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THE INNOVATION IN THE CERAMIC TILE EXPORTING INDUSTRIES IN SANTA CATARINA, BRAZIL

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ABSTRACT

Neurofibromatosis is an This article aims to identify the participation of the innovation in industries exporting ceramic tiles from the Southern area of Santa Catarina State in Brazil. The research was characterized as descriptive, as far as the ends, and, bibliographical and a multicase study, regarding the means of investigation, through a quantitative approach. The sample was attended by four industries that export ceramic tiles. The primary source data were collected through a questionnaire applied via e-mail to the Industrial Directors, PD & I Managers and Export Managers of the industries under study. South and North America are the major international markets with centralized outsourcing processes in Europe and Asia. The external market represents 15 to 30% of its overall production. The innovation occurs mainly in industrial products and processes directed to the company and to the market, with an incremental degree and of open and closed form. The stimuli are directed at the capture of ideas within the industries and financial support of FINEP. The percentage of revenue earmarked for innovation is still low (between 0.4% to 5%). In international insertion, innovation contributes to percentages ranging from 15 to 30%. Incremental innovations in products, design or packaging changes, sales methods, industrial processes, and differentiated services were developed in the last year.

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INTRODUCTION

Moved by the capacity to create and to foresee new business opportunities, innovation is not limited by the search for new products at all, but also to create a relationship with the new markets considered as mature ones (TIDD; BESSANT; PAVITT, 2008). In a wide context, it is possible to detect data that points out to the innovation as a determining key-factor for both, domestic and international economic growth. Inside the industries, Research and Development activities (R&D), for instance, allows them to absorb and to produce not only technological acknowledgment but a wide variety ranging from management to production. According to Bessant and Tidd point of view (2009), innovating is a matter of survival, because in case the companies are not fully committed to doing some changes in their products/services, as well as the way they market their products, they can easily be surpassed by the competition. Companies based in the European Community invest something like USD 700 billion/year in R&D.

The relationship between innovation and internationalization could be seen as a 2-way street. Arbix, Salerno and De Negri (2004) state that both have a direct influence and are interlaced in the search for the competitiveness of the companies. In the same way that an increase in competitiveness can be originated from leading-edge technologies acquired abroad, the internationalization might as well occur by an increase of the innovative power of the companies. The authors also argue that once internationalized, the companies have access to new markets, new quality standards, as well as new technologies, which could be turned into a bigger innovation capacity, though. This study is focused on Santa Catarina State – Southern Area – specifically in the Association of the Coal Minings Region – AMREC (comprising the cities of Criciúma, Cocal do Sul, Morro da Fumaça, Nova Veneza, Orleans, Içara, Balneário Rincão, Forquilha, Lauro Muller, Siderópolis, Treviso e Urussanga) and it must be highlighted that the economy of this region have some proper particularities, with a wide variety of industries, such as polymers, paintings, coal minings, clothing, metal-mechanical and chemical sectors.

The agricultural sector also plays an important role, mainly in the cities of Orleans, Nova Veneza, Içara, and Forquilha, with several companies, focused on agricultural business, as well as vini and viticultures in the Urussanga area (ZILLI; GIANEZINI; VIEIRA, 2015). The ceramic tiles sector – which is the main purpose of this study - is located in the Criciúma area and has several big local and international companies. According to the Industrial Developing Program of Santa Catarina (PDIC 2022), the regions of Criciúma, Sangão, and Tijucas has 8,000 manpower, which represents 42% of the overall workers in the sector throughout the state. With respect to the relevance of the ceramic tile sector for the local economic development, in the Cocal do Sul and Sangão areas, more than 50% of their total workforce belongs to the ceramic tiles sector (FIESC, 2014). The trade balance in the southern region, comprising the AMREC members reported a deficit of USD/FOB 4,470.247 in 2018. The counties with a positive trade balance are: Forquilha (USD/FOB 81,860.100), Içara (USD/FOB 38,481.509) and Cocal do Sul (USD/FOB 31,324.211), where exports surpass the imports, though. On the other hand, the counties where the imports were bigger than the imports are Criciúma (USD/FOB 191,282.388), Morro da Fumaça (USD/FOB 3,748.396) and Orleans (- 2,958.192) (BRASIL, 2019). According to the figures above, we can notice that the Santa Catarina Southern economy is increasing its performance during the last years, proving that new opportunities, whether internal or external ones have been created by the enterprises of the region, and that was possible due to the competitiveness that some sectors have achieved through innovation (MATTEI, 2011).

