



Typology of Sustainable Innovations and the Relationship with Knowledge, Learning, and Sustainability Impacts: a Model

Autoria: José Ednilson de Oliveira Cabral, Maria da Penha Braga Costa

Abstract

Innovation, in general, is influenced by several environmental and firms dimensions. But, it also produces impacts. Hence, the research about innovations encompasses not only the study of their sources, determinants, mechanisms or processes, but also their consequences. Regarding impacts the assessment focus, in general, on firm economic performance, through the results in productivity, growth, employment and production. But, there is the approach to focus on the impact on social and environmental sustainability. Hence, the goal of this paper is to delineate a conceptual model about a typology of sustainable innovations and the relationship with firms' knowledge sources and learning processes and with sustainability impacts of innovations. This model will be applied in a research assessing the mutual interaction amongst sources and consequences of different kinds of sustainable innovations. Hence, a bibliographical research about the themes was carried out and an in-depth study of the selected literature was undertaken. Specifically, we revise the proposed theoretical models; critically assess the suggested analytical models and conclude with an integrative model focusing on knowledge and learning for innovations types and sustainability. The main research question: are innovations types and innovative sustainability improved by differentiated knowledge sources and learning processes? After the evaluation of the literature, the paper's proposal is that a firm possessing higher levels of knowledge and learning activity focuses on developing innovations which bring not only high profits, but also social equity and environmental protection. In this case the firm is orientated by an innovative strategy focused in sustainable outcomes, its knowledge base and learning effort may direct toward concentrating its assets on developing capabilities, which results in higher levels of sustainability in new products or services. In contrast, the lower levels of knowledge base and learning effort lead the firm to focus on a cost leadership innovative strategy, which results in lower levels of sustainability in new products or services. Hence, the sustainability of the innovation outcome is greater in firms with high levels of knowledge base and learning effort, which in turn is steered by firm innovative strategy. This defined framework shall be applied in a research searching for homogeneous groups of firms regarding types of innovations in sustainable characteristics, applied resources (knowledge base) and capabilities (learning process) and sustainability impacts of innovations, in the Brazilian agro-food firms.



Introduction

Innovation refers to new combinations of existent knowledge and to organizational learning, according Schumpeterian definition (Schumpeter, 1936). For Kogut and Zander (2002) it is not only existent knowledge, but also created knowledge. Hence, knowledge and learning are two of the main mechanisms linked to innovations. According to Lundvall (1994) knowledge is the most strategic resource and learning the most important process of the contemporary capitalism.

For Garcia-Morales et al. (2008), based on Nonaka and Takeuchi (1995) and Senge et al., (1994), an organization should be understood as a ‘system based on knowledge, a system through which circulate information and basic knowledge (explicit and tacit), knowledge acquired from the outside (absorptive capacity), or existing knowledge in the organization (knowledge used and knowledge slack). This circulation of knowledge creates a knowledge flow that, through various processes of transformation (organizational learning), creates new knowledge which, when applied (innovation), generates essential competences for the firm’.

Innovation, in general, is influenced by several environmental and firms dimensions. But, it also produces impacts. Hence, the research about innovations encompasses not only the study of their sources, determinants, mechanisms or processes, but also their consequences.

Regarding impacts the assessment focus, in general, on firm economic performance, through the results in productivity, growth, employment and production. But, there is the approach to focus on the impact in social and environmental sustainability.

Hence, with this paper we intend to advance in the understanding of the causal relationship of firms’ knowledge sources and learning processes as bases for innovation types and from that to sustainability. With this understanding we will delineate a conceptual model about a typology of sustainable innovations and the relationship with firms’ knowledge sources and learning processes and with sustainability impacts of innovations. This model will be applied in a research searching for homogeneous groups of firms regarding types of innovations in sustainable characteristics, applied resources (knowledge base) and capabilities (learning process) and sustainability impacts of innovations, in the Brazilian agro-food firms.

From that, the main question is: how knowledge and learning interact in firms to produce kinds of sustainable innovations and which is the role of them on innovative sustainability? In other terms: are the types of sustainable innovations based on differentiated knowledge sources and learning processes and linked to different levels of sustainability impacts?

In methodological terms, it is characterized by a bibliographical research and an in-depth study of the literature about determinants, processes and effects of innovations. In this direction, we revise the actual trends in the field and critically assess the suggested analytical models. The proposed integration of the revised models in a synthesis not only will base future empirical research but also serve to managers and public policies makers in their work of assess the process of generation, adoption and technology transfer.

This is an important aim since the literature and research about the relationship above is scarce, in spite of a lever in the attention on innovation processes towards sustainable development. This paper adds to this literature by defining a theoretical framework for examining differences in firms’ knowledge and learning activities and the implications of these activities for a firm’s performance and sustainability of the innovative process.



