

A Strategic Innovation System Dynamics Process Model

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Introduction

Strategic management scholars such as D'Aveni [1994, 1995, 1999] and Markides [1997, 1999a, 1999b and 2000] developed dynamic approaches to competition that moved from Porter's [1980, 1985] widespread frameworks of industry structure and competitive advantage. According to these scholars, the industry structure can be considered a dynamic environment that can be modified by firm innovative strategies. The resource-based view of the firm [Barney 1986, 1991, Peteraf 1993] is particularly suitable to explain innovative strategies development and implementation .

Innovative positioning choices are unique and this uniqueness is a source of competitive advantage. The uniqueness of the position must be supported by a unique set of resources. Competitive advantage is highly sustainable when the resources on which it is based are not easily identifiable by competitors (causal ambiguity), and are scarce, or rather available to a limited extent and difficult to acquire. Teece [2007] argues that in order to sustain competitive advantage in rapidly changing environments a firm must own not only inimitable and non-substitutable resources, but also difficult-to-replicate dynamic capabilities that allow resource combination.

The strategic innovator determines a structural change of the industry when able to obtain the exclusive control of certain resources that

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have a critical role in the competitive advantage in the industry [Gambardella and McGahan, 2010]. The structural evolution of a sector can be analysed by referring to resources. Indeed, a sector changes structurally if the critical resources on which firms built their competitive strategies change.

Scholars converge on the idea that business model evolution and reconfiguration can be explained by looking at resource integration and combination [Jacobides, Kundsen and Augier, 2006; Johnson, Christensen and Kagermann, 2008; Teece, 2010]. Resources fuel strategic innovation processes. The strategic innovation process, generating strategic initiatives that may change competitive positioning, cannot take place without a specific set of initial resources. Furthermore, to develop and implement strategic initiatives requires developing new resources that advance the strategic innovation process. Resources are generated over time as a result of firm performance, especially profitability, and are the result of a complex accumulation process. Resource accumulation can be represented as positive feedback where the availability of resources sustains the implementation of innovative strategies that contribute to better performance.

The aim of the paper is to investigate strategic innovation through a System Dynamic based process model, built on a qualitative study, that explains the dynamics of innovative strategy generation and implementation within firms.

In our model the process of developing strategic initiatives is extensively influenced by a series of enabling activities that top management put in place to create the desired organizational context, a context that is characterized by an optimal level of entrepreneurial orientation.

According to corporate entrepreneurship studies [Guth and Ginsberg, 1990; Sharma and Chrisman, 1999; Covin, Ireland, and Kuratko,

2003; Kuratko et al.,2005a; Ireland et al., 2009] a new business idea is developed and implemented by an organizational unit that acts entrepreneurially as a new venture start-up within a larger organization [Beer, Eisenstat and Spector, 1990]. New idea development is determined by certain organisational actions that allow unleashing entrepreneurial behaviour within the firm and creating new ventures [Slatter, 1984; Grinyer, Mayes and McKiernan, 1988, Hayton, 2005].

The concept of corporate entrepreneurship evolved through the concept of strategic entrepreneurship entailing the diffusion of entrepreneurial behaviour within the firm to stimulate strategy renewal. Entrepreneurial strategies stimulate active, innovative and creative behaviour within the firm [Baron, 1998; Meyer and Heppard, 2000; Hitt and Reed, 2000] thus sustaining the development and implementation of innovative strategies.

Entrepreneurial orientation in the organization has a number of implications on the processes of generating, developing and implementing innovations. When considering the dimensions that define entrepreneurial orientation on a firm-level, we have seen that an organization with a strong propensity towards adopting innovations, extensive proactivity towards the market and a risk-taking attitude will more easily generate and develop strategic initiatives. The ability to act independently from middle level and frontline managers is crucial in the development and implementation phase, since this will require a lesser involvement of top managers who can continue managing the firm's ordinary activities.

The paper is structured into 5 parts. After a methodological note, the logical model that describe the process of strategic innovation is presented. The third part is dedicated to the organizational context and the diffusion of entrepreneurial orientation at firm level. The fourth part is focused on resource development and allocation process, the

last section explore the issue of execution and strategy implementation.

1. Methodology

The SD logical model was developed by adopting a longitudinal case study methodology [Yin, 1994 and 2004] that is well suited to responding to exploratory type research questions and allows analyzing the temporal evolution of strategic choices and the dynamic links between organizational structures, resources and positioning.

The research followed a multiple case study type design; in particular, three firms were selected that operate in different sectors and compete in competitive environments characterized by different levels of attraction and rivalry among firms.

The multiple case studies were preceded by an analysis of the literature that enabled selecting the units of analysis and defining the relevant constructs and propositions that guided the analyses. For each firm, a specific time interval of analysis was focused on that would allow capturing the most relevant part of the strategic innovation process.

Case selection. The cases were selected in order to analyze strategic innovation processes that would allow a sufficiently detailed longitudinal observation of the phenomenon [Leonard-Burton, 1990, Miles and Huberman, 1994, Pettigrew, 1990]. The case studies were chosen by selecting firms with very different prior histories and competitive success and profitability, however, common to all firms is having implemented strategic innovation processes and significantly redefining their strategic positioning. To increase the likelihood of obtaining relevant information, case studies were included that would allow observing the process of strategic innovation over a number of different time intervals and in different stages of the life cycle of the firm [Yin, 2000].

The companies under study were selected from a sample of successful firms included in the Business Model Innovation Observatory, a scientific database created and maintained by the Institute of Management at the University of Italian Switzerland, that since 2001 collects selected information on strategic decisions and the performance of a sample of innovative European firms. Based on this information, companies were selected that were of potential interest to the study, subsequently progressing to the data collection process.

