

## Circular economy: the case of the ecological production of "terrazzo" tiles, Questions & Answers

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Circular economy: reducing waste generation from industrial sources and /or reducing hazardousness of industrial waste

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The existing situation (state-of-play)

The product of the research project: The Eco Tiles project. Terrazzo tiles (graniglia) for flooring for indoor and outdoor

The Eco Tiles project fits well within the objectives of the life topic. It fosters the reuse/recycling of high quantities of Construction & Demolition Waste CDW 2016 LIFE ERE:

- today one of the biggest volumes of waste discarded in Europe. Construction and demolition are among the sectors that generate higher volumes of waste in Europe. Each year it produces one ton per capita, or 500 million tons in the EU EC 2015;

- and also products of energy-intensive processes needed to fire/treat the original raw materials.

The Life Eco Tiles project will demonstrate the possibility to produce recycled (up to nearly 70%) high-grade pre-casted cement-based products (Terrazzo tiles) using recycled glass (approximately 50-60% of total weight) from urban and industrial waste, ceramic and Construction & Demolition Waste (CDW) ECOTILES 2016.

Main innovations are related to the adding of CDW and/or construction waste precursors (up to 15% weight of the tile) to the traditional commercially available cement with the purpose to reduce cement intake although maintaining the properties ECOTILES 2016 b

Production effects of Eco Life Tiles:

- with the application of a low-energy process, the production will have a substantial less environmental impact than for traditional tiles:

It allows for a 20% reduction in energy consumption (compared to state of the art) for the production of the recycled Terrazzo tiles.

- facilitate the recycling of:

- up to 450 t/year of CDW and construction materials scrap;

- and 3 000 t/year of glass waste.

with a potential of around 1 000 times more in Europe if applied to a share of all pre-casted products;

- Eco Life Tiles improves the value of the glass waste increasing its range of application into high-grade final products, and potentially use of much larger volumes of recycled materials;

- Eco Life Tiles responds to the need of a much higher resource efficiency in the industrial sector By utilizing part of the production scraps and re-inserting them in the production cycle.

The Grandinetti company is a partner of the research project Life Eco Tiles and was established at the beginning in the year nineteen (1900) in San Severino Marche (Italy).

Grandinetti is leader in the production of the:

- traditional and artistic terrazzo tiles (traditional marble chip tiles);

- and cement tiles.

The century-old experience combined with a natural talent for innovation makes Grandinetti a leading company in Italy for the production of conglomerates and coverings.

The expected results of Life Eco Tiles project are:

- design, realize, fine-tune and optimize a series of three versions of industrial pre-casted products (Terrazzo tiles) with up to 70% content of recycled CDW, building materials (mainly ceramics) and glass waste;

- adapt and engineer a low-energy industrial process able to manufacture the recycled Terrazzo tiles at industrial scale, and consuming 20% less than traditional processes.

**I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?**

The main obstacles to the spread of Eco Life Tiles tiles are the following:

- absence in the local area of an adequate network of collection of the material of construction and demolition and, consequently, the absence of a chain of secondary materials recoverable from recycling;
- consumers' lack of knowledge about the high environmental sustainability characteristics of the tiles Eco Life Tiles Production System.

**I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?**

**1. Has your methodology/process/technology a high potential for replication/market uptake in your own country and/or other EU-countries? How did you measure/assess the potential?**

Our production process can be replicated on a national and European level because the technology used is common, there are in fact specific and / or important technical innovations for the production of ECOTILES.

The potential replication is high, also in consideration of the fact that all firms of our product are very "hungry" innovation because they must compete with very often cheaper alternative materials.

The potential replication is measured in qualitative terms. The extent of the potential replication of the product in terms of quantity is reflected by the market demand but at the moment this measure is not yet available because the product is being introduced. Today, we have only the first impressions, on average positive, on the part of market players.

After five years from the end of the research project, according to estimated market penetration, we expect to achieve the following results:

- potentially one manufacturer per year could adopt the ECO TILE approach (either the whole or part of it);
- increase of just under 30%, from € seven hundred thousand euros (€ 700.000) to nine hundred thousand euros € 900) only for Eco TILES - residential and non-residential;
- entry into the North Europe and US market. The baseline is 30% in Italy. 20% abroad (Europe (Austria, Germany, Switzerland and France.) And Middle East, Russia, Ukraine);
- entry into these different sectors: terrazzo tiles indoor and outdoor, cement (Portland) and other pre-casted products;
- two patents filed.