To achieve the goal, the remaining of the paper is structured as follows: first it is assessed the literature about knowledge and learning as mechanisms of innovation at firm level; in the second section the typologies of innovation are evaluated; in the third section it is assessed the literature about sustainable innovations; in the fourth section the relationship presents an analysis of the literature about the relationship knowledge, learning, innovations and sustainability is evaluated, and, the following section presents the devised conceptual model for the analysis of the relationship between knowledge and learning with innovations and sustainability is evaluated. Then, the paper is finished with the concluding remarks.

1. Knowledge and Learning as Sources of Innovations at Firm Level

This section presents the result of an in depth analysis of the literature about knowledge and learning as internal determinants of innovations. These sources have been acknowledged as main aspects of innovation development.

This acknowledgment reflects proposals, pioneered by Penrose (1959), that resources and capabilities are the basis for innovations. In these proposals, a set of in-house resources and capabilities, broadly defined to incorporate inelastic productive resources, is claimed to give rise to intra-industry heterogeneity and idiosyncratic (firm-specific) sources of competitive advantage.

The resource-based theory foundation is that firms are heterogeneous with respect to their resources and capabilities. These resources and capabilities are the basis of the growth of a firm. Teece et al. (1997), however, show that resources and capabilities are different concepts. Resources refer to firm-specific assets, tangible and intangible, such as physical, financial, human and organization (Barney, 1996). Examples of resources are production plants, property, organizational routines, workers' skills, reputation, structure, and brand name. Capabilities involve the use and adaptation of a set of resources based on accumulated organizational or collective experience, to fulfill the objectives of the firm and provide it with a competitive advantage. Resources and capabilities provide competitive advantage when they are difficult to imitate, replicate, or substitute. While resources can be tradable in (nearly perfect) factor markets, capabilities cannot, since they are firm-specific, i.e. created inside firms over time. Hence, authors as Mahoney and Pandian (1992) emphasize which firms' asymmetries are not defined by the ownership of resources, but by the way that they use these resources (capabilities).

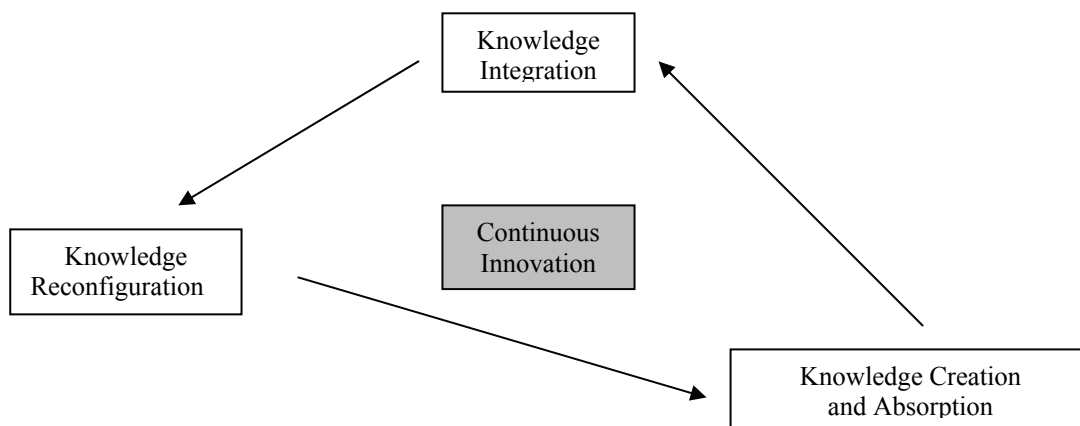
The “dynamic capabilities approach” (Teece et al., 1990, p.11), is built upon this resource-based theory. It stresses that one should not just view a firm as a bundle of resources, but note also the ‘mechanisms by which the firms learn and accumulate new skills and capabilities, and the forces that limit the ratio and direction of this process’. In this sense, Teece et al. (1997:516) define ‘dynamic capabilities as the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments’.

According Verona and Ravasi (2003) the dynamic capabilities are defined by the knowledge creation and absorption and by knowledge integration and knowledge reconfiguration which, in turn, are based on a coherent mix of resources. Organizational learning processes are key determinants of capabilities and the degree of innovation reflects the extent of new knowledge embedded in an innovation (Weerawardena, 2003).

As a result, the dynamic capability approach has broadened the analytical frameworks of the theory of the firm and strategic management, providing a richer framework for analyzing innovation within firms.

According to Nonaka and Takeuchi (1995) knowledge, tacit and explicit, is the epistemological dimension of learning. The process of knowledge and organizational learning creation works through different stages of socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit) and internalization (explicit to tacit). The process presents a rectangular form in the sense that carrying out the internalization; the process restarts beginning from a higher level of knowledge which ends with the cognitive evolution and knowledge accumulation.