The sample of companies used for the multiple case studies was construed to include:

- Two consolidated companies (firms that have existed for a number of years) undergoing a major change of strategy determined by the decisions of a new CEO who manages the process of change. Two very different companies in terms of their competitive position and performance were selected. ICP is a company in crisis where the CEO implements innovative strategies to manage the turnaround. ITT Friction is a successful company that is facing the challenge of growth that is managed by the new CEO leveraging on a series of strategic initiatives.
- A company that represents a case of long-term strategic innovation. Permasteelisa was created with an innovative business model and in the course of the period analysed has continued to renew its strategy with innovative strategic initiatives leveraging on entrepreneurial behaviour and the development of intangible resources.

Choosing the analysis time interval. The choice of the time interval of observation of the cases was based on the CEO's term of office. The analytical model foresees that strategic change is activated by the CEO's activities based on his strategic intentions. It was considered that the arrival of a new CEO marks the start of the process of

strategic change that is rooted in the implementation of innovative strategies.

Analysis levels. The analysis of cases is articulated on four levels:

1. The strategic intentions of the CEO, in particular, analyzing the deliberate strategy of the CEO at the beginning of the observation period and hence its evolution over the period analyzed.
2. The development process and the content of strategic initiatives promoted by the CEO.
3. Actions of organizational change aimed at increasing the level of entrepreneurial orientation in the organization.
4. Actions aimed at the development and allocation of resources.

Figure 1. Companies included in the case study

| Company | Industry | Initial competitive situation | Interval of observation | Strategy |
|----------------|---------------------|--------------------------------------|--------------------------------|--|
| Permasteelisa | Building supplier | High growth | 1984-2002 | Continuous positioning renewal |
| ITT Friction | Automotive supplier | Low growth | 2007-2011 | Foster growth through strategic innovation |
| ICP | Sanitary service | Near bankrupt | 1995-2002 | Managing turnaround leveraging on strategic innovation |

A specific activity concerned the analysis and classification of strategic initiatives undertaken by the companies under study,

reconstructing the development process and distinguishing the transition from the generation to the development phase and thereafter its implementation. Strategic initiatives were classified according to the impact they had on the strategic positioning dimension (value proposition and scope).

Data collection. Data collection took place via document analysis and interviews.

The document analysis focused on collecting documents related to the strategic initiatives underway (feasibility studies and extracts of the business plan). In some cases, it was possible to access documents that contained the planned organizational actions of change such as implementing a new organizational structure or the adoption of a new pay system for middle managers.

The interviews were conducted using a semi-structured interview approach, supported by a draft document data elaboration technique and, accordingly, three protocols were developed in line with the people involved: top management, middle management level and frontline managers.

The data collection and fieldwork lasted from 6 to 8 months and for each firm a minimum of 8 to a maximum of 20 interviews were held.

Data analysis. The data analysis was conducted using a grounded theory approach, namely, continuous interaction between the collection and analysis of data to verify the internal validity of the theories developed [Strauss and Corbin, 1990, 1994]. Data analysis was undertaken in a comparative perspective, that is to say, making comparisons between the cases in terms of processes, sub-processes and the relevant variables [Eisenhardt, 1989a].

System Dynamics modelling has been used to increase the level of internal consistency. The elaboration of the theory was supported by System Dynamics logical-analytical tools [Forrester, 1961, 1968]: the

use of the feedback concept and the distinction between stock and flow variables [Sterman, 2000].

In the following sections the presentation of the model has been integrated with box, that contains information about the companies included in the case studies, to exemplify the description of certain variables and processes.

2. Strategic initiatives and the evolution of firm positioning

The central variable of our model is represented by strategic initiatives that form the basic unit of the strategic process, they are innovative projects created within firms, typically designed with the aim of strengthening or changing the strategic positioning of the firm, defined in accordance with the strategic intent of top management and the deliberate strategies [Hamel and Prahalad, 1989]. Strategic initiatives drive strategic change inasmuch as they transform the firm's competitive position and help instigate and sustain profitable growth processes since they allow the firm to develop sales and, at the same time, improve operating margins through cost reduction or improvements in the price position.

The firm's strategy can be seen as a bundle of strategic initiatives. When strategic initiatives are aimed towards strengthening strategic positioning, they can be defined as organic strategic initiatives that fall within the scope of defending current competitive advantage. When the objective is to generate new forms of positioning, they can be defined as radical.

Incremental strategic initiatives are aimed at improving penetration of a market segment or improving the value proposition of the firm, implemented to maintain the current position and the ensuing performance. Radical strategic innovations are intended to change current positioning through, for instance, entry into new markets, developing new customer segments, expanding the product range.

Radical strategic initiatives are those that more accurately represent the concept of strategic innovation because they imply the redefinition of the strategic positioning and can entail changes in the competitive environment and can affect the firm's value proposition.

Redefining strategic positioning requires the introduction of substantial changes in the scope of the business and the firm's value proposition. Examples of strategic initiatives are the development of new products for existing segments or entering new segments where the firm is not yet present with existing products or a geographic expansion through the process of developing international markets. Among vertical integration choices, those downstream of direct distribution can be particularly relevant.

The redefinition of the value proposition affects the relationship between non-monetary value for the customer and the firm's cost structure and entails the reconfiguration of the value chain. The development of a better level of customer service can be achieved by redefining one or more activities of the value chain that allows the firm to apply a premium price exceeding that of a direct competitor who is unable to provide the same level of service. Strategic initiatives can be aimed specifically at cost savings. For example, a firm can develop strategic initiatives in redesigning the product or production process to reduce either the number of components used or the assembly time, and achieve cost savings that thus allow applying appropriate pricing policies. Firms can achieve significant cost savings by outsourcing part of the activities that were previously performed internally, which requires implementing specific strategic initiatives to coordinate logistics with suppliers and avoid diseconomies.

