

## Shared Knowledge and Production of Product Innovation

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### Abstract:

*Knowledge sharing is one of the ways to bring about important organizational change. The creation of innovative products can be explained by several factors. The literature that deals with these fields states that interaction between individuals, groups and the organization promote the generation of knowledge – explicit and tacit –, inducing the production of innovation. This study is supported by the qualitative approach, with descriptive and exploratory objectives. As a research strategy, a study was carried out in five companies associated with the Ceramic Industry Union of Criciúma. As a research technique we used a set of interviews in two groups of respondents, both management and operational. The data show that practices of shared knowledge are inducers of product innovation. Companies are heavily influenced by the environment and use common external sources for product innovation, although predominantly in trend searches over the internet and data analysis and observation by market behavior.*

**Keywords:** knowledge management, innovation, product development

### 1 Introduction

The ability to share knowledge and from this interaction to create and use new knowledge becomes a relevant factor for the modern organization (Nonaka & Takeuchi, 1997; Terra, 2007). It is worth emphasizing that as individuals share knowledge, they are also creating new opportunities for improvement, providing incremental and/or radical innovations in daily tasks (Terra, 2007; Trias de Bes & Kotler, 2011). However, the literature affirms that, nevertheless, there are barriers to be overcome in relation to individual's knowledge sharing practices. Starting with the manager's incentive stance and the company's cultural identity (Nonaka & Takeuchi, 1997; Terra, 2007; Tidd & Bessant, 2015).

It is also important to expose the interdisciplinary characterization of the product creation and development sector, which refers to the reflection before this study, since it requires a close interdepartmental relationship. Emphasizing, therefore, the importance of knowledge sharing, not only with those responsible for the development of new products, but also with the interconnected sectors that perpetuate the idea (Nonaka & Takeuchi, 1997; Terra, 2007).

Considering this context, we emphasize that the ceramic industry, covering in this context the coatings segments, as well as tiles and bricks, is related to the bearer sectors of the future, according to a study carried out by the Santa Catarina Industrial Development Program – PDIC (2013). Seeking to legitimize the facts of the remarkable participation of the ceramics industry, the Federation of Industries of the State of Santa Catarina (FIESC), through the study provided by the Santa Catarina Industrial Development Program (PDIC) carried out in 2013, identified that the industrial sector in question, holds the position of leadership in the ranking of contribution to the southern region of Santa Catarina.

However, the criterion of punctuation was given by the classification of concentration, specialization and growth of the industry, providing socio-economic development.

It is worth highlighting that the development of new products has provided prominent support for the ceramic tile industry in the market. Boosting mainly, the strategies of product differentiation, investing in new characteristics, textures and trends. Still in this context, it is possible to appreciate the wide range of products launched in the market by the ceramic coating industry, being however, similar items substitute materials such as wood, stone and paper, ensuring greater adherence, practicality and hygiene (Abceram, 2018; Anfacer, 2018; Anicer, 2018).

Given this scenario, the following research question emerges: Is sharing knowledge to generate product innovation an active practice in the ceramic tile industry? Given the above, the objective of this study is to investigate if – and how – knowledge sharing contributes to the generation of product innovation in the ceramic coating industry in the south of Santa Catarina.

## **2 Theoretical Framework**

### **2.1. Organizational Knowledge Management**

Much has been discussed about the impacts of globalization and in fact, since it was the great precursor of the technological advance, allowing instant communication and, thus, facilitating the monitoring of data, information and knowledge.

Nonaka (1991) emphasizes that successful companies are able to create knowledge and quickly transfer to new products, enabling the market to stand out and guarantee the competitive potential. The knowledge aspect disseminated long ago in society, receives greater organizational emphasis from the 1980s, based on the assumption that the human being carries a significant sum of knowledge acquired throughout the daily experiences and, which reflect on the good performance of organizational activities. As knowledge is shared, new opportunities for improvement are also created, providing even incremental and/or radical innovations in daily tasks (Nonaka&Takeuchi, 1997;Davenport&Prusak, 1998).

However, there are distinctions between data, information and knowledge. For Nonaka and Takeuchi (1997), we can consider that given the group of numbers, symbols and letters that do not constitute only a concrete meaning, however, are essential to subsidize the information base. In addition to the written form, the composition of the data also expands to the oral format, being valid only as it provides value to those who enjoy it. For organizations, for example, data can be related to reporting structures. As for data, they progress to the stage of information from the moment there is interpretation and analysis.