The majority of studies assessing the relationship between knowledge and continuous innovation emphasizes, according to Verona and Ravasi (2003), in a specific knowledge-related process. However, according to the authors, continuous innovation requires, simultaneously, the presence of three fundamental knowledge processes at the organizational level: knowledge creation and absorption, knowledge integration and knowledge reconfiguration (Figure 1).



Source: Verona and Ravasi (2003)

Figure 1 - Unbundling dynamic capabilities

The processes mean (Verona and Ravasi, 2003:579):

- Knowledge creation and absorption reflects a long-term commitment to the investment in basic science, its potential technological and market applications and the creation of a world-wide reputation in the scientific field in order also to absorb knowledge from outside.
- Knowledge integration refers to the capacity to shape and manage a context that stimulates latent and dispersed knowledge resources, so that they can jointly contribute to developing and launching new products.
- Knowledge reconfiguration regards the creation of an ‘open’ structure that makes it possible to redefine role systems and relational patterns in a flexible way in order to make it easier to recombine resources continuously; this process of recombination allows the company to keep the new product pipeline filled.

The processes above show that the sources of knowledge can be internal or external. The latter is analyzed by Zahra and George (2002) through the concept of absorptive capacity defined as a set of capabilities by which firms acquire, assimilate, transform, and exploit knowledge to produce and maintain firms’ capabilities.



Acquisition refers to the capability to identify relevant external knowledge, acquiring those which are critical to the firms functioning. Assimilation refers to the routines and processes that allow analyzing, interpreting and understanding the information obtained from outside sources. Transformation refers to the abilities to adapt routines aiming to combine external knowledge with internal knowledge. Exploitation refers to an ability to transform the new knowledge into a commercial product to achieve competitive advantage (Zahra and George, 2002).

Cohen and Levinthal (1990) were one of the first to show that absorptive capacity of a firm is critical to its innovative activities, since knowledge is only absorbed if the firms meet the capabilities to internalize it. In this direction, Chen et al. (2009) suggest that absorptive capacity comes to be one of the most important determinants of the firm's innovation performance through the development of ability to acquire, assimilate, and profitably utilize new knowledge. For them, when firms have greater absorptive capacity, it would increase their performances of innovation.

In turn, knowledge is the main input of the learning process. As stated above knowledge is the epistemological dimension of learning. According to Tran (2008:290) “the firm possess knowledge, resources, and skills but learning is the tool that enables the firm to make use of these assets in productive ways”. Slater and Narver (1995) suggest that firms satisfy the competitive advantage requirements when present a learning structure focused on the idea of continuous improvement. Zollo and Winter (2002) stress that dynamic capabilities result from learning. Tran (2008:295) proposes that “innovation and organizational learning are intimately linked. In an ideal world, they create virtuous circles where learning leads to new innovations which lead to new levels of learning”. In general, researchers have concluded that organizational learning is associated with the development of new knowledge

According to Weerawardena (2003), learning processes should focus on the acquisition of managerial competencies that permit the organization stay ahead of competitors. This requires the definition of organizational learning.

Organizational learning refers to the process by which new knowledge and information are applied with the goal of improve routines and performance (Fiol & Lyles, 1985; Huber, 1991; Simon, 1991). Based on Sinkula (1994), Huber (1991) and Slater and Narver (1995), Weerawardena (2003) defines organizational learning as the development of new knowledge or insights that have the potential to influence behavior, which can be distinguished from individual learning in an organization. Bell (1984) defines learning as the various processes by which additional technical skills and knowledge are acquired by individuals and, through them, by the organization. This process encompasses groups' interpretation, interaction, and integration of individual knowledge, which result is superior to the sum of the parts (Tran, 2008). Also, in this case “the output is greater than the sum of the parts” formed by knowledge from internal sources (exploitation), and knowledge from external sources (exploration). According to Crossan, Lane and White (1999) exploration involves creating new knowledge and exploitation involves using existing knowledge. To Easterby-Smith and Prieto (2008), the two “forms of knowledge can originate from outside the organization, as with ‘absorptive capacity’ (Zahra and George, 2002), or from inside the organization through various mechanisms of intra-organizational knowledge sharing (Tsai, 2002)”. According Tran (2008), “this information becomes the firm's knowledge base and is embedded in the information systems routines, procedures, and history that make up the organization's memory so that the knowledge remains even when members exit”.

Figueiredo (2003) breaks down organizational learning in two related processes: knowledge acquisition and knowledge conversion. He states that the first is linked to the



individual level and the second to the organizational level. Both are divided in two distinct subprocesses, generating four learning processes: external and internal knowledge acquisition; and knowledge socialization and codification.

Similarly, Weerawardena (2003) proposes organizational learning as comprising of four learning activities: knowledge acquisition (the development or creation of skills, insights, relationships), knowledge sharing (the dissemination to others of what has been acquired by some), knowledge utilization (integration of the learning so that it is assimilated, broadly available, and can also be generalized to new situations) and unlearning (the review and renewal of existing knowledge and communication of changes within the firm).