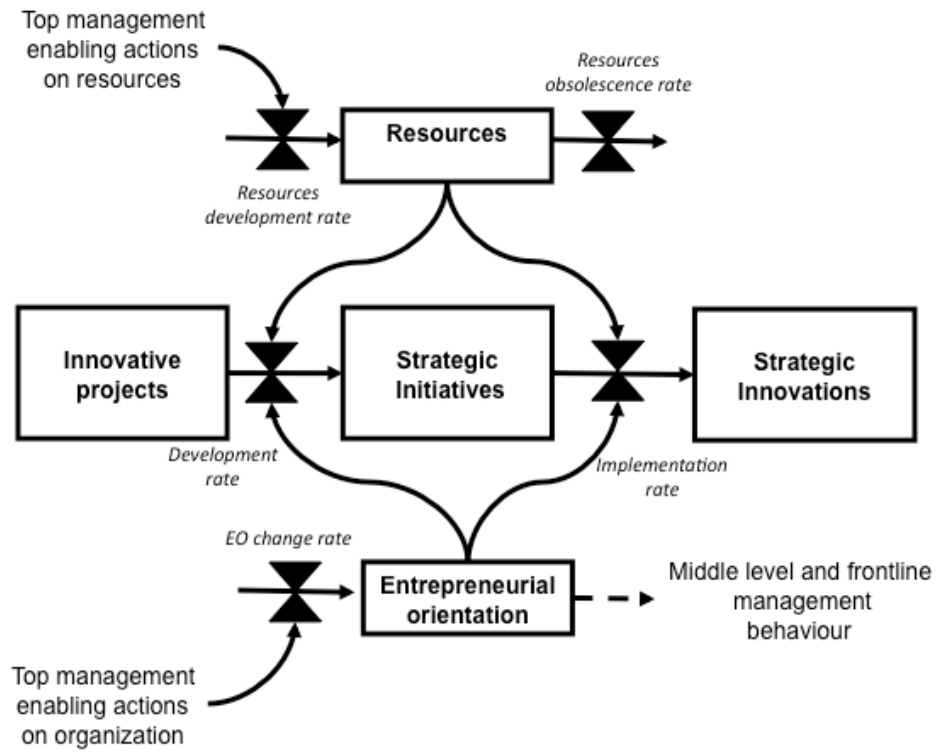
In our representation model of the strategic innovation process [Figure 2], strategic initiatives progress according to a top-down logic, expressing a deliberate top management strategy and fully developed in a process that consists in three phases [Burgelman, 1983].

- **Generation.** This is the stage where the initiatives are presented in the form of innovative projects from middle level management within the more general planning and budgeting process. The presentation of initiatives is generated and driven by top management.
- **Development.** Innovative projects become strategic initiatives and are developed into products, services and process innovations and are tested to verify their potential impact on the strategic positioning under the guidance of middle management. At this stage, innovative projects become strategic initiatives.
- **Implementation.** Strategic initiatives derive from the experimental development phase and become an integral part of the strategy as innovative strategies.

In the SD logical model [Figure 2], the generation, development and implementation of strategic innovations is determined by enabling innovation processes, namely, those processes through which top management creates the contextual conditions favouring the development of strategic initiatives. The two types of enabling processes are the creation of the organizational context and firm resource management. These are complex processes characterized by inertia and time delays between the action and implementation phases, and must therefore be planned and managed by top management.

Enabling innovation processes are supported by control and execution processes, or rather, processes that are put in place by top management to ensure that the strategic initiatives are actually achieved. These also entail two linked processes: control of the development of strategic initiatives and the execution or implementation of the initiatives.

Figure 2. A System Dynamics stock and flow models to represent the strategic innovation process



ITT Friction, leader in the field of brake pads and friction materials, is a subsidiary of ITT Corporation, the American multinational operating in various industrial sectors. In 2007, the company, under leadership of the new CEO, was undergoing strong growth despite the crisis in the automotive market.

Upon taking office, the new CEO realized that the company had great potential and developed a growth strategy by focusing on new markets and new customers and to develop innovative products. The CEO developed a long-term strategic vision and activated a series of strategic initiatives aimed at changing the firm's positioning, both on the level of its competitive environment and in terms of the value proposition.

In particular, the strategic intentions of top management included doubling the size of the company within 3 years by focusing on the original equipment segment for leading car manufacturers. The focus on original equipment was based on the fact that the company owned the necessary R&D competencies to create innovative products that are adopted in new platforms (with which different car models are created). In addition, the OEM market requires high production volumes, which under certain conditions allows developing economies of scale.

The new CEO formulated the company's strategy as a set of strategic initiatives dedicated to the pursuit of growth and customer value creation, which can be summarized as follows:

- development of products for several key platforms for customers in mature markets;
- development of highly automated production processes for high volume production;
- strengthening R&D activities to innovate in products and production processes according to an integrated approach;
- opening technical and commercial branches in mature markets to win new customers who are leaders in quality and innovation;

- development of a production and commercial structure in China to serve local car manufacturers;
- development of a production facility in Eastern EU to develop products for the aftermarket.

After defining the contents of the initiatives, the CEO distributed responsibilities and implemented processes to support the development of strategic initiatives in relation to resources and the change in the organizational context. The CEO, recognizing the validity of the original positioning of the company and using available resources, promoted a series of targeted initiatives consistent with the long-term objectives, which helped change the scope of the strategic positioning.

3. Creating the entrepreneurial context

Top management can shape the organizational context by introducing a series of organizational activities that directly influence entrepreneurial orientation at firm level [Morris & Jones, 1995; Garvin, 2002; Morris, Kuratko and Covin, 2008]. Innovations that are introduced in the organizational context to obtain the desired level of entrepreneurial orientation do not produce immediate effects. The process of changing operating mechanisms, the process of creating new organizational units, the selection and inclusion of new managers are activities that require time to be implemented and must thus be programmed in advance by top management.

Top management can act on two variables: the design of the organizational structure and the definition of the operational mechanisms that regulate the functioning of the organizational structure. In certain situations, specific actions can be taken by top managers to stimulate the so-called bottom up engine, which consists in the autonomous generation of strategic initiatives by middle level and frontline managers.

