

Are Innovation Resources and Capabilities Enough to Make Businesses Sustainable?

An Empirical Study on Leading Sustainable Innovative Firms

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Abstract

Increasingly, innovations aimed at sustainable development have occupied a top position in businesses' planning. Thus, this paper is aimed at contributing to the ongoing and current debate on sustainability-oriented innovation (SOI) development. Despite SOI's ability to bring forward new opportunities for companies, it is accompanied by increased complexity, which, in turn, may require adjustments to innovation resources and capabilities to address the challenges that arise. Starting from a conceptual framework of requisite resources and capabilities for innovations, we test these resources and capabilities empirically in five leading SOI firms. The results show that innovative SOI firms need to strengthen their exploration and exploitation capabilities, including unifying the incorporation of internal and external resources with a clear orientation. In that sense, these adjustments are hypothesised to be more important than R&D expenditures, symbolic capital growth and knowledge formalisation.

Keywords

Sustainability; Sustainable Development; Innovation Management; Sustainability Oriented Innovation; SOI; Intangible Resources; Organizational Capabilities; Exploration And Exploitation; Knowledge Retention; Internal Collaboration; External Collaboration; Open Innovation; Research And Development; R&D.

Introduction

Considering the increase in the world population and the earth's limited natural resources, there exists extensive concern about resource availability and a healthy environment, both present and future. Sustainability is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). Accordingly, businesses have been investing in sustainability initiatives that pursue short- and long-term goals of improving the standard of human living (social), conserving the environment and using resources efficiently (environmental), and advancing long-term economic competitiveness (economics).

Managers have been raising questions concerning whether existing paths of businesses are sustainable (Seebode, et al., 2012; Nidumolu et al., 2009; Adams, et al., 2015), and consequently, recent sustainability initiatives and researches suggest innovation as a persuasive means to enhance sustainability (Dangelico & Pujari, 2010; Horn & Brem, 2013). Innovations for sustainability are especially critical for dealing with economic trade-offs with environmental/social aspects (Hansen et al., 2009). On the other hand, sustainability would act as a resource for innovation, offering benefits beyond the economic ones, by allowing environmental and social returns (Seebode et al., 2012). “Whatever the perspective adopted, it is clear that change – innovation – will be needed” for sustainability (Seebode, et al., 2012, pp. 196).

In doing so, the development of new products and services, innovative efficient ways to use resource and energy and improved ways of working can release a new era for sustainable development. A variety of conceptualizations exist for innovations targeted

at sustainable development¹² and various labels have been applied to it³. In this paper, sustainability oriented innovation (SOI) is defined as the establishment of new products, processes, and/or management systems, where environmental, social, and economic goals are their foundations (Hansen et al., 2009). We treat sustainability as a dynamic and unfolding process that is achieved over time rather dichotomously (sustainable/not sustainable) (Adams et al., 2015). According to recent comprehensive reviews of the topic (e.g. Adams et al., 2015), previous work often focused purely on environmental aspect and overlooked the social dimension of SOI. The reason why, following Ketata, et al., (2015), Tseng et al. (2013) and Schiederig et al. (2012), a broad perspective for the definition is chosen to include also social issues.

Despite increasing firms' interest in developing SOIs, there are challenges to their management. (Seebode et al., 2012). It has been argued that SOI requires resources and related core capabilities (e.g. Chen, 2008; Yarahmadi and Higgins, 2012). Extant previous research corroborates the resource-based view as an applicable theoretical lens for studying resources and capabilities in achieving a specified purpose. In this paper, the specified purpose is considered as developing innovations aimed at sustainable development. The resource-based view (RBV) of the organization serves as a theoretical lens for achieving/maintaining competitive advantages by analyzing the role of intangible resources (Teece, 2007; Barney, 1991; Prahalad and Hamel, 1990, Wernerfelt, 1984) and organizational capabilities (Andrews, 1971; Hofer and Schendel, 1978; Prahalad & Hamel, 1990; Ulrich & Lake, 1991).

¹ E.g. Bl'attel-Mink 1998; Blowfield et al. 2007; BosBrouwers 2010; Elkington 1994; Fussler and James 1996; George et al. 2012; Gladwin et al.

²

³ green-, eco- or ecological innovation; social environmental management; and responsible innovation

Extensive innovation studies are applicable to hypothesize the required resources and capabilities for sustainability oriented innovations. According to innovation theories, the hypothesized capabilities are identified with an integrative perspective of both internal and external of organizational boundaries including exploration, exploitation and retention phases (Lichtenthaler, U., & Lichtenthaler, E. 2009). However, previous studies have argued that sustainability context of SOIs bring peculiarities compared to conventional forms of innovation (Sarkis et al., 2010; Ketata, et al., 2015) by its multidimensional objectives (Foxon and Andersen, 2009; De Marchi, 2012) for addressing sustainability targets beyond generating only revenues (Adams et al., 2012). Accordingly, SOIs may require similar capabilities with different emphasis (Shrivastava, 1995; van Kleef and Roome, 2007; Ketata, et al., 2015). Moreover, given the SOI peculiarities mentioned above, empirical investigations that examine resources and capabilities for innovations aimed at sustainability are sparse. Therefore, research is needed on managing resources and capabilities when innovation is aimed at sustainable development.

