

Report

Project SMARBLE BathTub | FORMAS DE PEDRA

Sustainability in the Extractive Sector

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Framework

This report reports on the activities carried out within the scope of the application for the “to test before invest” opportunity provided by EEN-Portugal, carried out by the company Formas de Pedra, within the scope of the type of actions “Action plans relating to new business models/ products/ services, circular economy, green entrepreneurship, resource efficiency and clean energy.” This project was developed by LNEG’s Circular Economy team in collaboration with the design and development team and management of the company Formas de Pedra European area to integrate their businesses into a path of sustainability.

Made up of more than 500 contact points, including 44 countries, the network offers a range of decentralized and local services that support SMEs in their internationalization process and in finding strategic partners for innovation and the sustainable development of their businesses.

Launched as part of the EU’s Competitiveness and Innovation Framework Program, it is the successor to the previous EU networks of Euro Info Centres and Innovation Relay Centres and offers a one-stop-shop service, bringing together the various solutions available in terms of EU instruments and programs to support SMEs.

In Portugal, the network has been run since 2015 by the new EEN-Portugal consortium, made up of ten public entities and associations, distributed regionally throughout the national territory, including the autonomous regions of the Azores and Madeira, which will be responsible for implementing the Enterprise Europe Network in our country over the next few years. Help with the internationalization of business.

- Facilitating the search for business contacts outside the country for companies wishing to expand their activity, both at European and international level.
- Support for innovation and technological partnerships.
- Helping SMEs gain access to EU programmes to support innovation and strategic partnerships, which enhance the industrialization of research and development results obtained in different countries.
- Encouraging cooperation in Europe.
- Disseminating business opportunities and helping to find potential commercial partnerships for production, technology transfer or other purposes, which encourage cooperation and international business activity.

The Network in Europe

To consult the contact details of the entities that make up the European Network, consult the map and contact details available on the network's European website (www.een.ec.europa.eu/).

Formas de Pedra Business Model

Characterization of The Current Business Model

Formas de Pedra was founded in 2008, with the aim of continuing the extraction that had been carried out by Moucheira Mármore e Cantarias since the 80s, a company that has been in the market since the beginning of the 20th century, as an extraction and processing company of Royal Stone and marble since the 40s. The new company Formas de Pedra was set up, with new managers and a different understanding of the business, particularly with regard to products and the management of raw materials.

Formas de Pedra's activity is concentrated in two distinct areas: a) marble extraction in the UNOR5_Pardais area (supplying raw material to be sawn and sold to processing companies) and b) design and innovation, resulting from the surplus of rejected raw material that is not transformed into blocks.

Part of this surplus is stored in a heap and part is turned into gravel for the construction industry.

Needs

The extraction of marble blocks is an activity with a very low rate of effective use of materials. Only around 30% of the material extracted is blocks. The remaining 70% are smaller elements that end up in heaps and of these, only a small percentage is used as gravel for construction.

From Formas de Pedra's point of view, the need is centered on developing a new product (or products) within the parameters of the available geological resource (not currently valued) and circularity strategies. or glued together to produce a variety of products. In this area, in addition to the technical and scientific issues that need to be explored (e.g. type of aggregates), there is also the market's receptiveness to new types of products. The impact that the project could have on the extractive activity will be of enormous importance, since it would open up a new area for marketing raw materials which, at the limit, correspond to 70% of the extraction volume.

The project creates a new supply of composite blocks, which currently generate no value and are deposited in a heap, which the company calls Smarble (small marble), parallel to the supply of solid blocks.

In the production of products, the joining of components according to the needs of the project makes it possible to reduce the volume of raw materials, using only what is necessary, energy and water consumption by at least 50% in the milling process, as well as the production of effluents.

In this area, the main customers will be, on the one hand, interior designers who want to use this type of product in their projects and, on the other, architects for fixed equipment and/or on construction sites. of its heritage, as well as communicating that the production of the products will come from the by-products of marble extraction with a strong association in the market with the Formas de Pedra brand.

This whole relationship is based on physical exhibitions presenting the products, as well as through social networks and publicizing them on the Formas de Pedra website.

Key Partners

Currently, Formas de Pedra's key partners in the product marketing business (excluding the block business) are:

- The transporters (transporting raw materials to the processing plant);
- The processing plant;
- Those responsible for packaging and wrapping;
- Logistics and shipping;
- The marketing and advertising company.