Actions on the hard variable: the organizational structure. Firms can create mixed organizational units where commercial and technical managers work on specific projects. This facilitates the management of technological innovation by empowering staff engaged in research and development, in terms of economic and competitive objectives, to optimize the flow of information both within the firm and from the market to the firm. Innovations on the organizational structure can be introduced even when strategic innovation and development processes are in progress (Figure 3). At a certain stage of the development or implementation of a strategic initiative, top management can create organizational units dedicated to an innovative project to isolate it from the management of current activities and promote the clear allocation of resources. The objective is to preserve the strategic development of the initiative thereby circumventing that this becomes the object of internal killing actions by the firm's organization.

The design of the organizational structure can be achieved by introducing individuals, such as project managers, who coordinate the business functions and are able to respond more quickly to market needs. These individuals, and the organizational units associated with them, tend to move independently and proactively with respect to the market.

Actions on the organizational context can also be implemented through the selection and inclusion of specific organizational figures who serve as activators of business processes. These individuals are middle level or top managers who have accumulated experience in managing strategic innovation and, in particular, the related organizational aspects, and can therefore act on the organizational structure to stimulate entrepreneurial behaviour in frontline managers and increase entrepreneurial orientation in the organization.

Actions on the soft variable: rules. Operating mechanisms are one of the most incisive elements to achieve a certain level of entrepreneurial behaviour in the organization. The key operating mechanisms are the definition of tasks, proxies and remuneration and career management systems. The definition of proxies must be structured to encourage autonomous behaviour by establishing limits and control mechanisms. The definition of tasks must include explicit rules for the time management of individual employees. Specifically, there must be a clear allocation between innovative projects and current operations. Remuneration systems always play an important role in stimulating entrepreneurial behaviour in the organization. These systems can be designed expressly to stimulate entrepreneurial behaviour on the level of organizational units, circumventing leveraging on only individual entrepreneurial behaviour, since these depend on the characteristics of the human resource and are not the result of an organizational learning process. Performance evaluation systems can be linked to the achievement of competitive goals (such as growth and level of customer satisfaction) and profit objectives. Intermediate evaluation systems of the development process of strategic initiatives can also be introduced, especially when these affect the development of innovative products that require time. In this last case, the contribution of managers to the development of the initiative is evaluated and directly rewarded in advance of the contribution to business performance. Assessment systems can provide cross-valuation mechanisms for frontline managers towards middle level managers to evaluate their ability to achieve goals while maintaining a constructive climate and encouraging the development of entrepreneurial behaviour among employees.

Monetary reward mechanisms can be integrated with non-monetary rewards, such as business awards, the assignment of new operational authority, involvement in higher-level organizational units for active participation in the strategic process. These rewards affect the

entrepreneurial behaviour of the individual resource and can only indirectly affect the organizational unit in which it operates.

Figure 3. Enabling actions on the organization to increase the entrepreneurial orientation at firm level.

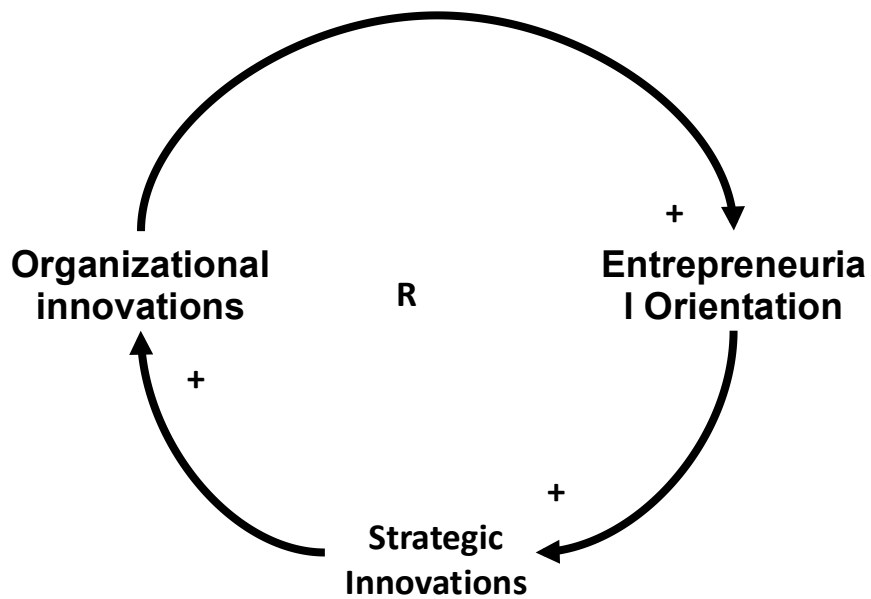
| Hardware –Structure | Software – rules |
|--|--|
| Reduction of organization levels to facilitate contact with top management | Definition of tasks that allow autonomous behavior |
| Creation of new roles in the organization and selection of the appropriate humane resource to accelerate the entrepreneurial process | Introduction of rewards (monetary and non monetary) |
| Creation of new organizational units dedicate to the development of strategic initiatives | Evaluation criteria for employees performance that take into account their entrepreneurial contribution to strategic initiatives development |

Igniting the bottom-up engine. Top managers, under certain conditions, can act to promote autonomous strategic initiatives from middle level and frontline managers. Literature presents an articulated debate on the possibility of frontline and middle level managers to offer strategic initiatives in a bottom-up approach [Burgelman, 1983, 1984, 1991; Kuratko et al. 2005b]. The debate stems from studies on internal venturing processes where the organizational units dealing with new strategic initiatives consist in frontline and middle level managers with the task of drawing the top management’s attention to new initiatives that are often inconsistent with the corporate strategy. In these projects, top management has a relatively passive role, setting

guidelines for the presentation of initiatives and, following the selection of projects to be developed, guiding their implementation.