This paper addresses the gap by answering to the following research question:

- *To add sustainability goals to traditional innovation, which innovation's intangibles resources and capabilities are needed to be reinforced or adjusted?*

Thus, this paper extends the resource-based view to specific context (SOI) by applying innovation theories on resources and capabilities, in leading SOI firms to understand the relative emphasis of such hypothesized resources and capabilities in the particular context of SOI.

Following, the theoretical framework for resources and organizational capabilities in both sustainability and innovation literature are provided. In the next section, the

methodology and data results are provided. Finally, the discussion and conclusion are reported.

1. Theoretical Background

1.1. Resources

The resource-based view refers to intangible resources as critical drivers of performance (Villalonga, 2004), meaning a firm's endowment of resources leads its competitive advantage over time (Wernerfelt, 1984; Rumelt, 1984; Barney, 1991). Intangible resources are difficult to assess from an accounting viewpoint, but should be recognized and deployed to achieve competitive success. According to the pioneer studies with comprehensive analysis of intangible resources (e.g. Hall, 1992), intangible (invisible) resources typically range from know-how to networks and reputation. In this regard, the know-how of the organization can be drawn from both individuals or the organization. Individual know-how, typically called as human capital, is assessed mainly by the level of professional development and employees' new skills and knowledge in firms (Bontis et al., 1999). While organizational know-how, called as organizational capital, refers to various perspectives of the organization including business philosophy/working style and institutionalized knowledge/experience, (Hall, 1992). Business philosophy and working style considers the critical principles that determine the formation and operation of a business. On the other hand, institutionalized experience/knowledge refers to the past experience of firms which leads to enhanced know-how to do better in future. The other key element (networks) is referred mainly to relational capital, which is divided into inter and intra-organizational relations. While interorganizational resources consider mainly the commitment, participation, and internal collaboration, the intra-relational capital is dealing mainly with the structure of company stakeholder

relationships (Salman and Saives, 2005). Finally, symbolic capital is mainly related to the reputation of the organization (Hall, 1992).

Capabilities

In this article, we define capabilities as a firm's capacity to deploy resources for some purpose.

“[They] can abstractly be thought of as ‘intermediate goods’ generated by the firm to provide enhanced productivity of its Resources” (Amit and Schoemaker, 1993, 35).

According to innovation studies, firms should be able to open up their innovations externally (Chesbrough, 2006) as well as devoting investments internally (Chesbrough, 2003; Dyer et al., 2004). In this regard, previous studies emphasize strongly the necessity of integrative perspectives where firms build strongly on external transactions to extend the internal bases (Lichtenthaler & Lichtenthaler, 2009; Argote et al., 2003). However, knowledge management research is often limited to specific internal knowledge processes, e.g. knowledge creation or exploitation (Grant, 1996; Nonaka, 1994). On the other hand, absorptive capacity⁴ is an effective theoretical lens, however it focuses mainly on utilizing external insights inside the firm (Cohen and Levinthal, 1990). More recently, the concept of combinative capability⁵ relates external knowledge accumulation to the necessity of merged internal collaborativeness (Gebauer et al., 2012).

The proven need of integrative perspective leads us to initiate our theoretical framework

⁴ Capability of implementing the sequence between the acquisition, assimilation, transformation, and exploitation of knowledge. They identify absorptive capacity as a higher-level capability, defined as transferring knowledge from one partner to another, aligned with a knowledge-management perspective.

⁵ Capability of not limiting to accumulation of external knowledge to succeed with strategic innovation but also coordinating to systemize the knowledge

based on the developed capability-based frameworks for innovation considering both inside and outside organizational boundaries (e.g. Lichtenthaler & Lichtenthaler, 2009).

Regarding the internal factors, the importance of R&D for innovations has been proved extensively by previous studies especially from the technological perspective (e.g. Guan & Ma, 2003). Neely & Hii, (1998) argued that R&D is the key input for linear model innovations which takes for granted the market as a ready platform for the innovation output. Apart from R&D, regarding other internal factors associated with capabilities for innovation, previous studies mainly proposed how organizational structure and autonomy/level of centralization may affect firms' openness toward new approaches, called innovative capacity⁶ (Neely & Hii, 1998). In this regard, previous studies mainly show the effect of organizational structures, designs and incentives for reacting to environment changes (Hilliard, 2006) through firms' dynamic capability⁷ (Teece et al., 1997; Teece, 2007).

Previous studies, however, argue the absolute need of considering external sources for more complex innovations (Neely & Hii, 1998). The extensive studies on the external collaboration and building networking capability⁸ is discussed mainly in open innovation literature (Chesbrough, 2006). Open innovation is defined as “a distributed innovation, based on purposively managed knowledge flows across organizational boundaries” (Chesbrough & Bogers, 2014, p. 12).