To measure the level of acceptance of Life Eco Tiles prototypes from customers we will review the results of questionnaires prepared specifically for the main categories of customers: architects, distributors, participants at fairs events, associations, cement and ceramic producers and workers and cement ceramic sector.

The objective assessment of the spread of the production of Life Eco Tiles will be given by the impact of employment: jobs creation, amelioration of work conditions, quality of life, etc. 2016 LIFE ERE: 68/117

- I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?
2. Do you have any plans to replicate the methodology/process/ technology in your country and/or other EU countries during LIFE project implementation/after project ends?

From the point of view of the manager of the company that produces Eco Tiles, the goal is to optimize the production of ecological tiles at their one factory located in San Severino Marche (Macerata, Italy). Looking ahead, the company does not exclude the know-how marketing but it is currently not scheduled.

The project team is willing to spread the proposed solution to other Countries within and outside Europe. Therefore, partnerships and links will be developed in order to develop similar production lines to be adopted by other companies, eventually in partnership with UNICAM and Grandinetti 2016 LIFE ERE.

The Life Eco Tiles project shall define a short plan to continue the legacy of project's results after the end of the project. An after-LIFE Plan will be divided into two sections: the first section will provide an overview of the project's objectives, methodologies and results 2016 LIFE ERE; the second part deals specifically with the communication and dissemination strategy of the project after its life.

List of possible actions for the continuation of the project will be verified and their feasibility assessed:

- possibility of commercial partnerships with other pre-casted products or ceramics/cement companies to enter into production ready to market;
- creation of a formalized legal entity (consortium, network, or similar) to promote clean and sustainable solutions for CDW and glass recycling in the Marche region, with the potential for obtaining further co-funding instruments (EU, regional, others);
- participation at waste and resource efficiency events attended by local authorities to present the high potential of the LIFE ECOTILES innovative approach if taken into account in the framework of their municipal sustainable strategy.

- I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?
3. What are the top 3 barriers/difficulties for replication of your project E.g. investments, technology, legal issues, location, patents/licenses, stakeholders?

The project team intends to widely disseminate the results to all potential stakeholders 2016 LIFE ERE especially focusing on changing the cultural mind-set of the pre-cast and adjacent industries in the EU and worldwide.

Due to the absence of significant technological barriers and/or investment to overcome, the company only assumes the cultural barriers - not everyone likes the idea of going to take raw materials from waste

In addition, we hypothesize the existence of a set of business organizational difficulties: it is necessary to create the network, organize the supply of alternative raw materials, treating the production of prototypes, invest time to the development of innovative product and a strong vocation innovation.

Some possible barriers to replicating the project are represented by:

- uncertainty about the quality of secondary raw materials. In the absence of EU-wide standards, it can be difficult to ascertain impurity levels or suitability for high-grade recycling;
- lack of motivation in traditional companies to adopt an environmentally sustainable production technique. Probably, this behavior is dependent on a still modest ecological demand of consumers.

I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?  
4. Do you expect that the market will be stimulated by your project in a way that other stakeholders/competitors will appear?

From the point of view of the firm that produces Eco Tiles, it is expected that the market will be stimulated by the offer of environmentally friendly product.

The company expects a high interest among stakeholders because it offered a product that respects the environment and helps to dispose of waste in an environmentally friendly way, today very sensitive issue for public opinion. The logical consequence of this reflection is the expectation of the expression of interest of competitors.

The construction sector will benefit enormously from the LIFE ECO TILES project, for the following reasons:

- valorization of construction production waste (i.e. scraps, ...) with reduction of disposal costs 2016 LIFE ERE;
- advancement of the eco-innovation potential especially related to the substitution of virgin materials (e.g. marble,...) with secondary raw materials coming from waste sources 2016 LIFE ERE. This will enhance the ecoinnovation potential of European SME in this important sector and beyond.

What results we estimate could be achieved after five years from the end of the research project: see I1.

In addition, we expected to obtain at least eight-ten agreements with waste management companies and construction products for the building of a recycling chain at local level in the Marche region and beyond, in order to ensure a constant flow of waste feedstock 2016 LIFE ERE. Also including fostering of Green Public Procurement (GPP) 2016 LIFE ERE.

I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?  
5. Did you develop a business plan, and/or financial plan within the LIFE project?

Among the research activities of the project we decided to make a business case to assess the cost of production of the tile prototypes 2016 LIFE ERE: 68/117.

The total cost of the innovative LIFE ECO TILES promises to be in line if not lower than traditional standard products currently on the market 2016 LIFE ERE.

