolters Kluwer, 2016.

SANDER F., SEMEIJN J., MAHR D., *The Acceptance of Blockchain Technology in Meat Traceability and Transparency*, in *British Food Journal*, 2018, 1.

SAPIENZA S., *Big Data, Algorithms and Food Safety, A Legal and Ethical Approach to Data Ownership and Data Governance*, Cham, Springer, 2022.

SARZANA DI S. IPPOLITO F., NICOTRA M., *Diritto della blockchain, intelligenza artificiale e IoT*, Milano, Ipsoa, 2018.

SATOSHI NAKAMOTO, *Bitcoin: A Peer-to-Peer Electronic Cash System*, 2008.

SCALIA F., *L'Accordo di Parigi e i «paradossi» delle politiche dell'Europa su clima ed energia*, in *Diritto e giurisprudenza agraria, alimentare e dell'ambiente*, 2016, 6.

SCIAUDONE A., *Le regole dell'UE in tema di qualità dei prodotti agroalimentari e il commercio con i paesi terzi*, in *Rivista di diritto alimentare*, 2010, 4.

SCHEBESTA H., *How to Save the Farm to Fork Strategy: A Two-Phased Approach*, in *European Food and Feed Law Review*, 2023, 4.

SCHEBESTA H., ALESSANDRINI M., CAZZINI F., MACCHI C., ROLANDI S., *Tour de table: Farm to Fork law update*, in *European Food and Feed Law Review*, 2022, 3.

SCHEBESTA H., CANDEL J. J. L., *Game-changing potential of the EU's Farm to fork Strategy*, in *Nature food*, 2020, 1.

SCHEBESTA H., BERNAZ N., MACCHI C., *The European union Farm to fork strategy: sustainability and responsible business in the food supply chain*, in *European food and feed law review*, 2020, 15.

SCHIANO R., *L'applicazione del diritto della concorrenza nel settore agricolo. Brevi note in margine al caso dei consorzi di tutela dei prodotti tipici*, in *Il Diritto dell'Unione Europea*, 2000, 4.

SCHINCKUS C., *The good, the bad and the ugly: An overview of the sustainability of blockchain technology*, in *Energy Research & Social Science*, 2020, 6.

SCHUSTER E., *Cloud Crypto Land*, in *LSE Law Society and Economy Working Papers*, 2019, 17.

SCUDERI A., *La digital transformation nel sistema agroalimentare*, in GUZZARDI G. (ed.), *Persona e mercato nella società digitale. Atti delle giornate di studi (Catania, 13 dicembre 2022 e 4 maggio 2023)*, Napoli, Editoriale Scientifica Italiana, 2024.

SCUDERI A., VERA F., TIMPANARO G., *The supply chain value of PDO and PGI food products through the application of blockchain*, in *Quality-Access to Success*, 2019, 2.

SECUNDO G., SCHENA R., RUSSO A., SCHIAVONE F., *The impact of digital technologies on the achievement of the Sustainable Development Goals: evidence from the agri-food sector*, in *Quality Management & Business Excellence*, 2022.

SGARBANTI G., *La cooperazione tra Stati UE (il caso Parmesan, il regolamento 2006/2004)*, in UBERTAZZI B., MUNIZ ESPADAE. (eds.), *Le indicazioni di qualità degli alimenti. Diritto internazionale ed europeo. L'Italia e la vita giuridica internazionale*, Milano, Giuffrè, 2009.

SGARBANTI G., *DOP, IGP e STG: strumenti per la valorizzazione della qualità dei prodotti agroalimentari*, in *Annali. Accademia Nazionale di Agricoltura*, CXXV, 2005.

SHEIKH H. et al., *Proof-of-Work Vs. Proof-of-Stake: A Comparative Analyses and an Approach to Blockchain Consensus Mechanism*, in *International Journal for Research in Applied Science & Engineering Technology*, 2018, 6, 12.

SILENZI B., *In Vino Veritas: la Blockchain per la lotta alla contraffazione del vino*, 2024.

SIMBULA M., *La normativa italiana sulle DLT*, in BATTAGLINI R., GIORDANO M.T. (eds.), *Blockchain e smart contracts. Funzionamento, profili giuridici e internazionali, applicazioni pratiche*, Milano, Giuffrè, 2019.

SINGHAL B., DHAMEJAG., PANDA P.S., *How Blockchain Works*, in *Beginning Blockchain. A Beginner's Guide to Building Blockchain Solutions*, New York, Apress, 2018.