All these players contribute to the development of marble pieces with added value through their design, their execution and quality finishes with the most appropriate technology and marketing actions aimed at the target public.

Cost Income Model

The main costs are centered on the transformation of the raw material (by-product of the extraction of marble blocks) and all the main activities external to Formas de Pedra transformation.

Value Proposition

Formas de Pedra's value proposition for its clients, who are mainly interior designers and architects, is based on products with a timeless design (pieces that stand the test of time and fashion) and which are a way of enhancing their furniture heritage.

More Circular Improvement Options

Needs of New Customer Segments

For the new circular business model, the company needs to focus on a customer segment that is concerned not only with quality and costs, but also with the environment and the use of natural raw materials.

This can not only bring in new customers who fit into the existing linear value chain (interior designers and architects), but also boost synergies with other players outside the chain (e.g. industrial symbioses, waste stream managers, etc.).

Initiatives could even be promoted to arouse interest from other customer segments, such as the jewelry, fine arts and installations sectors.

The main customer segment (interior designers and architects) should be attracted to the new type of product through its high efficiency, value and association with a premium brand.

Customers will relate to these products because of the material they are made from and their durability. There is also a relationship of trust, guaranteeing that the product, after the sale, can be upgraded, maintained, repaired, etc. in order to meet your expectations in terms of the value of your assets.

In this way, Formas de Pedra will meet the needs and expectations of a demanding customer segment and will establish itself in the market as a company that focuses on design and the use of natural by-products, enhancing the brand and its products.

Take-back or resale channels: the possibility of creating take-back or resale channels in a physical or virtual store could be considered, in order to make it known that the pieces can be repaired, either by the entity that sold them or by another marble processor.

New Circular Value Proposition

The value proposition is based on sustainability concerns, due to the valorization of the raw material used and which was usually rejected, which now gives rise to new pieces with a timeless design and thus contributes to the valorization of the end customer's real estate assets, from a sustainability point of view the possibility of repair (to be studied as to its feasibility), in the factory, after approval of the budget.

In order to consolidate these possibilities, partners must also be considered in the field of reverse logistics (allowing parts to be returned for repair, for example).

It is also necessary to ensure that the company responsible for production has the most appropriate technologies, as well as the transporter (transport of raw materials to the processing plant), marketing (marketing and advertising operations), packaging (production of packaging and packaging), logistics (storage of the finished product), shipping (transportation of the finished product for delivery to the customer). Market, assumed to be used (but no signs of use are evident) and that the repair must be carried out by a partner in a processing plant.

By repair, edge breakage, or larger, crushing by a blow, staining by absorption of chemical products or reagents.

Cost Revenue Model

The associated costs will be related to the activities described in the previous point, of which the following stand out: execution or repair costs, depending on the degree of complexity of the project and the equipment used; costs

dependent on the distance between the customer and the processing plant, with a preference for customers in close proximity.

In turn, revenue will continue to be generated mainly from the sale of products based on smaller parts/components and the use of another way of producing parts, with smaller components, aimed at other customers with greater purchasing power, who identify with the concept of by-product as value.

- All this combined with good design, quality production and service strategies throughout the product's life cycle.
- Reuse
- Remanufacturing / Refurbishment
- Maximizing Production Efficiency
- Material Recapture / Closed
- Loop Recycling.

Assuming that Formas de Pedra, through its new project, will consider the adoption of its whole, the next step was to link it to the design diagnosis, using the CE Designer tool, so that the product and business model are complementary and allow guidelines to be set for the development of new products based on the circular value proposition.

Design Diagnosis

With regard to the design and development process of a new, more circular solution, the methodology applied started with an analysis of the reference product (solid block bathtub) using the KATCH_e CE Designer tool with the aim of initially analyzing the sustainability and circularity profile of this product, identifying critical points with potential for improvement, identifying the main strategies and criteria to be implemented in the new product and identifying opportunities for improvement from a holistic viewpoint, addressing all stages of the life cycle. LNEG's circular, which made it possible to identify opportunities for improvement and potential solutions to be implemented in the new product.

After a new product concept was developed by the Formas de Pedra design team, the CE designer tool was applied again to analyze the new product solution to validate the sustainability and circularity profile as well as the comparison with the initial reference product.