From this context, the main purpose of this study is to identify the share of innovation in the export industries of ceramic tiles of the Southern area of Santa Catarina. This article has been organized and divided into five sessions, whereas the first one refers to the introduction itself, presenting a contextualization for the matter, as well as for the main purpose of this research. Afterward, there is a theoretical framework, focused on innovation and internationalization. The methodological procedures complement the third session, followed by the presentation and discussion of the results of this research. Last but not least, the final considerations and bibliographical references arise in the fifth session.

Theoretical Referential: This section presents the theoretical innovation, with an emphasis on the business area, its dissemination, impact/innovation levels and grade of control over the process.

Innovation: First off, it is worth distinguishing innovation from two similar meanings commonly misused; there is, invention and discovery. The invention refers to the creation of something that does not exist at all and, according to Schumpeter (1982), does not have an economic relevance, if not put into practice. On the other hand, discovery is characterized by a scientific fact, already present in mother nature, that needs to be socially validated (a new species, for instance). According to the perspective of Trott (2012), a new idea is the starting point for innovation. One single idea on its own is not characterized as an invention though, not even an innovation, as it is merely a concept or a group of thoughts. An invention refers to the process of converting intellectual thoughts into a new and tangible artifact (JENOVEVA NETO, 2016). In this sense, innovation depends on inventions; however, the inventions must be directed to the commercial

activities that may contribute to a better performance of the company. Still, according to Trott (2012, p. 15), he mentions: "innovation is the management of all activities involved in the process of generating ideas, developing technologies, producing and marketing of a new product (or an improved one), or a production or manufacturing process or equipment". The Organisation for the European Economic Co-operation - OEEC –according to the Oslo Manual (2004, p.55), presents a new concept of a broad innovation, as it predicts a wide range of possible innovations, as it refers to "[...] the implementation of a product (or service) brand new or considerably improved, a process, a new marketing method, or a new organizational method in business practices, inside the company or external relations. Based on the understanding of the concept of innovation and supported by the Oslo Manual - OEEC (2004) and Trott (2012), innovation can be categorized according to the business area, diffusion, impact or novelty grades and the grade of control over the process. In this perspective, in table 1 below highlights different typologies (business area), as well as their characteristics:

The social innovation must be highlighted, as according to Brignetti (2011), after a long period in that innovation has been almost exclusively linked to the technological field, this kind of typology became more important, though. These innovating typologies must have some degree of novelty and range (diffusion), as they can directly impact the enterprise, the market, and the whole world. The innovation for a specific enterprise can be the same one that has been adopted by another enterprise with good results, but if it is something new for this specific enterprise, it is an innovation after all. On the other hand, market innovation occurs when an enterprise becomes the first one to introduce such innovation in its market. At a worldwide level, innovation occurs when the enterprise is the first one to launch such innovating tools onto the markets and industries, whether domestic or international ones (OSLO MANUAL – OEEC, 2004). Another dimension of innovation refers to the level of novelty or impact, which comprises the incremental innovation, whether radical, disruptive, or architectural, according to the data described in table 2 below:

Regarding the innovation grade control, it can be called as open or closed innovation. In the first category, innovation is performed inside the enterprise. Furthermore, the control of the entire process includes the conception of the idea, prototypes, testing, implementation, and commercialization. On the other hand, an open innovation principle means that "[...]" not all intelligent people work for you" [...], "the useful knowledge is spread around the enterprises of all sizes and on several places around the world" [...] (CHEEDBROUGH, 2012, p.19-20). Lastly, it is not at all simple to precisely define the term innovation. "The generating process of innovation may sound random or chaotic, which means that in some situations it may seem difficult to be explained, but certainly possible to be manageable (JENOVEVA NETO, 2016, p.51). As far as the sampling goes, Lakatos and Marconi (2003) define it as a small part of the original population, chosen at an appropriate time. Therefore, the tools for collecting data on this research were applied to six enterprises, taking into account their availability and accessibility. Reinforced this idea, Gil (2008) defines the sampling as a non-probabilistic of accessibility, as a selection of the elements in which one has access. This way, the research has been applied through a proper questionnaire (SAMPIERI, COLLADO, LUCIO, 2013), including questions related to

Table 1. Innovation business areas

INNOVATION	CHARACTERISTICS
Product	[...] it is the introduction of a new or significantly improved good or service, according to its new characteristics or usage. Moreover, significant improvements must be included, such as technical specs, materials and components, updated softwares, easy of use or some other functional characteristics.
Process	[...] it is the implementation of a new or significantly improved production or distribution method. Overall improvements in techniques, equipments or softwares are also included.
Marketing	[...] it is the implementation of a new marketing method, with significant changes in the conception of the product, its package, placement, its promotion or its price policy.
Organizational	[...] it is the implementation of a new organizational method in the business practices of the company, in its working place, or in external relationships.