Figueiredo (2003) stresses three key features of the intra-firm learning processes: variety, intensity, and functioning. Variety refers to the ‘absence or presence of different kinds of learning process within firm’ (p.615); intensity means ‘the extent to which continuous efforts to create, upgrade, use, improve, and/or strengthen learning processes actually take place within the firm’ (p.616); and, functioning is understood as ‘the way learning processes are built and work over time within the firm’ (p.616).

Since “innovation implies the generation, acceptance, and implementation of new ideas, processes, products, or services”, It is obvious, to Calantone et al. (2002), “that a learning orientation is closely related to organizational innovation”.

According to Stata (1989) given the accumulated levels of learning from past experience and the technological advances, the degree of product and process innovations reaches high levels in the firms. At this point, lies in the management of innovations the new way to gather or develop innovative capacities.

Tran (2008) claims that the kind of innovation requires different learning processes. Hence, incremental innovations are based on existent knowledge and radical innovations demand new capabilities directed to new technologies, markets and strategies. This relationship suggests the existence of typologies of innovations, as we will see in the next section.

2. Typologies of Innovations

According to Moors and Vergrat (2002), many firms are adopting incremental technological changes in their production systems in order to taking up the environmental challenge, which they think are no longer enough. For them, high-level sustainability goals require radical innovations in industrial production.

This position is corroborated by Geels et al. (2004) who stress that the environmental challenge demands a change in socio-technical systems or a system innovation. This involves substantial changes in industries, firms, technical knowledge, user contexts and symbolic meanings; on the supply and the user side. System innovations are defined by Geels (2004, p.19) ‘as large-scale transformations in the way societal functions such as transportation, communication, housing, feeding, are fulfilled’.

However, Berkhout et al. (2004) propose a more ‘flexible’ view of transitions to sustainability, suggesting a typology of four ‘ideal types’, based on the degree of coordination of regime change between actors, networks and institutions; and on the locus required to respond to selection pressures acting on the regime. These types are: purposive transitions – derived from expectation located outside the regime; endogenous renewal – incremental transformation guided by past experience; re-orientation of trajectories – radical

transformation formed within the regime; and, emergent transformations – derived from uncoordinated pressure for change beyond the incumbent regime, in general science-based.

Geels and Kemp (2007) also offer a typology of changes based on a multi-level perspective of innovation. Three types of change processes are identified: reproduction, transformation and transition. ‘Reproduction’ refers to incremental change along existing trajectories. ‘Transformation’ refers to a change in the direction of trajectories, related to a change in rules that guide innovative action. ‘Transition’ refers to a discontinuous shift to a new trajectory and system. Using the multi-level perspective, the underlying mechanisms of these change processes are identified. Table 1 summarises the differences between these change processes in terms of underlying mechanisms.

	Reproduction	Transformation	Transition
Levels involved	Regime dynamics	<ul style="list-style-type: none"> ● Pressure from landscape ● Adaptation and reorientation in regime 	<ul style="list-style-type: none"> ● Pressure from landscape ● Increasing problems in regime, and attempts at re-orientation ● New innovation in niches that eventually break through
Role of actors	Incumbent regime actors	<ul style="list-style-type: none"> ● Pressure from outsiders ● Incumbent regime actors respond through re-orienting innovative trajectories 	<ul style="list-style-type: none"> ● Pressure from outsiders ● Incumbent actors fail to solve regime problems ● Outsiders develop new innovations

Source: Geels and Kemp (2007)

Table 1 – Different mechanisms in change processes

Common to these proposals is the suggestion that different types of innovations are linked to different levels of sustainable outcome, as it is shown in section 3.

3. Sustainability of Innovations

According to Werbach (2009) the growing evidences of damages caused by environmental catastrophes around the world, ‘have increased the recognition that economic prosperity is intimately entwined with environmental and social sustainability’ and ‘societies and the business that generate economic prosperity are searching for new sustainable patterns of development’ (p.322-3). As detached by Bryson and Lombardi (2009), the rise of the concept of sustainable development in the 1990s have lead to the inclusion of environmental and later social issues into business decision-making.

In spite of this recognition, there is not a clear consensus on how sustainability-ideas should be formulated (Carrilo-Heromisilla et al., 2009). However, Berns et al. (2009) found in their research that 64% of experts surveyed used one of two widely accepted definitions: the so-called Brundtland Commission definition or the triple bottom line definition, both of which incorporate economic, environmental and social considerations. In this line, Werbach (2009, pp.7-8) stresses that ‘a successful strategy for sustainability is different from and much bigger than just “green”: it must take into account every dimension of the environment in which your business operates – social, economic, and cultural, not just the natural environment’.

