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## INNOVATION NUCLEI FOR THE CERAMIC TILE SECTOR: A QUALIFICATION FRAMEWORK

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### ABSTRACT

This paper introduces a framework for the qualification of members of the Innovation Nuclei inside ceramic tile companies in Brazil. These Innovation Nuclei aims to create permanent channels of knowledge transfer between universities and companies, and, therefore, to transform academic knowledge into innovative and competitive products. A six-stage process for the implementation of Innovation Nuclei is presented, emphasizing the importance to qualify their members. A qualification framework is presented. This framework seeks to stimulate a constant interaction among theory, practice and creativity, taking into consideration knowledge related to materials engineering, design and product development management. The difficulties faced during the implementation of the Innovation Nuclei in the ceramic tile companies of Santa Catarina (Brazil) are discussed at the end of the paper.

**Keywords:** Innovation Management, Ceramic Tile, Qualification Program, Product Design

### INTRODUCTION

With the market opening, Brazil has been showing one weak point, which is the low innovative and competitive products fabrication, if compared with industrialized or some pre-industrialized countries. This has been showing up a low participation in the annual world ranking of new patents and also in the foreign commerce.

In Brazil, companies find it difficult to manage their innovation process, mainly because they generally don't have qualified personnel and also do not use integrated planning and developments management tools. Oppositely, great abilities can be found in Brazilian universities and research centers, which are able to support development processes and assist the companies in their innovation process as well. There is though a huge distance and common dialogue difficulties between companies and research centers, what shows how fundamental the institutionalization of relations is in order to create an innovation culture in the companies and to form permanent channels of communication and knowledge in the universities.

In the industry, until now, only few companies, generally the middle sized ones, had already installed an integrated system for planning, implementation and management of innovation on their products. The great majority of small and middle sized industries do not have an up-to-date process which guarantees the innovative and competitive products demanded by the global economy.

The analysis of these facts leads us to the conclude that the great dissociation in Brazil between knowledge generators, which are the universities and research centers, and the companies, normal locus of technological innovation, is the inexistence of institutionalized interlocution channels. In one side, the companies, mainly small and middle sized, partly do not possess an innovation strategy, because they normally do not carry out the innovation planning based on company strategies, do not have engineering

teams dedicated at least in an institutionalized way to the company innovation management. At the other side, universities and research centers are unaware of the ways to reach the companies and transfer the acquired knowledge. Due to the already mentioned distance and dialogue difficulty between companies and universities, most of the interactions occur fortuitous by individual contacts such like former-pupil with professors and in spite of being generally interesting always take the risk of discontinuity. Therefore, the institutionalization of relations is essential to build the innovation culture in the companies and to establish permanent channels of communication and knowledge in the universities.

In this scenario, the implementation of Innovation Nucleus inside the ceramic tile companies arises as an effective way to create permanent channels of knowledge transference between universities and research centers and the companies, in order to convert such knowledge into new competitive products and, therefore, into wealth, jobs and income within the country. With the aim of creating these Innovation Nuclei, a need for qualification of their future members is indispensable. This paper introduces a framework for the qualification of members of Innovation Nuclei. Such framework is used to plan a specialization degree program to be offered to the members of the ceramic tile industries.

## BRAZILIAN CERAMIC TILE SECTOR

Manufacturing more than 600 million square meters of ceramic tile per year, Brazil stands out as the third greatest producer, with chance to become the second one in the next few years (China is the first greatest producer, manufacturing more than 4 billion square meters per year). Brazil is also the second greatest consumer of this product (INSTITUTO EVALDO LODI – SC, 2005). With the foundation of the Centro Cerâmico do Brasil (CCB or Brazilian Ceramic Center) the Brazilian ceramic sector has established an exemplary certification system for the quality of its products. Today, the quality of Brazilian ceramic products (including ceramic tiles) can be compared to the quality of ceramic products from Italy and Spain (leader countries in this sector).