In a feedback loop interpretation of the strategic innovation process (Figure 4), initiatives are created with a top-down approach, or rather, induced by top management consistent with the firm's deliberate strategy. Widespread entrepreneurial behaviour stems from bottom-up type activities that have limited scope in supporting strategic initiatives, but that cannot be configured as autonomous strategic initiatives. Frontline and middle level managers can implement two types of activities that consist in either fine-tuning, namely, refining specific aspects of a strategic initiative or they can contribute to the acceleration process by helping to remove inertia and optimizing resource utilization to reduce the development time of the initiative.

Figure 4. A feedback loop interpretation of the relations between organizational innovations and strategic innovation



Permasteelisa and the creation of an entrepreneurial organization.

Permasteelisa, world leader in the construction of curtain walls for buildings, has been able to radically change its competitive position by changing its geographic scope and product range, and reinforcing a unique value proposition based on innovation, product customization, level of service and timeliness.

Permasteelisa introduced organizational innovations in the design of the organizational structure and in operating mechanisms that encouraged entrepreneurial behaviour. The organizational innovations stimulated and supported the development of strategic initiatives that contributed to the renewal of the firm's positioning.

The 'project manager' is the first organizational innovation, introduced to eliminate the inefficiencies associated with a lack of coordination between different business functions. Project managers developed close ties with customers and designers and have embedded themselves in the different markets of reference, which they often helped to create from nothing. Project manager impetus in the executive committee gave birth to the idea of developing new markets, such as the Japanese or American markets. Project managers also inspired the development of innovative products, such as the Blue Technology active façade system. The introduction of project managers helped highlight the problems and inefficiencies that characterized operations, such as during installation when external installers often jeopardized the quality of the execution, a problem that was resolved with the introduction of an original procedure of training installers. A further innovation introduced on the organizational structure by the firm was the method of constituting installation teams that were organized as small businesses with a coordinator involved in the stock options system.

A system of incentives based on sharing the entrepreneurial function (with associated risks and rewards) was introduced to facilitate the entrepreneurial development of project managers. Some of these have become business "champions" since by themselves, and with few resources available, they developed new export markets such as the British or Asian market, or were awarded contracts

that were particularly significant for the group's development. The extension of the incentive system to the front-line management level, such as site managers and factory managers, reinforced the spread of entrepreneurial behaviour characterized by initiation spirit, a proactive attitude to problem resolution and sharing the profitability and quality objectives of the firm.

4. Managing resource development and allocation

The development of strategic initiatives requires top management resource commitment actions. These are tangible, intangible and physical resources used by middle level management to develop strategic initiatives.

The progression of strategic initiatives is influenced by the allocation of resources that the initiatives are able to attain at different stages (generation, development and implementation). The generation of strategic innovation requires an initial stock of resources, such as technological know-how, business know-how, financial, physical and tangible resources. In the development of strategic initiatives, tangible physical resources as well as R&D laboratory facilities, pre-production and logistics management structures, can be as important as intangibles resources such as know-how.

The process of creating strategic initiatives begins with the resources that the CEO decides to allocate in accordance with certain criteria. During the strategic initiative, top management can conduct a series of interim evaluations to confirm the allocation of resources or to reduce and slow down or stop its entire development.

Resource allocation is a process that involves trade-offs, since resource endowment is - by definition - limited and therefore the allocation of resources to a specific project reduces the resource portfolio available for other projects. Strategic initiatives have the

characteristic of absorbing scarce resources within a firm such as financial resources and highly specialized human resources.

Top management, with the selection of allocating resources to strategic initiatives, initiate a process of selecting strategic alternatives and thus define the boundaries of the strategic positioning of the firm. During the strategic initiative development process, resource requirements increase linearly or in some cases exponentially thus, considering the limited availability of resources, the pressure on top management in the selection of initiatives to be developed and implemented increases.

Resource commitment follows the rules defined by budgeting and strategic planning but foresees a degree of flexibility to seize strategic opportunities. Some initiatives are subject to acceleration in their development and implementation due to either exogenous factors or the capabilities of middle level and frontline managers, requiring rapid rescheduling of the allocation time of resources to prevent the initiative from losing momentum and slowing down its development. Finally, the allocation of resources among strategic initiatives can be influenced by the negotiating skills of middle level managers, whereby allocation criteria do not always follow to plan and do not exclusively rely on the objective measures of performance expected from the strategic initiative. In a certain way, individual negotiation skills reflect individual entrepreneurial attitude and can be positively associated to the entrepreneurial orientation of the organization.

4.1. Dynamic capabilities and resource development

As in the case of organizational innovations introduced to achieve the desired level of entrepreneurial orientation, resource development processes must be planned by top management taking into account implementation times and the subsistence of inertia.

Resource development processes must be conducted independently from the strategic innovation development process. Indeed, the firm must rely on a set of resources that fuel ongoing management activities, or rather, the implementation of deliberate strategies, while proceeding with the development of new resources to meet the demand generated by strategic initiatives that are under development and implementation [Dierickx and Cool, 1989, Zollo and Winter, 2002, Romme et al., 2010].

Resource development processes have been studied extensively in management literature and are linked to the business organization's ownership of specific dynamic capabilities, enabling firms to externally acquire, internally develop and integrate resources to create strategic initiatives [Teece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000, Barney, 2001; Covin and Slevin, 2002, Helfat et al., 2007]. Dynamic capabilities were introduced to understand how firms manage their resources and to explain competitive advantage based on a combination of resources. Dynamic capabilities can be considered the ultimate source of a firm's competitive advantage inasmuch as they are the result of complex learning processes that are difficult to replicate [Teece, 2007, Wall et al. 2010]. Furthermore, the very nature of dynamic capabilities makes them difficult to identify and hence poorly immitigable by competitors.