SIRENAP., *Le questioni degli smart contract con riguardo alla struttura ed alla patologia del contratto. Intervento al Convegno Il robot tra diritto e processo*, Roma, 21 febbraio 2019.

SOARES J., *The New Frontier: How Sharing of Big Data in Agriculture Interferes with the Protection of Farmers' Ownership Rights over their Data*, in *S.J Agricultural Law Review*, 2016, 26.

SOFTWARE INFORMATION INDUSTRY ASSOCIATION (SIIA), *Data-Driven Innovation – A Guide for Policymakers: Understanding and Enabling the Economic and Social Value of Data*, SIIA White Paper, Washington DC, 2013.

SOTTE F., *La politica agricola europea. Storia e analisi*, Agriregionieuropa. Collana Economia Applicata, 2023.

SOTTE F., *Riflessioni sulla futura politica agricola europea*, in *Agricalabrieuropa*, 2021, 1.

SPOTO G., *Dagli accordi multilaterali a quelli bilaterali: la fine del WTO?*, in COSTATO L., ALBISINNI F. (eds.), *Trattato breve di diritto agrario italiano e dell'Unione europea. Agricoltura, pesca, alimentazione e ambiente*, t. II, 4th ed, Padova, Cedam, 2023.

SPOTO G., *Gli utilizzi della Blockchain e dell'Internet of Things nel settore degli alimenti*, in *Rivista di diritto alimentare*, 2019, 1.

STAFFORD J. V. (ed.), *Precision Agriculture '23*, Wageningen, Wageningen Academic Publishers, 2023.

STARK J., *How Close Are Smart Contracts to Impacting Real-World Law?*, 2016.

STARK J., *Making Sense of Blockchain Smart Contracts*, 2016.

STRANDBOURG K. J., *Monitoring, Datafication, and Consent: Legal Approaches to Privacy in the Big Data Context*, in LANE J., STODDEN V., BENDER S., NISSENBAUM H. (eds.), *Privacy, big data, and the public good: Frameworks for engagement*, Cambridge, Cambridge University Press, 2014.

STRANIERI S., ORSI L., DE NONI I., OLPER A., *Geographical Indications and Innovation: Evidence from EU regions*, in *Food Policy*, 2023, 116.

STREHLE E., *Public Versus Private Blockchain*, in *Blockchain Research Lab Working Paper*, 2020, 14.

SULKOWSKI A. J., *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers?*, in *Delaware Journal of Corporate Law*, 2018, 43.

SYLVESTER G., *E-Agriculture in Action: Blockchain for Agriculture. Opportunities and Challenges*, FAO, ITU, 2019.

SZABO N., *Smart Contracts*, 1994.

SZABO N., *Smart Contracts: Building Blocks for Digital Markets*, 1996.

TASSONI G., *Denominazioni di origine e compiti di vigilanza*, in *Il Diritto industriale*, 2023, 6.

TAVERNIER E. M., *An empirical analysis of producer perception of traceability in organic agriculture*, in *Renewable Agriculture and Food Systems*, 2004, 19.

TEITELBAUM L. E., *An Overview of the Law and Social Research*, in *Journal of Legal Education*, 1985, 35.

TERENZI M., *Riprodurre la forma di una DOP: un caso di evocazione o prassi idonea a indurre in errore il consumatore?*, in *Alimenta*, 2021, 1.

TESTI N., BORSACCHI L., SPIGARELLI F., *Blockchain technology for supply chain traceability: a literature review*, in *L'Industria*, 2023, 1.

TIAN F., *A supply chain traceability system for food safety based on HACCP, blockchain & Internet of things*, in *2017 International Conference on Service Systems and Service Management*, 2017.

TOMMASINI A., *Il Reg. (UE) 2024/1143 ed il consolidamento dei gruppi di produttori: evoluzione normativa o rivoluzione mancata?*, in *Rivista di diritto alimentare*, 2025, 3.

TOMMASINI A., *La "rivoluzione" tecnologica nell'agroalimentare: algoritmi e innovazione digitale tra rischi e opportunità*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

TOMMASINI A., *Il ruolo polivalente dei consorzi: dalle funzioni socio-economiche e territoriali alla tutela e promozione delle produzioni di qualità*, in *Rivista di diritto agrario*, 2020, 3, I.

TORRE G., *La disciplina delle certificazioni di sostenibilità dei prodotti agroalimentari e la comunicazione "business to consumer"*, in *Rivista di diritto agrario*, 2023, 4, II.

