

IO1 – Additional Report: SME innovation capacity

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Innovation Management in SMEs

Foreword

Innovation is a major issue for SMEs' success in dynamic competitive environments (Adams et al., 2006; Porter, 1991; Schumpeter, 1934).

Innovation capacity allows the firm to develop and coordinate the innovation process and to use innovation input to produce innovation output (Adams et al., 2006; Boly et al., 2014; Yam et al., 2004). Therefore, SMEs' innovation capacity appears to be a relevant concept in assessing SMEs' innovation activities and indirectly assessing SMEs' innovation performance.

While large corporations employ innovation managers and have their own departments for innovation and digital change, innovation in medium-sized companies is often managed by operational departments in addition to day-to-day business. Managing complex innovation processes, which require high time and human resources, is often simply not practicable for SMEs, sometimes not even necessary. Their speed of response, i.e. their ability to set-up, organise, efficiently manage and quickly adapt their products, services and processes and well as their business models is a key success factor of SMEs. This makes innovation management in SMEs special.

The innovation performance of SMEs comes from its ability to manage its technological core competences (Prahalad, Hamel, 1990) through R&D (both internal and external) and taking into account the shaping function of four sets of factors, i.e. market pressure, suppliers' and/or customers' input through co-design and co-creation, financial resources, culture and sense of mission.

Indeed, the focus of management is not on innovating per se but on increasing, or at least improving, total performance. Then, innovation is only one contributing factor to such global performance and therefore measuring the performance of an organisation should not be confused with measuring its innovativeness (Schroeder, Scudder, Elm, 1989).

Because only a third of SMEs have a recognized formal strategy dedicated to innovation, detecting and extracting innovation capacities of SMEs is difficult (De Jong, Marsili, 2006).

Theoretical background

Innovation Capacity

Innovation capacity is defined as a firm's continuous improvement of capabilities and resources in order to explore and exploit the opportunities of new product development to meet market expectations (Boly, 2014; Forsman, 2011; Szetto, 2000) and represents a firm's ability to innovate continuously ahead of its competitors (Qian and Li, 2006). These capabilities should enable a firm to leap into new markets, jump to new levels of customer value or gain competitive advantage by better processes or services (Qian and Li, 2006).

"Continuous improvement" is a core dimension of innovation capacity (Szetto, 2001) and refers to the continuous improvement of a firm's set of resources and capabilities in order to remain innovative and maintain the viability of the innovative process.

Dynamic capabilities represent an essential part of innovation capacity because they help maintain, improve and reconfigure the firm's set of resources and capabilities in dynamic environments (Boly, 2014; Eisenhardt, Martin, 2000; Forsman, 2011; Teece et al., 1997; Teece, 2007; Zollo, Winter, 2002). This constant adaptation, evolution and revaluation represents a major issue for firms that evolve in innovative and competitive markets, implying a volatile environment caused by market velocity and uncertainty (O'Connor, 2008).

The ability of a firm to quickly implement changes is key for SMEs' innovation capacity (Forsman, 2011).

Therefore, innovation capacity can be theoretically presented as a firm's set of resources, capabilities and dynamic capabilities dedicated to the innovation process.

A small firm is not a scaled-down version of larger firms. Larger and smaller firms differ from each other in terms of their organizational structures, responses to the environment, managerial styles and, more importantly, the ways in which they compete with other firms. (Tidd 2011)

The most important innovation capacities for SMEs are:

- capacity to create and maintain collaborative relationships, and
- capacity to exploit elements provided by network relationships (Forsman, 2011; Freel, 2003).
- ability to collaborate with both public and private partners is another source of SMEs' innovation capacity (Gronum et al., 2012; Keizer et al., 2001; Lasagni, 2012), even if SMEs are supposed to prefer networks directly linked to the market

rather than horizontal partners such as a university or a public center of research (Liu, Laperche, 2015; Zeng et al., 2010).

- owner/manager characteristics,
- user/customer integration (Liu and Laperche, 2015, von Hippel, 2005).
- innovation strategy and planning,
- culture and structure,
- innovation process management,
- learning process,
- innovation-dedicated resources and
- processes re-evaluation.
- Strategic scanning may reduce the risks of excessive dependency in SMEs' industry value chain, as well as market vulnerability due to evolving competitive or technological environments (Marchesnay, 2014).
- Innovation strategy should fit the firm's business strategy (Sundbo, 1997).
- The innovation strategy should support the firm's competitiveness in its environment (Leonard-Barton, 1993; Teece et al., 1997, 2007; Tidd et al., 2013). S
- SMEs with formal strategic design and planning seem to achieve better results (Mazzarol et al., 2009; Berman et al., 1997; Porter, 1991); in particular, they achieve better innovation objectives (Rothwell, Dodgson 1991; Terzirovski, 2010).

