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Business Model Innovation and exaptation: A new way of innovating in SMEs

Anna Paola Codini [b,*], Tindara Abbate [a], Antonio Messeni Petruzzelli [c]

[a] Department of Economics and Management, University of Brescia, Contrada S. Chiara 50, Brescia, 25122, Italy
[b] Department of Economics, University of Messina, Via dei Verdi, Messina, 98122, Italy
[c] Department of Mechanics, Mathematics, and Management, Polytechnic University of Bari, Via Edoardo Orabona 4, Bari, 70125, Italy

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ABSTRACT

Although research underlines the need for SMEs to innovate their Business Model, they face considerable challenges in exploring external business opportunities and experimenting/developing their available resources in unexpected ways. We posit that one way that SMEs can innovate their Business Model is through exaptation, a discontinuous evolutionary process that allows utilizing and adapting existing resources in new application domains. Using a case study approach, we investigate the case of a SME that has successfully innovated its Business Model through exaptation. We then discuss how three key exaptation processes lead to value creation, delivery and capturing, thus supporting Business Model Innovation in SMEs.

1. Introduction

Business Model Innovation (BMI) has been described as "the search for new logics of the firm and new ways to create and capture value for its stakeholders" (Casadesus-Masanell and Zhu, 2013, p. 464). In this perspective, firms can create and exploit new opportunities linked to their innovative Business Model (BM) by adopting different approaches. Firms might add novel activities through backward or forward integrations, connect activities in a novel way, or modify one or more parties dedicated to any of the activities (Amit and Zott, 2012). For example, firms can choose to alter the set of elementary activities they perform and rely on the resources or technological capabilities of external parties (such as individual, organizations, universities) to develop a new value proposition (Chesbrough, 2007; Saebi and Foss, 2015).

Researchers underline that BMI is becoming even more important for success than product/service or process innovation (Johnson et al., 2008; Amit and Zott, 2012). However, practitioners have little guidance on how to design innovative BMs (Foss and Saebi, 2017; Teece, 2018). This is particularly true for Small and Medium-Enterprises (SMEs), the main actors in innovation processes and technological development at the local, regional, and even national level (Lee et al., 2012). Accordingly, recent international policies have emphasized the need for SMEs to redefine their BM to sustain and promote their competiveness. In this perspective, BMI is a potentially relevant tool allowing SMEs to resolve the trade-off between innovation costs and benefits, enabling them to create, deliver, and capture new value.

BMI might entail designing new products or services for unmet customer needs, more efficient process innovation and product distribution, implementing new technologies, reconfiguring existing activities, or involving new partners (De Reuver et al., 2013). Therefore, the exploitation, definition, and implementation of an innovative BM implies the wide exploration of internal and external opportunities, experimenting with and developing available resources in original and unexpected ways. In other words, a learning approach in the evolution of the firm's capabilities is needed (Jacobides and Winter 2012; Teece, 2018). However, in developing innovative solutions, SMEs often face challenges linked to their lack of resources and hence exploring external opportunities represents a good option to innovate (Van de Vrande et al., 2009; Massa and Tucci, 2013; Brunswicker and Vanhaverbeke, 2015).

We argue that to solve these challenges, SMEs can innovate their BM through exaptation, a key process that allows utilizing and co-opting existing resources in new application domains (Dew et al., 2004; Cattani 2006). Exaptation is a discontinuous evolutionary process that "identifies a third channel driving the emergence of novelty: a functional shift of an existing artifact that is not traceable to the discovery of new

Abbreviations: BMI, Business Model Innovation.

* Corresponding author.
E-mail addresses: anna.codini@unibs.it (A.P. Codini), abbatet@unime.it (T. Abbate), antonio.messenipetruzzelli@poliba.it (A. Messeni Petruzzelli).

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phenomena or the pull from clearly defined needs" (Andriani and Cattani, 2016, p. 116). Since exaptation is considered a critical source of novelty generation (Cattani, 2006; Dew and Sarasvathy, 2016) allowing firms to catch distant (and superior) opportunities in existing landscapes (Andriani et al., 2017) and enabling to explore new markets, this process can surely help BMI. Furthermore, exaptation allows to generate knowledge, capabilities, new producers and users, in existing patterns (Bonifati and Villani, 2013), while favoring new applications of an existing product or process. Thus, exaptation might be particularly fruitful for SMEs, surely benefiting from developing new products and businesses (Vanhaverbeke, 2017), but facing manifold challenges in BMI, as high risky and time-consuming process.

Basing on these considerations, the present study therefore intends to deepen our understanding of exaptation as a way for innovating BM in the SME context. Thanks to an explorative qualitative case of COPAN, an Italian family business that develops discontinuous technologies through adapting existing technologies to new businesses, we demonstrate that exaptation – as articulated in distinct processes – contributes to BMI by means of value creation, delivery, and capturing.

To this aim, the paper reports a theoretical background explaining why, in the context of SMEs, exaptation can be considered a way to innovate the Business Model. Then, the empirical setting including research setting, data collection and analysis is defined. Findings are then reported, articulated in three sections devoted to the distinct processes of exaptation. Consistently with this articulation, the discussion describes the specific mechanisms that functionality emergence, deliberate selection, and adaptation activate in terms of value creation, value delivery and value capturing. Last, conclusions report the main theoretical contributions, as well as managerial implications and limitations of the paper.

2. Theoretical background

2.1. Business model innovation: the role of exaptation

The reasons behind the attention that managers, entrepreneurs, and academic researchers pose on BMI concept are almost twofold. First, BMI represents an indisputable, even often neglected, source of value (Amit and Zott, 2012). Second, BMI can be more difficult to replicate than a single novel product or process (Amit and Zott, 2012), hence representing a new source of competitive advantage (cf. Zott and Amit, 2007; Chesbrough, 2010; Teece, 2010; Ho et al., 2011), and allowing companies to gain a unique positioning in the competitive space.

Several studies have underlined that the BMI construct focuses on the BM itself as the subject of innovation rather than on innovations in products or processes (e.g., Baden-Fuller and Haefliger, 2013). These studies argue that innovation is a necessary part of the BM concept (e.g., Mason and Spring 2011), hence overcoming the traditional notion that BMs are concerned with "firm-level value creation" (Spieth et al., 2014), and presenting additional questions related to "novelty in customer value propositions and about logical reframing and structural reconfigurations of firms" (Spieth et al., 2014, p. 237). Nevertheless, even if research has shown that novelty is intended to capture the innovation dimension (Foss and Saebi, 2018), BMI research has mainly focused on the complex architecture of the set of connected activities underlying value creation, delivery, and appropriation (Zott et al., 2011; Foss and Stieglitz, 2015; Foss and Saebi, 2018).

The business modelling process can be understood as influencing, as well as being influenced by, not only internal, but also external resources. Therefore, BMs are inevitably dynamic in nature and their practices "might interact in an iterative and evolutionary way" (Mason and Spring 2011, p. 1033). Nevertheless, BMI is more complex, going far beyond changing isolated products/services or processes, implying considerable efforts to change the constitutive BM components (Massa and Tucci, 2013; Spieth et al., 2014). BMI does not necessarily refer to new services or products, but rather to new ways of developing existing products or services and capturing value therefrom. According to Amit and Zott (2012), BMI is changing the way of doing business and goes further than simply unveiling product, process, or technology innovations.

