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OPEN INNOVATION: SYSTEMATISATION OF KNOWLEDGE EXPLORATION AND TECHNOLOGICAL EFFECT FOR COMMERCIALISATION

Açık İnovasyon: Bilgi Keşfinin Sistematikleştirilmesi Ve Ticarileştirilmesi İçin Teknolojik Etkisi

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ABSTRACT

Organizations have to cope with a dynamic environment where innovation is essential for business success. Furthermore, the ability to innovate of any organization is directly related to a continuous flow of new ideas capable of responding to opportunities for new products and technologies. Despite its important role in initiating the innovation process, rather than trying to manage the emergence of new ideas, the approach most often advocated by companies is to encourage the generation of large numbers of ideas. However, the success of innovative product development, more than simply generating ideas requires that other process characteristics be considered. To help understand these characteristics, first, a Conceptual Modeling based on the analyzed literature is developed, later, to understand the behavior of these elements in practice, a Data Collection Instrument is applied, and a documentary analysis of a case study that is carried out in a company recognized as an innovator in its sector, the result is Applied Conceptual Modeling.

Keywords: innovation models; Projects; administration; technology; innovation strategies

ÖZET

Organizasyonlar, iş başarısı için yeniliğin gerekli olduğu dinamik bir ortamla başa çıkmak zorundadır. Ayrıca, herhangi bir kuruluşun yenilik yapma yeteneği, yeni ürünler ve teknolojiler için fırsatlara yanıt verebilecek sürekli bir yeni fikir akışı ile doğrudan ilgilidir. İnovasyon sürecini başlatmadaki önemli rolüne rağmen, yeni fikirlerin ortaya çıkışını yönetmeye çalışmaktan ziyade, şirketler tarafından en çok savunulan yaklaşım, çok sayıda fikir üretilmesini teşvik etmektir. Bununla birlikte, yenilikçi ürün geliştirmenin başarısı, basitçe fikir üretmekten daha fazlası, diğer süreç özelliklerinin dikkate alınmasını gerektirir. Bu özelliklerin anlaşılmasına yardımcı olmak için önce analiz edilen literatüre dayalı bir Kavramsal Modelleme geliştirilir, daha sonra bu unsurların uygulamadaki davranışını anlamak için bir Veri Toplama Aracı uygulanır ve bir vaka çalışmasının belgesel analizi yapılır. Sektöründe yenilikçi olarak tanınan bir şirkette, sonuç Uygulamalı Kavramsal Modellemedir.

Anahtar Kelimeler: İnovasyon modelleri; Projeler; yönetim; teknoloji; yenilik stratejileri

1. INTRODUCTION

The word innovation has been used throughout the world and in all sectors of modern society. It is connected to the competitiveness and survival of organizations, a fact that currently shows the need to train people who are increasingly creative and knowledgeable about innovative tools. For Von Hippel (2012), in an economy where there is an absence of a developed industrial sector, professionals must be prepared with differentiated and innovative capacities that really make a difference. In the specific case of applicability, it is important to know that innovation also covers the professional environment, directly affecting the officials who work with projects. For Mihaela and Titán (2014), there must be a coherent innovation policy, where the development process of a nation consists of a tripod - education, research and innovation.

Innovation in general should be the connection between theory and practice. You need to define what organizations really want and what organizations consider important. For Mahdi et al. (2015), practical activities produce the ideal motivation for company officials to become strong, motivated and confident. This is the new trend of innovation, working on projects with the support of organizations and companies.

This work focuses on the optimization of the process of development and innovation of industrial and environmental products of a private company of innovation, technological services and professional education, SENAI, located in Brazil, in the city of Manaus. SENAI has the following

mission: To promote professional and technological education, innovation and the transfer of industrial technologies, contributing to increase the competitiveness of Brazilian industry. SENAI meets the needs demanded by companies in the electronics, motorcycle, plastic material and metal-mechanical segment of the Manaus Industrial Pole (PIM), thus promoting innovation. In 2014, 15 internal innovation projects were developed by SENAI teams and none of these projects were used by industries. It should be noted that these problems directly affect the competitiveness of companies, which in the long run leads to a decrease in technical skills, which is why it is of interest to seek alternative solutions to the exposed problem.

