

The Path of Natural Coatings in Parallel with Industrialized Materials

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Abstract: Since the 1970s, the natural stone industries have been confronting the emergence of novel products in the surfacing market, such as quartz conglomerates and large-format ceramics. Through a bibliographic investigation employing a qualitative approach, this study scrutinizes data disseminated across specialized websites, scientific articles, and dissertations, with the intention of comprehending the marketing and communication strategies employed by competitors. The primary objective is to discern pathways for the modernization and fortification of the natural stone industry in response to a transforming market landscape. The overarching aim of this study is to expound upon the trajectory of natural surfacing materials, concurrently with industrially manufactured counterparts. In conclusion, it is recommended that, through an initiative orchestrated by representative bodies within the natural stone sector, in collaboration with governmental entities, a task force be instituted to facilitate a more enduring future for the sector over the medium and long term.

Keywords: Surfacing Materials; Natural Stones; Quartz Conglomerates; Large-Format Ceramics; Marketing.

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I. INTRODUCTION

The natural stone industry has been facing a significant challenge since the 1970s with the emergence of industrialized products competing for the same market. These products have been continuously advancing not only in terms of formats with similar dimensions but also in terms of equivalent, and sometimes superior, technical performance in certain applications.

In light of this phenomenon, the objective of this article is to gather and present information that elucidates the characteristics, strengths, and weaknesses associated with the main surface coverings available in today's market: natural stones, quartz conglomerates/mineral surfaces, and large-format ceramics.

Through a qualitative bibliographic research approach, this study examines information published on specialized websites, scientific articles, and dissertations to understand the evolution of natural stone utilization in architecture and engineering.

The general aim of this study is to delve into the path of natural coatings in parallel with industrialized materials. The specific objectives of this study are as follows: to reflect on the market trajectory of natural coatings in parallel with the performance of industrialized slabs and to investigate the main challenges and opportunities for industries operating in the natural stone sector, with a focus on the Brazilian market.

The study is organized into four sections. The first section serves as an introduction in which the research objectives are explained. The second section develops a theoretical framework based on contributions from authors who have addressed the same topic. The third section presents the methodological procedures adopted in the research, and finally, the fourth and last section highlights the research's concluding remarks.

II. EXPERIMENTAL PROCEDURE

Through a qualitative approach and a bibliographic research procedure, this study examined information from specialized websites, scientific articles, and dissertations to comprehend the evolution of ornamental stones in architecture and engineering.

To address the complexity of ornamental stone applications in civil constructions, this study adopted a qualitative approach. This allowed for a detailed analysis of the characteristics of the stones and emerging trends in the industry. (Silverman, 2020)

The methodology employed bibliographic research as the research procedure. This approach involved the search, selection, and analysis of information available in secondary sources, such as specialized websites,

scientific articles, and dissertations, to explore advances and applications of natural stones. (Machi & McEvoy, 2016)

The qualitative approach and bibliographic research employed in this study provided a solid foundation for analyzing the advancements and applications of ornamental stones in civil constructions. By examining information from specialized websites, scientific articles, and dissertations, the article contributed to understanding innovations in this field and their impact on architecture and engineering.

III. RESULTS AND DISCUSSIONS

3.1 The Path of Natural Coverings, in Parallel with Industrialized Slabs

Ornamental stones have been employed by humankind for thousands of years, manifesting themselves in various fields of activity. In civil construction, stones initially emerged as structural elements, first appearing in foundations and structures. In this regard, it is not difficult to enumerate several outstanding works that were constructed from rocks, spanned across centuries, and can still be observed on all continents, as exemplified sequentially in Figure 1 - Pyramids in Egypt (Africa) 2560 BC; Parthenon in Greece (Europe) 438 BC; Great Wall of China (Asia) 206 BC; Machu Picchu in Peru (Americas) 1420 AD, among others.

Figure 1 – Examples of Monuments where Ornamental Stones were used as Structural Elements



Source: Researchers' Data

Over time and with the evolution of construction processes, ornamental stones have increasingly assumed technical and decorative applications more oriented towards use as cladding for facades, walls, floors, and also countertops – the latter being the specific focus of reflection in this article.