According to Bos-Brouwers (2009) sustainable innovation has become nowadays the focal point to deliver evidence for the commitments of companies to the triple P (people, planet and profit) bottom line.



Hence, sustainability is defined here in accordance with the proposal presented by the Brundtland Commission to the UN since it is the most well-known definition of what had become known as sustainable development: “meeting the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1988, p.43). From this definition, Dyllick and Hockerts (2002, p.131) suggest the definition of corporate sustainability ‘as meeting the needs of a firm’s direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc), without compromising its ability to meet the needs of future stakeholders as well’. This concept is a new and evolving management paradigm since acknowledges that although profit (economic dimension) is a must for the firm survival, it is not enough for the overall sustainability of a corporation, demanding for this the integration of social and environmental dimensions.

In turn, ‘sustainable innovations are defined as innovations in which the renewal or improvement of products, services, technological or organizational processes not only delivers an improved economical performance (sustain economic growth), but also an enhanced environmental (conserve the environment, minimize environmental impact and protect the natural environment) and social performance (improve quality of life and quality of employment), both in the short and long term’ (Bos-Brouwers, 2009; Yakovleva & Flynn 2004). The integration of economic, social and environmental aspects distinguishes sustainable innovations from conventional ones (Bos-Brouwers, 2009; Yakovleva & Flynn, 2004). Hence, not every innovation achieves sustainability.

Also Yakovleva and Flynn (2004) show that concerns about sustainability arise either as a direct result of technological developments or as a by-product, as exemplified by the case of the food system where ‘the global sourcing strategies of food manufacturers and retailers is dependent upon innovations in distribution, storage and packaging. There are also, however, a number of benefits that will arise from innovations in the food industry or allied sectors. These will include reductions in waste up to the point of retail sale and more efficient use of energy per unit of output’ (p.227-8).

4. Knowledge, Learning, Innovations and Sustainability: The Relationship

One can conclude with the analysis above, in special the case of no sustainability of all innovations and varied developments, that the relationship between knowledge and learning, technological innovations and sustainability is by no means straightforward. This section presents a review of the proposed models.

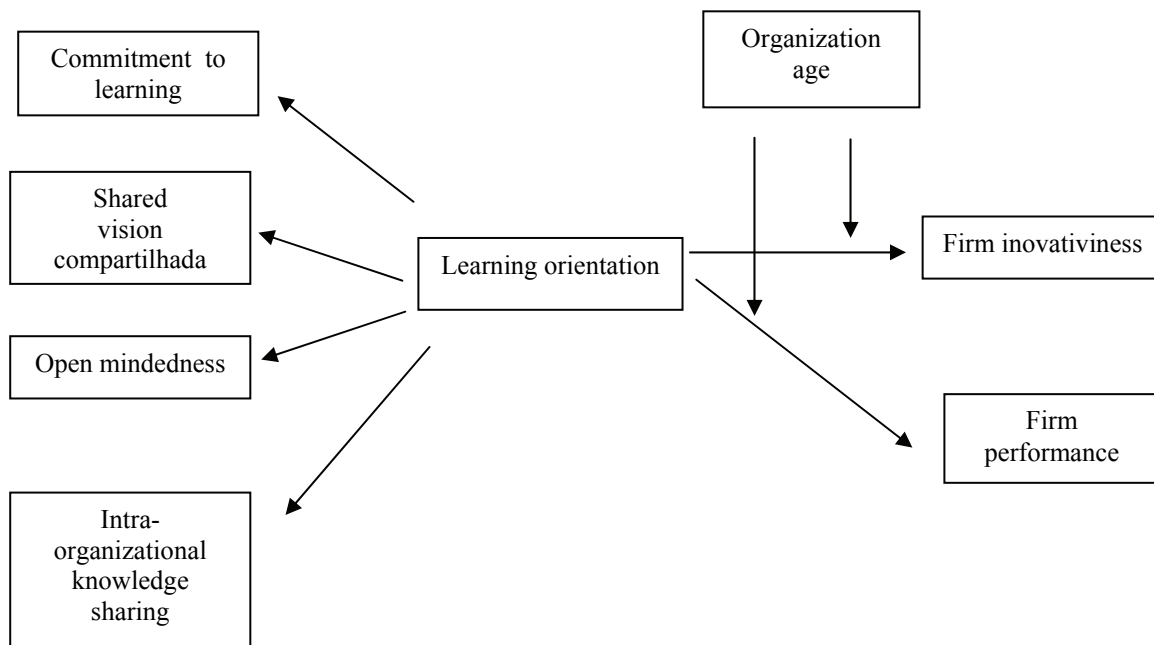
According Knight and Cavusgil (2004) organizational capabilities are the main sources of firms’ performance. Hence, firms develop knowledge and capacities that make them innovative, which in consequence, leverage their performance up.