The idea of internal projects with an active methodology with theoretical and practical access to innovative and creative activities that allow company officials to obtain this technical competence is increasingly requested. For Mâţă and Suciu (2014), a growing number of countries are following the models of the reforms of other countries that have already achieved success with this alignment between theory and practice. There must be a connection between companies and institutions that work with innovation. For Genis-Gruber and Öğüt (2014), the variety of customer demands forces the company to be more innovative, opening opportunities for strategic alliances to promote theory and practice.

This approach must be understood as a new methodology, the integration of a new point of view that will be established throughout the world. For Gündoğdu (2012), we must rethink internal innovation projects because the advancement of information and communication in recent decades has led companies to stay much closer to customers and respond more quickly to their needs. For Seman et al. (2012), projects that are widely used in the development of a new product can indirectly stimulate the creation of more innovation, that is, the innovation of other products, the innovation of production and manufacturing processes, innovation management and the marketing innovation.

Therefore, the purpose of this study is to explore the factors that influence the generation of internal innovation projects of companies and from this a new innovative tool is presented that can be used by all companies that wish to develop their innovation process internal and external. To achieve this, a review of the literature on the topic of innovation was also carried out. Thus, this study examines the relationship between the organizational culture of a private innovation company, technological services and professional education, and the orientation of innovation that occurs in companies. Finally, we conclude with our thoughts on the administrative consequences of the new innovation model available to all.

2. TECHNOLOGY AND INNOVATION MANAGEMENT

The boundary between technological management and the management of technological innovation is not clear, since between them there are intersections, overlaps. For practical purposes, and following Morcillo (1997: 107-108), let us say that technological management is oriented towards the diffusion and application of existing innovations, while the management of technological innovation is related to the creation and development of new ideas.

Technological management, which aims to manage (manage) the technological variable in the global strategy of the company, is the set of management activities related to the identification and acquisition of technology, research, development and adaptation of new technologies. technologies to the company and its exploitation in production; It also deals with technological surveillance and foresight, in order to detect technology of interest in the future, benchmarking, reengineering and outsourcing, reverse engineering or analysis of competitors' products, property rights and license, norms and standards, strategic alliances and forms of cooperation. In general, technology management includes product and process technology, such as that used in management or organizational functions. The technological management in the company consists, basically, of the set of decisions related to the creation and / or acquisition, development and / or transformation and commercialization of technology, from a strategic and operational point of view. In the company,

the technological management materializes in the technological strategy and in the strategic plan of technological development. The main functions of technology management are:

- ✓ «Inventory: Identify the technologies that are mastered.
- ✓ Monitor: Follow the evolution of new technologies; monitor competitors' technology.
- ✓ Evaluate: Determine your own technological potential; study possible strategies.
- ✓ Enrich: Plan research projects; buy technology; form alliances.
- ✓ Optimize: Use resources in the best possible way.
- ✓ Protect: Defend industrial property with patents, trademarks; etc.". (Madrid + d - CEIM, 2003: 40).

2.1. Innovation Management

Innovation for its part denotes change, better, it is the source of change. Innovation refers not only to technological change, but also includes social innovation and those generated in business management methods. In relation to products, innovation consists in manufacturing and commercializing new products or in improving existing products; instead, process innovation refers to the installation of new production processes that, in general terms, have favorable effects on productivity. Technological innovation is conceived as «that which results from the first application of scientific and technical knowledge in solving the problems that they pose to the various productive sectors, and which originate a change in products, services or in the society itself. company in general, introducing new products, processes or services based on new technologies "(Madrid + d - CEIM, 2003: 21). Technological innovation is broader than R&D, since it also includes commercialization activities and market acceptance of innovation; An innovation that does not pass the market test is not an innovation: it is an invention. For this reason, the management of technological innovation includes the activities of technological management, in the sense of a tool, plus the activities for the acceptance by the market of the innovation (commercial launch, market study, etc.). In the explanation of how the phenomenon of technological innovation occurs, several theoretical approaches concur. In the linear approach, the innovation that follows the sequence basic research -> applied research -> technological development -> marketing -> commercialization, that is, that has its origin in science or technology, is called science or technological push . In contrast, when the sequence for innovation follows the order: market needs -> development -> production -> sale, that is, when the innovation comes from a market need, the process is identified as market pull. However, linear models are unrealistic. The most widely accepted innovation model is Kline's, in which innovation does not follow a linear sequence, but ideas can arise at any point in the process. As a process, the Kline model integrates research, existing body of scientific-technical knowledge, potential market, invention (and / or analytical design), detailed design and testing, adaptation and production, commercialization of results, that is, products or processes. Innovation follows the central chain made up of activities that go from the potential market to commercialization, and are in permanent interaction with research.