Dynamic capabilities can be classified according to their contribution to the process of creating and implementing strategic initiatives [Zahra and Nielsen, 2002; Winter, 2003; Covin et al. 2003; Zahra, Sapienza and Davidsson, 2006]. Among different classifications, three types of dynamic capabilities are crucial to the strategic innovation process.

- Exploration capabilities: these are the firm's capabilities to implement the resource exploration process, to monitor the competitive environment in search of resources that can be used

for the development of certain strategic initiatives. Exploration capability is linked to the ability to search for heterogeneous resources with respect to those owned and serving the renewal of future strategic positioning.

- Integration capabilities: the ability to integrate within the firm the resources acquired through exploration activities, for example, human resources or a new industrial process based on the use of new technologies acquired externally under license.
- Exploitation capabilities are those that enable the firm to implement the resource exploitation process, to maximize the productivity of resources owned by combining them in innovative ways. These capabilities can also be defined as internal integration capabilities, since they allow rejuvenating the firm's portfolio of resources through new combinations of owned resources. This is the creation of new know-how using human resources, consolidated technological knowledge and physical resources.

Resource development is a critical process that firms must manage not only to stimulate strategic innovations but also to renew the resource base that sustains the current position of the firm. Resources are subject to a natural process of obsolescence depending primarily on endogenous factors [Penrose, 1959; Dierickx and Cool, 1989], namely, the intrinsic characteristics of resources that are consumed such as physical resources or those that become imitable, for instance, patents in the pharmaceutical sector. Resources also become obsolete because of competition that, for example, can render the technological knowledge at the base of a firm's competitive advantage redundant.

Firms must develop monitoring systems that can detect the rate of obsolescence of the resources they own. Based on information received from these systems, top management can decide whether to accommodate the natural obsolescence of the resources or activate

resource development processes by leveraging on the firm's capabilities.

Protection, use and development of resources in the ITT case study

The ITT case study shows that competition in the production of brake pads is based on the ability to develop unique formulas that enable superior performance. The development of new products depends on technical production process know-how and the formulation of compounds; clearly, this knowledge is encoded, in some cases patented, but in most is kept secret. The competencies of human resources, and in particular of formulators, are important for the development of new products inasmuch as the process of creating a new compound for brake pads is the result of creative contributions determined by the experience and subjective characteristics of formulators. A key issue is preserving and strengthening know-how and human resources with distinctive competencies. ITT's top management promoted the development of advanced research programs for the implementation of compounds and experimental processes. These research programs allowed keeping the tension high between employees engaged in R&D and foster technical learning processes, thus strengthening technological know-how and human resource competencies. These programs are supported by top management with investments in physical and financial resources dedicated to enhancing the capability of undertaking research and development.

Some of the knowledge developed within the advanced research programs has been patented, while in other cases, it is coded and kept secret. Top managers guided the resource development process by promoting only those research programs that allow the development of know-how that in the medium term can be transferred into new designs for customers. In particular, the CEO promoted research programs for compounds with high environmental compatibility and the development of so-called universal compounds, namely, compatible with the needs of the American market as well as with those of the European market.

4.2. The resource trap

Resource development processes and, in particular, exploitation and integration processes can be impeded by the so-called resource trap [Todorova and Durisin, 2007]. Firms with a competitive advantage based on a set of resources can manifest strong decisional and operational inertia in undertaking the processes of seeking, acquiring and integrating new resources; their core capabilities, based on a set of resources accumulated over time, become core rigidities [Nelson and Winter, 1982; Leonard-Burton, 1992].

The resource trap can also be manifested in firms in crisis facing discontinuity in the competitive environment and lacking some of the resources at the base of competitive advantage, where top management reacts to the situation by trying to make the most of existing resources without undertaking appropriate resource development processes [Gilbert, 2005].

The removal of inertia, rendering the resource trap one of the biggest obstacles to the strategic innovation process, is the responsibility of active top management activity aimed at achieving an optimal level of potentially strategic resources; or rather, those resources that could help the firm develop new initiatives, regardless of the resources owned. This involves conducting an undistorted analysis and diagnosis of both the strategic and organizational context of the firm and its competitive environment.

The resource trap can be mitigated or entirely removed by acting on those firm resources that generate it. Top management can implement two types of actions to remove the resource trap: actions to reorientate the resources of the firm or the rationalization of resources.

Reorientation. Reorientation actions foresee that the resources that could generate inertia are used in exploitation and integration processes together with external resources. Reorientation actions are possible when existing resources can be exploited in some way in the

strategic initiatives that the firm is developing. This is the case with particular technologies or trademarks or highly qualified human resources that can be used on their own or integrated with new external resources in the context of strategic initiatives such as the development of innovative products.

Rationalization. The rationalization process is achieved in the removal of resources that may cause inertia. These resources must be mobile, i.e., the firm must be able to extract them and place them on the market. Mobility depends on administrative and legal factors, the market value of the resource and the impact on the firm's economic equilibrium, which can be assessed by considering the exit costs that the firm would sustain if deprived of these resources [Tushman and O'Reilly, 1996]. For example, human resources cannot be easily removed from the business context since the rules for layoffs in some countries can be rigid or compensation may be foreseen that would jeopardize the economic viability of the firm. A patent on an obsolete technology could be sold at a low price or free of charge and this would cause a significant economic loss in the form of capital loss in the income statement. In some situations, firms cannot deprive themselves of some resources as they are essential for short-term operativity and thus for the current strategy, although they will no longer be required with the implementation of new strategic initiatives. Generally, the costs incurred and associated with the outgoing mobility of resources render the rationalization processes difficult and hence reinforce the inertia of the resource trap.

Resources that support the consolidated position of the firm may slow down or prevent not only the generation but also the implementation of strategic innovations, especially when they do not use the firm's consolidated set of resources but leverage mainly on new resources. The resource trap prevents the development of new strategic initiatives inasmuch as it prevents the firm from developing new

resources that are needed to support the implementation of high-potential strategic initiatives.