Referring to the transition from the information stage to knowledge, the same occurs when there is validation of the analyzes, acquired through the data, which result in knowledge regarding the analysis performed (Nonaka &Takeuchi, 1997). Thus, knowledge is multiplied when used and shared, unlike any other action that when shared by a party, the other results in loss. In this context, in a knowledge economy, the sources are unlimited, unlike natural resources, where it suffers from scarcity (Sveiby, 1998; OCDE, 2005; Fialho, Santos, Macedo & Mitidieri, 2006).

Davenport and Prusak (1998) define knowledge management as a conglomeration of experiences, information and values. In this bias, the authors also argue that knowledge originates in the minds of employees, being appropriate, therefore, by the organizations that implant the knowledge before organizational routines. However, organizations that transform ideas into knowledge also boost organizational competitiveness.

The knowledge present in organizations can be appreciated through two visions, being knowledge as process and knowledge as object. In this context, knowledge as a process is associated with the application, acting simultaneously as one learns, while knowledge as an object is associated with the organization's assets and can be acquired and sold (Fleury & Oliveira Junior, 2001).

Corroborating with the positioning, Alavi and Leidner (2001), state that knowledge in the perspective of object reflects on the need to store the knowledge of individuals so that it can be reused when necessary. However, in treating knowledge as a process, in this aspect, the interaction activities of the individuals require more attention, comparing to knowledge as an object. Since it proposes the stimulation of innovation, creativity and motivation for the development of competences. Knowledge as an object does not waste these efforts, and in some cases, lack of incentive for knowledge sharing to occur so that it results in improvements in processes, products and/or services.

Based on the assertion of Fleury and Oliveira Jr (2001), Alavi and Leidner (2001) and we realize the importance of simultaneously applying the two views of knowledge, since they are complementary. Knowledge as process drives the competencies of individuals, knowledge as object is responsible for storing the knowledge from the previous phase.

To become a knowledge organization, it is essential to have managers who actually invest in knowledge, seeking to break the barriers of financial capital, contemplating the ability to share knowledge among the team so that it can be disseminated in the processes, products and services, promoting the innovation of organizations. However, it is still noticeable in many organizations the tough positioning, when it comes to insisting on prioritizing the quantity of work before quality.

On the other hand, there are those who crave quality, but are not willing to invest in environments that are conducive to creativity, essential for the new knowledge economy of the twenty-first century (Sveiby 1998; Terra, 2000; Edvinsson, 2003; Mclean, 2005; Mulbert, Mussi & Angeloni, 2002; Fialhoet *al.*, 2006; Takeuchi & Nonaka, 2008; Etzkowitz, 2009).

In the mature perspective of knowledge management, learning has become a significant result and, by the way, it can be said that it also ensures relevant prominence in corporate sustainability, active concern, mainly, by managers and employees who work with intensive use of high technology. In the current economy, which is experienced by knowledge, those who become more competitive can learn faster and, from this learning, improve processes and products.

Terra (2007) that it is not enough to offer the market a reduced-price product, it is necessary, however, to sell experiences, which are only possible through individuals who experience the frequent knowledge, sharing with their peers.

Although much has been discussed about the importance of knowledge management, it is noticed that, still, there is a certain lack of attention in how, in fact, the process of creation of the knowledge is developed (Takeuchi&Nonaka; 2008). Abbariki (2010) suggests that the effective knowledge management process maintains a supporting role for the performance of organizations, in addition to ensuring maximization of innovation. The author also emphasizes that the practice of knowledge sharing is an essential factor for the success of organizational knowledge.

For Teixeira and Valentim (2012), the focus of knowledge management in organizations is to adapt an environment that allows, dynamically to all individuals, the sharing of tacit knowledge, contributing to the creation of new knowledge based on different shared perceptions. However, the information is portrayed as the raw material needed for knowledge and thus, the use of information technologies has a great participation in relation to the explicit knowledge sharing, allowing it to be available in digital spaces and accessible to interested parties. This is an important action for the organization, allowing the knowledge to be internalized and can be reused when necessary.

Knowledge management has gained greater participation in the business scenario due to the competitive differential provided, since quality and price are attributes that are easier to match among competitors, as for the organization that maintains practices of generation and sharing of knowledge, it remains constantly innovating in search of new alternatives to improve efficiency, quality and creativity of products (Davenport&Prusak, 2003; Takeuchi&Nonaka, 2008; Trías de Bes & Kotler, 2011).