3. INDUSTRIAL INNOVATION, CONCEPT AND ITS SCOPE

The Oslo Manual (2005) defines innovation as a new or improved product, a method of marketing and also as an organizational method that has been absorbed by the organization and is in operation. Knowing the concept of industrial innovation and its breadth is important to understand its operation, application and methodology.

The pioneer in the study of innovation was the Austrian Joseph Alois Schumpeter, who in the mid-1950s pointed out that the productivity and growth of an organization depend on technical changes. This means that companies that invest in technological innovation would generate the decisive factors for growth (Teulon, 2014). These new adjustments have been strategic for the emergence of new innovation concepts and their scope. In the administrative field, Hwang (2004), declares that innovation needs to have a direct focus on projects based on a suitable structure for the organization. For Birkinshaw et al. (2008), innovation is the implementation of a management

practice that encompasses the entire organizational process and aims to achieve new objectives of the organization. For Mol et al. (2009), innovation should be a project management practice whose objective is to improve the performance of the company as a whole. For Battisti and Stoneman (2010), innovation implies new practices, new marketing concepts and new projects with business strategies. For Damanpour and Aravind (2012), innovation is a new approach to administration, which produces a change in strategy, administrative procedures and the organizational system. Following this same concept, Rowley et al. (2011), provides another approach, beyond the topics already presented above, such as innovative products and services, production or process, that is, the authors introduce the invocation of people. This innovation begins with the focus on the individual, taking advantage of their creative experience to increase the level of internal projects of organizations.

The person alone or in a team, with full knowledge of the production process, develops creative skills with the help of the appropriate tools and a systemic methodology, contributing to continuous improvement and the generation of new ideas. For Manso (2011), innovation teamwork is so important that industries must create incentives for it. Innovation is often developed by teams working together on applied research, and for this reason it is interesting to create new opportunities for this creative work to flourish.

For this reason, the search for creative, efficient and innovative professionals is no longer an option to become a necessity in industries. The goal is for teamworkers to be able to look outside the organization, recognize that knowledge is widely available to all, and lead to consumer inventions from the market, which contributes to interaction between them. This search for creative professionals makes the departments more integrated. According to Hongxing and Pengfei (2012), the functional balance allows obtaining excellent advantages and increasingly innovative products for society. In this sense, the creation of collaboration between the organization's departments and the external market are necessary incentives so that they are aware of the need of potential clients for the innovation process, based on knowledge to innovate.

These incentives depend on the context of each company. The ideal is not the size of the investment, but that these incentives are carried out continuously as part of the organizational culture and that it can motivate others to obtain qualities that lead to creative and innovative thinking. In this sense, although innovation may involve an initial investment, risks and uncertainties, benefits such as competitive differentiation, customer loyalty, and competitive prices for innovative products exceed initial costs, thinking has no limits to innovation and companies that plan to exploit the potential of their employees have a great advantage, despite internal or external pressures. To bring all these benefits, it is necessary to plan strategies for more open project approaches and forms, taking into account the mechanisms to be implemented, the resources and capacities to be deployed to support open innovation.

According to the Oslo Manual (2005), innovation will be a success from the moment it causes a certain impact, generating financial returns and wealth. For industrial innovation must occur within a model aimed at increasing the value of its product in the market, generating benefits. Models of innovation are, therefore, of crucial importance to get out of crisis situations, which requires a concerted effort of the technologies of organizational structures, tools and policies. To work in crisis situations the organization must have its strategy and planning in detail, with a workflow model focused on competitiveness, being necessary to make an analysis of the various existing methodologies and measures and establish a model work of this methodology. According to Kadar et al. (2014), the correct innovation model helps in the recovery process by promoting growth and sustainable development.