Hence, the removal of the resource trap does not only affect the inertia that counteracts the process of igniting strategic change, but also favours the successful implementation of strategic innovations, especially when they involve a radical change in the firm's positioning.

Removing the resource trap in the ICP case

In the ICP case, top management expressly managed the problem deriving from the resource trap generated by human resources with competencies that were unusable in the strategic initiatives promoted to support the firm's re-focalization process. They could not dismiss these human resources for two reasons: they were critical to the firm's daily operations providing hospital services in several areas that could not be discontinued immediately while top management was subjected to pressure from political stakeholders aiming to preserve jobs and the positions of medical directors and administrative staff. Another resource trap was represented by physical assets such as buildings and obsolete equipment that were unsuitable for the development of services for paying patients. These resources could not be dismissed for legal reasons as well as the low value they would have obtained on the market. The top management's decision was to work on the re-orientation of resources, aiming to valorise human resources in the resource exploitation process by improving coordination between medical and administrative staff and involving medical staff in a series of strategic initiatives. Thus, resource exploration activities were activated by encouraging the entry of new professionals and the acquisition of new know-how (such as management control software systems). These new resources were part of the integration process with existing resources that the firm could not abandon. The re-orientation of resources made it possible to remove the inertia, without removing the resources and initiating the process of strategic change by focusing the firm on the therapeutic areas defined by the CEO. When the strategic focalization initiatives entered into the implementation phase and contributed to the improved performance of the firm, the CEO initiated a process of human resource rationalization, in particular, medical staff who had developed expertise in the area of maternal and child healthcare or in occupational medicine/rehabilitation. The removal of these resources allowed giving new impetus to the process of strategic change, which also benefitted from the development of bottom-up type initiatives promoted by medical staff and valorising the new specialist know-how developed by the firm.

5. Managing the development process of strategic initiatives

The strategic innovation process is fuelled by the spread of entrepreneurial behaviour within the organization that stimulates the participation of middle level and frontline managers in the strategic innovation development and implementation process. Furthermore, under certain conditions, the level of entrepreneurial orientation also allows frontline and middle level managers to directly participate in the process of creating initiatives by proposing innovations.

The process of entrepreneurial behaviour diffusion must be managed with appropriate systems to ensure that the organizational context does not become unruly and chaotic, namely, the creation of numerous projects that do not get beyond the generation or development phase or are not implemented. This type of context is unsustainable because it consumes resources without contributing to the renewal of the firm's business strategy and therefore to maintaining competitive advantage.

The introduction of measures aimed at increasing the level of entrepreneurial orientation in the organization must be accompanied by control and execution processes. These processes are managed directly by top management with the support of planning staff and have the dual purpose of monitoring and guiding the development process and the implementation of strategic initiatives.

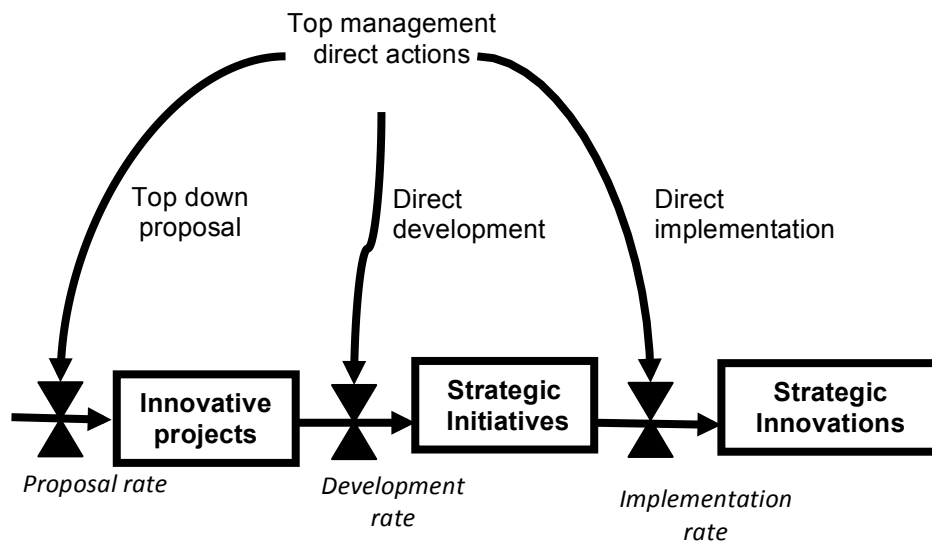
Control process. Control processes focus on monitoring the absorption of resources by strategic initiatives and the evaluation of economic and competitive performance linked to strategic initiatives. The main problem top managers have to face in designing control processes is the adoption of appropriate criteria to evaluate on-going strategic initiatives that do not produce appreciable effects on the firm's profitability and growth.

Execution process. Execution processes focus on the management of operational activities that support the development

and implementation of strategic initiatives. Top management can adopt two different approaches to execution management, the first leverages on direct top management execution while the second leverages on self-discipline.

- Direct execution is a participatory-type approach where management directly intervenes in the development of projects using the monitoring system to control middle level and frontline managers, while operational development decisions are taken directly by top management (Figure 5). In the self-discipline-oriented approach, top management is responsible for monitoring and sharing resources and information on the progress of strategic initiatives. This information is shared with middle-level management to whom the operational decisions are delegated that enable the development and implementation of strategic initiatives.
- The self-discipline-oriented approach relies on the entrepreneurial behaviour of middle level managers who are empowered to achieve the objectives and take a series of operational decisions driving the development of strategic initiatives. The self-discipline-oriented approach can also stimulate the entrepreneurial behaviour of frontline managers that fuel the fine-tuning process through which they contribute to refining the content of strategic initiatives.