Especially over the last three decades, the ornamental stone sector has witnessed a significant increase in the supply of industrialized products for countertop applications. Due to the characteristics of their production processes, these alternatives gain advantages in terms of scale and offer sufficient profit margins, even to support differentiated marketing efforts when compared to what we are accustomed to seeing in the traditional ornamental stone sector.

In their research on the ornamental stone production sector, Baylão and Wander (2022, p. 08) assert that: "stimulating private investment is an essential vector of economic policy, supporting the modernization processes of productive structures, which include technological capacity and international marketing capacity."

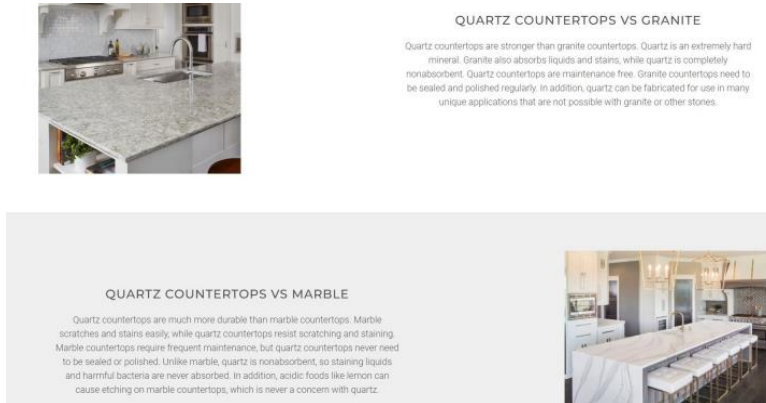
Given the consolidation of new players in the cladding market, it seems important to examine the ways in which the ornamental stone industries can modernize. This includes, for example, the communication and marketing strategies adopted for the promotion of quartz and ceramics.

What strategies can the ornamental stone sector adopt to enhance the value of its products? What concrete actions can be taken to inform and guide consumers regarding the characteristics and recommended uses of each type of material?

Clearly, it is deemed necessary to make a comparative analysis between natural stones and other surface options, listing the strengths and weaknesses of each and examining how the industries of quartz conglomerates and ceramics have positioned themselves within the market.

In this regard, a good example is the strategy adopted by the American company Cambria, a leader in the manufacturing of quartz conglomerate surfaces, headquartered in the USA, as illustrated in Figure 2 on the following page.

Figure 2 - Material Comparison



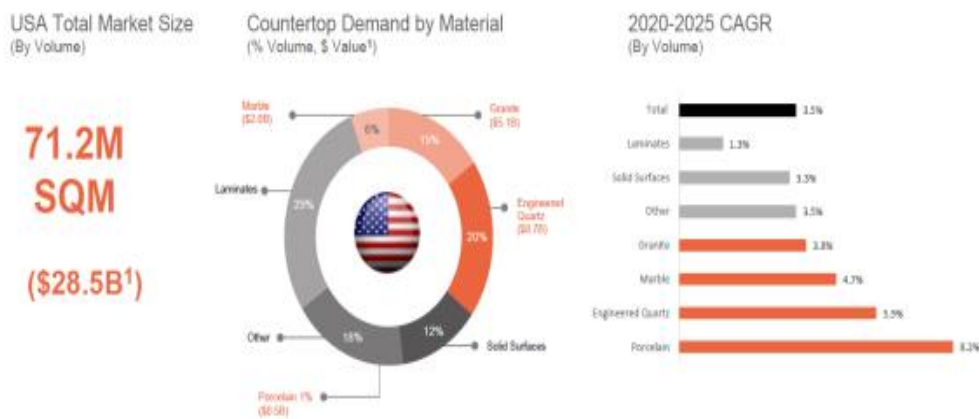
Source: <https://www.cambriausa.com/quartz-countertops/#/>

The omission of the natural stone sector in creating relationship campaigns and, primarily, in educating the community about the characteristics and risks of new countertop surface options is linked to the gradual decline of natural stones' presence in the construction and decoration sectors.