⁶ Capability to innovate new combinations.

⁷ Capability to 1) sense and shape opportunities and threats, (2) seize opportunities, and 3) maintain competitiveness by enhancing, combining, protecting and may reconfiguring the intangible and tangible assets.

⁸ Capability to establish short- and long-term extensive relationships with external actors

Lichtenthaler, & Lichtenthaler, (2009), based on extensive body of studies, distinguished capabilities for innovation development into three main categories: exploration (knowledge/opportunity creation), exploitation (knowledge/opportunity application) and retaining knowledge over time. Exploration and exploitation have been scrutinized through diverse theoretical perspectives, mainly knowledge management and organizational learning⁹. Exploration capability is defined as the businesses' ability to attract new ideas, while exploitation relates to implementation of the attracted new idea (e.g. Ketata, et al., 2015; Cohen & Levinthal, 1990; Seebode et al., 2012). The proposed routines for opportunity exploration capability typically include frequent opportunity recognition and new ideas' absorption, assimilation and idea reconfiguring and adjustment to the existing firm (Cohen & Levinthal, 1990; Teece, 2007). Finally, firms' ability to retain and formalize knowledge is discussed widely in innovation literature (Menzies, 1999; Cohen & Levinthal, 1990; Gebauer et al., 2012). Knowledge formalization relates mainly to methods and techniques for knowledge maintenance in businesses over time and their ability in reactivating the knowledge where necessary. Following, the hypothesized capabilities and their explanation are summarized (Table 1).

⁹ Capability of developing new or existing knowledge, skills, and experience through learning processes (Zahra & George, 2002; Cohen and Levinthal, 1990).

Table 1. The hypothesized capabilities according to innovation theories

	EXPLORATION	EXPLOITATION	RETENTION
INTERNAL	Research and Development		Knowledge
EXTERNAL	Internal organizational factors: - Organizational Structure and autonomy - Enterprise procedures, designs, and incentives Internal collaboration; Cross-functional and participative functions		Formalization: - Knowledge maintenance and reactivation
	Knowledge acquisition & recognition through socialization: -Stakeholder integration, dialogue, collaboration (relationship, communication style, stakeholder flexibility, openness to change by external views)	Assimilative, transformative and exploitative learning process and focus for knowledge assimilation, transformation, and application.	-Knowledge systemization Continuous re-alignment

Despite the proposed comprehensive framework of required capabilities for innovation, when sustainability is in the framework of the innovation objective, it may bring peculiarities. Previous studies investigated some aspects of the hypothesized capabilities in sustainability oriented innovations. However, in order to fully comprehend the existing literature on SOI capabilities, due to many terminologies used (Ketata et al., 2015), attention was given not only to studies clearly applying the terminologies of sustainability and innovation (e.g. Hall and Vredenburg, 2003; Ayuso et al., 2011), but also the ones stating similar terminologies such as eco/green innovation, etc (e.g. Senge and Carstedt, 2001; Bakhtina, 2011).

Regarding the internal exploration and exploitation, Müller and Siebenhüner, (2007) shows that R&D and technological development may address only one part of the change towards sustainability. Additionally, firms should establish sustainability-related research (improvements of cognitive knowledge about sustainability solutions) and enhance sustainability oriented learning processes (Müller and Siebenhüner, 2007). In a similar vein, previous studies show that enterprise structure may leverage indirectly the internal exploitation of SOI opportunities by supporting internal communications.

This is aligned with studies on dynamic capability perspective where organizational structure act as facilitator in innovation opportunity seizing (Wu et al., 2013). Indeed, the necessity of extensive internal collaboration is argued in previous studies for the particular context of sustainable development (e.g. Barratt, 2004). Firms can enhance internal collaboration through various proposed means including employee engagement, idea management, empowerment and training.

On other hand, when it comes to capabilities for external exploration and exploitation, contemporary scholars relate open innovation approaches to integration of interest groups to enlargement and exploitation of a firm's sustainability (Perl-Vorbach et al., 2014). In general, sustainability specific related opportunities, by nature, forces firms to learn new approaches around the core searching, selecting and implementation (Seebode et al., 2012). "In particular, they need capability (and enabling tools and methods) to acquire, assimilate and exploit new knowledge and to work at a systems level" (Seebode et al., 2012, pp. 197). In this regard, extant research suggests that SOIs require higher emphasis compared to conventional forms of innovation, on capabilities for external collaborations (Adams et al., 2012; Carrillo-Hermosilla et al., 2010; van Kleef & Roome, 2007). Based on a comprehensive review, Van Kleef and Roome (2007) argue that SOI requires active integration of a broader and more diverse network of actors, especially nonconventional ones, including customers, NGOs, and other stakeholders such as people involved locally (Gable and Shireman, 2004; Ketata, et al., 2015). Finally, previous studies on resources and capabilities needed in SOI context, bypass knowledge retention capabilities.

