
Strategic innovation planning and partnerships: aligning market, products/services/processes and technologies

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Abstract: There are different tools to support the innovation planning, however, the paradigm of open innovation shows that there is a need to adopt different partners in the development of technology, product, service or process, and many of the proposals in the literature ignore this theme on the innovation process. This study proposes a generic model to strategic innovation planning, especially for technology push approach. The model was developed from an action research and literature review, which includes these elements. This model contains three different stages ranging from the identification of markets and possible partners to carry out a strategic plan for innovation. The model application has the technology core of the organization and possible technology, products, services or processes to be developed as base. Results on the practical application of the model over different innovation processes can be objects of future research.

Keywords: innovation process; open innovation; strategic plan.

1 Introduction

Due the importance of innovation for the organization competitiveness, more and more researchers and managers focus their studies on the development of instruments, such as methods and tools, which contribute to making the innovation a reality. Many of these instruments also seek to include elements related to the open innovation paradigm, especially with regard to the planning of new technologies, products, services or processes according to the market opportunities.

Several instruments presented by literature can support the innovation planning at the organization, as the technology and product development process models (Clark and

Wheelwright, 1993; Clausing, 1993; Cooper, 2006; Creveling et al., 2003), the fuzzy front end of innovation methods (Khurana and Rosenthal, 1998; Lee et al., 2007), the technology roadmap methods (Albright and Kappel, 2003; Caetano and Amaral, 2011; Daim and Oliver, 2008; Farrukh et al., 2003; Gerdtsri et al., 2009; Holmes and Ferrill, 2005; Kostoff and Schaller, 2001; Lee et al., 2007; Phaal et al., 2001; Wells et al., 2004) and others which contribute to identify market, product and technologies at the innovation planning.

One of the main tools supporting innovation and may be customized at the open innovation paradigm is the TRM. It can offer better results if the enterprise expands its search for innovation information and market opportunities to the external agents located in several parts of the world. This is due the fact that the increasing complexity of technologies embedded in new products depends on greater knowledge than ever and, consequently, on the cooperation among different specialists. This makes the process of innovation more complex and their successful adoption more challenging. In fact, even mega-corporations, once famous for their self-sufficient R&D structures and product development processes, find it difficult to master satisfactorily all of their technologies due to the fast pace of today's scientific advancement. It appears that the practical application of open innovation can provide an adequate answer to this challenge because its main strategy is to deliberately develop new technologies through partnerships with diverse organizations instead of adhering to the classic model (closed innovation), which employs internal R&D structures (Chesbrough, 2006).

Despite the literature demonstrating the use of open innovation as a best practice innovation management, and there are several instruments that contribute to innovation planning, they neglect the adoption of partner at the technology, product, service and process development or market exploration. These different instruments presented do not provide a systematic solution to this action. Recently, studies as Caetano and Amaral (2011), Lichtenthaler (2010), Huizingh et al. (2010) and Badawy (2011), also demonstrates this problem.

In this sense, the main goal of this study is to answer how to consider the partnership adoption to align market, PSP (product, service or process) and technology on the strategic innovation planning at the open innovation paradigm and technology push approach. This study proposes a model to solve this question from different stages.

2 Theoretical bases

In order to effectively integrate technology into PSP it is fundamental that organizations adequately plan their technologies (Scott, 2001; 2005). Several tools may be employed to support this planning, e.g., generic management models (Clark and Wheelwright, 1993; Clausing, 1993; Cooper, 2006; Creveling et al., 2003) and specific methods and tools (Caetano and Amaral, 2011; Daim and Oliver, 2008; Farrukh et al., 2003; Gerdtsri et al., 2009; Holmes and Ferrill, 2005; Khurana and Rosenthal, 1998; Lee et al., 2007; Phaal et al., 2001; Wells et al., 2004). These are proposals which are applied through the use of information on both market and products and technologies.