User and Customer Integration

Users and customers are considered to be an important source of innovation performance and seem to be preferred by SMEs when integrating the market into their innovation process (Liu and Laperche, 2015, von Hippel 2005). Users and customers bring direct knowledge to the firm (Apiyah-Adu et al., 1998; Gronum, 2012; Von Hippel, 2005). Integrating customers and users into the innovation process provides new ideas and new insights to better understand users' needs. This integration allows the firm to ensure that they are responding to market needs and therefore avoiding potential losses due to market failure. This approach needs to be developed through the detection of non-usual and potential future users and customers to ensure the openness of the firm and its innovation capacity (Danneels, 2002).

Institutional Support

At the institutional level, the innovation system in which SMEs are embedded provides resources and the knowledge part of the innovation process (Laperche, 2012; Patel, Pavitt 1994). Public institutions can provide financial or technical support for innovation in SMEs (Kaufman, Todtling, 2002). Institutional support focusing on SME competitiveness and innovation has been widely used by public institutions since the 1980s to foster competitiveness and global growth (Laperche, Uzunidis, 2010).

This support relies on financial aid through tax incentives and direct financing, as well as coaching, networking and facilities support (Liu, Laperche, 2015). The ability to detect and use these supports is considered to be an innovation capacity and a factor of innovation performance for SMEs (Keizer et al., 2001).

However, to be used efficiently, this capacity requires human resources with a deep knowledge of national support systems. Innovation Strategy and Planning Innovation strategy refers to the innovative position designed by a firm that depends on its competitive environment (Dyer, Singh, 1998), its resources and its competencies (Helfat, Peteraf, 2003; Leonard-Barton, 1993; Prahalad, Hamel, 1990; Ramanujam, Mensch, 1985; Tidd et al., 2013; Teece et al., 1997, 2007).

Conditions for Innovation

The impact of the SME structure on innovation is controversial. The core debate concerns the degree of formalization of the organizational structure of SMEs needed to foster innovation (Terziovski, 2010). The organization should be flexible in order to adapt to the environment, liberate creativity, and explore and promote internal collaboration (Chesbrough, 2003; Damanpour, 1991; Teece et al., 1997, 2007).

The organization should also be structured to improve the innovation process, its operation and its efficiency (Lawson, Samson, 2001; Tidd et al., 2013).

To address both constraints, a hybrid organization dealing with structure and creativity should be promoted (Christensen, 1997; Bessant et al., 2005; Eisenhardt, Martin, 2000; Van de Ven et al., 1999). A firm's innovation culture can explain its choice of structure (Adams et al., 2003; Lemon, Sahota, 2004). The corporate culture is assessed by "corporate conditions for innovation" (Rothwell, 1992), "contextual factors" (Tidd et al., 2013) or "enabling context" (Nonaka and Takeuchi, 1995).

Innovation Process Management

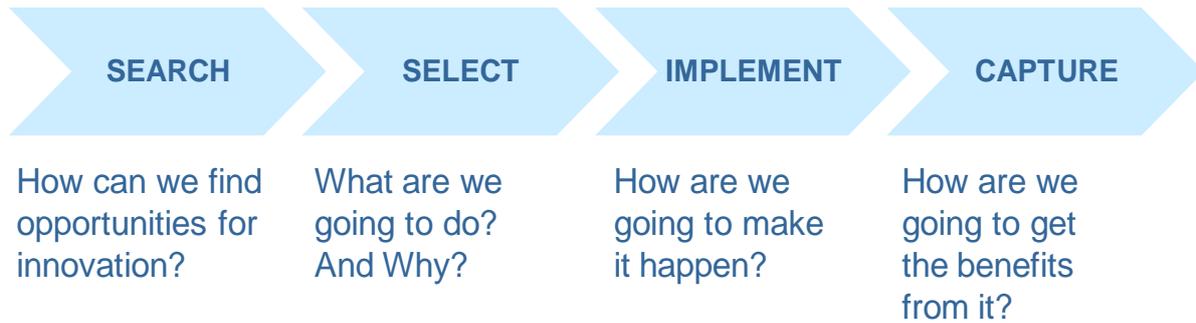
Innovation process management enables SMEs to produce innovation using scarce resources and capabilities (Boly, 2014; Forsman, 2011). In the past, the innovation process was described as a linear concatenation (Rothwell 1994), but more recently, it has been presented as iterative and discontinuous activities (Rothwell, 1994; Salerno et al., 2014; Van de Ven et al., 1999).

This dynamic series of activities is organized into three basic steps:

- finding ideas,
- developing concepts and
- implementation (Salerno, 2014, Tidd et al., 2013, Van de Ven et al., 1999).

Or as John Bessant (Bessant, 2018) put it:

Do we have a clear innovation mission & strategy ?



Is our organisation ready for this?

Among these activities, we need to identify

- the internal management of available resources and competencies (Afuah, 2002);
- the marketing capacity of detection, analysis and promotion (Adams et al., 2006; Chakravorti, 2004; Day, 1994 Verhaeghe, Kfir, 2002);
- the capacities of R & D (Deeds, 2001; Yam et al., 2004);
- production capacities and possibilities (Chiesa et al., 1997; Yam et al., 2004)
- and the capacities and possibilities of the sales force (Avlonitis et al., 2001, Song, Parry 1996).