In the last five years, the ceramic tile exportations have grown substantially: from 56 million square meters in 2000 to 115 million in 2006. However, despite this exporting effort and the excellent quality of the Brazilian products, the prices reached in the external market has been very below the prices of the products from leader countries in technology. These prices, considering the cambial fluctuations, are lower or similar to the average price in the domestic market. It must be taken into consideration that, with the recent retraction of the domestic market, many ceramic companies had been compelled to export its exceeding production. Even facing low international prices, many Brazilian companies are compelled to export their stocks in order to generate financial reserves (Dollars) and to honor the commitments assumed with the importation of equipments. On contrary to this, the exportation should be a consequence of a pro-active attitude, seeking the internationalization of the Brazilian companies on a sustainable and strategic way. Through the strategic innovation management, the companies can assume a pro-active attitude: investing in new product research and development; exploring existing customer needs; or identifying new niches in the market. Strategic innovation management is indeed an efficient instrument to develop an enterprise culture that positively affects the image of the organization, allowing the creation of an identity to the Brazilian products.

In the leader countries, the competition in the ceramic tile industry is characterized by a large number of companies that are able to compete through differentiation of their products. Their leadership was reached by the capacity of companies to innovate in many aspects, such as: product and process technology, design, production management, technological diffusion, marketing, logistics and service. In Brazil, the two most important ceramic poles differentiate themselves by their strategic orientation: the companies from the region of Gertrudes Saint (São Paulo) emphasize low costs for their products, while the companies from the region of Santa Catarina emphasizes the diversity of their products.

## INNOVATION NUCLEI

According with the new Brazilian Innovation Law (BRASIL, 2004), innovation nuclei are "agencies consisting of one or more scientific and technological institution with the purpose to manage its innovation politics". The implementation of innovation nuclei in the companies of the ceramic sector, adopting a methodology for innovation planning and strategic management, seems to be one of the most efficient ways to create permanent channels of knowledge transfer between universities and industries, and, therefore, to transform these knowledge into innovative products. In addition, the creation of innovation nuclei inside

the companies will contribute to develop interlocutors with competence to identify to new opportunities for partnerships (universities/industries), increasing the participation of the productive sector in cooperative projects, financed by governmental funds for innovation inducement.

Figure 1 presents the expected relationships between the innovation nuclei and the other components of ceramic tile sector. One should observe that these relationships should not be restricted to the laboratories from the universities and research institutes, but should also include close interactions with the market (consumers and competitors – from whom ideas for new products can be obtained) and with some design offices (independent design studios and the design staff of the *colorificios*). Internally to the companies, the innovation nuclei, should work in close cooperation with: the Marketing departments that hold important knowledge about the customer needs, business opportunities, and so on; the Production department that can inform the nuclei about the technical restriction and possibilities in terms of production process; the Product Development departments, including their designers; and the Management, responsible to take the strategic decisions necessary to promote innovation inside the companies. Interactions with other components of ceramic tile sector, not presented in Figure 1, are also expected.

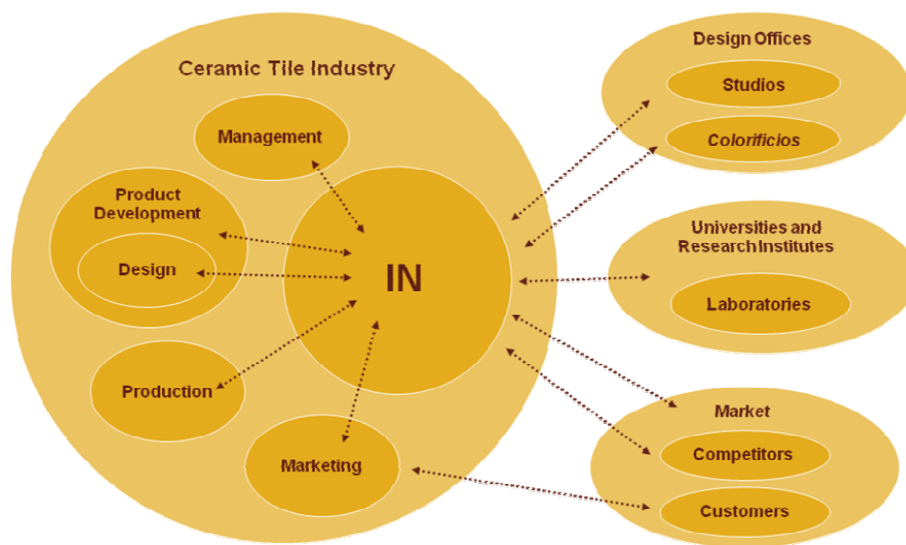


Figure 1. Relationships between innovation nuclei and other components of the ceramic tile sector.