Some of these tools were created from models for technology planning based on business process, identifying phases and activities, as in Clark and Wheelwright, 1993; Clausing, 1993; Cooper, 2006; Creveling et al., 2003; Schulz et al., 2000 and Whitney, 2007. Besides, these models address technology development as a process, with well

defined stages and decisions, which enables the identification of gaps leading to the establishment of partnerships.

Just to cite one example, it is possible to use one of these models presented by Cooper (2006). The author proposes a technology development process (TDP) model, Figure 1, whose activities are divided into three moments, which the author calls "stages":

- Project Scoping – where planning is mapped out, taking into account the business features;
- Technical Assessment – where the probabilities of developing the idea are demonstrated by means of analysis of partnerships and impacts of this technology; and
- Detailed Investigation – where, after having defined the technology scope, experiments are implemented and the technology values are defined for the organization.

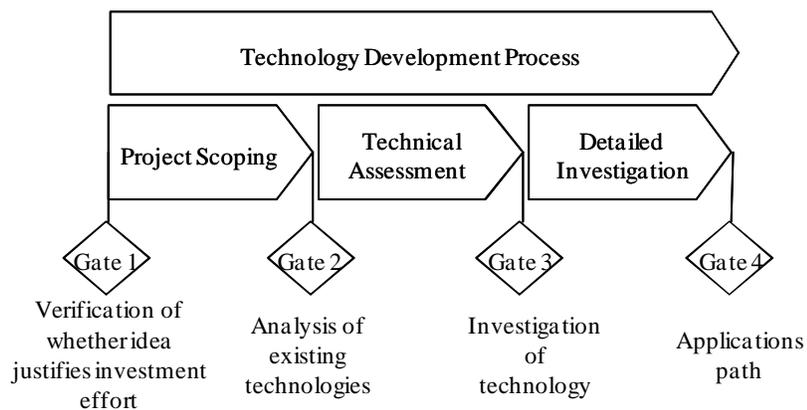


Figure 1 TDP model proposed by Cooper (2006).

These stages are preceded by three gates or decision steps, whose main characteristics are:

- Gate 1 – the organization's top administration and R&D leaders verify whether a given idea merits development effort and investment followed by formulation of project and scope;
- Gate 2 – the same actors as those at Gate 1 determine qualitatively the limitations of the project scope, which will enable the analysis of existing technology (technological evaluation);
- Gate 3 – the same actors from Gate 2/Gate 1 and other leaders involved in the business analyze the project viability using the information gathered at Gates 1 and 2, which will support the technological investigation.

In addition to these three gates that precede the three stages of this model, there is a fourth gate (Gate 4) involving the same actors as those at Gate 3 and other people interested in the commercial results of the projects. This gate is immediately after Gate 3

and closes the proposed model. At Gate 4 the product development process to which a given technology will be applied is determined and the TDP and the product development process (PDP) are integrated.

Whitney (2007) complements this logic presenting a set of technology development tools ranging from identification and selection of opportunities to development and evaluation of the final concept proposed for a given technology. However, the applicability of this author's model presented is restricted to the organization's internal processes, which places it in the closed innovation category.

Among several other models of TDP available in the literature some relevant studies propose which specific activities are necessary for the development of technology. The results presented by Clark and Wheelwright (1993), Clausing (1993), Cooper (2006) and Creveling et al. (2003) are the most detailed in terms of activities and phases of TDP and therefore were considered relevant to this study. The Table 1 presents a theoretical model of TDP with a set of these activities and stages that have been grouped by similarity from the propositions of these authors.

Table 1 Activities and stages decisions from the theoretical TDP model.