## 2.2. Knowledge Sharing

Faced with the new knowledge-driven economy, the existence of workers with proactive characteristics is a significant variable for the scenario, in which they are called corporate entrepreneurs or intrapreneurs. Thus, the individual who provides ruptures of processes through the renewal and exploration of new methods of action, has this classification and, not always, this individual will have a business of his own, being that the employee himself can have these characteristics in the very environment of performance (Choo, 2000).

Angeloni (2002) corroborates before the position that knowledge is related to three organizational competitive strategies, being: (a) Knowledge management strategy, fostering the development of networks among employees as a way to encourage the sharing of tacit knowledge among individuals; (b) Information Technology, in the case of IT investment, so that it can optimize the exchange of tacit knowledge and; (c) Human resources, related to rewards techniques for people who share knowledge directly with others.

In this bias, the sharing of knowledge is one of the important pillars for the development of organizations, being conceived through the interaction between individuals who share the experiences and knowledge, tacitly and/or explicitly, generating value and new knowledge for the organization (Takeuchi & Nonaka, 2008). Takeuchi and Nonaka

(2008) also report that knowledge sharing provides the opportunity to improve the performance of individuals, organizations and teams, through discussions and the generation of new ideas and innovations.

It is probable that the lack of the knowledge in question is supplied by the team itself and, for this reason, it is essential to evaluate the experiences and knowledge of the collaborators, since the knowledge sought may already be available in the team, however unnoticed or little explored (Tonete & Paz, 2006). Knowledge sharing is an effective practice to boost learning, both of the individual and of the organization, being essentially a social process involving integration of both tacit and explicit knowledge (Polanyi, 2009).

Nonaka and Takeuchi (1997) support that making personal knowledge accessible to all is part of the organization's profile that encourages the creation of knowledge. For this purpose, the trust allied with the reward makes it as if this culture is indeed accepted, and executed by the members who work in it.

However, one of the most valuable tools for knowledge management is the knowledge spiral, being one of the main responsible for the achievement of organizational goals.

Nonaka and Takeuchi (1997) of the four modes of knowledge conversion present in the SECI model created by them, which covers: (a) socialization, (b) outsourcing, (c) combination and, (d) internalization. Outsourcing becomes the key to knowledge creation, because it creates new and explicit concepts through tacit knowledge practices.

It is stated that when an individual can keep in tune with tacit and explicit knowledge, a new knowledge is revealed. Being that, by explaining the new knowledge generated, it is allowing the individuals who take ownership of them, internalize them, that is to say, promote the expansion of tacit knowledge itself that will serve as a subsidy for joining with another explicit knowledge, forming again, a new knowledge. Therefore, beginning again the spiral of knowledge, this time, with even more robustness and resourcefulness (Nonaka & Takeuchi, 1997).

The study by Wulf and Butel (2017) sought to ascertain how collaborative relationships can determine the efficiency of knowledge sharing in the organization, since for authors, knowledge sharing among partners, coming from collaborative relationships, becomes essential to support decision making, as well as the development of innovation.

In this way, interviews were carried out in four industrial sectors of the countries Germany and Italy, aiming to understand how the process of knowledge sharing, organizational learning and decision making occurs. It was found that the structure of collaborative relationships directly influences the efficiency of knowledge sharing, resulting, however, in the company's sustainable competitiveness. Stressing further, that the closer the work group, the less barriers there will be in sharing knowledge, being the basis for organizational learning (Wulf&Butel, 2017).

### **2.3 Innovation Process**

Nonaka and Takeuchi (1997, p. 79), report that "when there is interaction between explicit knowledge and tacit knowledge, innovation emerges", it is possible to observe the relevance of knowledge management to drive innovation. Thus, the knowledge aspect has been reaching an important function in relation to business development. In this scenario, organizations are challenged to restructure work so that creativity can flow generating innovation, with the objective of meeting the needs and leveraging the competitiveness (Mulbert, Mussi&Angeloni, 2002).

It is also worth noting, through a study conducted by the IBM Global Business Service (2006), that the most significant source of generating ideas and innovation is constituted, first, by employees, followed later by the relevance of partners and other interactions with the external environment.

The study by Trias de Bes and Kotler (2011) suggests the innovation A-F model, which aims to indicate the list of functions essential to conduct the innovation process while maintaining the flexibility and interaction of individuals during all stages of the process.