According to studies included in the August 2022 investor presentation by Caesarstone, one of the leading global producers of ornamental stones, it is anticipated that between 2020 and 2025, the growth of industrialized products will continue to outpace that of natural products in the American market. Figure 3 provides an explanatory graph regarding the discussion of Cambria.

In the United States and many other regions, the demand for industrialized products has significantly increased, partly due to the quality of these products. However, the natural stone market still maintains its customer base, particularly those who value the authenticity and the variety of patterns and colors offered by natural stones.

Figure 3 - Projection of Countertop Covering Growth (USA)



Source: Freedonia March (2021, cited in Caesarstone, 2021)

3.1.1 Quartz Agglomerates

Around 50 years ago, one of the first products to enter this "parallel market" for natural stone countertops was quartz agglomerates. Starting in the mid-1970s, thanks to technology developed by the Breton Group, tiles were manufactured from a mixture of natural aggregate (predominantly quartz) and a polyester resin. (Paz & Gomes, 2023)

The construction of the product involves three combined processes:

- 1) The mixture (resin and minerals) is placed in equipment where air is removed in a vacuum chamber.
- 2) Catalysis of the molded product occurs while it vibrates, and pressure is applied to the mixture.
- 3) Heat is then applied to relieve stress in the finished product.

Quartz agglomerate is a low-porosity and relatively stable cladding material. The process has evolved from 30 x 30 cm tiles in the late 1970s to sheets of over 4 m² about 30 years ago, and today, they reach dimensions of up to 3.25 m in length by 1.60 m in height.

On the other hand, after becoming common in the production sector, especially among stonemasons, mainly due to the ease of finishing and assembly processes, the quartz agglomerate industry has faced an urgent need for product reconstruction in the past two years, particularly concerning the minerals used in its composition.

These demands are primarily related to quartz, which can pose health problems for people working in the production process, both in the manufacturing of sheets and in the finishing and assembly of countertops. In Brazil, there is still no practical action from official environmental agencies, labor law enforcement, or even state and federal revenue agencies regarding companies operating in the penultimate and final stages of the production chain, specifically distributors and stonemasons.

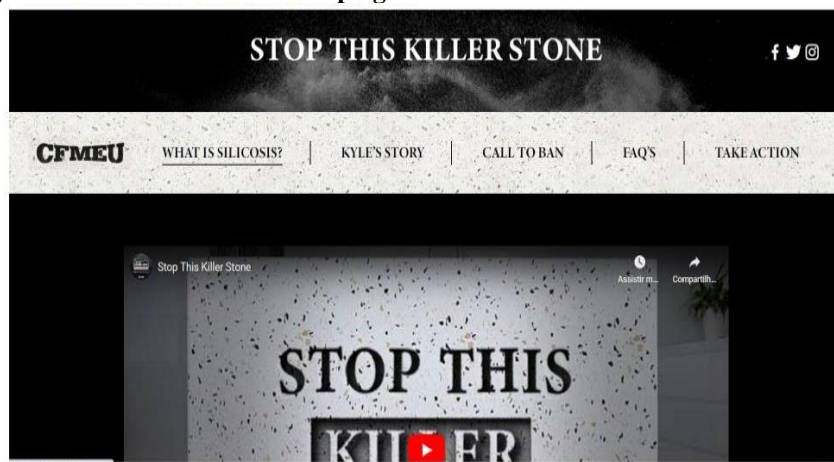
In other countries, however, we can observe a series of recent concrete actions taken by regulatory bodies, assigning responsibilities to manufacturers and launching communication campaigns aimed at completely banning products from some countries. In this regard, we can highlight recent developments in the Spanish market and usage restrictions in the Australian market – as illustrated in Figures 4 and 5 below.

Figure 4 – Cosentino Case (Spain)



Source: Latona (2023)

Figure 5 – Australia Case – Campaign for the Prohibition of Trade in the Country



Source: CFMEU (2023)

All of this prompts us to reflect on the actions that must be taken in the Brazilian market concerning importers and manufacturers who, following the example of what has occurred in other countries, have failed to address the risks and provide guidance to companies operating in other stages of the production chain regarding the care and necessary safety equipment for the processing of these materials.