Despite the increasing attention towards BMI and the practice-driven trend to apply visual and design informed tools to enhance strategic thinking about BMI, how processes of designing novel BMs actually inform the exploitation of emerging opportunities remain obscure. Especially, many operational gaps related to processes, linkages or structures emerge when it comes to explaining how firms can use BMI to capture more value, and how firms innovate or reinvent business models to improve their capacity to capture additional value in the market (Spieth et al., 2014). Thereby, in this paper, we identify exaptation as a way to innovate the BM.

The concept of exaptation is related to "characters evolved for other usages (or for no function at all), and later 'co-opted' for their current role" (Gould and Vrba, 1982, p. 6). Exaptation is a discontinuous evolutionary process (Andriani and Cattani, 2016, p. 116) that includes distinct sub-processes as: i) the emergence or association of a new function with an existing artifact, process, and ecosystem, ii) the deliberate selection of a new function as the basis for an innovative product, and iii) the adaptation as a process in which innovative products are transformed because of user selection (Andriani and Carignani, 2014, p. 169). In this sense, emblematic is the case of exaptation that allows existing technologies to (a) construct novel technological niches, (b) enter into existing niches, or (c) transform internal components of current products increasing their efficiency or extending their range of functionalities without creating any new products (Andriani and Carignani, 2014). Therefore, exaptation is a critical source of novelty generation (Cattani, 2006; Dew and Sarasvathy, 2016) that allows firms "to spot distant (and superior) opportunities on search landscapes" (Andriani et al., 2017, p. 1).

The role of exaptation is recognized in different disciplines including biomedicine, physics and materials science, economics, social sciences, computer science, psychology and architecture (La Porta et al., 2020). Acknowledging the importance of exaptation, and conceptualizing on the role of the unexpected, recently favored the development of new evolutionary perspectives (Cattani and Mastrogiorgio, 2021; Cattani and Malerba, 2021), thus enriching current approaches to technological innovation. Albeit the most popular experiences of exaptation-driven innovations deal with large firms (Cattani, 2006; Garud et al., 2016), benefits that SMEs may gain in developing new products and businesses (Vanhaverbeke, 2017), hence leveraging exaptation to innovate their BMs, can be grasped in some literature studies.

First, SMEs are sometimes faster in reacting to changing market demands (Parida et al., 2012), and this favors speed to market, playing a key-role in exaptation processes. Second, as they are sometimes more inclined to take risks (Vossen 1998; Parida et al., 2012), SMEs might have an advantage in selecting and adapting new functionalities emerged through exaptation. Third, thanks to their specialization often leading to the development of an intimate relationship with customers, and thus favoring quicker reaction to changing environments (Parida et al., 2012), SMEs can be more proactive than large firms. This allows them to capture new associations for existing technologies, thus fighting the commoditization of their products (Vanhaverbeke, 2017).

Because BMI is considered a potential source of firm heterogeneity and competitive advantage (Markides and Charitou, 2004), and superior value creation (Morris et al., 2005), markedly different from the traditional firm-level product-market strategies (Christensen, 2001), designing an innovative BM can be more disruptive and challenging than changing strategy (Keen and Qureshi, 2006). This is evident in SMEs, as, for them, "thinking outside the box is hard to do" (Gassmann et al., 2013, p. 2), and several barriers hinder the path towards innovative value creation approaches (Lindgren, 2012). Moreover, the need to reconfigure the ways of doing business is pressing, since SMEs are exposed to uncertainty and have to determine the potentialities of

improvements and continuous innovation. Due to often lacking manufacturing capabilities and distribution channels necessary to turn a new technology into a profitable business for small enterprises, a profitable niche market can sometimes change into a nightmare (Vanhaverbeke, 2017). Additionally, many SMEs – more heavily than how this affects larger firms – are unaware of the changes in the competitive landscape, since they work hard in the business with no time to reflect on how to change their strategy and no experience with strategy development and BMI. This starts a vicious cycle, since denying the need to change leads to a deterioration in financial situation and problem accumulation. Furthermore, even when SMEs realize that a different strategic positioning is required and that innovation is needed, this is developed mostly internally with consequent numerous problems (Vanhaverbeke, 2017). Thus, for SMEs, BMI can be problematic, high risk, and time-consuming, even if potentially contributing to sustainable business performance by reducing costs and increasing efficiency.

Therefore, due to exaptation's characteristics and to the potential benefits arising from this approach to innovation in SMEs, we posit that exaptation relates to BMI in SMEs for two main reasons. First, exaptation can represent a mechanism of technological innovation leading to BMI more rapidly and efficiently than deliberate technological innovation. Companies make substantial efforts to innovate products. Innovations to improve products are often really expensive and time-consuming, and this makes future returns on these investments often uncertain (Zahra, 2005). Exaptation as an innovative process enabling to transform an existing product by increasing its efficiency or extending its range of uses without the creation of any new products (Andriani and Carignani, 2014) might represent a technological innovation favoring BMI in a less expensive and time consuming way.

Second, exaptation represents an innovation mechanism consistent with the path that usually SMEs follow while innovating their BMs. According to Andriani and Carignani (2014) and Mastrogiorgio and Gilsing (2016), exaptation-driven innovation is the exploitation of a latent function in pre-existing artifacts for new contexts (Dew et al., 2004; Cattani, 2006; Beltagui et al., 2020), involving internal and external search processes or arising from individuals' serendipitous discoveries, rather than as the result of deliberate strategies (Garud et al., 2018). Hence, exaptation as the serendipitous discovery of a new function for an existing trait (Gould and Vrba, 1982) is aligned to this discovery-driven growth in SMEs (McGrath, 2010), used to develop their BM in a rather intuitive way (Vanhaverbeke, 2017). Since they often do not have required resources to analyze growth opportunities in a systematic way, in SMEs BMI often comes from experimentation rather from analysis (McGrath, 2010). The increasing opportunities enabled by changing customer expectations and technological advances require continuously experimenting with and developing internal and external resources/assets (McGrath, 2010; Teece, 2010), adopting a trial-and-error learning approach to explore, define, rethink, change, and implement innovative business models by continually refining the core elements.

Despite the potential role that exaptation might play in leading SMEs to BMI – helping them to face the main challenges in innovating their BM while supporting their typical BMI paths – no contributions hitherto focused on this gap. Hence, in order to fill this literature gap, in this paper we argue that exaptation can represent a way for innovating BM in SMEs. Specifically, we discuss how functionality emergence, deliberate selection, and adaptation – as the key processes of exaptation – might contribute to value creation, delivery, and capturing.

3. Empirical setting

The case study method is deemed suitable for developing theories on phenomena where little is known about their dynamics, especially referring to the context where they occur (Yin, 2003). This approach permits investigating the "how" and "why" of contemporary manifestations over which the researcher has little control (Yin, 1994), allowing describing, explaining, and understanding their dynamics. Longitudinal real-time studies are considered useful to study the change processes in organizations (Barley, 1990; Van de Ven, 1993), and especially exaptation phenomena (Cattani, 2006; Andriani and Cattani, 2016), calling for detailed historical data to identify key shifts in the environment producing functional exaptive changes in existing artifacts and their impact on the evolution of a nascent market or industry (Ching, 2016). Therefore, our study concerns the longitudinal analysis of two exapted technologies, as considered suitable for describing the inherent complexity of exposing the micro-evolutionary processes underlying exaptation (Andriani and Cattani, 2016). Examining exaptations of two different technologies allowed us to counter the limitations of a single case study as to compare the findings to search for similar patterns and confirm the emerging concepts (Davis and Eisenhardt, 2011). As a result, this multiple case approach offers more generalizable and robust evidence than a single case, allowing further theory extensions (Davis et al., 2007). As Eisenhardt (1989) suggested, the case was chosen combining theoretical interests and ongoing research activities (Siggelkow, 2007) to better understand the critical role of exaptation as a source for BMI in SMEs.