The first stage of the process consists in the definition of the activators, which can be: (a) Administration/Management, through specific requests to those involved in the execution of projects; (b) Employees, being these members of the own organization that activate by means of suggestions spontaneously or through technological channels for this purpose; (c) Interest groups, referring to investors, customers and suppliers and; (d) Scientific Community of Research, in this way, the suggestion is activated by the academic and research institutions (Triás de Bes&Kotler, 2011).

The reflection is also involved, to the types of resulting activation, before the choice of the activators, being able to be related to: (a) Activation from top to bottom, when the activation is initiated by the administration/direction, being directed to the other involved of the company; (b) Activation from the inside out, at which point it maintains if the initialization by the top management/direction, but the execution is directed to the external environment, being the interest groups or the scientific community; (c) Bottom up activation, the initiation by the actual official with the

follow-up of the administration/direction, before the budgetary approvals and; (d) Activation from the outside in, beginning with indications of the external environment, being the scientific community or shareholders (Trías de Bes & Kotler, 2011).

Those responsible for the creation, framed as creators in the A-F model, have the task of evaluating ideas that can transform into innovations, so the function of the creators is not only to suggest the ideas as done in the initial process, dealing with the activators, but rather to guarantee the applicability. While the developers, who are responsible for the next stage, are responsible for realizing the idea created so that it can be marketed (Trías de Bes & Kotler, 2011).

After the activity of the developers, the action of the executors is to effectively implement the introduction of the product and/or service in the market. This phase, however, is characterized by market feedback as the received innovation.

The fact that the A-F model of innovation proposes flexibility and interaction among those involved, ensuring teamwork, it is essential for the parties involved to follow the market returns, improving what is still necessary (Trías de Bes & Kotler, 2011).

Finally, the role of the facilitators, portrayed by Trías de Bes and Kotler (2011) is to maintain the financial analysis while the innovation project is under development. According to Trías de Bes and Kotler (2011), creativity is essential for companies, because without creativity there is no innovation. They approach that creativity, ideas and new technologies alone are not enough because, the innovation process must have people to manage them, need new skills related to business management. Moreover, the company that is limited only to the technological aspect of research and development loses the creative potential of professionals working in other departments. From this context, the knowledge management approach can be considered to consolidate innovation in companies.

#### **2.4. Product Innovation**

The study by Nonaka (1991) emphasizes that the success of companies is linked to the ability to create knowledge through the interaction of employees' experiences and, with this, disseminate them into new products. Kogut and Zander (1993) claim, when the intellectual capital of companies is well managed, it is possible to obtain an extended application of the knowledge interactions in new products, since the fact of containing several individuals acting on the same perspective, differentiated positions can be raised on the same theme, centralizing demand and proliferating the ideas transferred in product innovations.

The study by Clark and Fujimoto (1991) portrays the development of products in five stages. The initial stage, characterized as a product concept, refers to the analysis of market information, including customers, suppliers and competitors, as well as technological opportunities. In order to define the concept of product, it also takes into account the price, quality and functionality characteristics goals. Then, product planning is carried out through the mapping carried out previously during the product conceptualization stage. During the stage of product engineering and testing, the information cleared and transferred to the prototypes for testing and analysis is centralized. On the other hand, the stage of process engineering is committed to the transfer of information crucial to the development of the product, in information also for the process necessary for its materialization. Finally, the production comprises the first pilot production lines to determine the result and provide the necessary arrangements (Clark & Fujimoto, 1991).

In addition, a reflection on dependence on product planning and development, in relation to the cultural identity of the company. In this context, the need to expose, mainly to those involved with the productive process of creation, in the mission of the company with clarity, covering the markets that it intends to serve and which technologies to meet such strategy. Based on this, those involved are encouraged to maintain the interaction of knowledge to promote innovation in new products (Leonard-Barton, 1995; Nonaka & Takeuchi, 1997).

A variety of concepts and interpretations about the incentive of knowledge to the development of new products are brought to the surface, emphasizing the essentiality of practicing knowledge sharing to induce innovation between the planning and development of products. Since knowledge is enhanced with the interaction of individuals, and the more records can be maintained in relation to previous projects, the better the reuse and creation of new knowledge (Mckee, 1992; Bartezzagi *et al.*, 1997; Nonaka & Takeuchi, 1997; Davenport & Prusak, 1998).