Source: self elaboration, based in the Oslo Manual - OEEC (2004, p. 57-61).

Table 2. Novelty or impact grades

INNOVATION	CHARACTERISTICS
Incremental	Presents slightly less changes on existing products, which reflects into small and continuous improvements over the existing products or product ranges, exploring this potential of a pre-established project, reinforcing the capacity of such projects, also known as sustainable ones (JENOVEVA NETO, 2016, p. 45). Studies about the incremental process of development [...] suggests that the cumulative gains of efficiency are far bigger in the long term, rather than those obtained with occasional radical changes (TIDD; BESSANT; PAVITT, 2008, p. 33-34).
Radical	The radical innovation presents a new paradigm, as it changes the current business model with drastic changes in the way the product or service is used (OSLO MANUAL - OEEC, 2004). Schumpeter (1982) entitles these as rupture innovations (TIDD; BESSANT; PAVITT, 2008).
Disruptive	Such occurs when new products has a huge impact over the current productive chain system, that can even make the existing technological bases to become obsolete ones, creating new markets and changing the society's behavior. Some good examples of a revolutionary technological innovation are the television, telephones (landlines and mobiles), personal computers and the internet (JENOVEVA NETO, 2016, p.45).
Architectural	The term architectural innovation is used to call attention to innovations using several basic concepts of project, into a new architecture frame, thus having a significant impact in the relationship between components, rather than the component technologies themselves (HENDERSON; CLARK, 1990, p.13).

Table 3. Profile and international presence

PROFILE	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Employees	1.695	2.010	480	300
Exports	Argentina, Paraguay, Bolívia, USA and UK	Argentina, Paraguay and USA	Argentina, Paraguay, Uruguay and USA	Argentina, Paraguay, Uruguay, USA, Honduras, Panama and Costa Rica
Outsourcing	China, Italy, Índia and Turkey	Índia and Japan	-	-
Production for international markets	15%	25%	30%	30%
Sales on international markets	15%	13%	30%	30%

Source: self elaboration based on data of this research.

Table 4. Typology, diffusion, impact and innovation control

BUSINESS AREA OF INNOVATION	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Product innovation	Always	Always	Always	Frequently
Industrial processes	Frequently	Always	Frequently	Frequently
Management processes	Sometimes	Sometimes	Frequently	Sometimes
Marketing	Frequently	Frequently	Frequently	Sometimes
Services	Frequently	Frequently	Sometimes	Sometimes
DIFFUSION OF INNOVATION	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
For the company	Frequently	Always	Frequently	Frequently
For to market	Frequently	Frequently	Sometimes	Frequently
For the world (global)	Very seldom	Very seldom	Very seldom	Very seldom
IMPACT OR NOVELTY OF INNOVATION	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Incremental	Frequently	Always	Frequently	Frequently
Radical	Sometimes	Sometimes	Very seldom	Very seldom
Disruptive	Very seldom	Very seldom	Very seldom	Very seldom
INNOVATION CONTROL	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Open innovation	Very seldom	Sometimes	Always	Always
Closed innovation	Always	Always	Sometimes	Sometimes

Source: self elaboration based on data of this research.

innovating practices, using the Likert Scale (never, very seldom, sometimes, frequently and always). Such a questionnaire, directed to the Industrial Directors, Export and R&D Managers were applied during the period between 01- 10 October 2018, with four effective feedbacks.