All these activities depend also on managerial capabilities, which enable the iterative development of innovation projects such as:

- project management,
- project portfolios,
- internal communication capabilities and
- decision-making capabilities (Tidd et al., 2013).

Knowledge Management

SMEs' learning process and knowledge management activities play a key role in innovation management (Adams et al., 2006; Darroch, 2005). The detection and integration of external knowledge increases the knowledge capital of the firm. R&D investments, subcontracting and the integration of networks allow the renewal of

internal knowledge (Ferreira et al., 2015; Darroch, 2005). SMEs' usual lack of qualified human resources may have a negative effect on their ability to absorb knowledge (Farace, Mazzotta, 2015; Liu, Laperche, 2015; Muscio, 2007).

Innovation-Dedicated Resources

Innovation capacity depends on capabilities and resources that are highly specialized in the innovation area targeted by the firm (Birchall et al., 1996). Successful firms invest massively in specialized resources to gain a specific advantage from the production of innovation (Keizer et al., 2001). Specialized resources refer to human resources and equipment, depending on the industry in which the firm is involved (Forsman, 2011; Freel, 2003, 2005). Diverse human resources shall provide external knowledge and can also offer new ideas and disruptive thinking (Birchall et al., 1996; Boly et al., 2014). Equipment specialization and accuracy is also a determinant of innovation capacity (Garcia, Calantone, 2001; Koc, 2007). High quality, specific equipment is a solid investment for proposing and maintaining competitive innovations (Birchall et al., 1996; Boly, 2014).

Process Re-Evaluation

Successful SMEs tend to integrate strategies and tools to constantly update their set of innovation capacities, their innovation strategy, their process and their organization. This allows them to remain innovative and thus competitive (Forsman, 2011; Helfat, Peteraf, 2003; Keizer et al., 2001; Teirlinckand, Spithoven, 2013).

The assessment of innovation capacity is therefore seen as an important tool for constantly improving and updating firms' sets of resources and capabilities to address evolutions in the environment and stay competitive (Boly et al., 2014; Motwani et al., 1999; Teirlinck, Spithoven, 2013).

Several factors can explain this diversity. First, only a third of SMEs have a deliberate innovation strategy (De Jong, Marsili, 2006). For most SMEs, innovation activities refer to common activities used to produce innovations. Since the boundaries of innovation are vague, innovation capacity dimensions are difficult to identify in overall SME activities (De Jong, Marsili, 2006). Because SMEs' innovation capacity is not easy to define, few studies focus on precisely describing its roots (Forsman, 2011).

The Innovation Process

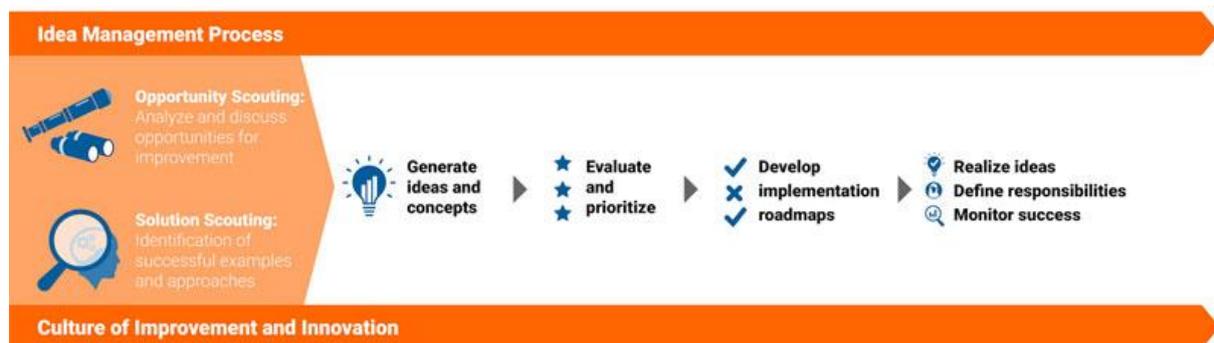
An innovation process is an organizational method that divides the uncertainties within an innovation project into clearly subdivided steps and decision points to drive development forward efficiently, while at the same time avoiding potential risks.

Especially in complex projects such as the development of innovative technologies, processes are of great importance. For example, in the 1960s, NASA developed pioneering innovation processes such as Phased Project Planning to enable the management of development projects.

- The NASA innovation process served primarily for control: the clear division of the process into different phases was intended to prevent errors from being transferred from one state to the next.
- Methods such as the Stage-Gate process which has been developed by Robert G. Cooper adopted the NASA method and developed it further.

The general idea is to divide the innovation process into stages and gates: The development takes place in different stages, whereby the gates are decision points.