Within the few documented studies on SOI capability, previous research has almost entirely focused only on environmental aspect of sustainability (e.g. environmental/green/eco-innovation in Horbach et al., 2012; Kesidu and Demirel, 2012), or focused mainly on one of the theoretical perspectives (e.g. absorptive capacity in Ketata, et al., 2015). Therefore, there is an obvious lack of empirical studies with the integrative capability perspective for innovations aimed particularly at sustainable development (e.g. Ayuso et al., 2006; Dangelico et al. 2013; Adams et al., 2015; Ketata, et al., 2015). This is especially important to be investigated, because to add sustainability in traditional innovations, businesses may require to reinforce or adjust some of their traditional innovation capabilities. This was also clearly stated, by Hart and Dowel (2011), as the “key areas for further research” to answer what capabilities are required to enable firms succeeding when innovation is embedded with sustainable development (Hart & Dowell, 2011, p.1476). Therefore, the objective of this paper is to extend the existing literature by investigating the sustainability oriented innovation resources and capabilities empirically (Hall and Vredenburg, 2003; Ketata, et al., 2015). The following research questions guided this study:

- To add sustainability goals to traditional innovation:
 1. which intangible resources are needed to be reinforced or adjusted?
 2. which capabilities are needed to be reinforced or adjusted?

2. Methods

A qualitative, in-depth, multiple-case-study methodology was chosen for several reasons. First, there is lack of extant, empirical research on the topic (Yin, 2013).

Consequently, we needed an exploratory/theory-building approach (Eisenhardt, 1989). Second, qualitative data were needed because of a variety of terminology used by practitioners and scholars in this field, and a need to develop deep insights (Alvesson and Sköldbberg, 2009). The nature of firm-specific, organizational processes suggests that the relationship between SOI and organizational capabilities is path dependent (Bos-Brouwers, 2010; Mahoney, 2000); detailed case studies were required to evaluate path-dependent processes (Mahoney, 2000). Leading sustainable-innovative firms were chosen based on successful SOI projects and sustainability/innovation visions/rankings. Ultimately, based on convenient sampling, five cases were chosen. The size of the firms and the products they produced were also considered (Table 2). For data collection, interviews and observations (i.e., plant visits) were combined to offer stronger evidence of constructs and for data validity. Interviews were conducted with each case, with the purpose of covering information from varying perspectives of sustainable development responsible, innovation manager, and operations manager. Especially regarding the smaller companies, not all three positions were present. In these cases, managers in positions responsible for SOI were interviewed using all three perspectives (Table 2). On average, two interviews were conducted per case.

Table 2. *Case descriptions*

	A	B	C	D	E
Country of Origin	United States	Italy	Sweden	United States	Italy
Size	Big and multinational (88,000 employees, \$29.6 billion Revenue)	Small and local (20 employees, €4 million revenue)	Big and multinational (139,000 employees, €27.628 billion Revenue)	Big and multinational (69,000 employees, \$18.769 billion Revenue)	Micro/small and local (10 employees, 150,000 € revenues)
Product	More than 55,000 products (e.g., adhesives, abrasives for medical products)	High-quality household products	Furniture, appliances, home accessories	Home appliances	Smart phone/earphone covers
Interviewee	Sustainability business and development manager	Sustainable development responsible & R&D manager	Environmental manager and communication responsible and shopkeeper	R&D manager for cross-category technology development and global sustainability responsible and HR manager and site manager	Entrepreneur
Used secondary data	Company website, Innovation project portfolio/examples across company branches	Company website and reports	Company (group) website, Company group report on their approach to sustainability, Company group sustainability reports	Company website and reports, company sustainability reports	Company website, company vendors' information, company report.

To gather data from interviews, a structured research protocol was developed. Several topics were discussed during interviews concerning sustainable innovation projects, including:

1. the organizations goals, programs, and processes of sustainable development and sustainability innovation;
2. two specific successful and any available unsuccessful projects' visions and goals;

3. internal and external processes of collaborative learning and development, especially weaknesses, strengths, and results.

For the interviews regarding innovation development and R&D, the following topics were discussed:

1. organizational goals and processes of innovation for sustainability;
2. use of internal R&D functions and resources;
3. the firm's orientation toward use of internal/external sources of knowledge.

For the interviews regarding operations, the following topics were discussed:

1. organization of innovation for sustainability in operations;
2. the importance and process of learning;
3. operations' practices for fostering innovativeness and sustainable innovation at the plant level;

All interviews except one (interviewee did not allow), were audio recorded and transcribed for data analysis, and analyzed through coding (Charmez, 1983). Due to the large number of questions, they were grouped and labeled as general questions, and delivered to interviewees as discussion topics prior to the interviews. Regarding the design of the questions, to understand the importance and possession of capabilities, both direct and indirect questions were asked. Concerning indirect questions, for each capability, a short checklist of building routines was designed for each question.