<i>Nº</i>	<i>Activities</i>	<i>Stage</i>
1	Define the enterprise' strategic planning;	I Invention
2	Determining technology strategy;	
3	Identify the voice technology;	
4	Identify the voice of the consumer (market research);	
5	Idea generation;	
6	Develop project scope;	II Project Scope
7	Mapping future plans;	
8	Conducting research literature;	
9	Conduct patent searches;	
10	Identifying opportunities;	III Technology concept development
11	Identify the potential of the idea under certain conditions by preliminary experiments;	
12	Identify necessary resources and solutions to the gaps identified;	
13	Designing product platforms;	
14	QFD to create a technology (technology needs);	
15	Conduct benchmarking of available technology;	
16	Develop network of partners;	
17	Defining features of the new technology;	IV
18	Identify the impact of technology in the company;	
19	Analyze documents and generate technology concept;	
20	Select and develop concept of superior technology;	

21	Define commercial products and processes possible;	Technology development
22	Decompose system functions into sub functions;	
23	Define system architecture;	
24	Use mathematical models that express the ideal function of technology;	
25	Develop and test prototype;	
26	Identify market impact and manufacture of these possibilities;	
27	Prepare to implement the business case;	
28	Identify and evaluate critical parameters;	
29	Optimize technology from its critical parameters;	V Technology optimization
30	Analyze factors that may result in platforms;	
31	Develop subsystems of the platform;	
32	Implement and optimize experiments;	
33	Analyze data from experiments;	VI Technology transfer
34	Design a platform;	
35	Integrate the subsystems;	
36	Performance testing of the system;	
37	Define criteria for selection of technology;	

Source: Clark and Wheelwright (1993), Clausing (1993), Cooper (2006) and Creveling et al. (2003) – adapted by the authors.

According to Table 1, it is possible to observe that the development of technology starts from the strategic planning of the organization, along with defining the technology strategies and idea generation make the initial invention in the TDP. In sequence are conducted the stages of project scope, technology concept development, development and optimization of technology and, finally, the stage of technology transfer.

It should be noted that these activities of the TDP only in the third phase of this theoretical model, or after being held about 40% of the proposed activities in the process, the authors propose the creation of networks of partners, which requires an analysis of the TDP in accordance with the paradigm of open innovation.

Another point of these models is that they was designed for organizations that have R&D and product development departments, usually large corporations, or small enterprises developing technologies to meet specific needs identified in PSP. The authors also consider only the market pull approach, since the identification of the customer's voice is already made in the early stages.

An analysis of methods to support the innovation planning was also made in the literature. Among them, one of the most cited has been the technology roadmapping (TRM), and among the most cited TRM is the T-PLAN, developed by Phaal et al. (2001). The authors suggest looking for partners in order to acquire certain necessary resources. However, they do not specify how this search should be performed or take into account the different types of partners and the criteria needed for their selection and prioritization. Furthermore, from the state of the art on open innovation analysis, Huizingh (2011)

presents the challenge of integrating current management practices and issues of open innovation. The Table 2, presented by Caetano and Amaral (2011), summarizes the studies related to innovation planning method and the adoption of partnerships identified on literature.

Table 2 Studies related to innovation planning and the adoption of partnerships.

<i>Authors</i>	<i>Description of application</i>	<i>Adoption of partnerships</i>
Albright and Kappel (2003)	Distributed in three sections: market, product, and technology; market trends, competitors' strategies, competitive products, and technologies needed for these products are identified.	Indication of technologies which can be acquired from the partners.
Daim and Oliver (2008)	Method application in four steps: planning and identifying the needs of the energy sector, training for the preparation of roadmapping, implementation by defining goals and monitoring the roadmap.	Identifies organizations that develop technologies in similar areas.
Gerdri et al. (2009)	Application through the preparation of the organization, identification of people to be involved and the necessary information, and integration of the roadmap in planning business activities, being constantly revised.	Involvement of key players in the organization in innovation planning.
Holmes and Ferrill (2005)	Implementation of Operation and Technology Roadmapping (OTR) in five modules: analysis of current technological situation and market position, analysis of market requirements, conceptualization of products and services, identification of technological solutions, and drawing of the roadmap by integrating all these items.	Do not consider partnerships.
Kim et al. (2009)	Method to identify development areas in building in the Republic of Korea.	There were partnerships among the interviewed organizations for the innovation planning.
Lee et al. (2009a)	Use of a QFD matrix to identify gaps in the relationship between data on the needs of consumers that use a given technology and engineers that develop it, pointing out key elements for new competitive technologies.	Do not consider partnerships.
Lee et al. (2007)	Method divided into six stages: initiation, selection of topics to be addressed, assessment of technology needs, preparation of technology development plan, roadmapping implementation, and roadmap updating.	Seeks to identify consortium opportunities between enterprises and research institutes.