Negreiros Filho (2019, p. 21) reminds us that: “Occupational exposure to dust containing crystalline silica is associated with the risk of developing diseases such as silicosis, chronic airflow limitation, lung cancer, kidney failure, an increased risk of pulmonary tuberculosis, and collagen-related diseases”.

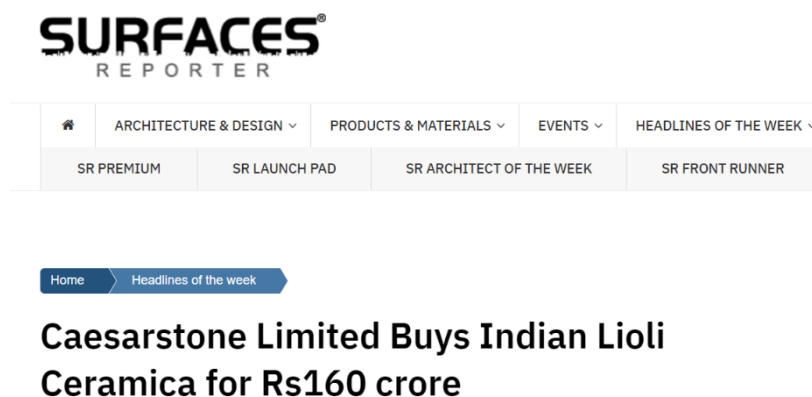
In general terms, we observe that, with the exception of the world's leading producers of such surfaces, which are the Chinese factories, the quartz agglomerate industries have recognized the mentioned risks and have been working to reduce the volume of quartz in this type of surface. In doing so, they aim to minimize the health impacts on the workforce involved in the production processes and also ensure the survival of the product itself in the international market, as some countries have already taken steps to prohibit the use of the product in its original characteristics.

3.1.2 Large-Format Ceramics

Another path pursued by the leading manufacturers of quartz agglomerate is the inclusion of ceramic surfaces in their product lines, considering that, due to their production processes, such surfaces pose lower risks to the workforce.

This shift is already underway in two of the three top global producers, Cosentino and Caesarstone, which also engage in natural coatings and have, in fact, expanded their investments in the stone sector, as can be observed in Figures 6 and 7 provided below, respectively.

Figure 6 - Capital Acquisition by the Cosentino Group for Investments in Alternative/Renewable Energy Sources to Expand the Ceramic Line (Dekton)



Source: Cosentino (2023)

Figure 7 - Caesarstone Acquires Indian Large-Format Porcelain Industry



Source: Surfaces Reporter Magazine (2023)

About 20 years ago, in a paradigm-shifting movement, the ceramic industry began to seek ways to improve its products and production processes. In this context, the Italian group System, a traditional supplier of equipment to the ceramic industry, stands out. After years of development, in 2002, they introduced not only the technology but also the product that would become both the namesake of the factory and the generic name for large-format products: the LAMINA (Figure 8).

Compared to the previous production model, the significant change presented by the System group was the transition from "pressing" to compaction. Initially, this enabled the production of sheets with very low thickness and large formats, allowing for applications in various sectors of the industry beyond construction. With thicknesses starting from 3 mm and dimensions reaching up to 3 m² per piece, ceramics, which had been primarily used for floor and wall coverings until that point, reinvented itself as a product and began to be perceived—and communicated—as a "skin."