Interview transcripts were analyzed using coding and a qualitative interview analysis technique (Charmaz, 1983), and detailed analyses of cases and cross-case analyses were conducted. Table 3 shows how the data analysis was conducted.

Table 3. Coding scheme for each case

<i>Dimensions of each resource or micro-foundations of each capability</i>	<u>Case</u>
Perceived importance of resource/capability/routine SOIs (as an absolute measure and also compared to conventional forms of innovation)	
Whether the existing resource/capability/routine already developed for conventional innovations was sufficient (Suf.) or required enhancement for SOI projects (Enh.)- If enhanced, how?	
Whether the resource/capability/routine was one of the most important success factors of SOI project(s) or a limitation & challenging for the SOI success ¹⁰	

Perceived importance was assessed based on direct questions regarding the importance of each capability, in addition to the analysis of success factors. A scale from 1 to 3 assessed perceived importance of the capabilities, ranging from 1 (low/not important), 2 (important but not considered a success factor), to 3 ((very) important; a success factor). Detailed analysis of the cases was used to understand firm specifics, which requires investigating theories-in-use (Argyris and Schön, 1978; Mariadoss et al., 2011). Cross-case analysis and corroboration between data types were used for pattern recognition.

3. Findings

3.1. Intangible Resources

In order to understand the answer to the first research question on which intangible resources are required to be reinforced or adjusted when sustainability goals are added

¹⁰ This factor acts as a validation for the results. In case a resource/capability/routine have been a success factor for SOI success, it means that its very high importance while the existing was sufficient. On the other hand, in case of being a limitation, it shows its high importance while the already developed one was not sufficient.

to the traditional innovations, each category of intangible resources (including human, organizational, relational and symbolic capital classified in the theoretical background section) has been tested empirically based on the importance level perceived by cases' managers for developing successful SOI projects (Table 4).

Table 4. *Data results for intangible resources for SOI development*

Single cases' analysis and supporting informants' statements

		A	B	C	D	E
Human Capital	Importance	<i>1</i>			<i>2</i>	
	Sufficient OR Enhanced ¹¹	<i>Suff.</i> Only necessary for understanding the global sustainability challenges	<i>Suff.</i> Similar to conventional innovations to be open to new approaches	<i>Suff.</i> Similar to conventional innovations to cope up with challenges after implementation	<i>Enh.</i> SOIs require particular human capital in terms of technical sustainable changes	<i>Enh.</i> SOIs require particular human capital in terms of technical sustainable changes
Organizational Capital	Importance	<i>3</i>			<i>2</i>	<i>3</i>
	Sufficient OR Enhance	<i>Enh.</i> A need of clear direction towards both sustainable development objectives and innovations is requisite for SOIs. Moreover, institutionalized knowledge and experience facilitates the road towards SOIs and the businesses' direction. All need to be accompanied by collaborative decision making and management style of all firms' members.				
Inter and intra-relational Capital	Importance	<i>3</i>				
	Sufficient OR Enhance	<i>Enh.</i> Employee involvement is more required for SOIs to increase exposure to new ideas through establishment of (in)formal communication channels and practices (e.g. job rotation). Higher density of relationship with mainly customers as well as suppliers and industrial partners are needed. Moreover, relations with indirect stakeholders are needed for SOI know-how acquisition.				
Symbolic Capital	Importance	<i>2</i>				<i>3</i>
	Sufficient OR Enhance	<i>Suff.</i> Similar to conventional innovations, the critical element is to provide a common acceptance of innovation, but also SOIs require this for sustainability to enhance employees' willingness (e.g. to change and internal transparency (Case C), increase employees' satisfaction (Case B)).				<i>Enh.</i> Reputation of the company for sustainability was required

¹¹ Whether existing resources were sufficient (Suf.) or required enhancement for any SOI project (Enh.)

Results suggest that organizational and relational capitals are requisite, intangible resources for developing SOI projects. Business philosophy is highly important perceived by all managers for successful SOI development, for formation of clear direction towards sustainable development and innovating. Firms see the importance of institutionalized experience as a driver of enhanced problem-solving ability in different directions. All cases see the importance of institutionalized knowledge to build a clear orientation towards sustainability and/or innovation. Regarding the decision making and management styles, collaborative decision making (mainly internally but also externally) with management system providing employees with a common acceptance are recognized as critical principles in cases. For instance, as the communication responsible of one of the cases mentioned:

The most important capability of the firm for SOI development is “the attitude of the employees to have a common understanding, acceptance and approach for a project.... Regarding the relational capital, both internal and external relations are quite important in successful SOI development. Meaning very high focus on employee and departmental involvement would increase exposure to new ideas through informal and strong relationship with external partners (mainly customers as well as suppliers and industrial partners but also indirect stakeholders-e.g. mainly universities, research/national labs or centers NGOs, service provider firms, consultants, technical experts, vendors- for know-how acquisition). Internally, firms achieve “creative abrasion” through higher informal and deeper formal interactions with employees and cross-functional interfaces to enhance out-of-the-box thinking. Creative abrasion is a phrase coined by Jerry Hirshberg, founder and president of Nissan Design International

and describes a culture where ideas are productively challenged. In one of the cases, employees were allowed to work a fixed percentage of working time on their own interests, called the innovation time-off program. A sustainability development manager explained:

Our ten-percent culture has been around for many years. The challenge to R&D professionals: 10% of their overall time is reserved to pursue their own research interests, with the remainder focusing on their own challenges aligned with the division. It is also an opportunity to innovate in other areas and work across divisions, and share information and technologies across the company to solve those challenges.