This system can be exemplified by a funnel of stages in the innovation process. The funnel has as inputs the ideas that become projects, then the projects into business. Success is strictly defined as a new product, technology, or market for the company. Funnel innovation is a linear model that describes a set of various steps required to achieve product development. All ideas are filtered, to

get the best for the receiving market. Open innovation, proposed by Chesbrough (2006,) is an innovation model that works similar to the linear model, however, it is changing with its external environment, creating new knowledge and better opportunities for consumer markets. One of these new points of view may be the growth and development of telecommunications, which create a favorable environment for the expansion of this type of open innovation. For Nylén and Holmström (2015), the use of digital technology offers industries the strategic opportunity to negotiate with customers to share their intentions and preferences in order to obtain knowledge about usage and purchase patterns.

Each type of innovation should generate some value, therefore, the base of everything begins in knowledge of the market and of the clients. According to Dahlander and David (2010), open innovation should establish an analysis from the perspective of the product life cycle and the different phases that it evolves from concept to commercialization. This effect is due to the fact that the external market is constantly changing, that is, the greater the uncertainty, the more conservative the innovation projects for this market will be and the greater the possibilities of working with open innovation. Open innovation leads the organization to evolve from the paradigm of competition with the paradigm of everyone's collaboration in the search for excellence. Without a doubt, open innovation aims at impressive results. For Huizingh (2011), open innovation is a concept that fits very well with many trends in management. Open innovation comes in many forms, increasing the concept of wealth. Therefore, the development of structures of these types of innovations is necessary.

3.1. Strategic Management Of Technology

As Thompson and Strickland (2002) state, if a company does not have a corporate strategy, neither will it 'have a frame of reference to weave the different decisions into a coherent whole, nor will it have a broad rationale linking departmental operations in an effort to team. Strategies are action plans that, in corporate, business, functional and operational terms, seek not only a good financial performance of companies but also improve their competitive strength and good business performance. It also consists of the choice of an option, a direction, among several alternatives to specify the organizational commitment with respect to specific markets, ways of operating and competitive approaches. As it is the prescription strategy for the business, it offers a framework of reference to technological management and with it to technological strategy, so that the actions undertaken in this field are directed towards the achievement of the strategic objectives of the company. In this way, technological management is articulated with organizational management and, consequently, technology becomes a means to an end. It is at the beginning of the eighties when the technological management is included in the global strategy of the company.

As for the term strategy, since the organization is considered an open system, affected by internal and external variables, by immediate, mediate and international environments, the company develops systematically and rationally designed behaviors: this behavior is called strategy. The technological strategy is the use of technology to obtain a sustainable advantage over competitors; It is an action plan that involves the functions of research, development, design, manufacturing, marketing, sales, distribution, and customer service, but these are linked to the business strategy. The technological strategy is essential to maximize the returns on investments, if it is fully integrated into the business strategy; to define the technological innovation strategy and exploit the technological capacity and ability of the company. Due to the fundamental role for the achievement of the objectives and the long-term sustainability in the companies, the technological strategy has been defined, since the eighties, at the highest organizational level. Integrated into the global strategy of the company, the technological strategy is reflected in a plan that, including the different action programs (such as R&D programs, external purchase of technology, cooperation agreements, alliances, etc. .) is integrated into the overall plan of the company. Corporate strategy arises from technological and commercial considerations, and it is from this that the technological strategy is

derived, which, in turn, is translated into the technological plan. Some support tools in the design of the company's global and technological strategy are:

- ✓ Elaboration of the technology / product matrix. Technological inventory of the company; technological domain; relation of key technologies, incipient or emerging; know-how capacity.
- ✓ Technology attractive matrix / technological position. The technological attractiveness indicates representative variables of the technologies over which the company has no control; The technological position indicates the mastery reached by the company of a technology or a trajectory. Dual tech tree. It is dual because it includes product and process technology. It consists of choosing, in the face of different technical options in the development of a product, that dominant technology in the future. It allows the company an overview of technological options.
- ✓ Matrix of access to technology. Determination of ways of facing the different areas of technology: research and development, use of the research capacities of external centers, links with other companies. These forms can take place through outsourcing and partnerships. The formulation and development of the technological strategy may involve the company, given the impossibility of technological self-sufficiency, derived from the complexity of technological developments, the realization of different links, alliances, contracting or research and development schemes and technology transfer. It is for this reason that many companies contract research and development, a situation that stimulates the emergence of a technology market in which universities, public and private research centers, technology centers and small technology-based companies participate as suppliers of technology. + D and technology. The company has some modalities to access R&D, such as:
- ✓ Outsourcing of services. It is the purchase of a product or services by a company from a supplier.
- ✓ Outsourcing. It consists of hiring totally or partially a line of research.
- ✓ Collaboration. They are agreements between two or more companies to share R&D resources and mutually benefit from their own knowledge (know-how) in order to reduce costs.