3.1. Research setting

The case study selected is COPAN Italia S.p.A. (henceforth COPAN), an Italian family firm founded in 1979, operating in the distribution and manufacturing of laboratory products, and counting 346 employees (2019) and 85 million € total revenues (2019). Thanks to its innovation propensity, the firm has been able to develop discontinuous technologies, some of which can be considered exaptation exemplars. As the evolution of the firm's structure shows, some of the innovations launched on the market led the firm to renew its whole BM. As a result, COPAN today is the holding company of a group of firms, each operating within a specific business and target markets, such as diagnostic and laboratory automation systems. COPAN has achieved numerous ambitious goals in terms of growth and innovation. Indeed, the firm won the "2020 Financial Attractiveness" award in the Italian "Entrepreneurial excellence" program (Eccellenzedimpresa, 2020), the local "Financial Statement Oscar" award (GDB, 2021), and, last but not least, is a prominent protagonist in the fight against COVID-19, developing ad hoc solutions to face this crisis (COPAN news-events, 2020). For the reasons above, we selected COPAN as our single extreme case (Yin, 1994), documenting and analyzing that (Yin, 1994; Shakir, 2002). According to the literature on the use of extreme cases, COPAN demonstrates an unusual manifestation of a phenomenon, such as outstanding success (as in our case) or notable failure (Patton, 1990), which contribute to recognizing, analyzing, and discussing the processes of interest.

COPAN was founded in 1979 as an Italian family business that manufactures and distributes a number of laboratory products. The company has evolved considerably by developing different business initiatives in addition to its core laboratory products, mostly thanks to the exaptation of existing technologies. From its beginnings as a small Italian business to its current status as a notably medium-sized international group, COPAN has always provided uniquely innovative products on a global level. In 1982, the company began to produce swabs, while in 1992 it started approaching the automation sector with the invention of Ghibli, a solution for the large-scale production of its products. In 2003, COPAN invented FLOQSwabs®, the innovative solution for sample collection, transportation, and preservation for diagnostic, biotechnology, and life science companies. In 2007, WASP®, the first laboratory automation system for sample processing in microbiology labs was developed. Finally, in 2016, the company launched NewLab Engineering for the development of instruments to process DNA collection cards in forensic laboratories (COPAN website, 2020).

For investigating exaptation at COPAN, we focused on two exapted technologies that enabled the company to innovate its business model. The first is MicroFLOQ®, a nylon swab for sample collection and

handling human DNA in forensic investigations. This function emerged as an exaptation of the existing swab technology that COPAN developed and that French *Institut de Recherche Criminelle de la Gendarmerie Nationale* (IRCGN) patented. The second is Cyclone™, a laboratory automation system for sample processing in the food industry. This technology emerged as an exaptation of the aforementioned WASP technology (laboratory automation system). Cyclone™ was developed to satisfy a specific request from Danone – global manufacturer of dairy products – searching for automathizing the microbiological analysis of yogurt to detect contamination.

Because of the different uses for which the two new are facts were developed (sample biological specimen collection for FLOQSwab vs human DNA collection for MicroFLOQ®; automated specimen processing for WASP vs automated microbiological analysis of yogurt), and because of the serendipitous nature of their functional emergence (COPAN never thought to develop these specific uses of the original artifact before being contacted by the customers asking for its support), both the cases we selected can be considered as exaptations in light of the definition provided by the literature (Andriani and Carignani, 2014).

These two cases allowed COPAN to innovate its traditional business model (see Tables 2a and 2b). Indeed, the first exapted technology – MicroFLOQ – enabled the firm to enter the forensics business, while the second – Cyclone™ – enabled the company to enter the food industry. In fact, the exapted technologies allowed COPAN to address radically different customer segments with a new value proposition, entirely revise the way of creating value, and partially restructure the way of delivering and capturing value. Much of the exaptation process was aimed at exploiting existing key partners, activities, and resources for empowering existing resources in the transition towards a new BM. This consequently affected the way of capturing value and led to slightly changing the revenue streams to face the rigid cost structure.

BMI triggered by exaptation is not the unique experience of BMI that COPAN tried out. Especially, when COPAN launched the first WASP® Walk-Away Specimen Processor for microbiology laboratories moving from the original core business of laboratory products to automation a new BM was developed. However, comparing the exapted-driven BMI with the other BMI, some differences emerge. Previous BMI, indeed, started as a more deliberate process, since the company was searching for new tools to better address the existing customers (microbiology laboratories) expanding in a radically new business (automation) deliberately developing new technological solutions. This probably entailed radical changes in some of the mechanisms of value creation (key activities and key partners), as in value capturing, as a consequence of a deliberate process. Because of its origin (deliberate new technology development), this BMI process was really time and resource consuming. On the other side, when BMI was triggered by exaptation, the process changed direction. The unintentional process of functionality emergence favored the birth of a new value proposition as the main source of value creation and this consequently implied innovations in value delivery and value capturing too. Compared to the previous process, the unintentional development of the exapted technologies surely contributed to innovate the BM more rapidly and more efficiently.

Table 1
Interviews.

Interviewee	Role	Business Unit	When
Giorgio Martello	Senior Project Manager	COPAN Italia S.p.A.	April 2017
Camilla Masneri	Event Communication Manager	COPAN Italia S.p.A.	April 2017 July 2018 October 2018 November 2018 September 2020
Mario Savarese	Chief Strategy Officer	COPAN WASP s.r.l.	October 2018
Michele Frosio	Application Specialist	COPAN NewLab Engineering s.r.l.	November 2018 September 2020
Elisa Piovanelli	Business Development Manager	COPAN Italia S.p.A.	November 2018 September 2020
Gabriele Savoldi	Business Development Manager	COPAN Group S.p.A.	September 2020
Giorgio Triva	Strategic Project Manager	COPAN Group S.p.A.	September 2020

3.2. Data collection

The data collection spanned from early April 2017 to September 2020. To overcome the challenges of a multiple case study approach, we collected data by a triangulation method integrating multiple sources in a multi-method design (Jick, 1979). The use of multiple sources is a necessary element of the analysis, since it ensures the variety of perspectives required by the constructivist principles. In the first data collection stage, the study focused on secondary sources, such as archival records and documentary information. Then, one of the authors conducted two onsite visits followed by discussions with the other authors to share the data collected in the first step and the basic framework to conduct the in-depth interviews. Specifically, this stage led to revealing COPAN's innovativeness as well as the presence of the exaptation phenomenon as a possible source of BMI. As the innovative projects emerged from the first visit, the second on-site visit was aimed at identifying those projects that could be observed as cases of exaptation. Then, we conducted different rounds of interviews with key informants to obtain a deeper view of the phenomenon (Eisenhardt and Graebner, 2007). Finally, we conducted another round of interviews with the same key informants and with others to better define the BMI aspect leading to exploiting the exapted technologies and making explicit reference to the BM canvas. The use of a variety of data sources at multiple times enabled overcoming the limitation of separate sources and contributing to the findings' reliability (Lindgreen et al., 2009).