Results suggest that a participative decision-making, common acceptance of the SOI necessity, fewer departmental barriers, technology- and knowledge-sharing platforms, and less hierarchical structures support firms regarding creative abrasion.

3.2. Organizational Capabilities

In order to understand the answer to the second research question on which organizational capabilities are needed to be reinforced or adjusted when sustainability objectives are added to the traditional innovation development, the results are provided based on the hypothesized theoretical framework of capabilities for traditional innovation. The emphasis of each capability or its building routine has been tested empirically (Table 5).

Table 5. Data results for capability micro-foundations

<i>Capability</i>		<i>Building routine</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>Cases' statements</i>
Internal Exploration and Exploitation	Research and Development	R&D	2 Suf.	3 Suf.	2 Suf.	3 Enh.	2 Suf.	B&A&E: Internal R&D is perceived as persuasive and important but not external R&D. D: Establishing a new local legal entity for external R&D.
		Sustainability oriented R&D	3 Enh.		2 Suf.	3 Enh.	C: Establishing a new research department on sustainable products. B&A&E: Establishing particular R&D process for sustainability mainly on the availability of materials and technology from early stages of the project.	
	Internal organizational factors & functions	Organizational structure	1 Suff.		Cases have different type of organizational structure. A&C: hierarchical autonomy may prohibit the enhancement of internal collaborations.			
		Internal collaboration, cross-functional & participative functions	3 Enh.		Suff.		A: establishing internal information sharing channels. B & C: establishing and promoting high internal daily involvement of diverse employees and departments.	
External Exploration	Knowledge acquisition & recognition through socialization	Stakeholder integration, dialogue, collaboration	3 Enh.		All: not only establishing specific relationships with critical external partners (mainly suppliers), but also extending the external relationships to entities particularly related to sustainability (e.g. NGOs, research centers) A: establishing a structured user involvement for new sustainable product developments. A&C: New ideas' attraction from very diverse type of sources. A&D&E: Increase communication channels with customers because they are seen as a main source of new ideas. B&C&E: Planning frequently projects with opportunity generation/recognition. A&B: Planning multiple frequent new radical and incremental sustainable products/services/processes with company level economic objectives (versus for each project)			
External Exploitation	Opportunity Exploitation with outside view	Assimilative, transformative and exploitative learning for application	3 Enh.		All: openness to co-creation development project with external entities: Presenting the recognized opportunities to main external partners (B) and extending the involved competent external entities (B) particularly with continuous exchange of information (C&D) from early stages of prototyping (E). Establishing continuous improvement plans. D: Establishing frequent continuous structured testing processes with users A: establishing a continuous potential sustainability improvement plan for all the products			
R	K		2	1				

		Knowledge formalization and systemization (maintenance and reactivation) and continuous re-alignment	Suff.	All: Knowledge maintenance and reactivation are not really feasible and economically reasonable for SOI projects because of the peculiarity of sustainability knowledge as tacit and innovation knowledge as non-replicable except for similar projects (Case B) or similar products (Case D)
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Results, on internal exploration and exploitation capability, show that despite recognized importance of mainly internal R&D for (sustainable) innovations, particularly SOIs require firms to establish additionally sustainability oriented research and development processes. For example, case C established a new research department working specifically on innovative sustainable products. In a similar vein, the results on internal organizational factors -organizational structure and internal collaboration- provide interesting insights. The results show that organizational structure doesn't have any specific influence on the SOI development, however the structure may facilitate or act as barrier in enhancing internal collaborations. In this regard, we argue that democratic organizational structure and non-hierarchical autonomy may support internal collaborations and participative approaches in the organization. This is important mainly because the results show that internal collaborations are very important for SOI development and act as a primary key success factor. As the communication responsible of one of the cases mentioned: The most important capability of the firm for SOI development is that "a basis should be created for a new project in the co-workers to have everybody on board and not be imposed by a part of organization. Our company is very democratic and we have to have internal agreement and acceptance through internal communication for the SOI. This is necessary to be able

to work internally to change the people attitude and mindset and help them for an innovative approach towards sustainability.”