It is also possible to argue that the idea brought by Thomke and Fujimoto (2000), on the "front-loading-problem-solving" approach proposes the identification of solutions to the process gaps presented in the initial phase of product development. In view of this, the authors suggest the use of shared knowledge, rescuing previous actions, to align the impacts presented in the initial phases, in parallel with the involvement of advanced technologies that enable the instant simulation of prototyping.

In addition, Ulrich (2000) reports that the company that appropriates knowledge as a competitive advantage ensures greater approximation with the market leadership that acts, because knowledge is something relatively difficult to copy, hence the reason for constantly promoting moments of interaction in the business environment, so that knowledge sharing is often driven. However, it hampers the market share of competitors who do not use this potential to boost the strategies, thus also hinders the innovation process.

Another vision, about the innovative potential for product development, proposes that in order to culturally implement innovation in business actions, it is essential to maintain a balance between what has been discovered and, which it is necessary to maintain the holding. The synergy must be constant in this respect. In summary, it can be said that the balance between discovery and exploration in the field of innovation, is also acquired through the interaction of knowledge with the peers, at which moment the shared tacit knowledge is investigated by different angles, improved and, by means of the implantation in products (Takeuchi & Nonaka, 2008; Trías de Bes & Kotler, 2011).

However, some characteristics differentiate innovative companies from other players in the market, which can be grouped into two categories, being: a) strategic skills, in which it maintains the long-term vision and with the capacity to even anticipate some market actions and, b) organizational skills, as it relates to the willingness to risk and also the ability to manage it, there being cooperation between the operational sectors and even, external consultancy assistance, aiming at the development and positioning of the organization (OCDE, 2005).

In this way, diverse possibilities are identified for organizations to innovate in the development of new products and, irrespective of the type of innovation they practice, both small improvement and radical change, there is a logical sequence, consisting of the beginning of the idea until it is actually implemented. It is worth mentioning that many ideas come from the employees themselves, those who experience the day-to-day operation. Others, however, may depend on complex research, involving environmental monitoring and the hiring of specialized companies to assist in the process (Terra, 2007).

Relevant part of the organizational innovations is the result of individual initiatives, or even from groups that share the knowledge and interest in finding solutions (Terra, 2007). In this context, the existence of the motivating leader is essential, which will encourage the proactivity of the employees, providing environments that stimulate creativity.

Due to this expressive presence of innovation, the development of new products has evidently become essential for companies that seek to remain in the market. Suppliers constantly seek to attract the target audience through technological raw materials that guarantee maximization, in the quality content, to the product. The company, by acquiring differentiated inputs for production, seeks to position itself in the market before the quality, delivering value and a new experience to the customer (Nonaka & Takeuchi, 2008; Trías de Bes & Kotler, 2011).

In the same direction, Takeuchi and Nonaka (2008), conceptualize the value of a product when it can respond to what was created, what is the potential and who is targeted. In this context, the production process has a relative interference with the value that is being delivered to the customer and/or final consumer.

In the study by Trott (2012), it is proposed that the innovation process is related to three factors: (a) Individual creativity, responsible for promoting differentiated actions in daily activities in the application of knowledge and experiences; (b) Operational functions, when companies take ownership of the knowledge of the individuals who work for them, applying new solutions to processes and products and, (c) Market demands, which involves the interaction of companies with the external environment in order to identify opportunities and with this, develop or improve the products.

### **3 Research Methodology**

#### **3.1 Research characterization**

To reach the proposed objective, the methodological procedures were defined, being qualitative research. In this bias, the qualitative approach entails to the researcher the use of several techniques through the interpretation, flexibilization and expansion of possibilities of action, while negotiating the transformation of the reality classified as empirical in science (Creswell, 2007).

The investigation of the research is developed in a descriptive and exploratory way. However, the descriptive practice allows exposing systematically, attitudes and relations of a certain problem. The exploratory scope is classified by exploring the select theme, with depth. Being possible to appreciate and embrace a certain circumstance and that fact, to create hypotheses (Yin, 2001; Creswell, 2007).

The study had as a research strategy the scope of multicases. As pointed out by YIN (2001), the technique proposes the use of multiple cases as a means of replication and not, generalization of results, allowing mainly, the monitoring of several realities in relation to the same object.