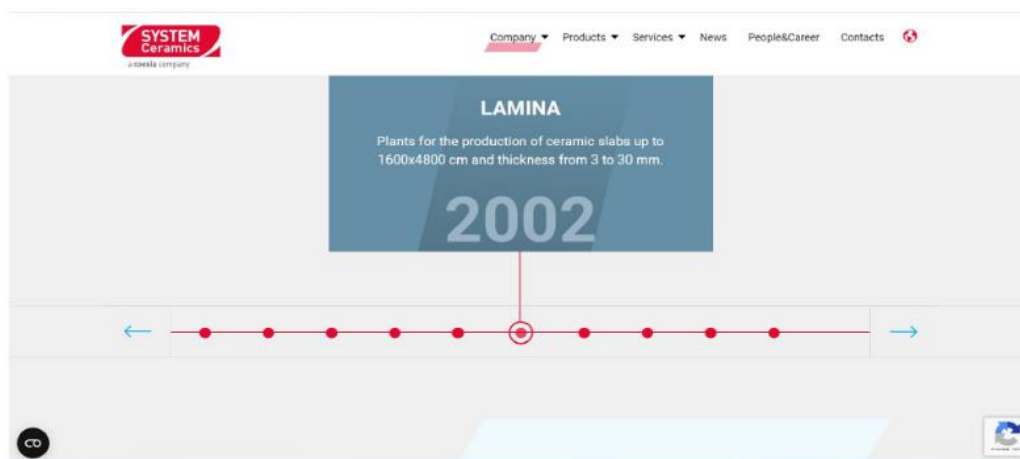


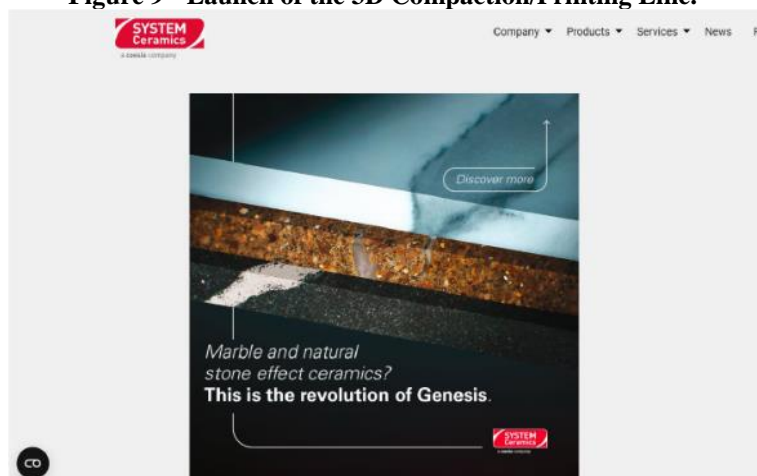
Figure 8 - System Group's Timeline and Inauguration of the World's First Factory to Produce Low-Thickness, Large-Format Porcelain Tiles.

Source: System Ceramics (2023)

Over time, other Italian industries also developed their own machinery and technologies, solidifying the new business model as a path to be followed worldwide by leading companies in the sector. This significant change is also taking place in the Brazilian industry, with plans to have six compactors capable of producing large formats in operation by 2025.

The machinery industry for the ceramics sector is now embarking on a new challenge, which involves three-dimensional product printing. With this transformation, printing, which previously only occurred on the surface of the piece, will now be present throughout its thickness (Figure 9).

Figure 9 - Launch of the 3D Compaction/Printing Line.



Source: System Ceramics (2023)

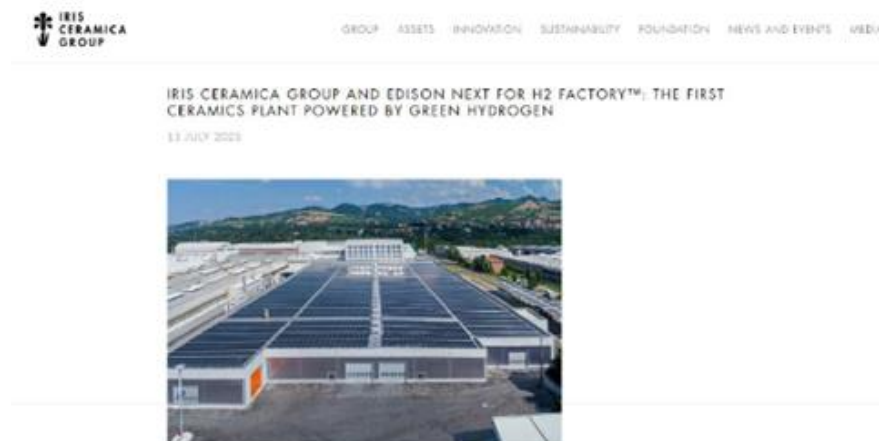
Currently, these Laminas are available through stone distributors and, together with quartz agglomerates, constitute the product mix offered to customers by stone fabrication shops.