#### INNOVATION NUCLEI DEVELOPMENT

This paper presents a six-stage process for the development of Innovation Nuclei inside the ceramic tile companies (see Figure 2) that is used by our group:



Figure 2. Innovation Nuclei implantation methodology.

1. Sensitization: this first stage aims to have the managers of the companies committed with the innovation process in their companies. The importance of the innovation (technological and non-technological) for the competitiveness of the ceramic products is discussed with the management representatives. In this context, the need for Innovation Nuclei inside the companies is emphasized. An Innovation Program should have the CEO of the company as its 'godfather'.
2. Diagnostic: once the management agrees to start with an Innovation Program and the creation of Innovation Nuclei inside the company (with a formal signed agreement), all the necessary information necessary to support the creation of the Innovation Nuclei is collected.
3. Qualification: before the Innovation Nuclei are created, their possible future members are submitted to a well-structured qualification program. This qualification program approaches theoretical and practical aspects of three imperative areas of knowledge to the innovation in the ceramic tile sector: Product Development Management; Product Design (Style); and Materials Engineering. More about this qualification structure for the Innovation Nuclei (main subject of this paper) is discussed in the next section.
4. IN Creation: at this stage, based on the interest and the good performance of the employees that took part of the qualification program, Innovation Nuclei are formed inside each company that joint the Innovation Program. Each Innovation Nucleus should be composed by, at least, four member of the company. The management board should, as much as possible, support the activities and decisions taken by the Innovation Nucleus.
5. Methods/Tools Deployment: this corresponds to the stage when the members of the INs will actually work together with the other components of the of the ceramic tile sector in order to create permanent channels of knowledge transference and, therefore, to convert knowledge into competitive products for the companies.
6. Follow-up: in parallel to the last stage, the management board should follow-up the work of the members of the INs.

#### QUALIFICATION FRAMEWORK

The qualification program framework, see Figure 3, with a focus on Innovation Management and Strategic Product Development, aims to develop and to transfer specialized knowledge for the employees of the Brazilian ceramic tiles (specially from the pole of Santa Catarina) in order to provide them with the necessary knowledge to innovate and, therefore, to create value to the products and services of their companies, making it possible for their company compete in the global market.

| Modules/Stages        |                       | Innovation and Strategic Product Development Management Qualification Program |                                       |                                       |
|-----------------------|-----------------------|---|---------------------------------------|---------------------------------------|
|                       |                       | Planning  | Early Product Development             | Detail Development + Prototype        |
| Theory                | Management            | Classes   | Classes                               | Classes                               |
|                       | Design/Style          |   |                                       |                                       |
|                       | Materials Engineering |   |                                       |                                       |
| Practical Development |                       | Experimental Development  | Experimental Development              | Experimental Development + Prototype  |
| Work Presentation     |                       | Monograph and 1 <sup>st</sup> Defence   | Monograph and 2 <sup>nd</sup> Defence | Monograph and 3 <sup>rd</sup> Defence |

Figure 3. Qualification Program framework.

For the conception and development of innovative products a coherent and structured set of interdisciplinary knowledge should be included in the qualification framework. Disciplines from Product Development Management, Product Design and Materials Engineering compose such framework.

Updated knowledge from materials and manufacturing technologies, including Cleaner Production concepts, creates opportunities for innovation and potentiates the designer development. On the other hand, the perception of new formal and aesthetic aspects is a fundamental tool in the definition of strategies proposed by the designers that materials engineers must be able to support. This multidisciplinary knowledge in engineering and design, together with knowledge about innovation management (CHRISTENSEN et al, 2001) and product development methodologies (ROZENFELD et al, 2006), propitiates a suitable academic background to face the challenges of today society.