3.3. Archival and documentary information

First, we analyzed the company website, official dossiers, internet documents, and published interviews, followed by project documentation, emails and minutes, strategy reports, videos, scientific studies, and a variety of documents on the innovation projects. The acquisition of this information helped us build preliminary knowledge of COPAN's history and the development of its innovation activities. A further interesting contribution derived from the analysis of COPAN's main projects in terms of budgets, schedules, scope, and participants, which allowed us to identify a group of innovative projects that could be considered, first, exapted and, after, a source of BMI. Within these projects, we selected only the exaptation cases, coherently with our research aims.

3.4. Individual interviews

To gain insights on COPAN's BMI, we integrated and complemented the information from secondary sources with a number of interviews conducted with key informants (see Table 1). These interviews allowed us to explore how the association of the new functions of existing technologies emerged, how the new functions were selected, and how the innovative products were transformed and pushed for new uses. The COPAN's Event Communication Manager was our main contact and provided access to the other informants. She acted as a facilitator, supporting the project selection and the identification of the key informants. In view of her strategic role, she was directly interviewed and also attended all the interviews to facilitate communication among the researchers and the key informants.

Table 2a
BMI: The first exapted technology.

		Original technology: FLOQSwabs®	New technology: MicroFLOQ®
Value creation	Value proposition	Intended use: Biological sample collection for different applications (genetics, forensics …) Key performance: high recovery of trapped sample, ergonomic	Intended use: DNA collection and rapid testing for Forensic applications (human identification) Key performance: ready to use, rapid testing
	Key partners	Mostly internal key activities, same suppliers	Criminelle de la Gendarmerie Nationale (IRCGN), same suppliers
	Key activities	Mass production (high automation)	Manual process (limited automation)
	Key resources	Human resources	Human resources
Value delivery	Customer relationship	Co-testing Product validation Post-sale service	Co-testing Product validation
	Customer segments	Medical, food, pharma	Forensic
	Channels	Genetic distributors (large network – high cooperation) Ad hoc communication	Forensic distributors (concentration – no cooperation)
Value capturing	Cost structure	R&D and production costs are spread over large volumes (scale economies)	Premium price allows recovering the high R&D and production costs
	Revenue structure	Price sensitive market, Negotiation/volume dependent	Negotiation/volume dependent (anticipated fees with an increasing granted minimum)

Table 2b
BMI: The second exapted technology.

		Original technology: WASP®	New technology: Cyclone™
Value creation	Value proposition	Intended use: modular, scalable, long-term system for the efficient automation of specimen processing in bacteriology laboratories. Key performance: automating all machinery activities	Intended use: fully automated system for quality control in the industries. Key performance: cutting costs, safer and more accurate analysis
	Key partners	Mostly internal key activities, same suppliers	Manufacturing companies, same suppliers
	Key activities	R&D	R&D, marketing, and sales
	Key resources	Human, technology	Human, technology, marketing, and sales
Value delivery	Customer relationship	Co-testing, co-promotion	Co-testing
	Customer segments	Bacteriology laboratories	Dairy, food, baby food, special nutrition, cosmetics manufacturing, pharma industry, service labs
	Channels	B2B distributors in microbiology business, ad hoc communication (trade fairs, microbiology conferences)	New B2B distributors in the food industry, B2C distribution, LinkedIn, word-of-mouth, trade fairs
Value capturing	Cost structure	Premium price allows recovering the high R&D and production costs	Premium price allows recovering the high R&D and production costs
	Revenue structure	Product feature dependent (pay per use)	Negotiation (technical assistance contracts)

The interviews were semi-structured and open-ended and lasted from one to 3 h. The interview protocol was designed to cover the main research questions but also leaving room for the respondents and researchers to extend the discussion to unexpected issues (Yin, 2003). In this way, we ensured respondents were free to interpret each question from their own perspective. In some cases, informal follow-up questions were sent to respondents via e-mail for further clarification.

3.5. Data analysis

As textual analysis is suited for the articulation of a narrative perspective of exaptation (Andriani and Cattani, 2016), the interviews were recorded to minimize data loss, and then transcribed for textual analysis and to identify the key processes with which COPAN innovates its business model through exaptation. Following the procedure that Easterby-Smith et al. (2012) suggest, we re-read the collected transcripts to familiarize ourselves with the data and for a preliminary assessment of the main dynamics emerging from both the secondary data and the interviews. Then, we expressed critical judgments on the collected data in light of the exaptation and BMI literature. As a result, we identified a set of concepts that the interviewees mentioned and that we considered relevant to understanding the topic under investigation, namely the "evolution" of existing technologies to new uses, the "co-development" with key partners, the "value creation" and "value capturing" dynamics. Finally, we searched for patterns and relationships among these concepts and developed an analytical framework to address our research question.

The integrity of data and the consequent robustness of the findings were ensured in several ways. First, by combining different perspectives, we triangulated the data from multiple sources (King et al., 1995; Marks, 2007) to enhance our understanding of the variable of interest and increase the validity of the overall findings (Stoker, 2011). Aggregating information, especially in case of biases among different sources, we adopted a "winner takes all" strategy (Leuffen et al., 2013), according to which only the most reliable source (usually interviews) was used to describe the phenomenon. Second, each researcher independently read the data collected. Then, the researchers intensively discussed their interpretations with the main purpose of reaching agreement on the inferences and activating the interaction between the theoretical concepts and the data collected. This allowed obtaining results appropriately grounded both theoretically and empirically.

4. Findings

In accordance with the aim of our study, in this section we provide a deeper understanding of exaptation as a way for innovating BM in the

SME context. Thanks to the case of COPAN, we demonstrate that exaptation – as articulated in the processes of functionality emergence, deliberate selection, and adaptation – contributes to BMI by allowing to innovate value creation, value delivery and value capturing dynamics. In this section, the findings are articulated and discussed according to the three processes, showing the impact of each process on BMI. Considering that we focus on two exapted applications, each sub-process is described referring to the two technologies examined.

4.1. Functionality emergence

During functionality emergence, a new function of an existing artifact emerges and, thus, creates exaptation. This process is usually preliminary to the deliberate selection, since it represents the "technological pre-adaptation as the part of the firm's technological knowledge base that is accumulated without anticipation (foresight) of its subsequent uses, though might later on prove valuable for alternative, yet unknown applications" (Cattani, 2006, p. 289).

In COPAN case, functionality emergence enabled to innovate the BM by means of value creation and value delivery specific mechanisms. Especially, functionality emergence led the company to the development of a new value proposition. This transition was triggered by activities and resources related to the company core technologies and supported by the partnership with potential customers suggesting a new idea.

COPAN was founded by Giorgio Triva in 1979. Since then, a 40 years-long story of dedication brought Copan from the small town of Mantua to exporting its know-how all over the world (COPAN, 2021). The original brand COPAN, which stands for the Italian acronym, "COadiuvanti per ANalisi", identified the core business of the company that was laboratory products. In 1982 COPAN begins to produce swabs and then changes the acronym to "COllection and Preservation for Analysis". In 1994 COPAN enters the automation sector with the invention of Ghibli for largescale production of its products. In 2003 Daniele Triva invents the FLOQSwabs® and patents the technology. Daniele Triva conceived the original idea of this technology after looking at the flocked surface of some clothes hangers, but its development was mostly internal. The basic idea was a stick with rolled up fiber allowing to make microbiological samples liquid and able to capture and hold the entire sample with no dispersion. This was essential for those microbiological screenings where bacteriological material is poor, since this system increases a lot the opportunities of finding pathogens.