The average price for a Terrazzo tile is in the range of 20 €/m<sup>2</sup>. It is estimated that an initial entry price for the LIFE ECO TILES products on the market could be in the range of 28-30€/ m<sup>2</sup> 2016 LIFE ERE. Therefore allowing at least a 8-10€/m<sup>2</sup> margin. However, if a cheaper glass waste can be used, instead of a high quality glass waste, maintaining the physical characteristics and aesthetic appeal, a much larger margin is left for the producer 2016 LIFE ERE.

Considering the actual volumes sold by Grandinetti and the market projections, approximately 30.000 m<sup>2</sup> sold once the system is industrialized 2016 LIFE ERE. This could mean a potential of approximately 9 Mln € value of pieces sold 5 years after the project's end 2016 LIFE ERE.

- I. What are the success factors to replicate and transfer your technology or methodology during or after the project end? What are the main barriers of replication and transferability?
6. What the LIFE Programme can do to help you enter the market/get bigger market share?

At the beginning of our activity our idea was limited to aid in economic terms. Afterwards, we have understood that the LIFE program is also a great marketing and public relations tool. Thanks to LIFE, we started a work of unthinkable networking.

- II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials?

At present, secondary raw materials account for a small proportion of the material use in the EU. Waste management practices have a direct impact on the quantity and quality of the materials and therefore actions to improve these practices are crucial.

- II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

1. More efficient recycling processes? If so, how could recycling processes be improved. E.g. could improved eco-design at production level that would facilitate recycling down the loop?

We think that there are more efficient recycling processes. The most delicate point consists in the efficiency of costs: a waste, to which are attributed to transport costs and costs of processing, can achieve the same price if not more than a raw material "pure." Therefore, for this reason it is necessary that these positive processes are financed so as to create a best practice and start a flywheel which can promote lower prices and a consolidation of the products on the market.

Emphasis will be given to the impact of the material efficiency at product level 2016 LIFE ERE, that is using waste as a valuable secondary raw material and energy consumption at process level.

- II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

2. More efficient collection of materials? What inefficiencies could be improved and how?

According to the firm's point of view that collaborates in the research project, also the collection is efficient, both in reference to the glass and construction and demolition waste.

Improving the waste management in the construction of demolition sector CDW can have a significant impact on the circular economy.

The influence of the creation of a local network to facilitate the collection of construction and demolition waste and glass waste can be of great help to increase the efficiency of collection 2016 LIFE ERE.

II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

3. Are substitutes to hazardous substances currently missing from the market? Which are the barriers in finding and using substitute substances?

In this research project are not used hazardous substances.

II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

4. More policy and economic incentives? Which incentives could be implemented? It is also essential to facilitate the cross-border circulation of secondary raw materials to ensure that they can be traded easily across the EU

To facilitate the recovery of secondary raw materials, it could completely reducing taxes for transportation service and waste processing.

The spread of stricter environmental standards can contribute to the creation of secondary markets products.

Life Eco Tiles products will compliant with Green public Procurement practices (GPP, COM 2003/302 and COM 2008/400). Spreading at a fast pace in Europe, which foster the obligation of purchases of more sustainable materials and products in public offices 2016 LIFE ERE. In particular, Terrazzo Tiles have been already inserted in the EU GPP criteria for Hard Floor Coverings.

Life Eco Tiles products will be compliant with LEED certification or Leadership in Energy & Environmental Design (<http://www.usgbc.org/certification>) 2016 LIFE ERE a US green building certification program that recognizes best-in-class building strategies and practices. LEED assigns a ranking to buildings and houses on the basis, among other criteria, of their usage of green materials. US contracting authorities give authorization only if a certain amount of “green” points is reached.

II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

5. More innovation and efficiency at all stages of the recycling system? What improvements could be made to collection, pre-treatment and processing and what type of innovation could help in the recycling business?

We don't have an answer to this question.

II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

6. Ways to avoid ‘down-cycling’? What innovations are needed so that materials keep their value in recycling processes?

In our case, the production process is only of down-cycling. We do not believe that this practice is wrong. On the contrary, we believe that for some types of products this is the only way for a reuse.

II. How should we minimise the discrepancy between material input, waste generation and recycling flows? What is needed to create a market for secondary raw materials:

7. Greater industrial symbiosis? How can this be created?

Greater industrial symbiosis could be stimulated by economic incentives. The goal should be to foster collaboration between companies to improve their condition and that of the community.

## References

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