In particular, informants claim that higher level of internal collaborations are required when innovations are aimed at sustainable development. The reason, our cases establish frequent information channels either formally or informally to connect cross-departmental and crossfunctional employees. Likewise, enhanced external partnerships is a key success factor for SOI development. In this regard, not only establishing relationships with critical external partners is necessary, but also for SOIs, this should be extended to entities particularly related to sustainability (e.g. NGOs, research centers) and users.

Next, the ability to explore and exploit externally the SOI opportunities and knowledge is perceived as critical success factors. This is especially true for SOIs because many sustainability oriented ideas are not able to be recognized through traditional approaches (market-pull or technology-push). Our cases show that these capabilities, as well as internal collaborativeness, need to be reinforced accordingly for SOI development, compared to traditional innovation. In our cases, diverse type of new ideas' sources, enhanced communication channels with customers, planning multiple frequent new radical and incremental sustainable products/services/processes support SOI external exploration capability. Regarding the external exploitation, co-creations and establishing continuous improvement plans for sustainable products/services-if not business models- can facilitate opportunity exploitation. However, knowledge formalization including maintenance and reactivation seem to be less significant in SOI capability development. In this regard, our results show that the sustainability-related know-how are often project-specific and tacit so firms should have the ability to acquire

and commercialize specific knowledge for each project compared to maintaining and reactivating previous knowledge.

The results on capabilities is coherent with the findings on resources. In this regard, the enhanced sustainability-oriented R&D derives from improved organizational capital where businesses have a clear direction towards both sustainability and innovation. The structured process for sustainability research will enable improved organizational capital in terms of its institutionalized knowledge and experience. As the environmental manager of one of the cases mentioned: We have established a “specific research and development department as an internal R&D called sustainable innovations in the headquarter. This supports us in having a structured international sustainability direction called with 3 main aspects: Energy..., Social issues..., and sustainable life at home.....We have a goal to increase the sales of sustainable products, the number of sustainable products, the communication and the knowledge.” On the other hand, inter-organizational capital as a requisite resource enable businesses to build micro-foundations for enhancing internal collaborations and participative approaches. Finally, the key role of intra-organizational capital in SOI development support external exploration and exploitation.

4. Discussion

Integration of sustainability objective in innovations is important, however, it can also bring forward its own peculiarities. This is why firms might be required to reinforce or adjust their traditional innovation capabilities accordingly. Based on the combined insights from resource based view and capability view for innovations, this study examines intangible resources and capabilities for particular context of “sustainability oriented innovations”. Starting from RBV view in innovation literature, this study

proposes a framework to conceptualize resources and capabilities. Proposed resources and capabilities for innovations are scrutinized using five leading firms in developing sustainability oriented innovations (SOI).

In terms of intangible resources for SOI development, the results show that businesses have to adjust not only organizational and inter-relational capital but also intra-relational capital according to sustainability context. The key dimension of organizational capital for SOIs is identified based on the empirical assessment as the need of a clear direction and orientation towards sustainable development. This result is confirming previous studies showing that applying long-term sustainability vision for business planning deliver business with the environmental, social and economic benefits (Seebode et al., 2012). Moreover, the role of internal human relations is undeniable for SOI development (Neto and Jabbour, 2010). Employees can help to improve working routines, affecting behavior and increasing sustainable consciousness (Remmen and Lorentzen, 2000). To do so, employees are required to have strong inter-relations between each other. In this regard, our results confirm the previous studies that internal organizational human resource should strictly cooperate in SOIs collectively (Bettley and Burnley, 2008) with adequate communication (Ketata et al., 2015) to fully grasp its benefits (Ketata and McIntyre, 2006). In a similar vein, the necessity of inclusion of diverse perspectives in innovations aimed particularly at sustainable development, is revealed from the cases. Hence, networks and relations with external actors as capital are fundamental (Keskin et al., 2013). In this regard, SOI requires wide variety of actors with committed relationships. Consistent with extant results regarding organizational resources, as a social and cognitive activity, organizational learning enhances the probability of the

emergence of creative ideas since the number of associations increases through knowledgesharing and group interaction (de Sousa, 2006). Our results are aligned with extant studies that examine diverse-group interactions for sustainable development, improved innovativeness, and better performance (Fadeeva, 2005). However, our results show that human capital in terms of employees' level of professional development and employees' new skills and knowledge in firms (Bontis et al., 1999) is not noticeably required to be reinforced or adjusted when sustainability goals are added to the innovation development. Likewise, symbolic capital, which is mainly related to the reputation of the firm (Hall, 1992), seems to be adequate for SOI development in traditional innovator firms. In conclusion, we argue that to add sustainability in innovations, a firm should be able to reinforce and/or adjust their orientation and inter/intra relational capital according to the sustainability context. Accordingly, following hypothesis is proposed for further testing.

Proposition: The establishment of a new or enhanced orientation -towards sustainable development- and inter/intra-relational capital would enable firms to integrate sustainability objectives within its innovations.

Regarding organizational capabilities for SOI development, we based the conceptual framework on an integrated perspective of key capabilities for the innovation development including both internal and external exploration, exploitation and retention.