TORRE G., *L'accordo di partenariato UE-Giappone: l'impatto sull'agricoltura e sulla filiera alimentare*, in LUCIFERO N. (ed.), *La tutela internazionale delle indicazioni geografiche dei prodotti agroalimentari*, Milano, Wolters Kluwer, 2023.

TORRE G., *La tutela delle indicazioni geografiche originarie dell'Unione europea oggetto di esportazione in Paesi terzi. Il caso «Feta» nel contesto della giurisprudenza della Corte di giustizia*, in *Diritto e giurisprudenza agraria alimentare e dell'ambiente*, 2022, 6.

TOSOVIC V., *Der DAO-Hack und die Konsequenzen für die Blockchain*, in BURGWINKE D. (ed.) *Blockchain Technology. Einführung für Business- und IT Manager*, De Gruyter Oldenbourg, 2016.

TRAPÈ A. I., *Le specialità tradizionali garantite*, in BORGHI B., CANFORAI., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

TRAPÈ A. I., *Le indicazioni geografiche tra territorio e mercato internazionale*, in CARMIGNANI S., LUCIFERO N. (eds.), *Le regole del mercato agroalimentare tra sicurezza e concorrenza*, Atti del Convegno di Firenze del 21 e 22 novembre 2019 in onore della prof.ssa Eva Rook Basile, Napoli, Editoriale Scientifica, 2020.

TRAPÈ A. I., *Le indicazioni geografiche: un sistema plurale tra esigenze di semplificazione, diversificazione e tutela*, in *Rivista di diritto agrario*, 2019, 4, I.

TRAPÈ A. I., *I segni del territorio. Profili giuridici delle indicazioni di origine dei prodotti agroalimentari tra competitività, interessi dei consumatori e sviluppo rurale*, Milano, Giuffrè, 2012.

TRIPOLI M., SCHMIDHUMBER J., *Emerging Opportunities for the Application of Blockchain in the Agri-Food Industry*, FAO, ICTSD, 2020.

TYLER T. R., *Methodology in Legal Research*, in *Utrecht Law Review*, 2017, 3.

TZOULIAE., *The blockchain ecosystem in the light of intellectual property law*, in *Journal of Intellectual Property, Information Technology, and Electronic Commerce Law*, 2022, 3.

UBERTAZZI B., *EU Geographical Indications and Intangible Cultural Heritage*, in *International Review of Intellectual Property and Competition Law*, 2017, 48.

UBERTAZZI B., MUNIZ ESPADA E. (eds.), *Le indicazioni di qualità degli alimenti, Diritto internazionale ed europeo*, Milano, Giuffrè, 2009.

VAL I. L., *The EU AI Act and the Food System: How the European Union AI Act Applies to Agrifood*, in *European Journal of Risk Regulation*, 2025, 1.

VAN DER MEULEN B. (ed.), *EU Food Law Handbook*, Wageningen, Wageningen Academic Publisher, 2014.

VAN DER VEER L., *Real Food from Virtual Shops (A Case Study from the Netherlands)*, in *European Food and Feed Law Review*, 2012, 7.

VAN HILTEN M., ONGENA G., RAVESTEIJN P., *Blockchain for Organic Food Traceability: Case Studies on Drivers and Challenges*, in *Frontiers in Blockchain*, 2020, 3.

VAN WYNSBERGHE A., *Sustainable AI: AI for sustainability and the sustainability of AI*, in *AI and Ethics*, 2021, 1.

VANDECANDELAERE E., SAMPER L. F., TARTANAC F., VITTORI M., *Sustainability Strategy for GIs: A Bottom-Up and Participatory Approach for GI Sustainability*, in VANDECANDELAERE E., MARIE-VIVIEN D., THÉVENOD-MOTTET E., BOUHADDANE M., PIEPRZOWNIK V., TARTANAC F., PUZONE I., *Worldwide Perspectives on Geographical Indications*, Cham, Springer, 2025.

VANDECANDELAERE E., SAMPER L.F., REY A., DAZA A., MEJÍA P., TARTANAC F., VITTORI M., *The Geographical Indication Pathway to Sustainability: A Framework to Assess and Monitor the Contributions of Geographical Indications to Sustainability through a Participatory Process*, in *Sustainability*, 2021, 13.

VARAVALLO G., CARAGNANO G., BERTONE F., VERNETTI-PROT L., TERZO O., *Traceability Platform Based on Green Blockchain: An Application Case Study in Dairy Supply Chain*, in *Sustainability*, 2022, 6.