Figure 5. System Dynamics Stock and Flow model representing the strategic innovation implementation process



Direct execution does not always accelerate the development and implementation process. The acceleration of the process depends on the CEO's commitment and productivity that if absorbed by ordinary company management may, in some cases, slow the development of the strategic initiative. In fact, in a situation of direct execution, the CEO is responsible for strategic and operational decisions that facilitate the progress of the strategic initiative, and thus, in the absence of his decision, the process is interrupted.

Direct management is not a characteristic of the organizational context, but is a management choice in the strategic initiative development process that can be modified by top management over time or at a certain stage of the strategic initiative's development. In

the ITT case study, strategic business development initiatives, after being launched by direct action of the CEO, have devolved to middle level managers who have been granted a high level of managerial autonomy in execute them.

Self-discipline and the management of strategic growth initiatives. The Permasteelisa case study

The Permasteelisa case study allows fully understanding the importance of self-discipline in strategic innovation processes. The company has adopted a network structure with production and commercial distribution centres in different geographic markets endowed with strategic and operational autonomy. The choice of granting autonomy was motivated by the need to create light and flexible structures able to handle orders with a high service level and hence responding quickly to customers.

The company's growth and international expansion was managed through a series of strategic business development initiatives assigned to firms in the network operating in different geographic markets. The strategic growth initiatives were supported with the diffusion of entrepreneurial behaviours in the organization, more specifically, assigning property rights to managers. These managers are held accountable for the growth and profitability results of the strategic initiative in their charge, which allows minimizing control activities over the process of developing new markets. This system was designed to minimize top management intervention in managing the strategic growth initiatives and instead focus on the direct management of the strategic product and process innovation initiatives and external growth through acquisitions. Notwithstanding the level of self-discipline induced by the equity sharing system, a sophisticated performance control system was developed that allowed top management to continuously monitor the activities of middle level managers involved in the development of new markets.

Accelerating the process of strategic change by leveraging on direct execution. The ITT case study

The ITT case study provides an example of the interaction between direct execution and self-discipline. Top management, recognizing the value of human resources and know-how in the research and development function, promoted a series of strategic initiatives aimed at developing new products and processes. The management of these initiatives was delegated to middle level managers involved in R&D. To appropriately orient the development process, the CEO facilitated coordination with the marketing function through a series of actions on the organizational structure and on operational mechanisms. Furthermore, systems to monitor the development of strategic initiatives and use of resources were also implemented. The allocation of resources and, particularly, investments in R&D facilities were used as non-monetary incentives in support of the proactive behaviour of researchers.

The CEO directly managed several strategic initiatives aimed at business growth; in particular, he undertook the development of growth initiatives in foreign markets where the implementation of production facilities and applied research were foreseen. Direct management was motivated by two factors: the lack of qualified human resources to entrust the projects to and the need to accelerate the implementation process.

The choice of approach depends on several factors and is influenced by the mental models of top management. Often the approach is the result of competitive-type macro environmental pressures on the firm or pressures from major stakeholders such as creditors or shareholders who may ask for a greater degree of control and the active participation of top management in the development and implementation process of strategic initiatives. In managing situations of strategic change, such as turnarounds, actions aimed at the dissemination of entrepreneurial behaviour are difficult to implement, since there are targets for the recovery of profitability and to cover the firm's short-term financial commitments. In these cases, top management focuses on strategic initiatives aimed at the structural containment of costs, activating direct management activities. Actions on the organizational context can be oriented towards inducing a reduction in entrepreneurial orientation by changing operating procedures, reviewing tasks, including or eliminating some organizational figures. This situation can last for a certain period of time and hence management can decide to increase the level of entrepreneurship to pursue the process of growth and improve profitability.

The strategic innovation model proposed does not foresee an *a priori* choice of approach to be adopted to control the strategic innovation process; in fact, top management should have the perceptiveness to modify the trade-off between self-discipline and direct execution by assessing the impact on the effectiveness of the strategic innovation process. The ultimate goal of top management must be to maintain, over time, the capacity to generate strategic innovations that are functional to profitable growth.

Conclusions

Specifically, some critical decisions emerge that determine the effectiveness of the strategic innovation process. These critical issues could constitute an operational agenda for managers in carrying out decisions and for strategic management scholars who could develop further research aimed at understanding these issues.

Managing organizational change. Strategic innovation processes are characterized by time delays that are associated with the execution times of processes that must be monitored and actively managed by senior management. The process of organizational change is characterized by perception and decision-making time delays.

Top management wanting to change the organizational context by acting on the entrepreneurial level of the organization must measure and evaluate entrepreneurial orientation to implement changes in the structure and in operational mechanisms. These actions of change require instances of verifications with potentially interested parties and relevant stakeholders. Once determined, the organizational change must be executed. Consider, for example, the implementation of a new organizational structure or the introduction of new systems of incentives and the resulting performance measures. These are complex processes that top management and the team dedicated to human resource management can design and launch, but they require the organization's active commitment and participation.

Managing the resource development process. The development of resources is another process characterized by time delays that are similar to those found in the organizational change process. Delays in perception stem from the fact that the CEO may not perceive the importance of the endowment of critical resources for strategic innovation. In this case, the development of strategic initiatives suffers a slowdown that affects the ability to renew the firm's strategic positioning. The information gap can be actively managed by senior

management through the implementation of an internal and external monitoring system of the competitive environment that allows identifying those resources that are important to compete and those that the firm is lacking.

The processes of acquiring resources are themselves complex inasmuch as the exploration process that includes research and negotiation must be managed. Also to be considered is that an externally acquired resource becomes fully productive only after having been integrated into the company's portfolio of resources and this requires time that depends on the organization's integration capabilities.

Top management can reduce acquisition times by building and maintaining a network of relationships with individuals holding critical resources such as research centres, distributors, financial partners, strategic suppliers. The relational network facilitates locating and acquiring resources such as know-how, human resources with specific skills or financial resources to support innovative projects.

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