Cooperation. This option consists of two or more companies joining together to carry out a common R&D project, hiring a research center for this. In general, cooperation can be capital (in the form of royalties or shares), product technology (patents, designs, results and research capabilities, know-how capabilities). It is the development of links between companies, universities and other types of organizations, which has led to the appearance of terms such as networking and clusters. The term clusters, coined by M. Porter, designates the association or grouping of companies, research centers and support organizations, linked to an activity (transport, health, tourism, etc.). Joint Ventures are forms of technical, financial or commercial cooperation between companies from different countries. It enables a company to enter a new foreign business in a new territory. The goal is to reduce political and economic risks by having a local business partner. Economically, technology is a commodity, with use value and exchange value. However, it has many ways to configure and access it. For the company, technology is an asset (there is a form of ownership) and, therefore, an object of purchase, sale or transfer. The process of transfer (of negotiation) is complex as technology is conceived as an intangible good. The innovative company can decide to exploit the results of R&D or transfer them to third parties, that is, transfer the product to process for another to exploit it commercially. That company that acquires a third-party innovation for its commercial exploitation is equally innovative. The different modes of transfer apply not only to technological innovation, but also to any form or configuration of technology. However, this way of looking at technology transfer is an orthodox view. The economic developments of the 1980s have focused the analysis of this issue on the technological absorption capacity of the host country (or companies).

3.2. Concepts of Innovation

Regarding the exact meaning of the term innovation, it can be said that there are many definitions presented by various authors in the literature, and that there is little consensus in relation to it. Tidd et al. (2008, p. 32) affirm that "the novelty is in the eye of the beholder." The term is derived from the Latin “Innovare”, which means “to do something new”. In essence, innovation is the process of converting an opportunity to new ideas and how to put these ideas into practice (Flynn et al., 2003). Already in the 21st century, it can be said that innovation ended up becoming a meta-concept that is condensed in one word, a wide range of new experiences in terms of "new" to society. This meta-concept, which now has a strong economic and market bias, interferes with both the creation and survival of organizations (Moldaschl, 2010; Godin, 2011), with the following understandings that continue to coexist today:

- ✓ Innovation as a noun: meaning its own news (new ideas, behaviors and objects);
- ✓ Innovation as action: introducing meaning, or bringing something new; and
- ✓ Innovation as a process: that is, the process from the invention to its dissemination and commercialization.

By going through the innovation literature with a critical eye searching for concepts, an evolution of the concept could be observed between the 20th and 21st centuries. In this way, concepts proposed by different authors and presented in Table 2, which present this evolution, were selected.

Innovation is extremely difficult to conceptualize, for the most part, a new meaning is defined in each new context studied (Neely and Hii, 1998). This characteristic makes it always necessary to take into account the different circumstances involved in order to apply such innovative concepts for new studie. Joseph Schumpeter was one of the pioneers to conceptualize the term innovation. Responsible for the contributions that have influenced economic theories for decades, the author defends the concept of innovation such as the introduction of new products, new production methods, the opening of new markets, the conquest of new sources of supply and the adoption of new forms of organization. His proposals had as a conceptual core, the idea that economic development is driven by innovation through a dynamic process in which new technologies replace the old, a process he calls "creative destruction" (Schumpeter, 1934)

It is important to note that an organization innovates not only because of the desire to compete in the market, or because of the search for competitive advantage, but also to seek changes in the direction of its strategies, a new growth platform for its business, the need to generate growth opportunities, and the management of collaboration in the development of the organization's strategy. According to S. Takahashi and V. Takahashi (2007), innovation is associated with changes and can be divided into products, services offered by the company, or process, which involve the way in which the delivery was created, produced and carried out. of the product, including the method of work, business, technology and marketing that the organization uses. Innovation is just a materialized concept. For more innovative ideas to be produced, you need to have a process that supports the systematic creation of these ideas. It can be said that innovation is the path from what is known to be done, towards what is not yet known. Innovation is the generation of alternative solutions to old solutions, or new alternatives to solve new and old problems (Kilian, 2005).