Presentation and discussion of the results

International presence and profile: According to the Federation of Industries of Santa Catarina State – FIESC

(2014), through the Industrial Development Program of Santa Catarina – PDIC 2012, the ceramic tiles segment includes the segments of refractory materials, red and white-bodied wall and floor tiles, though. The industries in this study are classified into the red/white-bodied tiles, sub-class 2342/7/01 (ceramic biscuits for wall and floor tiles, plain or decorated, porcelain tile, mosaics, and several other special finishing materials), according to the National Economic Activities Classification – CNAE. Totalizing 4.475 workers, the industries on this study are all located in Criciúma Region, in

the southern area of Santa Catarina State, emphasizing its regional vocation for the production and sale of ceramic tiles in the domestic and international markets. Such vocation is highlighted by FIESC (2014), pointing that the geographical distribution of the jobs in the sector are concentrated over the Great Florianópolis Area and over the Southern Region, mainly in the counties of Criciúma, Tijucas, and Sangão, with an 8,000 employees workforce, representing 42% of the workforce inside the territory of Santa Catarina. In this context, table 3 below presents a profile of such industries and their market share overseas.

The production and sales towards overseas ranges between 15-30%, showing that the domestic market is by far the main focus of their operations. The highlight must be made to Industry B - the bigger one – as it is exporting 25% of its total production, though.

Business area, diffusion, impact, control, and innovating practices: According to their business areas, the ceramic tile manufacturers in this research concentrate their innovating efforts mainly in products and industrial processes.

Table 5. Innovating practices

INNOVATING PRACTICES	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Difficulty to perceive the need of innovation	Never	Very seldom	Very seldom	Very seldom
Capacity to envision opportunities	Always	Frequently	Frequently	Frequently
R&D support on external activities	Frequently	Frequently	Frequently	Frequently

Source: self elaboration based on data of this research.

Table 6. Encouragement and support for innovation

INSTRUMENTS TO SUPPORT INNOVATIONS	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Instruments to stimulate internal innovations	Yes (PIC)	Yes. There is a formal R&D management system. There are improvement groups, with a 35% volunteer participation.	Yes	No
Financial support (public)	Yes (FINEP)	Yes (FINEP)	No	No

Source: self elaboration based on data of this research.

Table 7. Participation and generation of innovation

PARTICIPATION IN INNOVATION	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
Income percentage for innovation	1%	Intended for innovation investments in improvements (incremental), 1,5%.	0,40%	5%
Innovation impact (percentage) of the innovation over the international markets	20%	There is no such a distinction. Projects aims mostly on products, which benefits both markets (domestic/export)	30%	15—20%
Starting points for innovations	Both (head office/branch/branch /head office)	Head office to branch. Note: there are no restraints in the branches for actions, but the the overall idea takes into account the strategic alignment of the projects defined by the head office.	Both (head office/branch/head office)	Head office only (no branches at all)

Source: self elaboration based on data of this research.

Table 8. Innovation on last year (2017)

INTRODUCTION OF INNOVATION ON LAST YEAR	INDÚSTRY A	INDÚSTRY B	INDÚSTRY C	INDÚSTRY D
New products introduced	Yes	Yes	Yes	Yes
Design and packaging changes introduced	Yes	Yes	Yes	Yes
New sales methods intrduced	Yes	Yes	Yes	Yes
New logistic methods introduced	Yes	No	Yes	Yes
New supporting methods for systems introduced	No	Yes	Yes	Yes
Creation or acquisition of new brands	No	No	Yes	Yes
New industrial processes introduced	Yes	Yes	Yes	Yes
New management methods introduced	Yes	No	Yes	Yes
Differential services introduced	Yes	Yes	Yes	Yes

Source: self elaboration based on data of this research.

The internationalization is focused mainly on trading with South America (Argentina, Paraguay, Bolivia, Uruguay), as well as North America, having the USA as their main target. Markets such as Central America and the United Kingdom are part of such a portfolio, but with a lesser share. Besides the trading practices, the industries A and B above – the biggest in the area – are also internationalized by third party services (outsourcing), with partnerships with Asia (China, Japan, and India) and Europe (Italy and Turkey).

Management, marketing, and services are also noted, but with less importance, when questioned about the grade of influence, according to table 4 below: The research identified that the innovations developed by the industries are aimed at the company and to the market, in an incremental form. Regarding the innovation control, manufacturers A and B (the biggest in the area), opted for the closed innovation (intra-company), which consists in having control of the whole process, including the conception of the idea, prototypes, bench tests,

implementation and commercialization (CHEESBROUGH, 2012). On the other hand, the other two manufacturers (C and D) opted for the open innovation system, though. Under the perspective of the innovating practices, table 5 below shows the perception of the industries regarding the need for innovation, visualization and opportunities, and support from R&D department: When questioned about the difficulties to perceive the need for innovation, the industries pointed out that very seldom or never have issues in this regard, which shows that they are fully aware of this particular, as well as on other sectors that are parts of this universe, such as the design and the fashion segments. In this same perception, they answered that they are aware to visualize new business opportunities, with support of the R&D Departments on external activities.