The KATCH_e CE Designer tool applied in this process is a qualitative tool

developed by LNEG as part of the European KATCH_e project:

Knowledge Alliance on Product-Service Development for the Circular Economy and Sustainability in Higher Education, which allows easy integration of circularity strategies into the product and service development process.

It includes 8 strategies that address the most relevant issues that a designer needs to consider in the process of developing new products or services oriented towards the circular economy opportunities for improvement.

The analysis of the reference product was the basis for a brainstorming session, where the project team defined and explored new opportunities to be developed, so as to later be able to compare the reference situation with the new concept or new product, which will make it possible to demonstrate where and how the new solution performs best.

This tool is available on the project website at www.katche.eu.



Figure 1 - Prototype of the new product

Comparative analysis of the traditional bathtub model made from a solid marble block and the new SMARBLE bathtub made using the new construction method of gluing marble blocks together using the “KATCH_e CE designer” tool.

The following figure shows the comparison by strategy.

Summary

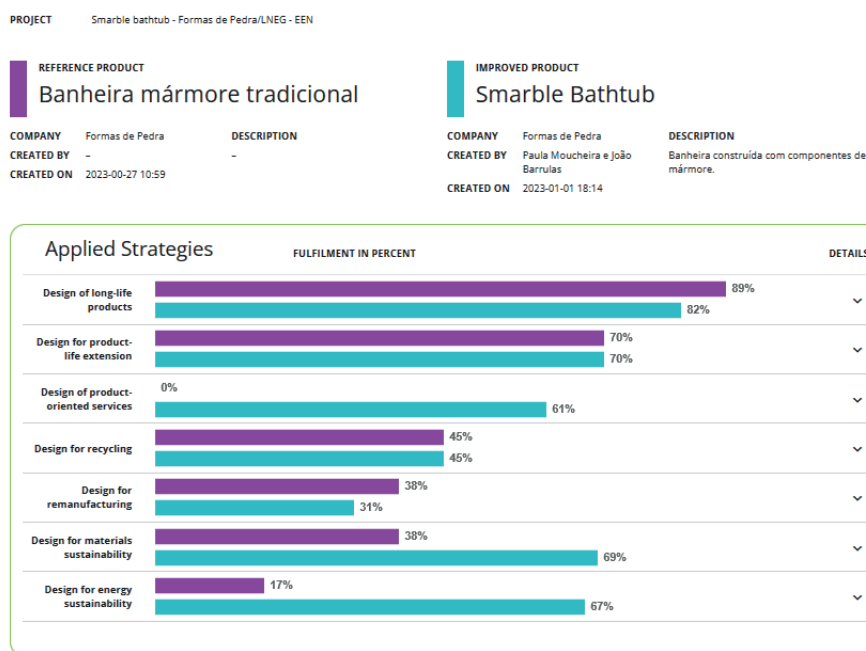


Figure 2: Summary of the evaluation of the reference product and the new product

Using the CE designer tool, it was possible to analyze the reference product and identify opportunities for improvement to be implemented in the new product.

Based on these results, the Formas de Pedra design and development team, with the support of the LNEG team, developed a new product with improvements to its sustainability and circularity profile product shows significant improvements, however it should be noted that in some strategies, the results show a slight worsening, which results from the trade-offs that arise in any design project for the circular economy and sustainability.

The results, analyzed individually by strategy and by the criteria that make up each strategy, were as follows:

1. Long-life product design



The result of the evaluation of this strategy shows a slight reduction in the new product.

These figures are the result of moving from producing the piece from a single block of marble to a set of glued blocks.

Here the criteria “use of durable and wear-resistant materials and components” and the criterion “reliability” score lower.

As far as improvements within the scope of this strategy are concerned, information on the product’s lifespan has been improved.

2. Design for product life extension



Although this strategy was analyzed and implemented in the development of the new product, it shows an equivalent result (discharge valve) and two others with a lower rating compared to the initial product (“Use of durable and wear-resistant materials and components” as there is no quality certificate for the aggregate yet, and “Simplification of the product structure” as production is more complex).

3. Product-oriented service design



This strategy has a significant rating, from 0% to 61%. This assessment is due to the fact that in the initial model there were no services provided by the company and that in the new tub, with the implementation of the strategies, the introduction of new services into the product system was considered.