In 2007 the first WASP® Walk-Away Specimen Processor for microbiology laboratories is conceived. In 2012 the first WASPLab™ Customizable specimen processing, culture incubation, and work-up system for Clinical Microbiology is installed. The development of WASP® is strongly related to FLOQSwabs® technology. Thanks to the clever combination of internal R&D and different technologies co-developed with selected partners operating mostly in robotics and textile industries, WASP® is developed as a system able to leverage all the benefits of sample collection of FLOQSwabs®. Indeed, by means of this new processing and incubation system, dispersion of microbiological samples is minimum, empowering the strengths of FLOQSwabs® technology too.

As usually happens in exaptation processes, the new functionalities emerged by chance, thanks to the prolific context unintentionally created by the company while accumulating experience in the original core-business that was then essential in converging with new functions.

> *"The open mindset of COPAN allows it to run into new experiences and relate with manifold other new businesses; the attitude to discover and to promote new technologies without knowing exactly how these will evolve, together with the desire to try something new, enable the company to be always up-to-date and to acquire competencies from everywhere"* (Application Specialist, COPAN NewLab Engineering)

Therefore, thanks to the activities and resources that COPAN accumulated in the core business of FLOQ technology, the emergence with an existing artifact was initially triggered by luck occurred when potential customers contacted COPAN. The French *Criminelle de la Gendarmerie Nationale* (IRCGN) contacted COPAN to develop a new DNA collection system simplifying the process(Ambers et al., 2017, 2018). The French Gendarmerie suggested developing a solution, but COPAN immediately realized that this idea was not feasible.

> *"The customer came asking to develop a tool for direct amplification of DNA. The idea of the customer was great, extraordinary and fantastic idea, very innovative, but the problem is the ramp-up, in other words, how can we produce these tools?"* (Business Development Manager, COPAN Italia S.p.A)

The functionality emergence in the Cyclone exaptation case was similar. Danone was searching for a company able to automate the quality control process of the yogurt product line and identified COPAN as a potential supplier due to its microbiology competencies.

> *"Danone was interested in starting their 'Ideal Factory' project to digitalize all the manufacturing processes, including the quality control … so they searched for a company able to do this thing ex novo, since this technology doesn't exist. They knew that there was something similar in hospitals and so, thanks to their distribution networks that are our suppliers, so an intricated commercial net, in the end they reached COPAN"* (Application Specialist, COPAN NewLab Engineering)

Despite the evident troubles in making the idea feasible, it was clear that in COPAN a new value proposition could appear, mostly thanks to the experience acquired in its core business.

The high recovery of trapped sample of FLOQSwabs® was, indeed, one of the key performance that in DNA collection – and in the further development of the exapted MicroFLOQ® technology – would have been most appreciated, albeit this was a technical feature developed for biological sample collection.

Similarly, modularity, efficient automation, and high quality of specimen processing characterizing WASP® technology were drivers of safer and accurate analysis as key performance in quality control of manufacturing industries guaranteed by the exapted Cyclone™ technology.

Once a new value proposition emerged, COPAN was so able to start addressing new customer segments, as the case of forensic segments in the case of MicroFLOQ® and dairy segments in the case of Cyclone™.

4.2. Deliberate selection

After a new function of an existing artifact emerged, the SME innovating by means of exaptation has to convert the existing artifact into an innovative commercial offers. This requires the construction of a dedicated architecture around an exapted module (Andriani and Carignani, 2014). At this stage, the SME looks for the best process to increase the perceived value of the exapted technology. While in functionality emergence the process is almost serendipitous, in deliberate selection higher level of foresight starts guiding the efforts (Cattani, 2006).

Deliberate selection in COPAN enabled to innovate the BM by means of specific value creation, value delivery, and value capturing mechanisms. During deliberate selection, existing activities and resources, as co-develoment with potential customers, were crucial in shaping the new value proposition. This enabled the company to concretely reach the new customer segments in the new businesses. Furthermore, consistently with the new value proposition, premium prices solutions became feasible, hence opening up to new revenue streams.

So, for both the exapted technologies, deliberate selection started when the customer asked for developing new solutions and COPAN, keeping in mind the customer's final goal and thanks to trial-and-error, was finally able to develop a new product from the existing technology.

Hence, starting from FLOQSwabs®, COPAN technicians applied a chemical treatment to the FLOQ fibers. The process of coating the swabs

in a chemical substance was well known to COPAN. What changed was the type of chemical reagent, but the manufacturing process was almost the same as for the FLOQs.

> *"So, keeping in mind the final goal, as to say having a tool for direct amplification starting from a sort of swab, we tried to abandon the idea suggested by the customer and we thought: 'we are good at producing FLOQSwabs, and we have already automated and industrialized the entire process, so why don't we use another type of chemical treatment and why don't we apply it to the FLOQ fibers?'"* (Business Development Manager, COPAN Italia S.p.A)

At the same, thanks to the hard work of COPAN's engineers, from COPAN automation technologies, Cyclone, as the fully automated yogurt quality control system was named, was developed as a dedicated architecture around the emerged function.

> *"So, in the case of Cyclone, the first competence clearly came from our WASP colleagues […] taking the know-how from COPAN's microbiology background, and bringing it into another business"* (Application Specialist, COPAN NewLab Engineering)

Specifically, in both COPAN's exapted technologies, conversion of the existing technology into new products favored BMI thanks to internal R&D with the support of different departments. As the size of the swab was proportional to the amount of reagent needed for FLOQ and affected the possibility of going straight to direct amplification, the aim was to reach the optimal number of fibers to collect the ideal amount of DNA with the right amount of chemical reagent.

> *"… this was not an innovation driven by a single department, but an innovation developed by two departments, each involved testing and retesting the results concurrently"* (Business Development Manager, COPAN Italia S.p.A.)

Furthermore, the prototyping and testing activities were supported by the ongoing customer relationships. COPAN supplied customers with the first prototypes, then tested and revised to meet their needs. This process was replicated until the product became definitive and fitting the customer' benefits.

> *"… they made the official validations, so they were our 'beta test' laboratory; once COPAN had realized and tested the product, the customer tested it again; each time fine-tuning was needed, we went back and adjusted the product until we reached the final product design"* (Business Development Manager, COPAN Italia S.p.A.)

Similarly, for Cyclone the conversion process was mostly internal. However, to capture the external competences needed to support conversion in the exapted technologies, the company recruited people with different backgrounds and expertise. These human resources were essential in determining the new product applications and hence meeting the customer needs.

Furthermore, despite microbiological similarities in WASP and Cyclone technologies, moving from microbiological analysis conducted into a hospital to the same analysis conducted by a company producing yogurt required changing the standard and regulations. In this sense, the customer relationship was essential to translate the existing technology into a new product.