Lee et al. (2009b)	Application from analysis of patents to identify organizations that can develop certain sub-technologies or products in the search for new business opportunities.	The analysis of patents indicates organizations that could become partners.
Lichtenthaler (2008)	Method taking into accounts the possibilities of commercialization of ready-developed technologies with external agents.	Seeks commercial partners for licensing.
Mitchell and Nault (2007)	They indicate that cooperative planning can reduce both downstream as upstream rework on a project.	Interdepartmental partnerships.
Phaal et al. (2001)	Workshops with multidisciplinary teams from business and technical areas to roadmap products and technologies needed for specific products and markets.	Adoption of partnerships to provide certain resources.
Wells et al. (2004)	Method applied in two workshops: planning to identify the participants' interests through brainstorming techniques, relate identified opportunities, and draw a roadmap.	Suggests the participation in networks to carry out research activities.

Source: Caetano and Amaral (2011).

According to Table 2, the different methods present considerations about partnerships, but do not presents a systematic framework to adoption of partner during the innovation process. Despite Albright and Kappel (2003) present the technologies which can be acquired from the partners, they do not classify the partners and the criteria to select it. This happened with another studies, e.g., on McAdam et al. (2008), which addresses the use of partnerships in the development of new materials, the authors propose to systematize the incorporation of partnerships into technology planning from benchmarking, meetings with partners, and the use of a portal of knowledge to define the necessary expertise. However, the authors do not differentiate among types of partners or present predefined criteria for their selection and prioritization. This shows the limitation on considering partnerships adoption on innovation planning.

3 Methodology

This study began with a bibliographical review (Bereton et al., 2007) and a specific action research (Coughlan and Coghlan, 2002; Ottosson, 2003). An action-research team was form with members of a research group to which the authors belong and members of an organization which develops technologies and needs partners to develop PSP to explore markets, a common situation experienced by companies.

The first step of the study was to make a diagnosis of the management process of technology projects from this organization, identifying their characteristics and difficulties in integrating their technologies into PSP of commercial interest. The diagnosis also involved the analysis of distinct projects of technologies developed by this organization, which made possible to identify their main difficulties in the innovation

process. Among these difficulties was the absence of more elaborated strategy to support the innovation process.

The second step was the creation of strategic plan to a technology which was in its final stages of development at this organization. Altogether, it took about one year of intervention and approximately 400 hours were spent in the action research. At the end of the intervention the field data, minutes of meetings, artifacts and templates for documents and records generated in minutes were synthesized on a guide for the planning application in the organization.

The third and final step was the analyses of this guide on different fields, as services and process development. It was possible to create a generic model to strategic innovation planning considering the steps one and two at light of open innovation and technology development literature. For this, the proposal described at Caetano and Amaral (2011) has been considered as the base due the details of this systematic method to technology roadmapping.

4 Strategic innovation planning considering the partnerships and open innovation paradigm

The results from this research present a strategic innovation planning model with three different stages according to open innovation proposal. The model is based in central idea that the company should advise your effort of innovation from your core technology and ideas about possible technology, products, services or processes that can be developed. The company, a technology based enterprise or research lab, use its core technology to develop masters package technology which goes to the market through partner companies, which produces the finals products, services or process (PSP).

The partnerships with customers and other foreign technology developers that provide information about the market and the related technologies. The Figure 2 presents the stages of the proposal.