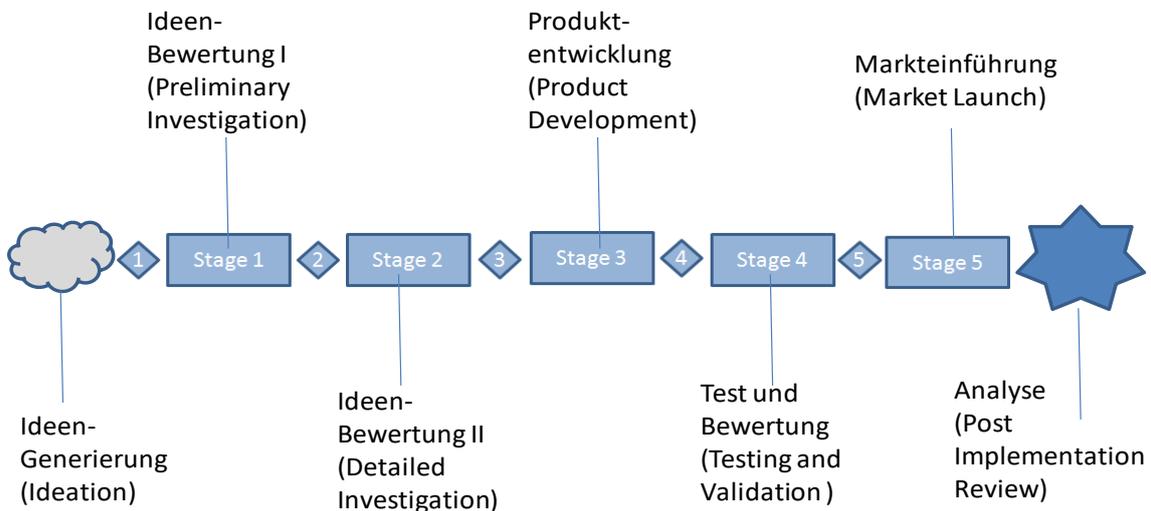
In this chart, you can see the typical workflow of an innovation process. Although innovation processes within companies are different, they often follow a similar logic.



- In the beginning, the search for opportunities and solutions that others have developed elsewhere stands in the foreground. This stage is the so-called “fuzzy front-end of innovation”.
- The next phase is idea generation. Internal and external team members develop ideas, concepts, and innovative solutions. Here, companies often rely on innovation challenges and utilize the so-called “swarm intelligence” of a crowd.
- Ideas are evaluated and prioritized – often by an innovation committee or by employees and managers in an innovation network.
- The best ideas are further developed into innovative concepts. Innovation projects are launched and listed in the form of an innovation roadmap.
- In the implementation phase, innovation teams realize innovation successfully.

- Constant measurement of innovation ensures that key performance indicators are achieved.

Stage-Gate®-Model



Source: Cooper (2003)

In recent years, so-called “linear innovation processes” like the Stage-Gate Process have increasingly come under criticism because they focus merely on incremental innovation.

- Traditional concepts of innovation processes assume a linear process from the search for opportunities to their implementation, which is not always the case in practice.
- The same management methods that lead to incremental innovation projects to success might cause innovation projects with a higher degree of innovation to fail.
- Correspondingly, companies tend towards incremental innovation.

Especially for the development of higher degrees of innovation – radical or disruptive innovations – the concept of a linear innovation process doesn’t work. Agile processes and concepts like agile development, desing thinking or innovation labs are needed.

Design Thinking, Innovation Labs and Agile Innovation Processes

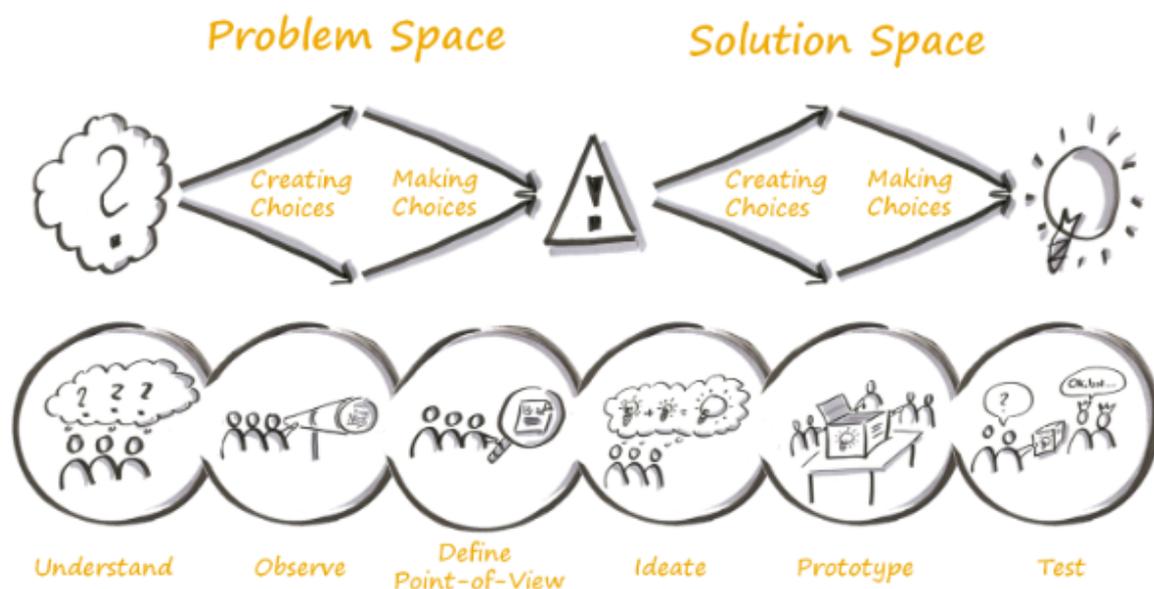
Companies need to drive different types of innovation: Product development, service innovation, business model innovation, the creation of digital business models or the implementation of strategies in the field of digital transformation. And times are changing quickly – so we also need processes which adapt to this velocity.