Encouragement and support for innovation: The manufacturers A, B, and C have the proper tools to stimulate internal innovations. Between the encouragements, the highlight is made to the Program for Corporate Ideas (PIC), duly implemented by the manufacturer A, as well an improvement group, with voluntary participation of 35% (manufacturer B), according to the table 6 below. The financial backup (public sector) highlighted on industries A and B comes from the Studies and Projects Financing Office (FINEP), which is a public enterprise that financially supports science, technology and innovation, linked to the Ministry of Science, Technology and Innovation. In this context, it must be emphasized the study of FIESC (2014), called Sectorial Strategic Routes for the Industry of Santa Catarina 2022, as it shows that in relation to the offer of research and technological development in the sector, there is a low representativeness of groups and research lines present in public or private universities (2-3% in the State). In this sense, the study indicates an insufficiency of the government in R&D, in part due to the lack of investments and incentives, as well as the distance between universities and enterprises.

Participation and generation of innovation: Table 7 below shows the income percentage for innovation, the innovation impact for international markets actuation, as well as the starting point of the innovations (from the head office to the branches, from the branches to the head offices, or both). The research identified that the income percentage for the innovation is quite low (between 0.2% up to 5%); however when questioned about the impact of innovation at international level, manufacturers A, C and D showed percentages ranging from 15 to 30%. In this regard, manufacturer B said that there is no distinction at all, as their projects are focused to be beneficial for they actuating markets; therefore no distinction between markets, though. Regarding to the starting point of the innovations, manufacturers A and C reports that it may occur, on both situations, from the head office to the branch, or vice-versa. Manufacturer B argues that there is no restraints for new ideas coming from the branches; however, due to the fact that their strategic planning were made in the head office, the starting point starts from the head office on to their branches. Manufacturer D does not have branches at all. And to finalize, table 8 shows the innovations developed by the industry in 2017.

Final considerations: The main purpose of this study was to identify the use of innovations throughout the export of ceramic tile manufacturers in the Southern area of Santa Catarina. To do so, the research, we had the collaboration of four leading industries, with an overall workforce of 4,485

employees, representing the importance of these industries in the local economy. It was noted that both the South and North American markets are indeed the bigger actuating business areas at the international level and that outsourcing partnerships have been made with Italy, Turkey, China, Japan, and India. The overseas markets represent 15 to 30% of their overall production, which means the domestic market is, by far, the most important one. Under the perspective of innovation in business areas, the highlight has to be made to the innovations in products and industrial processes directed to the enterprise and the market, on an incremental basis. The two bigger manufacturers in the area, which are part of this study, chose the closed innovation. Among the internal encouragements for internal innovation, we must mention the Program for Corporate Ideas (PIC) from the manufacturer A, as well as the improvement groups, with a 35% volunteer participation for manufacturer B. As for the financial public support, the FINEP was mentioned. The industries understand quite well the importance of innovation in their business; however, the income percentage towards innovation is still pretty low (between 0.2 up to 5%). Regarding the innovation impact on internationalization, manufacturers A, C and D showed percentages ranging from 15 to 30%. For manufacturer B, there is no distinction whatsoever, as their projects are developed to benefit both markets.

On manufacturers B and C, innovation arises from the head office, as well as from there to their branches, or vice-versa, as pointed out by manufacturers A and C. There was also a consensus that in last year some incremental innovations have been accomplished in products, design and packaging changes, sales methods, industrial processes, and differentiated services, though. As a contribution, the study also brings the participation of the four leading ceramic tile manufacturers, playing an important role in Santa Catarina's Southern Region economy, providing a realistic vision of the innovation practices, with a direct connection with the international markets. However, this study still presents, as a limiting factor, the absence of six other manufacturers comprising the exporting industrial core of ceramic tiles in the area, as well as the lack of a more detailed interview along with the people involved in this research, which could certainly increase the level of acknowledgment, due to their domestic and international experiences, though. This leaves the door open for a new study that could provide a more precise view of the application of innovation in our region.

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