As Nelson and Winter (1982) stressed the superior ability showed by some firms to innovate and, consequently, create new knowledge, motivates the development of organizational capacities, comprising of internalized routines and core capabilities. These capacities are linked with superior performance in firms, especially in competitive or challenging environments. For them, an established innovative behavior makes firms more capable, which in turn is linked to performance. Hence, the relationship firms’ capacities and innovation, in a dynamic way, is bidirectional and mediated by environmental aspects.

As Morgan and Berthon (2008), based on several other previous studies, stressed: although the literature of business performance detach the need to align strategy to environmental changes, this alignment should not be seen in a deterministic way since the organizations also use their internal resources and capabilities to change the environment, through innovation.

Yeung et al. (2007) state that in a knowledge based economy, organizational learning and innovation are the most critical intangible assets that a firm can apply to achieve a superior organizational performance. According Tran (2008) firms' innovative asymmetries are related to the learning culture predominant in these firms. For him, the product (innovation) of the process (learning) can be very different depending on intensity of work and resources utilized.

Calantone et al. (2002) proposed a framework (Figure 2) to test the relationship amongst learning orientation meaning the organization-wide activity of creating and using knowledge to enhance competitive; innovativeness meaning organization's willingness to change; and, firm performance regarding financial goals. Learning orientation was measured by four dimensions: commitment to learning, shared vision, open-mindedness, and intraorganizational knowledge sharing. The first three dimensions were measured by four questions and the fourth one was measured by five questions formulated in a seven-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Innovation was measured by six questions also formulated in a seven-point Likert-type scale and firm performance was measured by three objective measures (ROI, ROA, and ROS), and one subjective (overall profitability). Their model (figure 1) was extracted from the organizational learning and new products development literature and hypothesizes that learning orientation is an antecedent (determinant) of innovativeness, which in turn impacts firm performance. However, organization age moderates the relationship between leaning orientation and innovation, and also of learning with firm performance. Specifically, the following hypotheses were formulated: 1: The higher the level of learning orientation, the greater the degree of firm innovativeness; 2: The higher the level of learning orientation, the greater the firm's performance; 3: The higher the firm's innovativeness, the greater the firm's performance; Hypothesis 4: The older the organization, the stronger the relationship between learning orientation and firm innovativeness; 5: The older the organization, the stronger the relationship between learning orientation and firm performance.



Source: Calantone et al. (2002)

Figure 2. Framework of the relationship learning orientation, innovation and performance



The analysis of results confirmed the theoretical hypotheses showing that learning orientation is related to innovativeness and also to firm performance. The relationship of learning and innovation is mediated by age; while it does not moderate the influence of learning on performance. Hence, learning is important not only to old organizations but also to young ones. The main conclusion is that learning and innovation are different constructs since the first emphasizes the importance of knowledge absorption, while the second emphasizes the organizational will to change.

In line with these results, Chen et al. 2009 show that ‘the relationship learning and absorptive capacity had positive effects on innovation performance, and innovation performance had a positive effect on competitive advantage’. It was confirmed that ‘the more the investments in relationship learning and absorptive capacity, the better is the innovation performance. Besides, the more investments in innovation performance, the better is the competitive advantage’. Hence, innovation performance mediates the relationship learning and knowledge with competitive advantages.

Garcia-Morales et. al. (2008), in turn, analyzed the direct and indirect influence of knowledge and innovation as mediating variables on the relation between transformational leadership and performance, and found out that knowledge slack improves the knowledge absorptive capacity. In turn, the higher absorptive capacity facilitates the acquisition, transfer and use of tacit knowledge, which in conjoint, improves the organization’s average performance, whether appropriately managed (leadership).

The link between knowledge, learning and innovative performance is mediated by innovative type according to the degree of complexity and change. According to Bos-Brouwers (2009) many sustainable innovations directed at the improvement of technological processes (eco-efficiency) and to lower costs of production are incremental in nature. However, firms with sustainability integrated in their orientation and innovation processes show the development of products new to the market (radical innovations or transformational by nature).

5. Knowledge, Learning, Innovations and Sustainability: The Model

The revised works about sources and impacts of innovations show that these relationships are subject to internal and external determinants and to the institutional environments.

Hence, the proposed model, in Figure 3, shows relationships including firm specific factors and environmental dimensions as determinants of innovations types; these as determinant of sustainability.

The model selected the firm specific factors, learning and knowledge, and hypothesizes their influences on the sustainability through the full mediator, innovativeness. Hence, learning processes and knowledge sources are the two antecedents of the research framework in the study and the consequent is sustainability, whilst the full mediator is innovation types.