> *"… both WASP and Cyclone deal similarly with microbiology […] the technology looks very similar, but is radically different. The processes are different and they follow different environmental conditions, the requirements in terms of sterilization such as controls and timing are regulated differently"* (Application Specialist, COPAN NewLab Engineering)

Therefore, in deliberate selection, thanks to the mentioned value creation mechanisms, the new value propositions were shaped, and this allowed to better reach new customers. Even though the technology the two products (FLOQSwabs and MicroFLOQ) share is almost the same (COPAN 4N6FLOQSwabs product description; COPAN 4N6FLOQSwabs product video; COPAN MicroFLOQ product description), thanks to the new architecture created around the exapted module, COPAN was so able to address rapid DNA testing as a different use. Furthermore, the key benefits perceived by the two targets differed – high recovery of the trapped sample, ergonomic shape for genetic applications, and a rapid and ready-to-use system for DNA collection for forensic applications (Hubac et al., 2018; Hubac et al., 2016).

Also for Cyclone (Cyclone product description; COPAN Cyclone product video), even though sharing the WASP technology (COPAN WASP product description; COPAN WASP product video), the new product is targeted towards a different customer segment, namely the dairy industry vs. microbiology labs. Furthermore, the main sources of customer value also changed. Indeed, while for microbiology labs the main benefit is automating activities, for the dairy industry, savings in terms of full-time equivalent (FTE), high level of accuracy, and safety are essential.

4.3. Adaptation

Adaptation of the exapted technology is the process whereby the new product based on an emergent functionality, gets transformed on the basis of users' selection, and where users' selection turns the functionality embedded in the new product/service into a market-driven function (Andriani and Carignani, 2014).

Adaptation in COPAN enabled to innovate the BM by means of specific value creation, value delivery, and value capturing mechanisms. During adaptation, exploiting existing activities and resources, further developing marketing and sales activities as co-develoment with new customers and with potential new customer were crucial in consolidating the new value proposition. At the same time, in order to reach the new customers and identifying new ones, ad hoc distribution channels were then created. Last, thanks to new segments expansion and to the development of modular solutions the revenue streams approaches previously developed were consolidated.

During adaptation, the company aimed at scaling up the business by exploting co-development relationship with new customers and developing new ones with potential customers. Engaging the customers was a good opportunity for COPAN to develop the solutions they sought, but also recombining and testing new applications (Rosso et al., 2018). In the case of Cyclone, after Danone commissioned the development of the automation system, it was immediately evident that the machinery had great potential, analyzing yogurt or milk, as well as mascara and medicines. Although the main function of this technology is detecting bacteria in materials that are in contact with the human body, the business applications might radically differ. Hence, when developing the project for Danone, COPAN started to grasp the novel potential applications of the technology to new customer segments.

> *"… in 2017, it was like 'Ok, let's make it for Danone', now we thank Danone for giving us the opportunity to develop a system that is potentially able to do way more"* (Application Specialist, COPAN NewLab Engineering)

However, as the investments in exaptation are considerable, COPAN searched for new applications with no radical changes to the product. Given that the experience developed in a specific business often cannot be replicated in other businesses, this creates some challenges when reusing the same exapted technology. Nevertheless, distributing samples and collaborating with other labs all over the world opened up new business opportunities, extending the same function to slightly different applications.

> *"… we noticed that in distributing samples and collaborating with other laboratories all over the world, every laboratory perceived MicroFLOQ differently. For example, in America, according to a forensic analysis*

guru, MicroFLOQ is a system for subsampling" (Business Development Manager, COPAN FLOQ Technologies)

Specifically, MicroFLOQ was promoted to new potential customers to test it and search for new applications. However, given that customers have their own protocols, COPAN focused on the easiest application (Castriciano et al., 2017) that the market can then freely select.

"… you are in front of manifold applications (of the same product) and then they (the customers) tell you 'It doesn't work […]' I can tell you that I validated it as it is, but you can decide to make it work differently with our support" (Business Development Manager, COPAN FLOQ Technologies)

Furthermore, if the application proves unsatisfactory, customers are invited to change the protocol and retest the product. At the validation stage, changing the product is the last option, as this would lead to new product versions, requiring additional investments. In this sense, modularity in original product development, even though unintentionally developed, revealed to be a critical activity while reaching new customers with adapted solutions.

"This strategy was then revealed as fundamental for the automation progress, as the architecture developed in 2007 is the same of the one in 2018 and maybe it will be the same forever … we entered the market in 2007 claiming that we would have the slides module … in 2007 maybe Daniele (the entrepreneur) really didn't know what we were talking about, but, making it, we were able to also satisfy the customers that in 2008 bought the machinery simply including some 'software pieces', as the architecture and the complexity of the R&D that we promote is based on compatibility as a 'must'" (CSO - Chief Strategy Officer, COPAN WASP)

On the other side, in COPAN case, adaptation required investing in further developing commercial and marketing activities aimed at promoting the company's new products (COPAN, 2017; COPAN event portal, 2019).

When the product gets transformed on the basis of users' selection, creating new distribution channels was then crucial, as the forensics sector required different distribution channels. At the same, in the automation system exaptation, the distribution and communication channels to reach markets other than microbiology labs differ radically. Even though COPAN used to take advantage from the distribution system adopted in its core business, it is conscious that these new businesses require ad hoc distribution channels.

"Even though we tried to use the same distribution channels because of the consolidated relationships, we immediately realized that access to the new market required the development of relationships with new distributors operating in the food industry" (Business Development Manager, COPAN Group)

"*While in FLOQSwabs the business distribution system is composed of a mass of distributors with whom we have a tight relationship, in the case of MicroFLOQ, the distribution system is centralized in a single large multinational that is not particularly cooperative"* (Strategic Project Manager, COPAN Group)

Similarly, for the marketing and communication channels:

"Trade fairs are really, really selective, in my opinion, they are industry-specific […] I went to a cosmetics fair with my wonderful machinery and people passing through asked 'What does this machinery make? Does it produce lipstick?'. This is just to say that outside our original business, the machinery is out of context and requires specific investments to be promoted and reach the right customers" (Application Specialist, COPAN NewLab Engineering)

Last, since the high costs of new product development generally decreased – as a result of new segments expansion and of modular solutions adoption – premium pricing solutions previously developed can thus be consolidated.

5. Discussion

The findings reported in the previous section show that exaptation in COPAN represented a viable, radip and efficient way for innovating its BM, triggering the main mechanisms of value creation, value delivery, and value capturing. In this section we discuss how the different stages of exaptation – as to say – functionality emergence, deliberate selection, and adaptation – may contribute to BMI in SMEs. To this aim, we described the specific mechanisms that functionality emergence, deliberate selection, and adaptation activate in terms of value creation, value delivery and value capturing (see Table 3). Even though not generalizable, as based on the evidences of a single case study, we believe that this systematization could represent a frame for guiding SMEs taking into consideration exaptation as an option to renew their BMs.

Following the articulation of findings section, and the consequent articulation of Table 3, discussion will go through the three processes of exaptation evidencing how each one can activate new mechanisms of value creation, delivery and capturing.

An exaptation process starts when a new functionality is associated to an existing artifact (Andriani and Carignani, 2014). This new functionality, often emerging serendipitously (Merton and Barber, 2004), creates the premises for developing new value propositions, thus approaching to new potential customer segments as the basis of a new BM. So, the sources of new value creation opportunities surely lie in the new value proposition, but key partnerships, key activities and key resources that the company has been able to develop along the time actually represent the fertile context in which a new function, and thus a related new value proposition, can born. In other words, in the real essence of functionality emergence, as to say – the technological pre-adaptation accumulated without foresight (Cattani, 2006) – the actual sources of new value creation can be traced.