### 3.2 Object of Analysis

In order to select the companies that operate in the ceramic tile industry, we opt for those that internally maintain the product creation and development sector. For this we obtained as a parameter, the analysis of the companies associated to the Union of Ceramic Industries of Criciúma (SINDICERAM), and of the twelve associated companies, in consultation with SINDICERAM (2016), only ten were in accordance with the objective of the present study and, from these, it was possible to carry out the multiple cases study in five companies. It covers 50% of the ceramic tile companies in the southern region of Santa Catarina, associated to SINDICERAM, being: Cecrisa Revestimentos Cerâmicos; Cerâmica Artística Giseli; Ceusa Revestimentos Cerâmicos; Eliane Revestimentos Cerâmicos and, Gabriella Revestimentos Cerâmicos.

The selection of the sample group through the Union of Ceramic Industries - Criciúma (SINDICERAM) is justified in view of the range of companies covered, in which it maintains an important reflection in the economy of the region. It should be noted, however, that during the presentation of the results companies will be fictitiously and, at random, as companies A; B; C; D and E, to guarantee the identity preserved in relation to the reports presented.

### 3.3 Data Collection

For the conduction of the data collection process, first by telephone, with the six companies associated with the Union of Ceramic Industries – Criciúma (SINDICERAM) that internally own the product creation sector, that is, that do not outsource such activity. Thus, of the six companies contacted, only one did not return in a timely manner with the agenda available for study participation. In this way, the study counted on the participation of five companies from the cited industrial segment.

Following this, we started the on-site realization of the case study in the mentioned companies, dedicating approximately 5 hours per study, considering, nevertheless, the period for the displacement to company, as well as the application of the interview and subsequent interaction dialogue with the parties involved.

When initiating the interview process, we initially sought to carry out the case study with the managers of the sectors of product creation and human resources. Subsequently, we started the process with the product creation operational sector, which included a respondent in each company: A and D and two interviewees in the companies B; C and E, due to the availability of interviewees by companies. It should be noted, however, that the number of participants did not interfere in the result of the comparative analysis.

It is highlighted that in order to obtain the expected success in the accomplishment of the activity, the researcher carried out a personal schedule to keep organized the dates and the time necessary to carry out the study in each company belonging to the sample group.

The companies showed interest in contributing to the study in question, which socialized internal practices and, in some cases the lack of them, in relation to knowledge sharing and the product innovation process, helping in this way, in the improvement and strengthening, of the segment of ceramic tiles. The study period in the companies of the sample group comprised the months of May to September of 2017, totaling 4 months of field research, comprising 25 (twenty-five) hours of recorded interviews, plus transcripts, which ended in October 2017.

## 4 Results and Discussions - Sharing combined knowledge to drive product innovation

This section aims to demonstrate the application in the SECI model of knowledge interaction and, in the A-F model of innovation, the results obtained before the action of the multiple cases study in the companies A; B; C; D and E belonging to the ceramic coating industry. It should be noted, however, that an attempt was made to improve the understanding of the quadrants responsible for the SECI model, proposed by Nonaka and Takeuchi (1997) being: (a) Socialization; (b) Outsourcing; (c) Combination and; (d) internalization.

Regarding the category in question, the objective was to verify if there is sharing of combined knowledge, to drive innovation in the development of new products in the ceramic tile industry. For this section, we counted on the positioning of the managers of the product development sector, classified as E2 and the designers and/or technicians at the forefront of the innovation process identified as E3, both followed with the fictitious identification letter of the company belonging, being: A, B, C, D and E.

It should be pointed out, still in this direction, that companies B, C and E made available in addition to the interviewee E3, plus one employee in each company, and for these the sample will also follow with interviewee E4 followed by the fictitious identification of the companies already mentioned (B, C and E).

In this bias, we initially questioned the interviewees about the process of innovation of ceramic coatings, considering the format and design, which sought to ascertain the inspirations sought at the time of innovation, as well as the interactions and knowledge tools used.

The interviewee E2, belonging to company A, said that innovation is a prerequisite of the company, all products launched must be innovative, whether in texture, raw material and design. In this direction, the interviewee still states that the innovation process begins with the internet trend surveys, visits to fairs, What fashion is suggesting from clothes to cars, this, because the interviewee states that regardless of the area, it can always generate inspiration for the development of the ceramic coating.

The interviewee E3, also represented company A, emphasizes that innovation in the development of new products is related to the observation, when he states that:

"[...]we are very much in noticing manifest, trends, of what they are using, of what you need in the market, then we are always analyzing. So it's not just the fair, but also the experience that the user "is" having with what he "is" consuming, so we can fix it very well, we can do it inside a store, analyze the customers, experiences, or even on social network. Then, we analyze the consumer, architect, and then, we can embody the company within it".