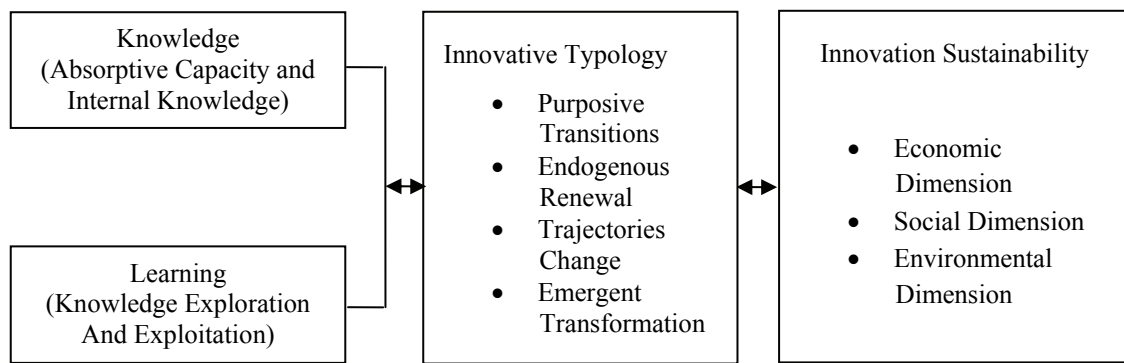


Figure 3. Model of the Relationship Knowledge and Learning, Innovation and Sustainability

According to this model, the type of innovation is a function of differentiated knowledge sources and learning processes. In turn, innovation types impact firm and societal sustainability in differentiated levels. The bidirectional arrows to and from innovation to sustainability indicate that there is mutual interaction between them. In other words, the relationship is not of cause-effect, but systemic.

Hence, the future work shall respond to the following questions:

First, are differentiated knowledge sources and learning processes related to different types of innovative types?

Second, are differentiated innovation types associated with different sustainable levels?

6. Concluding Remarks

This paper, after in-depth evaluation of the literature about some sources and impacts of innovation, delineates a multidimensional model of the relationship amongst knowledge and learning with sustainable innovation types and sustainability impacts.

The model goes in the direction to assess what Ely and Bell (2009, p.35) propose regarding directionality of innovations: “The role for innovation in the current context is not merely to drive economic growth, but rather to contribute to objectives of development and sustainability, as defined by different actors, at different levels. This may include economic growth (at least in the least productive economies), but prioritises those forms of growth which are more equitable in their distribution of benefits and risks, and which are environmentally sustainable”.

From the scientific-academic point of view, the model fills in an important gap in studies about the determinants and results of innovation.

References

Barney, J. B. The resource-based theory of the firm. *Organization Science*. 7 (5), September-October, pp. 469, 1996



- Bell, M. . “Learning” and the accumulation of industrial technological capability in developing countries. In M. Fransman & K. King (Eds.), *Technological Capability in the Third World*. London: Macmillan, 1984.
- Berkhout, F.; Smith, A.; & Stirling, A. Socio-technological regimes and transitions context. In: Elzen, B.; Geels, F.W.; & Green, K. System innovation and transitions to sustainability: theory, evidence and policy. Cheltenham: Edward Elgar, 2004
- Bos-Browsers, H.E.J. Corporate sustainability and innovation in smes: evidence of themes and activities in practice. *Business Strategy and the Environment*, 2009.
- Bryson, J.R. and Lombardi, R. Balancing product and process sustainability against business profitability: sustainability as a competitive strategy in the property development process. *Business Strategy and the Environment*, 18, 97-107, 2009
- Calantone, R.J. & Cavusgil, S.T.; Zhao Y. Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management* 31, 515– 524, 2002.
- Carrilo-Heromisilla, J.; González, P.D.R.; Könnölä, T. *Eco-innovation: when sustainability and competitiveness shake hands*. Basingstoke: Palgrave Macmillan, 2009
- Chen, Yu-Shan, Lin, Ming-Ji James e Chang, Ching-Hsun , The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. *Industrial Marketing Management* 38, 152–158, 2009
- Cohen, W. M. & Levinthal, D. A. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152, 1990.
- Crossan, M.M., Lane, H.W. & White, R.E. An organizational learning framework: from institution to institution. *Academy of Management Review*. 24(3), 522-537, 1999
- Dyllick, T. & Hockerts, K. Beyond the business case for corporate sustainability. *Business Strategy and the Environment*. 11, 130–141, 2002
- Easterby-Smith, M. & Prieto, I. M.. Dynamic Capabilities and Knowledge Management: an Integrative Role for Learning? *British Journal of Management*, 19, 235-249, 2008.
- Ely, A. and Bell, M. The Original ‘Sussex Manifesto’: Its Past and Future Relevance, STEPS Working Paper 27, Brighton: STEPS Centre, 2009
- Figueiredo, P. N. . Learning, capability accumulation and firms differences: evidence from latecomer steel. *Industrial and Corporate Change*, 12, 3, 607-643, 2003.
- Fiol, C. M. & Lyles. M. A. Organizational Learning. *The Academy of Management Review*, 10, 4, 803-813, 1985.
- García-Morales, Victor J., Lloréns-Montes, Francisco. Javier. & Verdú-Jover, Antonio J. (2008). The effects of transformational leadership on organizational performance through knowledge and innovation. *British Journal of Management*, 19, 299-319.
- Geels, F.W. & Kemp, R. Dynamics in socio-technical systems: typology of change processes and contrasting case studies. *Technology in Society*, 29, pp.441-455, 2007
- Geels, F.W.; Elzen, B.; & Green, K. General introduction: system innovation and transitions to sustainability. In: Elzen, B.; Geels, F.W.; & Green, K. System innovation and transitions to sustainability: theory, evidence and policy. Cheltenham: Edward Elgar, 2004
- Huber, G. Organizational learning: the contributing processes and literature. *Organization Science*, 2, 88-115, 1991.