Outside the daily business, employees work on an innovation project – sometimes together with customers, suppliers or external expert – the live „open innovation“ (Chesbrough, 2003). The project is driven forward from initial ideation to realization.

- In an innovation lab, small and agile teams with intrinsically motivated employees act like independent start-ups.
- Tight deadlines and internal pitching can significantly speed up the innovation process.
- Employees develop innovations with more passion, creativity, and energy.

Within innovation labs, agile innovation processes are used to enable employees to react quickly to discoveries and developments.

The Design Thinking approach gives the opportunity to step back from each phase to another phase in order to implement learnings and thus create a breakthrough idea.



Info-Graphic of Design Thinking Steps and Mindset at SAP.
 Derived from Tim Brown, IDEO & HPI/D-School, Potsdam.
 Illustrated by Tobias Hildenbrand, SAP

Success factors for the Innovation Process

Of course the requirements for developing an innovation process vary from one company to another, is different according to the industry, depends on the different strategies of companies and will also be dependent of the resources and the persons involved. There is no cooking recipe. Nevertheless, there are several success factors and building blocks that have proven to be particularly useful.

- **Identify market opportunities:** Following an analysis of trends, customer needs, customer pains, technology developments and business competencies, the innovation process will initially show how future offerings should be designed to create new markets.
- **Develop ideas:** In the innovation process, new ideas for products, services, processes and business models are generated by applying different creativity techniques and inspirations from inside the company as well as from outside.
- **Putting together teams:** Within the company, multidisciplinary start-up teams have formed that work autonomously with entrepreneurial thinking and acting.
- **Marketing ideas:** In pitchings, management concepts have to be put to the test time and again. This encourages the development and maturation of the best ideas.
- **Rapid prototyping:** Prototypes increase the speed of development and minimize the risk of errors. Iterative development loops contribute to a fast optimization of the innovation process.
- **Innovation culture:** Team members are trained as innovation coaches. They learn to apply the innovation methods and pass on their know-how. The innovation process supports the establishment of an enterprise-wide innovation culture.
- **Innovation labs:** Within innovation labs, agile innovation processes are used to enable employees to react quickly to discoveries and developments.

SME innovation process

SMEs have a very clear approach to innovation – they are highly output-driven. These four dimensions appeared as important measurements for SME owners: (Bidaurratzaga, Dell, 2012)

- generate cash flow,
- gain the confidence of private investors,
- integrate intellectual property and
- integrate standards and regulations regarding innovation performance.

According to Waterman and Kirk (in Bowen & Ricketts, 1992) the following actions are the most important in SMEs:

- Analysing technology development, changes in customer value and competitors effectively;
- Promoting a positive culture;
- strong internal and external communications;
- Fostering close relationships with customers, suppliers, external partners and investors;
- Nurturing successful and protectable new products, services, processes and business models through the vulnerable early stages.

From this the following basic guidelines for SMEs can be deduced:

Start with small innovation steps	<p>Innovation in SMEs means one thing above all: developing new ideas and leading them systematically to success.</p> <p>Start small: e.g, with an ideas competition within the company. Call your employees to think about a topic in which ideally everyone has a say – ask for ideas, not necessarily ready to be implemented solutions. Hold this ideas competition for two to four weeks.</p> <p>You will soon feel that employees get more enthusiastic about idea_management and innovation management if the task is not too complex.</p> <p>Evaluate the ideas quickly and give feedback.</p> <p>Award various innovation prizes: for the best user idea and the best jury idea.</p> <p>After all, the best ideas should be implemented.</p>
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<p>Define roles for innovation</p>	<p>Innovation coaches: They are contact persons for employees who have ideas and would like guidance on how to develop them further.</p> <p>Idea partners: Managers who make themselves available to take on sponsorships for ideas and commit themselves to these ideas within the scope of their creative possibilities</p> <ul style="list-style-type: none"> • Innovation know-how (creative techniques, development of digital business models, design thinking) • Digital expertise (web design, CMS systems, video editing)
<p>Involve the entire company</p>	<p>There are two different philosophies in innovation management:</p> <ul style="list-style-type: none"> • Outsourcing innovation and digitization to your own departments • bring the topic to a company's specialist departments <p>Some companies use a mixed model: Certain types of innovation are implemented in departments, for other departments or temporary teams are created.</p> <p>Innovation in SMEs does not necessarily require their own departments. SMEs are characterized by the fact that they often develop innovative problem solutions for customers quickly and agilely. Therefore, innovation management is often the task of all employees – literally from gatekeeper to management.</p> <p>In contrast to large corporations, where work is often managed through regulated procedures, SMEs are more improvised. Improvisation is not negative, but the ability to adapt existing knowledge to the situation and apply it in a modified form.</p> <p>Distributing innovation throughout the entire company means using and strengthening the existing innovation culture.</p> <p>Own departments for innovation in SMEs only make sense if they are to implement concrete projects that are far from daily business (e.g. development of digitalisation strategies or radical product innovation).</p>
<p>High degree of internal networking</p>	<p>Innovation is like a big puzzle: The individual pieces of the puzzle are present in many minds in the company. When developing new products and offers or digital innovations, it is important to identify the right pieces of the puzzle in the minds of employees and to link them intelligently.</p> <p>The rapid internal exchange of ideas and knowledge is one of the SMEs' greatest competitive advantages. that SMEs that want to drive innovation must ensure an</p>