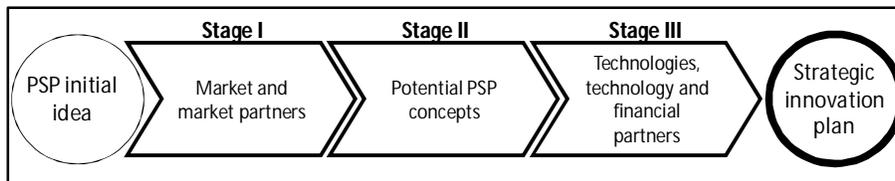


Figure 2 The phases of strategic innovation planning.

According to Figure 2, the goal of the first stage is to identify and prioritize markets which can be apply an initial idea of the potential PSP (product, service or process) which can be developed considering the core technology at the organization. This initial idea consists of a element, which a initial perception about its power of create value to the consumer or enterprises, that has been mentally devised by the professionals from the organization, but has not been developed are available on the market.

Based on this initial idea of PSP to be developed, at the first stage must be realized the activities of strategic innovation planning starting term, with some information like the project name, project manager and team members.

The identification of potential markets is based on results of a survey of potential group of consumers to the PSP idealized. It should provide data regarding the size of this market, in terms of volume of business generated during recent periods of time, and their expected future growth (Cooper, 2008).

At the same time, future partners, known as market partners (MPs), are also identified for each market. When gathering information about market characteristics and sizes, the participants of the strategic innovation planning team also identify players that distribute or develop this kind of PSP and can be a partner to the organization in the introduction of these elements in the market. This provides the opportunity of building partnerships at the marketing exploring. Furthermore, it is possible to involve the partner at the innovation planning through the provision of market information and new possibilities.

Once markets and potential MPs are identified, they must be prioritized. Some suggested prioritization criteria to do this are: market size, growth expectations, alignment with strategies of organization and expectations of market partnerships (Scott, 2005; Cooper, 2008; Chesbrough, 2006). However, other criteria may be added according to the needs of the organization.

A list containing the priority markets and their corresponding MPs is submitted to a decision group, which may be composed by a general coordinator, backed by partners, the top tier of the organization, consultants and specialists, who will decide whether to approve the prioritization. If it is approved, the second follows, otherwise the process goes back and the market prioritization criteria are reassessed.

The second stage proposes the identification of potential PSP and the assessing the priorities to be developed. The objective of this stage is to identify and prioritize concepts of possible PSP based on the market prioritized in first stage. They are just concepts because so far there is no detailed description of their specifications, but only a preliminary description.

The second stage begins with the thorough study of the priority market and its possible segments. The purpose of this study is to identify different groups of potential consumers who can contribute to the idealization of potential PSP concepts. Market segments may be distinguished based on diverse criteria, like geographical localization, extension, demography and economy among others.

A preliminary performance dimensions of the potential PSP these possibilities are also identified. It consists of the preliminary identification of attributes related to these PSP that have or may have some importance for the consumers or business. Among several possible dimensions of PSP performance can be the consumption of natural resources, emissions, energy efficiency, price/cost, and financial potential among others.

It is to prioritize the market segments. Furthermore, it also important to identify their level of compliance to performance dimensions, which refers to how the PSP meets the needs of the segment in terms of the performance dimensions identified. A list of priorities PSP for each of the identified segments is submitted to the approval at the end of this stage.

The third stage proposes the identification of priorities potential technologies to be developed which me make possible to develop the PSP prioritized in the previous stage. Additionally, this stage assists in the identification of possible technology (TPs) and financial (FPs) partners, who may be mobilized in the development of different technologies to be prioritized.

The necessary technologies are defined through the identification of this PSP features and functionalities that would only be possible with the development of specific solutions, such as knowledge, machine or a set of specific skills and expertise.

The identified technologies are prioritized in order to make a distinction between the technology related to the organization's core business and other supplementary technologies. To this end, factors such as the technology alignment with the organization's strategy, the novelty degree of the technology, the possibility of establishing technological partnerships, among others, should be taken into consideration.