The interviewee E2, representing company B, stated that the process starts with the trend information, emphasizing that *"[...]we have behaviors that are studied, we structure these behaviors, then we have trend, behavioral profiles."* Also in this direction, the interviewee E2 mentioned that the innovation process covers searches on fashion sites, programs of creativity and even inspirations in objects, when he states that:

[...] in this part of construction if it is a wood, you have to buy, process, move the way you want to take pictures, take pictures, also scan to get the relief map, then this process is done and prototyping begins to occur.

For the respondent E3, also representing company B, inspiration is associated with observation and exchange of ideas and knowledge with the team, when he states that:

[...] some ideas come from the development, other ideas taken from the same head and that is not a trend, "I looked at the middle of the street and thought of such a thing" and can become a product and is not fashionable, the competitor does not have it. There are products that come from the market, for example, the commercial that is selling and says "oh the competition is selling this product a lot, we have to create one to counter act", and then they focus on the competing with that product.

The interviewee E4, also belonging to company B, corroborates the position of the previous interviewee E3, complementing that part of the innovation also depends on the interaction of knowledge with the industrial sector, when he emphasizes that *"[...]now we are launching small, special pieces, there is a whole new line, so the factory brought "oh we'll produce such formats" then we bring trends within that format.*

Referring to company C, respondent E2 emphasized that product development currently occurs at the customer's request, therefore, there is no innovation process on the part of the company, which emphasizes that:

"[...]when the client makes the request, he already chooses the format, or he suggests and we negotiate with some format that we already have in production line, in many cases they already bring the image or they bring the product very specified".

In this direction, the interviewee stressed that a change is being made in the sector so that the company can also acquire the creative identity. As for interviewee E3, also from company C, stressed that with the structuring of the sector vis-à-vis the creative side, the purpose is also to work outside the company to boost the creative sense, when he reported that:

[...]all the ceramics I saw there in Sao Paulo during a course, everyone searched the internet and all the designers were complaining about it, because they "often" visit interest, those sites that have a lot of images and end up "pruning you" in the creation part.

Also in this direction, the interviewee E4 pointed out that *"[...]we spend more time on the computer, but cannot be alone in one place, you have to have several sources of research, if not everyone will end up doing the same thing and it is noticeable at fairs"*.



In the case of company D, initially the interviewee E2 emphasized that the innovation process occurs with the interaction of external information, in relation to what the market needs in addition to the trends followed in websites, fairs, samples for the process involves technology and design, he points out that:

[...]we follow this trend of technology, make an analysis of the strategic positioning of the company and on top of that if a decision is made. They are big investments, installing a furnace and a press are way more than 50 million BRL, not a simple investment, so they are very strategic, the technological trend is analyzed according to the position of the market and the company decides to invest or not. It depends on many variables, the product department obviously contributes, but it receives this as a guideline, and with this directive we will create conditions, but is well connected to strategic planning, by the level of investment that is made.

Respondent E2, representing company E, stated that the innovation process is associated with the customer's need, which emphasizes that:

[...]a distributor from the Northeast wants 20 new products. Is more like they like it in the Northeast? There their product is more earthy, stronger, for example, from there we direct our project". "Ah let's do for architects who need the part for dark environments, then go to that project over there" And when you do not have any dedicated project, "What do we strengthen in 2018?" "Ah we will search and provide freedom even for the creation". And that's how we start adding it to the product.

Respondents E3 and E4, also related to company E, emphasized that the process of innovation of ceramic products consists of the analysis of trend and texture of the market, by means of searches on websites, fairs, for example.

The figure 1 shows the comparison between the companies A; B; C; D and E in relation to the sharing of knowledge combined to drive innovation. The results indicate the action taken by the sample group in consulting the trends through technological resources and investigating the behavior of the market through observation and direct contact with the customer, to assist in the generation of product innovation. Thus, the expectation of the present category was sought to identify if those responsible for the creative process use combined knowledge to drive innovation.