	uncomplicated access to knowledge and challenges and contrigute to this base.
Focus on temporary campaigns and create a long-term innovation culture	<p>It is a typical characteristic of SMEs that workload temporarily rises or falls sharply. It can therefore make sense to promote innovation, especially in times when the workload is lower.</p> <p>This approach has the following advantages:</p> <ul style="list-style-type: none"> • times of low capacity utilization are being used specifically to drive the company forward. • In times of high capacity utilization, the company can focus completely on day-to-day business without neglecting innovation management. • Due to the temporary character, the interest and involvement of employees remaine higher

Needed areas of knowledge

Key dimensions	Areas of knowledge
Action for continuous improvement	<ul style="list-style-type: none"> • Staff improvement • Product & Technology improvement • Service improvement • Process improvement • Value chain improvement • Knowledge improvement • Management structure improvement • Creativity techniques for problem solving • performance measurement • Innovation process & management assessment • Continuous improvement tools
Technology management	<ul style="list-style-type: none"> • Trend scouting • Foresight • Technology portfolio analysis • Technology committee • technology strategy develop ment • High innovation profile • Design to meet market
Internal management system	<ul style="list-style-type: none"> • Innovation management • Performance and innovativeness measurement

	<ul style="list-style-type: none"> • Process monitoring • Innovation Controlling • Support for creative people • Innovation KPIs
Pressure for cost cutting	<ul style="list-style-type: none"> • Waste reduction (MUDA) • Process analysis and optimisation • Cost reduction through digitalisation, industry 4.0, automatisisation and robotisation • Value chain optimisation
Structure for managing technology	<ul style="list-style-type: none"> • • Promotion of innovative behavior
Sectorial technological innovativeness	<ul style="list-style-type: none"> • High technological specialization • R&D dependence for innovation
Internal management systems	<ul style="list-style-type: none"> • benchmarking • Performance measurement tools for managers • Strategic goals & objectives • Internal detection & support of creative HR • Innovation-dedicated & leader managers • Capitalization of previous innovation experiences
Structure for managing innovation	<ul style="list-style-type: none"> • Portfolio management • Technical committee • Internal promotion of creative and innovative behaviors • Innovativity, positive determinant factors • Foresight
Owners characteristics	<ul style="list-style-type: none"> • Work experience • Cosmopolitaness • Attitude to risk • How to work with failures
Resources	<ul style="list-style-type: none"> • Technological information • External training • R&D expenditures • Investment in AMT (advanced manufacturing technology) • Networks, OI networks • people
Innovative capabilities:	<ul style="list-style-type: none"> • Machinery adaptation

	<ul style="list-style-type: none"> • Design capability • Entrepreneurial capabilities (Detect - Seize - Exploit opportunities) • Risk management capabilities / Risk assessment • Networking capabilities • Capabilities to create collaborative relationships • Capabilities to exploit innovation developed by others
Firms characteristics	<ul style="list-style-type: none"> • Innovation culture • Idea generation • Organizational Structure • Innovativity • Owners characteristics • financial resources • Strategy • Structure • Technology policy • Level of education • Investments in R&D • Collaborations with other firms • Professional Background of Founder/ manager(s) • Skills of workforce • Cross functional teams • reward systems for innovative ideas
Human resources	<ul style="list-style-type: none"> • Training • permanent technological monitoring • Employee willingness to share information • Perception of technology as a critical success factor • Willingness to learn
Knowledge management and online collaboration	<ul style="list-style-type: none"> • Teamwork and communication channels • Systems for data base, data transfer and documentation

So from this can be deducted that an innovation facilitator for SMEs needs to have profound knowledge in the following fields:

- Detect • Seize • Implement DC AC

Topic	Capabilities
Creation of innovation strategies	<ul style="list-style-type: none"> • Roadmaps • Strategic plans
Innovation culture	<ul style="list-style-type: none"> • Analyse • Create
Assessment and improvement of technological and innovation capabilities	<ul style="list-style-type: none"> • Analyse • Prioritize
Knowledge accumulation and exploitation	<ul style="list-style-type: none"> • Incorporation of new members • Learning and capacity building • Research and development • Competence management
Change management	<ul style="list-style-type: none"> • Quickly implement change • Intra organization collaboration
Organization: <ul style="list-style-type: none"> • Staff training and attitude • Criteria for promotion and rewards • Risk taking • Formal structure 	<ul style="list-style-type: none"> • Moral support • Coaching • Process management • Collaboration tools • Collective learning
Design	<ul style="list-style-type: none"> • Create design mindset
Project management	<ul style="list-style-type: none"> • Teach and implement
Innovation process	<ul style="list-style-type: none"> • Development • Improvement
Communication of innovation	<ul style="list-style-type: none"> • Internal as well as external PR
Customer and suppliers relationship; external collaborations	<ul style="list-style-type: none"> • Network management • Open innovation • Co-Creation • Intellectual Property Rights • Collaboration tools • Customer relationship management

Some authors consider that SME specificities allow them to perform better in innovation than large companies (Martinez-Ros, 2008; Lee, Chen, 2009), while other authors instead consider these specificities to be a curb on SMEs' innovation activity (Camison-Zornoza et al., 2004; Hitt et al., 1990). Also, the simple, informal and flexible structure of SMEs could also limit innovation activities. Because SMEs do not have processes or methods to properly assess ideas, the costs of the innovation projects or the time-to-market, managing the innovation becomes difficult (Hadjimanolis, 1999, 2000). Thus, innovation activities could be less efficient in SMEs than in large companies. On the other hand, some authors highlight the velocity of SMEs and start-ups as positive factor for innovation (Christensen 2015). More research on this is obviously needed, potentially transdisciplinary.

Building on the literature concerning SME specificities, we have identified three SME characteristics that could influence their innovation capacity:

- the scarcity of resources (human, financial and technological resources)
- the leading role of the owner/entrepreneur: The entrepreneur is perceived as the main driver of innovation activities (O'Regan et al., 2005; Teirlinck, Spithoven, 2013) and innovation activities depend on the entrepreneur's vision (Garcia, Calantone, 2002; Julien, Carrier, 2002; Guijaro et al., 2009). The personal experiences, knowledge, competencies and abilities of the entrepreneur have a significant impact on SMEs' innovation activities. Previous experiences and academic background can influence an SME's innovation activities (Birchall et al., 1997). personality and behaviour of the owner, which also impacts the SMEs' innovation activities, particularly with regard to the will to innovate (Miller, Toulouse, 1986; Lefebvre et al., 1997).

And

- the SMEs' informality and flexibility. SMEs have been shown to compensate for their lack of resources through a high level of flexibility (Qian, Li, 2003; Wolff, Prett, 2006). SMEs are simple organizations with little hierarchy and in which power is centralized. Thanks to this simple organizational structure, SMEs can easily integrate market needs and technological changes (Rothwell, 1989). The organizational structure of SMEs is also informal and flexible, allowing them to respond rapidly to any change in the environment (Qian, Li, 2003; Wolff, Prett, 2006). Informal interactions between members accelerate communication and enhance collaboration and thus creativity (Julien, Carrier, 2002; Qian, Li, 2003).

Innovation Process Management

Innovation management appeared as a relevant dimension of SMEs' innovation capacity.

- First, the pooling of different competencies (marketing, engineering, and management) is essential to ensuring the accuracy of the innovation process
- Second, the capacities to constantly manage the portfolio of innovation projects are necessary. Portfolio management is essential to permanently assess the innovation potential of the firm. The ability to end projects with no potential in their early stages is critical for SMEs' viability
- Third, efficient project portfolio management ensures the respect of quality time and reduces costs

This managerial technique allows SMEs to maximize their innovation return on investment.

Learning Process

The learning process appeared as a relevant dimension of SMEs' innovation capacity.

First, the ability to integrate external knowledge is a major factor in firms' innovation capacity. Because they lack resources, SMEs need to develop external collaborations that offer strong opportunities to acquire knowledge. However, firms often express difficulties in establishing a deliberate learning process.

Second, the ability to constantly train human resources is expressed as determinant factor in maintaining firms' innovation capacity. Diversified training programs, intrapreneurship, and internal training processes by senior employees are considered to be levers by which new knowledge can be integrated

Dedicated Resources

Resources dedicated to innovation are a relevant dimension of SMEs' innovation capacity. Human resources dedicated to innovation appear to be essential to generate valuable innovation outputs. Technical and nontechnical expertise are both required. Technical and scientific experts are essential to ensure viable innovation outputs. Nonexperts dedicated to innovation are also needed to generate new ideas and foster creativity. SMEs' capabilities to manage permanent collaboration between different profiles are essential. Technical resources are expressed as less important factors of innovation capacity.