From this point onward, the entire supply chain had to adapt to the new product, whether by seeking new inputs such as blades and adhesives or by adopting new production techniques. Just like quartz agglomerates and natural stones, Laminas have their unique characteristics. This demand has caused, and still causes, difficulties for many companies, primarily due to the final production process. Unlike cutting applied to rocks and agglomerates, in the case of Laminas, assembly becomes a significant craft. Despite the increasing investment in tools and equipment, the end of the countertop production/assembly process remains manual.

Consequently, there arises the challenge of training thousands of finishing professionals in the most effective techniques for the proper use of this new product. It is essential to note that specifiers, designers, and consumers also need to have a better understanding of the characteristics and technical limitations of these materials, overcoming a scenario in which projects for installations and applications are often developed incorrectly—resulting in rework and even product replacement.

In addition to producing pieces with lower impact resistance at their edges, a significant challenge facing the ceramic industry worldwide relates to the high energy consumption involved in its production processes. Combining gas and electricity, the large kilns in this industry extend to over 200 linear meters, with peak temperatures approaching 1200 degrees Celsius. The pursuit of alternative energy sources has been highly encouraged, as depicted in Figure 10.

Figure 10 - Case Study: Group Iris - The Race for Alternative Energy Sources for Kilns.



Source: Iris Ceramica Group (2023)

3.2 Discussions

3.2.1 Challenges and Opportunities for the Natural Stone Sector in the Brazilian Market

It's important to understand that, in general, natural stones tend to appreciate over time—with the exception of some rocks that have significant production. Whether due to production scale, the popularization of technology mastery, or even standardization, industrialized products often distance themselves from the audience seeking differentiated products.

Common cases in the luxury market, such as in the fields of watches, handbags, travel, and automobiles, among others, have shown that the perceived value by consumers is linked not only to ownership but primarily to exclusivity—a significant value of the natural stone sector, considering stone as a non-renewable and exclusive resource.

In general, the purchasing experience has also become a significant differentiator in the market, influencing the perceived value of each product and becoming one of the decision-making factors. Many stone fabrication companies and some industries have been moving in this direction and achieving above-average financial results in the sector.

Speaking specifically of stone fabrication shops, the development of sales teams through training, the improvement of customer service spaces, organization, and enhancements in the presentation of inventory—spaces where customers typically choose products for their projects—have also become established measures that create value and directly impact purchase decisions.

On the other hand, a significant challenge for the natural stone sector is the low barrier to entry for new players in the stone fabrication sector, as, in the Brazilian context, regulatory authorities are still lax when it comes to legislation. Considering the market as a whole, a significant portion of active companies may not be able to

operate due to non-compliance with labor, environmental, and tax regulations. Thus, even in the midst of a traditional and economically significant sector, many reputable companies face the difficult reality of competing in the same market with actors who benefit from what is considered informal economy.

Regarding this situation, Santos, Alves, and Teixeira (2018, p.118) suggest "[...] the intensification of competent oversight, verifying and applying available and appropriate regulatory standards [...]". Another point to highlight is that competing products of natural stones also originate from the mining sector, and in many cases, their raw material consists of a byproduct of rock mining. A good example of this is Feldspar quarries, which supply the ceramic industry with the waste material that didn't become blocks.

IV. CONCLUSION

The research has identified opportunities for the natural stone industry to strengthen itself as a sector and, in doing so, slow down the pace at which industrialized alternatives are advancing and gaining market share.

For example, it was observed that there is a need to work on formalizing the natural stone sector by creating legal barriers to protect companies that strive for excellence and comply with environmental, tax, and labor requirements.