VENTURA S., *Il caso Parmesan visto dalla Corte di giustizia. Una sentenza deludente – A proposito della DOP «Parmigiano Reggiano» e del suo sinonimo «Parmesan»*, in *Diritto comunitario e degli scambi internazionali*, 2008, 1.

VENTURA S., *L'origine dei prodotti e la promozione collettiva agroalimentare: aspetti giuridici*, in *Il diritto comunitario e degli scambi internazionali*, 1998, 4.

VENTURI F., *The Farm to Fork Strategy. A Comprehensive but Cautious Approach to “Multidimensional” Food Sustainability*, in *Rivista quadrimestrale di diritto dell'ambiente*, 2021, 1.

VIOLINO S. et al., *Are the innovative electronic labels for extra virgin olive oil sustainable, traceable, and accepted by consumers?*, in *Foods*, 2019, 8.

VITI D., *Certificazioni di qualità di organismi privati*, in BORGHİ B., CANFORA I., DI LAURO A., RUSSO L. (eds.), *Trattato di diritto alimentare italiano e dell'Unione europea*, 2nd ed., Milano, Giuffrè, 2024.

VOLTI R., CROISSANT J., *Society and Technological Change*, 9th ed., Long Grove, Waveland Press, Inc., 2024.

WANG H., ZHANG M., YING H., *The impact of blockchain technology on consumer behaviour: a multimethod study*, in *Journal of Management Analytics Online*, 2021, 3.

WEBLEY L., *Qualitative Approaches to Empirical Legal Research*, in CANE P., KRITZER H. (eds.), *The Oxford Handbook of Empirical Legal Research*, Oxford, Oxford University Press, 2010.

WELLMAN B., HAYTHORNTHTWAITE C., *The Internet in Everyday Life*, New York, Blackwell Pub, 2002.

WERBACH K. D., *Trustless trust*, in *TPRC Conference on Telecommunications, Information, and Communications Policy*, 2016.

WILSON J. E., *Terroir*, University of California Press, 2012.

WRIGHT A., DE FILIPPI P., *Decentralized Blockchain Technology and the Rise of the Lex Cryptographia*, 2015.

WOLFF J., *How is Technology Changing the World, and How Should the World Change Technology*, in *Global Perspectives*, 2021, 2.

WOLFERT S., GE L., VERDOUW C., BOGAARDT M. J., *Big data in smart farming – a review*, in *Agricultural Systems*, 2017, 153.

WU K., MAY Y., HUANG G., LIU X., *A first look at Blockchain-based decentralized applications*, in *Software Practice and Experience*, 2019, 51, 10.

YE L., YANG H., *From digital divide to social inclusion: A table of mobile platform empowerment in rural areas*, in *Sustainability*, 2020, 12.

YIANNAS F., *A New Era of Food Transparency Powered by Blockchain*, in *Innovations: Technology, Governance, Globalization*, 2018, 12, 1-2.

YIN R. K., *Case Study Research Design and Methods*, 2nd ed., London, Sage Publications, 2003.

YLI-HUUMO J. et al., *Where Is Current Research on Blockchain Technology? A Systematic Review*, in *Plus One*, 2016, 11, 10.

ZAPPALAGLIO A., *EU Geographical Indications and the protection of producers and their investments*, in BONADIO E., GOOLD P. (eds.), *The Cambridge Handbook of Investment-Driven Intellectual Property*, Cambridge University Press, Cambridge, 2023.

ZAPPALAGLIO A., *Anatomy of Traditional Specialities Guaranteed: Analysis of the Functioning, Limitations and (Possible) Future of the Forgotten EU Quality Scheme*, in *GRUR International*, 2022, 12.

ZAPPALAGLIO A., *The Transformation of the EU Geographical Indications Law. The Present, Past and Future of the Origin Link*, Londra, Routledge, 2021.

ZAPPALAGLIO A., *The 'Piadina Romagnola' mess. A new legal case for an old question: what is a GI?*, Second International Conference on 'Agriculture in an Urbanizing Society. Reconnecting Agriculture and Food Chains to Societal Needs', 2015.

ZAPPALAGLIO A., GUERRIERI F., CARLS S., *Sui Generis Geographical Indications for the Protection of Non-Agricultural Products in the EU: Can the Quality Schemes Fulfil the Task?*, in *IIC – International Review of Intellectual Property and Competition Law*, 2020, 51.

ZOGRAFOS D., *Geographical Indications & Socio-Economic Development*, in *IQsensato Working Paper*, 2008, 3.

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