For an innovation to be a reality, it is necessary to apply knowledge, in various areas of the organization, together to promote the expected return. Therefore, the level of maturity of the organizations is also represented by the knowledge acquired and used to improve innovation projects. A working group that has carried out an experiment, succeeding or not, throughout the project has learned something that may be useful in the future (Patterson, 1999; Harkema, 2003). The paths of innovation can occur in two ways: innovation can be “driven by the market” (market pull), when the development process of an innovation begins with a complaint or need from this market, thus the innovation is driven by the market perspective. In this way, the company seeks its internal or external knowledge to develop the product to meet market demands. In another way, an

innovative product is created by the company with new knowledge or technology. In the development of this new and competitive product, the "technology push" occurs (technology push2). This knowledge can be created directly at the company's research center or at a university. (Rothwell, 1994). The complexity in the development of new products requires complex and multidisciplinary solutions that promote interdisciplinary research practices. Given that each organization has the capacity for a certain business, through the exchange of knowledge and experiences, two or more institutions can improve the level of innovation and internalize the new knowledge generated. Companies seeking innovation can strengthen Research and Development (R&D), collaborate with users and providers of open innovation programs, or motivate employees to innovate. These different approaches are based on the perception of the theory of innovation that believes that innovations can come from different sources: users, workers, manufacturers or suppliers (Von Hippel, 1998). Innovation is a complex and diverse activity (OECD, 2010). Where innovation is an Integrated process. A formal concept that represents this school is presented by Tidd et al. (2008), where innovation represents a change. The same author says that innovation is driven by the ability to establish relationships, detect opportunities and take advantage of them, not only to open new markets, but also in new ways to serve current markets.

Innovation is a strategic issue that is still under study, and therefore, there are differences in the constitution of its models. Scholars of the subject present different concepts and models, some focusing more on a specific process and others on the process as a whole. What is important is that they indicate directions that the organization can take, or attitudes that can improve or foster innovation within the organization. According to Tidd et al. (2008), innovation is a process in which the results are affected by the progress of the process itself, and not a single event, which means that it is possible to manage the process. Another point addressed by the authors is that innovation must be managed in an integrated way with the business. Already Baregheh, Rowley and Sambrook (2009) affirm that innovation is the multi-step process, through which organizations transform ideas into new or improved products, services or processes, in order to advance, compete and differentiate successfully in your market. The characteristic of a process is that its stages must be well executed so that the final product is aligned with the objectives of the organization. Innovations are the result of this process that involves many variables and attributes. Tidd et al. (2008) believe that there are three pillars in the development of this process: knowledge, information and creativity, and that it is the responsibility of the director responsible to find out which way to go, taking into account the type of business, the market, the public to be achieved, suppliers, and customers, that is, the variables that intervene in the process of organizing the specific innovation.

It is not the focus of this research to describe in an exhaustive way the existing innovation management models, or how the innovation process is carried out in the vision of each author studied, since there are different models or classifications for the different types of innovation and the The objective of this study is not to point out the best existing process or model, but to understand the importance of the different elements that make up the process and their integration in the creation of innovative products.

3.3. The Plan of Innovation

Innovation planning includes the initial phases and activities of the innovation process and creates a connection with the strategic planning of the company (Wheelwright and Clark, 1992). It encompasses the activities carried out prior to the development of technologies and products, which begin with the identification of an idea or opportunity and end, when the company approves the initial development of the proposed product (Crawford and Di Benedetto, 2006). The uncertainty and dynamism of the information used in innovation planning make it difficult to manage and promote a low level of formalization of its activities. According to Engwall, Kling and Werr (2005), models have been used to demonstrate the flow of the product innovation process. Through them, the rules, guidelines and procedures to be followed in the activities of the innovation process are organized. There are also other authors who investigated the models of the innovation process

(Sperry and Jetter, 2009). In general, all have indicated the need to differentiate the models according to the characteristics of the innovations of each company.