Costs induced by this equipment convince SMEs to use their networks to gain access to technical resources. Highly specialized human resources tend to facilitate access to an extended network and to potential collaborations; therefore, human resources, networks and collaboration are considered critical factors in gaining access to specialized equipment.

Strategy and Process Re-Evaluation

The re-evaluation of strategy and process is perceived as an ambiguous dimension of SMEs' innovation capacity. The re-evaluation of strategy is related to the firm's ability to stay innovative over time. This ability depends on the alignment of the firm's strategy with the evolution of the environment. This re-evaluation is thus very difficult and might not be a priority for SMEs, and it is essentially presented as a simple analysis of current project evolution.

Access to Funds

The ability to generate cash flow through their innovation is a highly relevant dimension of SMEs' innovation capacity. The generation of cash flow can be used to fund new innovation activities. A sustainable long-term innovation policy cannot rely on external fundings and financial institutional supports alone. SMEs that generate cash flow improve their innovation capacity. They can easily convince new partners to become involved in the innovation process, and they can access more institutional supports. Cash flow generation also allows SMEs to gain the confidence of private investors, such as business angels or venture capitalists, to support their innovation strategy

Most relevant dimensions for an SMEs' innovation performance

(1) The ability to generate cash flow has been presented as a lever that enhances SMEs' innovation capacity. It helps the firm convince potential partners to invest in the innovation process and to develop strong collaborations. This ability relies on qualified human resources. Thus, the design of business models, which allow cash flow generation, is an essential dimension of SMEs' innovation capacity.

(2) A permanent integration of standards and regulations appears as a major determinant of SMEs' innovation capacity.

(3) Access to private funding has been described as an important lever of innovation performance and a fully integrated dimension of SMEs' innovation capacity, as it allows the firm to overcome its natural lack of resources to invest in multiple dimensions of their innovation activity. This capacity needs to be enhanced by specialized resources that require high skills in finance, business strategy and networking.

(4) The strategic management of IP has been highlighted as an important dimension of SMEs' innovation capacity. It permits SMEs to secure their innovation activity and outputs, to generate cash flow and to convince potential partners to invest in the SMEs' innovation activities.

The role of SME innovation manager:

- Ability to propose a clear vision of their strategy
- Detection capabilities of the firm are addressed as the main lever for accessing private investments. Many SMEs thus focus their recruitment around experienced resources that have succeeded in previous operations.
- Analyse and size potential market opportunities;
- Innovation strategy and planning; Innovation strategy operationalization: ability to plan innovation strategy into short, mid and long run plan and roadmap; Innovation

strategy support: implement strategy revaluation based on internal and environment evolutions; based on O/M ability and external advices

- Innovation culture: clear communication on innovation goals; constant support and considerations for ideas; financial and reputational incentives for innovation; adapted work environment fitting with employee needs; targeted recruitments adapted to innovation practice
- Organizational structure: discussed by results on the need for dedicated organizational structure in the field of SMEs. Expressed as natural for SME's and does not deserve special care
- Innovation process management
- Ability to communicate plan and roadmap inside to employee and outside to partners
- Technology and knowledge transfer
- Ability to integrate end-use customers into their innovation process. This integration allows the firm to dedicate innovation output to well-known segments of customers and thus offer this segment something with a clear and targeted value
- Ability to think and propose a business model that coincides with their strategy. This business model can be directly linked to innovation output value, or it can rely on annexed commercial activities linked to SMEs' core competencies as services
- Ability to detect and use distribution channels very early. Channels are highly dependent on firms' sectors
- Detect and benefit from private fundings
- Strategic Management of IP (patents, trademarks, copyrights). IP management is considered to be an important lever to ensure an SME's position in a highly competitive environment, as it provides clear and tangible proof of firms' core competencies, knowledge and expertise. This impact allows access to markets, generates revenues and therefore invests in essential compartments of innovation capacity. Most SMEs do not have specific competencies in IP management, but they recognize its importance in maintaining their innovation capacity
- Ability to secure transfer of technology and knowledge
- Basic knowledge about public fundings
- Basic knowledge about standards and regulations
- Business development abilities
- User integration: early integration of market needs; secure access to market; users' contribution and ideas; resources saving in development phases
- Institutional support available: financial support and tax incentives; operational support; technical support Firm capabilities: detection capabilities to target support available regarding firm position and activity
- Implementation capabilities to efficiently answer to institution prerequisites and guidelines successful coordination and aggregation of internal resources and capacities; environmental opportunities and threat; corporate strategy alignment
- Personality: openness; risk taking; communication on vision and objectives
- Activities integration: involvement of firms different profiles and activities in the innovation management process

- Portfolio management: introduce innovation project hierarchy analysis, evaluation and selection; targeted allocation of resources
- Project management: quality, time and cost management; dedicated human and technical resources
- Knowledge management; IP thinking; Clear delimitation of knowledge transfer with partners; skilled resources that can integrate external knowledge
- Innovation funding & financing;
- Market analysis and sizing;
- Customers integration;
- Business model development.

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