A list of priority technologies is performed to identify and prioritize possible FPs for these technologies, who can finance the technologies projects or just provide secondary resources to maintain structures or activities essential to the development of technologies. The FPs can be prioritized from some criteria like confidence, non-competing goals, capacity to pay, experience in collaboration, innovation expertise, familiarity in terms of reputation and friendship, honesty, motivation and interest in the partnership and cultural compatibility.

A list of technologies, TPs and FPs is submitted to the approval at the end of this stage. In the end of this sequence of stages a strategic innovation plan is drawing containing the market to be tapped, PSP to be developed, core and supplementary technologies to be developed and the necessary resources and partners to be mobilized. This can be a guide to the detailed planning and management of partner relationship during the innovation process.

This process model makes sense in the context of the innovation network with partners as described at the Figure 3. The Figure 3 represents the innovation process components considering the partner adoption from a strategic innovation planning. There are two different contexts to analyze, the innovation network and the worldwide market. The organization will integrate a network which make possible to transform its core technology and another ones, developed through the technology development process (PDT), in a commercial PSP, developed through a PSP development process (PSPDP). To this it is necessary to identify what is happened around the World, as market and technology trends, related to its technologies, the partners' interests and the costumers' needs.

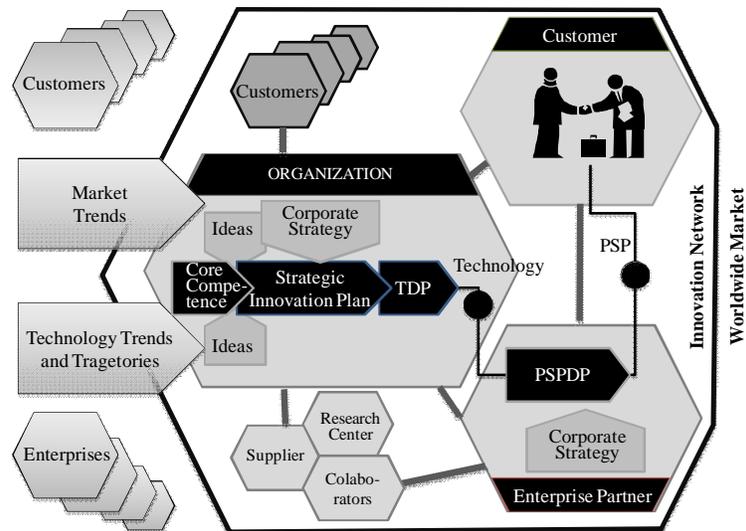


Figure 3 innovation process components at the open innovation and technology push approach.

5 Conclusion

This study presents the sequence of stages and the principal components of the strategic innovation planning considering the open innovation paradigm, e.g., the different classification of partner according to partnership interest and present a set of criteria for their selection and prioritization.

An advantage of this model is to show the possibilities to develop some technologies at a partner and the PSP at another ones simultaneously. This decrease the technology transfer time. The company partner, e.g., a manufacturing company, can conduct the product development incorporating the technology on development. So, the launched of this product in market can arrive faster, starting with that customers which helped during the innovation process – a kind of clients lead user. This makes the reduction of time of insertion of the product in the market.

The practical implications of this model to the strategic innovation planning is not just to organizations which develop technologies, but small and medium enterprises and another ones organization that wants plan their innovation using the open innovation paradigm. These organizations can use this model to choose the best way to be competitive on the market, realize partnership both in the technology development when in the PSP development. In addition, teachers can use this model in the classroom in the conceptualization of different elements of innovation, as market, PSP, technology and partnerships.

This study fills a literature gap on innovation planning considering the partnerships adoption and combines the organization needs to the open innovation paradigm. Future research should present results from the application of this strategic innovation planning model at different kind of organizations, technologies, products, services and process developed.

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