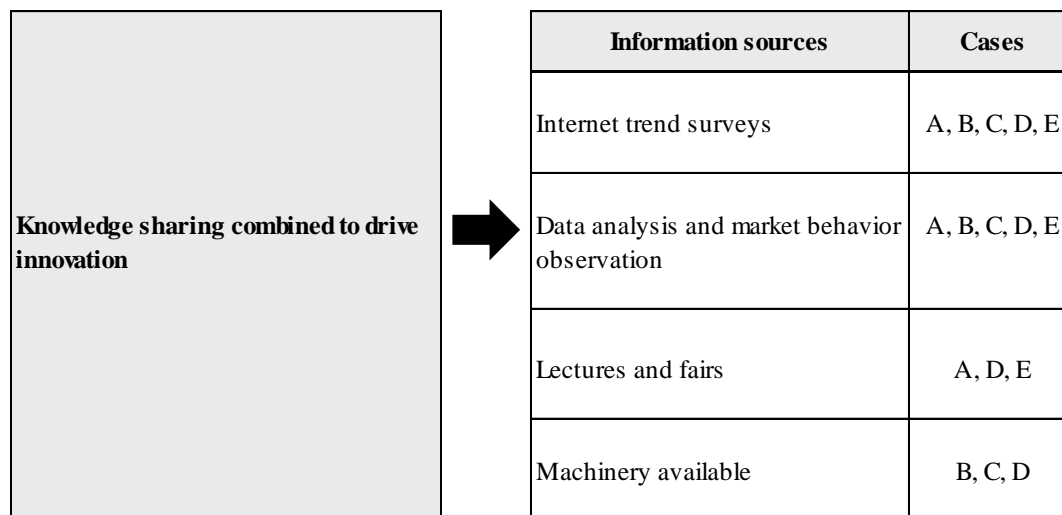


Figure 1: Knowledge sharing and innovation source- Authors' own elaboration (2018).

This report confirms also with the positioning by Nonaka and Takeuchi (1997), Schumpeter (1997), Edvinsson (2003), Fialho et al., (2006), Sabbag (2007) and, Trias De Bes and Kotler (2011), when they affirm the need to understand the dynamics that surround the market so that products and/or services can be offered that meet the needs of the respective target public. Since innovation will only succeed if it is useful to the target audience (Takeuchi & Nonaka, 2008; Trias de Bes & Kotler, 2011). The companies B, C and E also showed the type of equipment available in the company to carry out the innovation project, being a fundamental factor in the decision-making process.

## 5 Conclusions

This study investigated the importance of knowledge sharing in contributing to the generation of product innovation in the ceramic coating industry in the south of Santa Catarina – largest ceramic pole in Brazil. The internal focus of the analysis unit was the product, represents the strategic point of the ceramic tile industry, since it is from this activity that the new products take shape and direct the tasks to the other departments.

In the development of research, it was possible to identify the richness of internal resources derived from socialization, outsourcing, combining and internalizing the knowledge of its employees to generate product innovation, since it is fundamental to the success of the organization's performance. For this purpose, we sought to portray the positioning of the authors Nonaka and Takeuchi (1997) and Trias de Bes and Kotler (2001), fundamental authors for this study, through the SECI models of knowledge interaction and A-F of innovation to contemplate the analysis of the results, in addition to maintaining theoretical support of authors pertinent to the theme.

However, one of the limiting factors was due to the absence of published works using this same practice, however, it shows originality, when the SECI knowledge and A-F innovation models were used simultaneously, demanding in this way, a greater depth in the analysis so that implantation in the study in question was feasible.

In the context of research relevant to knowledge sharing and the process of innovation of ceramic products, we perceive commonalities in the following external sources: (i) trend searches over the internet and (ii) data analysis and observation by market behavior. This demonstrates the determinism of the environment about the internal decision-making of companies. In addition, (iii) lectures and fairs and (iv) machines are emphasized by some of the companies as determinants in the process of sharing and innovation.

We also highlight the interaction of knowledge with universities and suppliers, promoting the capture of knowledge of the external environment, through exchanges of knowledge and experiences, which is reversed in dialogues with the product creation team. This action results in the longevity of the company that appropriates the benefits promoted by the shared knowledge to boost the activities in the market.

This study represents the beginning for endless possibilities in the industrial sector of ceramic coatings and suggests, expansion to the other industrial and commercial sectors, since, there are no application restrictions, adding the essentiality of knowledge to the development of activities in the current economy. The study also contributes to the expansion of knowledge in the academic scientific society, in addition to helping to promote socioeconomic development. The research will only be based if it is associated with the growth of knowledge and the improvement of society.

Considering the results presented in relation to the shared knowledge, interaction and production of innovation in the ceramic coating industry of the southern region of Santa Catarina, we suggest deepening the research and analysis in relation to the organizational learning reflexes. Expanding also, for the other industrial and commercial sectors, seeking to improve the economy through knowledge and innovation.

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