More precisely, regarding key partners, tieing co-development relationships with selected actors, usually operating in industries other than the company core business was proved valuable when identifying, assimilating, and applying external knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002) from different domains (Schweisfurth and Raasch, 2018), hence developing new unknown applications of the original technology. Otherwise, what emerged from our case study was the ability of sustaining these external relationships with an internal pre-existing knowledge (Cohen and Levinthal, 1990).

The co-development relationship with the potential new customer operating in businesses other than the company core business, favored the emergence of the idea that was further developed and transformed into a new product in the following steps. This was so the starting point for the new value proposition development as the new potential customer segments identification, showing the connection between functionality emergence and value delivery mechanisms.

Albeit customer relationship was essential in starting the process, exaptation in COPAN was not just a reaction to customer request, but rather the result of a strategic and proactive response to this contingency, surely favored by some SME's key activities and resources – namely internal R&D, human and intellectual resources. This was probably due to the serendipitous nature of functionality emergence, as the result of the combination of search (direct effort), contingency (favorable accidents), and prior knowledge (Dew, 2009). Despite the direct effort – comparable to the well known entrepreneurial alertness (Kirzner, 1979, 1999; McMullen and Shepherd, 2006; Tang et al., 2012) that probably favored the process, COPAN proceeded without any certainties about the existence of a market for his new potential function, similarly to what happens in effectuation (Sarasvathy, 2001; Read and Sarasvathy, 2005). Futhermore, the exaptation solution development and especially the customer request acting as a contingency, make exaptation in COPAN aligned to need-solution pair concept (Von Hippel and Von Krogh, 2016), where, as a result of informal problem solving

Table 3
A frame of BMI through exaptation.

	Value creation				Value delivery			Value capturing	
	Key partners	*Key activities*	*Key resources*	*Value proposition*	*Customer Relationship*	*Customer Segments*	*Channels*	*Cost Structure*	*Revenue Streams*
Functionality Emergence Association of a new functionality with an existing artifact (or component of it) which is often serendipitous.	Developing supply partnership with raw materials suppliers and co-development partnerships with selected actors operating in other industries providing technological solutions. Starting co-development (idea generation) with potential customers operating businesses other than the company core business.	Developing production and R&D activities (mass production – high automation; internal R&D; modularity in product development).	Developing human resources (integrating cross-functional core competences with competences of other but related businesses). Developing intellectual resources (patents of the original technologies).	Consolidating original value proposition (intended use, and key performance in the original core business) Starting to glimpse a new value proposition.	Strengthening relationships with key customers in the core business for capturing new functionality insights (co-testing, product validation, co-promotion, post-sales service). Starting developing relationship with potential customers operating businesses other than the company core business (idea generation).	Focusing on original customer segments. Starting to find new customer segments in businesses other than the company core business.	Developing channels for reaching original segments (distribution network with high cooperation; ad hoc communication by channels addressed to the core business)	Acting on R&D and production costs spread over large volumes benefiting from scale economies. Acting on developing modular solutions to payback the high R&D investments.	Searching for solutions for price sensitive market (negotiation/ volume dependent contracts). Searching for solutions for customized offerings (product feature dependent, pay per use contracts).
Deliberate Selection of the new functionality as the basis for a new product/service. The phase may require the construction of a dedicated architecture around an exapted module.	Exploiting supply partnership with raw materials suppliers. Continuing co-development (co-testing, and product validation) with key potential customers operating businesses other than the company core business.	Exploiting production and R&D activities (manual process – limited automation; internal R&D).	Exploiting existing human, and intellectual resources. Developing new human resources integrating competencies from businesses other than the company core business. Developing new intellectual resources (patents of the new technologies).	Shaping new value proposition (intended use, and key performance adapted to the new segment).	Weakening relationship with key customer in the new business for leaving room to internal development (supporting co-testing, product validation).	Reaching new customer segments in businesses other than the company core business.	Exploiting existing channels (distribution network with high cooperation; ad hoc communication by channels addressed to the core business)	Fixing a premium price to recover the high R&D and production costs due to new product development.	Searching for solutions consistent with new value proposition (negotiation/ volume dependent contracts).
Adaptation The process whereby the new product/ service, based on an emergent functionality, gets transformed on the basis of users' selection. Users' selection turns the functionality embedded in the new product/service into a market-driven function, which then controls the adaptive trajectory of the technology.	Exploiting co-development (customized/ modular solutions) with key customers operating in businesses other than the company core business. Starting new co-development (co-testing, product validation) with other customers in the new business, and in businesses other than the company core business.	Exploiting production and R&D activities (manual process – limited automation; internal R&D; modularity in product development). Developing marketing and sales activities to reach the new segments.	Exploiting new human resources integrating competencies from businesses other than the company core business. Exploiting new intellectual resources (patents of the new technologies).	Consolidating new value proposition (intended use, and key performance adapted to the new segment and to new potential segments in the new business).	Strengthening relationship with key new customer and other customers in the new business for fitting new customer requirements (co-testing, product validation).	Consolidating new customer segments. Searching for new customers in the new business, and in businesses other than the company core business.	Developing new channels to reach the new customer segments (new B2B and B2C distribution network, ad hoc communication by channels addressed to the new business).	Exploiting modularity to balance the high costs of new product development. Benefiting from decreasing costs due to new segment expansion.	Consolidating new solutions consistent with new value proposition (negotiation/ volume dependent contracts, technical assistance contracts).

approach, a need and a solution are often discovered together, while problem identification and formulation come after. However, no new function – and thus no new solution – could emerge without the knowledge acquired when the first core technologies were patented by COPAN, thanks to internal R&D activity (Arora et al., 2016) and to cross-functional human resources (Smith et al., 2005; Toh and Polidoro, 2013). These key resources and activities were then crucial in making the exaptation process mostly orchestrated by the SME, thus avoiding the risk of being held captive by its customers, even staying close to him (Christensen, 2013).

Around the new emerged functionalities, a new product has to be developed. The exaptation process now starts to be less serendipitous and characterized by higher levels of foresight (Cattani, 2006). Thus, this transition from the new functionalities to a new product in deliberate selection makes the new value proposition clearer. The new intended use and the key performances are now shaped to concretely reach the new markets glimpsed during the previous step. So, value creation and value delivery mechanisms are triggered, similarly to what happened in functionality emergence. Since the new value proposition is consolidated and the new potential markets become actual segments, new revenue streams open up, thus making new value capturing dynamics appear.

More precisely, in terms of key partners, co-development with key potential customer operating in new businesses, distant from the company core business, was further developed, even though focused in this step on co-testing and product validation. This co-development was then supported by internal R&D, as by existing human and intellectual resources. Thus, further developing external relationships as exploiting internal activities and resources were crucial to access and combine existing internal knowledge and competencies (Ettlie and Kubarek, 2008; Kapoor and Adner, 2012), and to meet customer needs (Grimpe and Sofka, 2009; Hoffmann, 2007; Sofka and Grimpe, 2010).

Additionally, as deliberate selection requires new knowledge to adapt the existing technology to new segments, COPAN recruited new human resources from other businesses. Integrating different knowledge domains to favor knowledge-sharing (Grant, 1991; Kogut and Zander, 1992) proved fruitful in further developing new applications from existing knowledge. However, harnessing and coordinating knowledge (Kogut and Zander, 1992) from multiple individuals to develop the new products, did not require structured and formalized approaches to stimulate social interaction (Hargadon and Sutton, 1997; Fleming, 2002; Grigoriou and Rothaermel, 2014).