Formas de Pedra will associate its new product with a set of services provided

at home to repair and maintain the product, thus increasing user satisfaction and potentially increasing the product's lifespan.

4. Design for recycling

Design for recycling	fulfilment of strategy	REFERENCE 45%	IMPROVED 45%	▼
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With regard to recycling, although the rating is low, it is considered that this strategy will not change with the development of the new product.

It was not possible to implement solutions to improve the recyclability of the product since it is produced with marble and aggregate.

5. Slightly lower.

Design for remanufacturing	fulfilment of strategy	REFERENCE 38%	IMPROVED 31%	▼
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Although the new solution scores better on the criterion "Integration of technology/technology stabilized over time" because it adopts an efficient and stable production technology in production, the criterion "Use of durable and wear-resistant materials and components" because there is no certification of the aggregating material and because this criterion has a much higher relative importance compared to the first, the total evaluation of the strategy is reduced by 7%.

6. Design for the sustainability of materials

Design for materials sustainability	fulfilment of strategy	REFERENCE 38%	IMPROVED 69%	▼
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This strategy is significantly improved by the use of material that was originally discarded in the stone extraction process, the use of recycled material from the quarry heaps and also by the communication associated with the product with more information about the product and its sustainability profile.

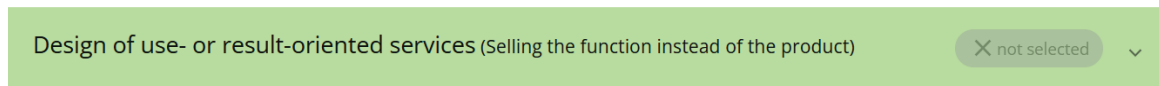
This strategy thus shows improvements in the criteria "Optimization of product design to reduce material consumption", "Use of recycled materials" and "Product sustainability information for the consumer".

7. Design for energy sustainability



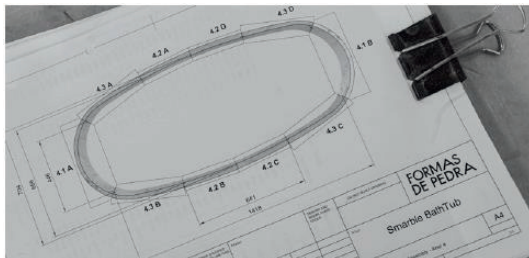
This strategy also shows a high improvement, from 17% to 67% that the material used is secondary material recovered from the quarry's slag heap.

8. Use- or results-oriented service design



As this strategy is not considered to be applicable to the product and project under development, it was not considered in the evaluation of the reference product and the new product.

Main Conclusions and Results



Formas de Pedra has in its DNA the urgent consideration of the need for good management of mineral resources, which includes, among other things, the circularity of products and the use of natural materials.

As a result, SMARBLE was created - a new product concept resulting from the agglomeration of small marble blocks classified as waste.



With SMARBLE, the company aims to add value by developing a more sustainable and circular project aimed, in this case, at the high-end market, for the sanitary equipment that is a bathtub.

The raw material used for this product comes from the surplus of the extraction process and is thus reintroduced into the value chain, in the sense that the raw



material that was previously considered waste is added to give rise to a new raw material of effluents and sludge, which are briefly presented in Table 1.

	Produto de referência (banheira a partir de um único bloco maciço de mármore)	Novo produto Smarble BathTub (a partir de resíduos da extração do mármore)
Massa inicial de mármore necessária	0,765 m ³	0,318 m ³
Massa de mármore utilizado no produto final	0,108 m ³ = 14%	0,108 m ³ = 34%
Lamas geradas no processo de fabrico	0,657 m ³ = 86%	0,210 m ³ = 66%
Tempo de maquinação em CNC	70 horas	37 horas
Trabalhos complementares	29 horas	60 horas

So instead of starting the bathtub production process from a single block, it is designed and produced from small aggregate blocks, strictly using the raw material needed to develop the product.

The creation of components for the Smarble BathTub thus enables not only cost-effective production of the product, but also versatile and original aesthetic solutions.

Thanks to the quality of the material used - marble - the product itself guarantees long-term durability.

In order to test the concept, a prototype of the Smarble BathTub was developed, using the sequential phases of material collection and selection, component cutting, aggregation, machining and finishing.