This section analyzes the different patterns of the models used for the first stages of the innovation process, that is, those that comprise innovation planning. For this, the models found in the literature are divided into three types, in accordance with the proposal of McCarthy et al. (2006): linear (or sequential), recursive (or circular) and chaotic. Linear models are those that interpret the procedure as a series of discrete and sequential events and activities. This type focuses on the structuring of the process and the interface between the phases. According to McCarthy et al. (2006), linear models often ignore important aspects of the innovation process, especially when the innovation has a higher level of uncertainty. Innovation in linear design, specifically in the science push approach, is understood as a flow of stages in which new knowledge derived from scientific research leads to processes of invention, and then to applied research and development activities. technological, resulting in the introduction of marketable products and processes. Recursive models have been developed in response to the need to include commonly observed uncertainties and iterations in innovation. Therefore, they assume that the limits and connections between events and activities of the process are less clear and rigid, since innovation can be considered dynamic, non-linear and disorderly (McCarthy et al., 2006). The innovation process can be analyzed as the result of collective learning, as a result of collaborations within the company and between it and other organizations (Cassiolato, et. Al., 2014).

In this scenario, technology is considered endogenous, highlights the systematic correlation between economic agents, and underlines the capacity of companies and individual skills in the innovation process. Chaotic models are considered an extension of recursive models for the representation of the innovation process as a random and non-linear system, which creates irregular and disordered actions. Improvised and flexible classification models can also be considered chaotic models (McCarthy et al., 2006). Table 6 presents a comparison of the characteristics, benefits and limitations of each of these three types of models of the innovation process. The theoretical references of the models were chosen because they are among the most cited and used in the areas of product development and innovation management, or because they have special characteristics that are not found in other models.

The literature describes many approaches that have been grouped into six generations of innovation process models. These models have evolved over time from being a rudimentary and linear effort, created to deal with technology to develop products, to becoming a complex management system.

The generations described by the aforementioned authors and others found in the literature are listed below: The first generation is characterized by linear sequential models “pushed by technology” (technology-push), based on studies by Schumpeter and which prevailed in organizations between 1950 and 1960. This is a proactive model, with its emphasis on research and development activities in basic science, in which efforts are concentrated on obtaining the desired innovative results to be “pushed” by the organization in the market. The second generation models of innovation prevailed between the mid-1960s and the early 1970s. They continued to be linear and sequential in their structure, but they also began to be reactive, because they are "driven by demand" (market pull), that is that is, by market forces, such as the orientation of economic theory and organizational studies, which looked towards the market and consumer needs.

The third generation of innovation models emerged in the 1980s, inspired by the work of Nelson and Winter and the studies of Kline and Rosenberg, resulting in so-called “interactive models”. Innovation began to be understood in a more complex way, which is produced from a combination of the previous models, interactively, through feedback loops between them (Tidd, 2006).

Interactivity is maintained in the fourth generation of innovation models, but a strong sequential line and parallel lines emerge, which integrate the organization with the market and with the state of the art of science and technology. Despite the rather linear appearance, the information flow is not

necessarily linear, allowing overlapping activities that lead to a reduction in the development time of the innovation. This model is called the "integrated model", after having emerged in the mid-1980s in the Japanese automotive industry (Tidd, 2006).

4. CONCLUSION

The strategic perspective of technology management and innovation highlights the need to integrate technology and innovation with business strategies. Therefore, the acquisition of a social competence in the management of technology and innovation is an imperative for developing countries, since it allows anticipating technological evolution and development, valuing technology as an asset and harmonizing investment in technology. , as in R&D, with business and corporate strategies. Proper management of technology is necessary to achieve and maintain competitive advantage.

It is concluded that the optimization of the innovation process with internal projects covering the fifteen steps, has managed to significantly raise the level of acceptance by the companies of the Manaus Industrial Pole (PIM), repositioning SENAI as a promoter of innovation and technology transfer .

In addition, the following conclusions can be obtained: 1) the results achieved to date stimulate the company to move forward without developing the efficient innovation process of internal projects with the integration of theory and practice, stimulating other companies, industries and organizations; 2) the new model presents a contribution for innovation projects since it suggests a real approach method; 3) the model is simple, easy to use and includes all the main points to develop an internal project.

It is important to say that SENAI already has ISO 9001: 2008 certification, where it achieved many benefits with the complete integration of its internal processes with the fifteen steps. Thus, other organizations that have environmental certification: ISO 14000, generic for environmental standards and ISO 14001 specific for environmental management in companies are also benefited in the corporate improvement of their products and customers.

Just a great idea is no guarantee of the success of a new product. The innovation process is part of a whole. The VIDA model presents important points that can serve as an incentive for all companies that wish to initiate or wish to systematize innovation and creativity of their projects in their internal process.

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