Furthermore, it is crucial to emphasize the importance of investing in marketing and communication strategies that are better suited to a transforming market, taking as examples the measures adopted by their competitors - the industries of industrialized products such as quartz agglomerates and large-format ceramics.

Finally, it is recommended that, through an initiative led by industry representative bodies in collaboration with government agencies, a task force should be created to facilitate a more solid future for the sector in the medium and long term.

Conflict of interest

There is no conflict to disclose.

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REFERENCES

- [1]. Baylão, M. C. C., & Wander, A. E. (2022). Ornamental Stone Industry: A Systematic Literature Review. *Research, Society, and Development*, 11(14), e316111436278. <http://dx.doi.org/10.33448/rsd-v11i14.36278>.
- [2]. Caesarstone. (2021). Life in Stone. Caesarstone Investor Presentation.
- [3]. CFMEU. (2023). Stop this Killer Stone. Canberra: CFMEU. <https://stopthiskillerstone.com.au/what-is-silicosis/>
- [4]. Cosentino. (2023). EIB lends €120 million to Cosentino Group to support its sustainability and circular economy strategy. Almería: Cosentino. <https://www.cosentino.com/news/eib-lends-e120-million-to-cosentino-group-to-support-its-sustainability-and-circular-economy-strategy/>
- [5]. Iris Ceramica Group. (2023). Iris Ceramica Group and Edison Next For H2 Factory™: The First Ceramics Plant Powered By Green Hydrogen. Fiorano Modenese: Iris Ceramica Group. <https://www.irisceramicagroup.com/en/media/iris-ceramica-group-and-edison-next-for-h2-factory-the-first-ceramics-plant-powered-by-green-hydrogen-produced-on-site/>
- [6]. Latona, D. (2023). Owner of Spain's Cosentino admits negligence over silicosis in workers – documents. Reuters. London. <https://www.reuters.com/business/owner-spains-cosentino-admits-concealing-cause-silicosis-1900-workers-2023-02-07/>
- [7]. Machi, L. A., & McEvoy, B. T. (2016). *The Literature and the Research Process: From Initial Processes to Literature Citations*. Porto Alegre: Artmed Editora.
- [8]. Magalhães, R. da S., Santos, R. M. dos, Silva, A. A. M. da, Marques, F. P., & Gomes, E. R. (2021). Properties and Industrial Applications of Clays from the State of Maranhão. *Brazilian Journal of Development*, 7(8), 82090-82108. <http://dx.doi.org/10.34117/bjdv7n8-425>
- [9]. Negreiros Filho, P. R. R. W. de. (2019). Occupational Health Surveillance of Workers in Marble Workshops in the Northwest of Espírito Santo: An Approach from the Production Chain Perspective (Dissertation). Professional Master's Degree in Worker Health Surveillance, Graduate Program in Public Health, National School of Public Health Sergio Arouca, Oswaldo Cruz Foundation. Rio de Janeiro: Oswaldo Cruz Foundation.
- [10]. Paz, G. A. R. da, & Gomes, R. L. R. (2023). Marble workshop of the future: Technology, innovation, and sustainability. *World Journal of Advanced Research and Reviews*. Volume (19). Issue (3). eISSN: 2581-9615. <http://dx.doi.org/10.30574/wjarr.2023.19.3.1957>.
- [11]. Santos, T. L. F. dos, Alves, L. C., & Teixeira, V. D. de S. (2018). Labor and Subjectivity of Stonemasons. São Paulo: Fundacentro.
- [12]. Silverman, D. (2020). *Qualitative Research*. Porto Alegre: Artmed Editora.
- [13]. System Ceramics. (2023). Revolutionary Innovation for Latest-Generation Processes – LAMINA. Modena: System Ceramics. <https://www.systemceramics.com/en/who-we-are/history>
- [14]. Surfaces Reporter Magazine. (2023). Caesarstone Limited Buys Indian Lioli Ceramica for Rs160 crore. New Delhi: Surfaces Reporter Magazine. <https://surfacesreporter.com/articles/71988/caesarstone-ltd-acquires-the-majority-stakes-of-indian-lioli-ceramica>

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