The proposed qualification framework also focuses on the concrete application of concepts from product development management, product design and materials engineering. The organization of knowledge from such distinct areas allows the mutual recognition of the specific competencies that materializes in more competitive products.

As show in more details in Figure 4, the qualification framework has a matrix structure (three modules versus three phases), serial and complementary. This structure represents a learning environment that conciliates constant interaction among theory, practice and creativity, taking into consideration aspects related to engineering, design and product development management.

| Innovation and Strategic Product Development Management Qualification Program |   |            |   |            |   |            |            |
|---|---|------------|---|------------|---|------------|------------|
| Modules   | Planning  | W.H.       | Early Product Development   | W.H.       | Detail Development + Prototype  | W.H.       | TOTAL      |
| Product Development Management  | PDM1 Innovation strategic planning<br>PDM2 Information management<br>PDM3 Strategic product planning<br>PDM4 Project management | 60         | PDM5 Informational design management<br>PDM6 Conceptual design management   | 30         | PDM7 Detail design management<br>PDM8 Production design and product launching | 30         | 120        |
| Product Design/Style  | PD/S1 Strategic design<br>PD/S2 Consumer and behaviour<br>PD/S3 Trends research<br>PD/S4 Aesthetics and Semiotics               | 60         | PD/S5 Creative process<br>PD/S6 Colours for products and interiors<br>PD/S7 Universal design<br>PD/S8 Product conceptualization | 60         | PD/S9 Virtual modelling<br>PD/S10 Prototyping                                 | 45         | 165        |
| Materials Engineering   | ME1 Material's selection and specifications<br>ME2 Ceramic materials manufacturing processes                                    | 30         | ME3 Enameling processes and surface quality<br>ME4 Pigments and decoration techniques   | 30         | ME5 Ceramic tile specification and constructive technologies                  | 15         | 75         |
|   | Theory  | 150        | Theory  | 120        | Theory  | 90         | 360        |
| Practical Development   | TE1 Practical development: Strategic product planning and project management  | 75         | TE2 Practical development: Informational and conceptual design  | 75         | TE3 Practical development: Detail design and prototype                        | 75         | 225        |
| Work Presentation   | WP1 Strategic product planning and project management   | 15         | WP2 Informational and conceptual design   | 15         | WP3 Detail design and prototype   | 15         | 45         |
| <b>Total</b>  | <b>Planning</b>   | <b>240</b> | <b>Early Product Development</b>  | <b>210</b> | <b>Detail Development + Prototype</b>   | <b>180</b> | <b>630</b> |

Figure 4. Qualification Program framework details.

## CONCLUSION

During the sensitization stage in the companies that we have chosen to work with, some difficulties were detected: the excess of fear from the management of the companies to sign formal agreements; the difficulty of some managers to understand the importance of innovation for the competitiveness of their products (and the subsequent survival of the companies in the global market); fear about industrial secrecy; among others.

The specialization course – design on the basis of the proposed qualification framework – did not attract a sufficient number of employees from the ceramic tile companies. These employees suggested formatting another course that could provide them with a Master Degree, in order to allow them to tech in local Colleges. Today we are working in this direction, adapting the proposed course in terms of class hours, disciplines, docents, and so on.

After the implementation of the Innovation Nuclei inside the companies, the university must verify, evaluate and try to validate the achieved results. This will allow us to analyze the evolution of the investments in innovation, as well as to measure the benefits for the companies obtained from these innovations. This work, carried out on a constant and systematic way, allow the constant improvement of partnerships developed between universities and companies,

## REFERENCES

- BRASIL. **Lei de incentivo à inovação**. Lei nº 10.973 de 02 de dezembro de 2004. Brasília, 2004.
- CHRISTENSEN, C.M. et al. **Harvard Business Review on Innovation**. HBS, 2001.
- INSTITUTO EVALDO LODI - SC. **Diagnóstico setorial da cerâmica para revestimento catarinense**. Elaboração: Rafael Ernesto Kieckbusch, Fabrício Paulo Lopes. Florianópolis: IEL-SC, 2005.
- ROZENFELD, H. et al. **Gestão do processo de desenvolvimento de produtos**. Saraiva, 2006.