Regarding internal exploration and exploitation, our results confirm previous studies that despite the recognized importance of R&D for innovations, an additional sustainability-specific research taking into account newly emerging innovation

trajectories is important when sustainability goals are added to the conventional forms of innovation (Seebode et al., 2012). SOIs are argued to require a broader scope of research by spanning the human resource department and/or the R&D department (Noci & Verganti, 1999). The reason is that sustainability-driven teams promotes learning at several organizational levels, which is useful in order to identify innovations in the sustainability context across firms' operations (Neto and Jabbour, 2010). Moreover, we suggest that the merits of internal R&D may be limited since key sustainability oriented technologies may emerge outside a firm's conventional technological and R&D competence (Shrivastava, 1995; Ketata, et al., 2015). Of this, Ketata et al., (2015) made a fitting example of the technological breakthroughs in energy (e.g. batteries) for hybrid cars. Accordingly, we hypothesize that increased investments in sustainability related research and development in organizations increase the degree of sustainability within a firm's innovation activities. On the other hand, this study's

Moreover, our results show that to add sustainability objective in innovations, both internal and external sources for exploration and exploitation should be reinforced and/or adjusted according to the particular context. However, as confirmed by previous studies, search and selection opportunities are hard for SOIs since it is, by its nature, "impossible to predict what is going to be important or where the initial emergence will start and around which feedback and amplification will happen" (Seebode et al., 2012, pp. 198). Moreover, our results show that the challenge of SOI exploration and exploitation capability can be faced thanks to not only enhanced external cooperative efforts from very diverse type of sources but also through integrative perspectives of both internal and external of the organization. The former is aligned with previous

studies showing that SOI implies a higher intensity in cooperative effort, leading to more intensive partnerships and requiring higher complementarities among partners according to the sustainability context (De Marchi 2012; Laperche and Picard 2013). Moreover, for SOI, stakeholders are not limited to supply chain actors, but also beyond supply chain to bring forward the unexpected points of the company horizon (Polonsky and Ottman, 1998). The results are in line with existing theories that learning from various stakeholders through strong and diverse interactions enables innovative performance, enhances learning, and reduces uncertainty in a firm and in its networks (Larson, 2000). However, the latter is more aligned with views on sustainable new product development showing the necessity of acting functional departments together in an integrated way with external actors (e.g. Adams et al., 2015).

Hypothesis: Enhancing the cooperative efforts - especially with externalities beyond supply chain actors - with higher complementarities among both internal and external actors would make businesses more capable of adding sustainability goals in their innovations.

In conclusion, innovations for sustainable development has significant implications for a firm's capabilities; its networks of stakeholder relationships and wider systemic relations both internally and externally; its ability to recognize and acquire new opportunities; the vision for sustainability; to plan and implement collectively and frequently new sustainable products, services, practices and strategy (Adams et al., 2012). This study implies that developing sustainability oriented innovation is not just a matter of feeding additional objective to the conventional innovation management, but requires particular adjustment in some traditional innovation capabilities and resources.

We argue that SOIs are required to follow new approaches, mainly for involving and incorporating internal and external partners and new configurations of knowledge. The key issue would be that this change may challenge existing innovators (Seebode et al., 2012).

Conclusion

The integration of sustainability objectives in innovation is proven to be necessary for the business success. However, sustainability context may require advancement and/or adjustment of the conventional innovation resources and capabilities. This study examines resources and capabilities for sustainability oriented innovations. Insights from resource-based and capability view serve as a theoretical perspective to guide empirical research. Starting from proposed resources and capabilities for innovation development, this study proposes a framework to conceptualize them that are then scrutinized using five leading businesses in SOI development.

Results from this study provide contributions regarding the role of capabilities to enhance a firm's sustainable development through innovation. First, the study contributes to the capability view of sustainability by conceptualizing and empirically validating SOI resources and capabilities. Results suggest that businesses need to stress more in exploring and exploiting SOI opportunities with a clear direction and to draw both broadly and deeply from diverse and both internal and external sources, rather relying mainly on conventional R&D and knowledge formalization (systemized maintenance and reactivating knowledge). On the other hand, from a managerial perspective, one question firms engaging in such initiatives (SOI) must address is how

they can build or leverage the conventional innovation capabilities. The study findings would support businesses facing this challenge.

The study is exploratory, and there exist several domains for future research. This study needs to be extended through more cases and finally a generalizable quantitative investigation. One relevant arena in the existing theories regarding exploration and exploitation capabilities is the concept of

‘ambidexterity’ (Tushman and O’Reilly, 1996), which argues that the different degrees of novelty may require different balance of exploration and exploitation capability (Benner and Tushman, 2003). The triangulation of this study results, which shows the necessity of the adjustment of exploration and exploitation capabilities for the particular context of SOI development, open an interesting future research area depending on the degree of novelty in SOI development. Moreover, the process, methods, and techniques used to build the capabilities should be scrutinized.

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