- Knight, G. A. & Cavusgil, S. T. . Innovation, organizational capabilities, and the born-global firm. *Journal of International Business Studies*, 35, 124-141, 2004.
- Mahoney, J. T. & Rajendran Pandian, J. The Resource-Based View Within the Conversation of Strategic. *Strategic Management Journal*, 13, 5, 363-380, 1992.
- Moors, E.H.M. and Vergrat, P.J. Technology choices for sustainable industrial production: transitions in metal making. *International Journal of Innovation Management*, 6(3):277–299, 2002
- Morgan, R. E. & Berthon, P. (2008). Market orientation, generative learning, innovation strategy and business performance: inter-relationships in bioscience firms. *Journal of Management Studies*, 45, 8, 1329-1353.
- Nelson, R. R.; Winter, S.G. *An Evolutionary Theory of Economic Change*. Cambridge: Harvard University Press, 1982.
- Nonaka, I. & Takeuchi, H. *The Knowledge – creating company: how japanese companies create the dynamics of innovation* (5. Ed.). Porto Alegre: Oxford University Press, 1995.
- Penrose, E. T. *The theory of the growth of the firm*. Oxford: Oxford University Press, 1995 (1st.published 1959), 1995.
- Schumpeter, J. A. *The Theory of Economic Development*. Cambridge: Harvard University Press, 1936.
- Senge, P., Roberts, C., Ross, R., Smith, B., & Kleiner, A. . *The Fifth Discipline Fieldbook*. New York: Doubleday, 1994.
- Simon, H. Bounded rationality and organizational learning. *Organization Science*. 2 (1), February, pp.125-134, 1991
- Sinkula, J.M. Market information processing and organizational learning. *Journal of Marketing*. 58, p.35-45, 1994
- Slater, S. F. & Narver, John C. Market orientation and the learning organization. *Journal of Marketing*, 59(3), 63–74, 1995.
- Stata, R. Organizational learning: the key to management innovation, *Sloan Management Review*, 30(3): pp.63-74, 1989
- Teece, D. J., Pisano, G. & Shuen, A. (1997). Dynamic capabilities and strategic Management [Special issue]. *Strategic Management Journal*, 17, 509-533.
- Teece, D. J., Pisano, G. & Shuen, A. Firm capabilities, resources, and the concept of strategy. University of California, mimeo, 1990
- Teece, D. J., Pisano, G. & Shuen, A. Dynamic capabilities and strategic Management [Special issue]. *Strategic Management Journal*, 17, 509-533, 1997..
- Tran, Thuhang A conceptual model of learning culture and innovation schema. *International Business Journal*, Vol. 18 No. 3, pp. 287-299, 2008.
- Tsai, W. Social structure of "coopetition" within a multiunit organization: coordination, competition, and intraorganizational knowledge sharing. *Organization Science*, 13(2), p. 179-190, 2002.
- Verona, G. & Ravasi, D. Unbundling dynamic capabilities: an exploratory study of continuous product innovation. *Industrial and Corporate Change*, 12, 3, 577-606, 2003.



WCED (1988) Our Common Future - G.M. Brundtlandt Report, World Commission on Economic Development.

Weerawardena, J. Exploring the role of market learning capability in competitive strategy. *European Journal of Marketing*, 37, 3/4, 407-429, 2003.

Werbach, A. Strategy for sustainability. Boston: Harvard Business Press, 2009.

Yakovleva, N. and Flynn, A. Innovation and sustainability in the food system: A case of chicken production and consumption in the UK', *Journal of Environmental Policy & Planning*, 6(3), pp.227-250, 2004

Yeung, Andy C.L.; Lai, Kee-Hung & Yee, Rachel W.Y. Organizational learning, innovativeness, and organizational performance: a qualitative investigation, *International Journal of Production Research*, 45, 11(1) 2459-2477, 2007.

Zahra, S. A. and George, G. Absorptive Capacity: a review, reconceptualization, and extension. *Academy of Management Review*. Vol. 17. No. 2, 185-203, 2002.

Zollo, M. & Winter, S. G. Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3), 339-351, 2002.