While making the value proposition clearer and new customer segments concrete, fixing a premium price to recover the high R&D and production costs due to new product development was now possible. Pricing and contract solutions were thus customized (negotiations and volume dependent contracts), consistently with the new intended use and key performances guaranteed by the exapted solutions.

After the new architecture is created around the exapted model, the product evolves on the basis of users' selection (Andriani and Carignani, 2014). While following this market-driven trajectory, the new value proposition further consolidates, and new customers in the new business, other than the key customers recommending the new applications, arise. Therefore, value creation at this stage is mostly based on the co-development relationships (focused on co-testing and product validation). Since penetrating these new market segments require the development of new activities, such as ad hoc marketing and sales, exploiting existing activities (especially modularity in R&D) as the recently developed human and intellectual activites are essential for guaranteeing value creation dynamics. Furthermore, new segment expansion and modularity in new product development become the main drivers for balancing the high carried investments and, combined with new pricing and contract solutions, open up to new value capturing streams.

Entering new business sectors thanks to the exapted technologies require investing in new distribution channels and establishing new customer relationships. Even though for SMEs like COPAN leveraging the existing distribution channels and communication strategies to reach the new customers could represent the less expensive solution, new investments are necessary to considerate the new business. As a result, acquiring specialized complementary assets (Teece, 1998) to manage the exapted technologies would ensure against imitation and provide a source of competitive advantage (Ceccagnoli et al., 2010; Ceccagnoli and Hicks, 2013).

However, as investments in exaptation are often high, SMEs like COPAN often tend to develop new applications with no radical changes to the product. Because reproducing the exapted technology requires slightly adapting the core product to better reach the new targets, combining existing technological component parts, assemblies, and methods (Arthur, 2007; Fleming, 2001) using the modularity approach (Henderson and Clark, 1990), could prove a valuable solution for capturing value in adaptation processes.

6. Conclusions

Prior research has emphasized the pressing challenge for SMEs to exploit, define, and implement an innovative BM to remain competitive. Anecdotal evidence shows that innovative BMs are closely linked to exaptation, observed as an important mechanism to use resources in ways for which they were not originally intended (Dew et al., 2004; Cattani, 2006). This might be particularly fruitful for SMEs that have some difficulties in "thinking outside the box" (Gassmann et al., 2013, p. 2), but at the same time, specific advantages in developing new products and businesses (Vanhaverbeke, 2017). Prior BMI studies have mainly focused on large firms and start-ups, but seldom on SMEs, and to the best of our knowledge, no studies have hitherto focused explicitly on the processes to be implemented to sustain BMI through exaptation in SMEs.

This study has investigated how SMEs might innovate their BM through exaptation. In analyzing the exaptation process in SMEs, we advance knowledge on how and why exaptation favors BMI. In addition, our study highlights how each stage of exaptation process contributes to BMI by means of value creation, value delivery and value capturing.

This research has important implications for scholars. First, we contribute to the existing management literature by focusing on BMI as an important phenomenon that requires further conceptualizations and investigations (Foss and Saebi, 2017). In this respect, the study sheds new light on how firms might innovate their business offerings through exaptation, introducing a frame that explains and describes the main contributions to BMI of three key exaptation processes. In addition, this study contributes to the literature focused on how SMEs struggle with innovating their business model (Vanhaverbeke, 2017) by proposing exaptation as a mechanism that can stimulate the use and combination of existing resources in a new function or application domain. Therefore, exaptation can be considered as a mechanism of technological innovation leading to BMI more rapidly and efficiently than deliberate technological innovation. This makes the process of BMI for SMEs less time and resource consuming.

Exaptation may support SMEs in exploring innovative business opportunities/trajectories and glimpsing different ways of creating, delivering and capturing value by facing their technological and organization weaknesses in the innovation process. More precisely, when a new functionality emerges, SMEs act on value creation, as this stage specifically triggers the birth of a new value proposition and the consequent ability to find new customer segments. In this stage, co-development with new potential customers as key activities and resources accumulated along the time all contribute to value creation dynamics. When converting the existing artifact into an innovative product (deliberate selection), SMEs activate value creation and value delivery mechanisms and start developing new value capturing dynamics. In particular, further co-development, supported by internal R&D, as by existing human and intellectual resources contribute to define the new value proposition in line with the new customer segment.

Furthermore, when the new value proposition further consolidates, and new customers in the new business arise, new activities, such as ad hoc marketing and sales, need to be developed for delivering value. New segment expansion and modularity in new product development are now the main drivers for opening up to new value capturing streams.

The present study also has implications for practitioners. First, to face the challenges and difficulties characterizing the exploitation, definition, and implementation of an innovative BM, SMEs might adopt an exaptation strategy that can facilitate the exploration of internal and external opportunities, and the experimentation with and development of available resources in original and unexpected ways. As a result, the exaptation strategy may stimulate the exploration of unconceived and profitable business opportunities. Second, while recommending new ways to innovate their offering, the study identifies how each step of the process can contribute to BMI. The processes of exaptation phenomenon have specific effects on each BMI mechanism. With reference to the BM canvas, functionality emergence, deliberate selection, and adaptation are all exaptation processes necessary to create, capture, and deliver value. Our findings show that these three processes impact value creation – the first two contributing to sourcing (functionality emergence) and shaping (deliberate selection) a new value proposition. This creates the premises for finding (functionality emergence) and reaching (deliberate selection) new customer segments, thus impacting value delivery mechanisms. So, when the new value proposition is shaped and the new potential segments come true, new distribution and communication channels are necessary to maintain a competitive advantage in the new business (adaptation). Entering a new business, on the other side, and consolidating the positioning in a new market (adaptation) opens up to new pricing and contract solutions, leading to new value capturing dynamics.

This study also has some limitations that provide avenues for future research. First, our analysis is based on a single case study, albeit including multiple projects. Hence, scholars could extend the generalization of our findings by conducting empirical investigations. In addition, the case study was selected as representative of the phenomenon under investigation. However, as a future research direction, other multiple technology studies in SMEs innovating their BM through exaptation – in different businesses – might strengthen the findings from our study.

Second, this study focuses on exaptation without considering traditional new product development. Therefore, comparing exaptation and new product development without earlier technologies to build on might help clarify some critical aspects. Moreover, comparing this case study with other SMEs could be fruitful, as we are aware that COPAN cannot be considered a traditional SME given the number of employees and group structure.

Third, even though we tried to make clear how the different stages of exaptation identified in the literature impact on BMI, actually capturing exaptation processes still remains a tough task. This is particularly true for functionality emergence, due to the unintentional and serendipitous nature of this process.

Finally, albeit our paper identifies exaptation as a viable, rapid and efficient way for SMEs to innovate their BM, we also recognize that this is not the unique pathway to BMI in SMEs. Changes in markets and consumer behavior are surely important to identify profitable opportunities for SMEs, but just in case these are steady and slow. Similarly, changes in government policies at the business environment could represent another important driver of BMI in SMEs, but it is well-known how fast and unpredictable shifts in market demand as in regulations can seriously threaten SMEs' competitive positioning. Likewise, the emergence of new and disruptive technologies offers good opportunities for SMEs searching for innovating their BM, but only under several conditions (Vanhaverbeke, 2017) (i.e. pursuing markets that are too small to interest large companies, or collaborating with a range of knowledge partners).

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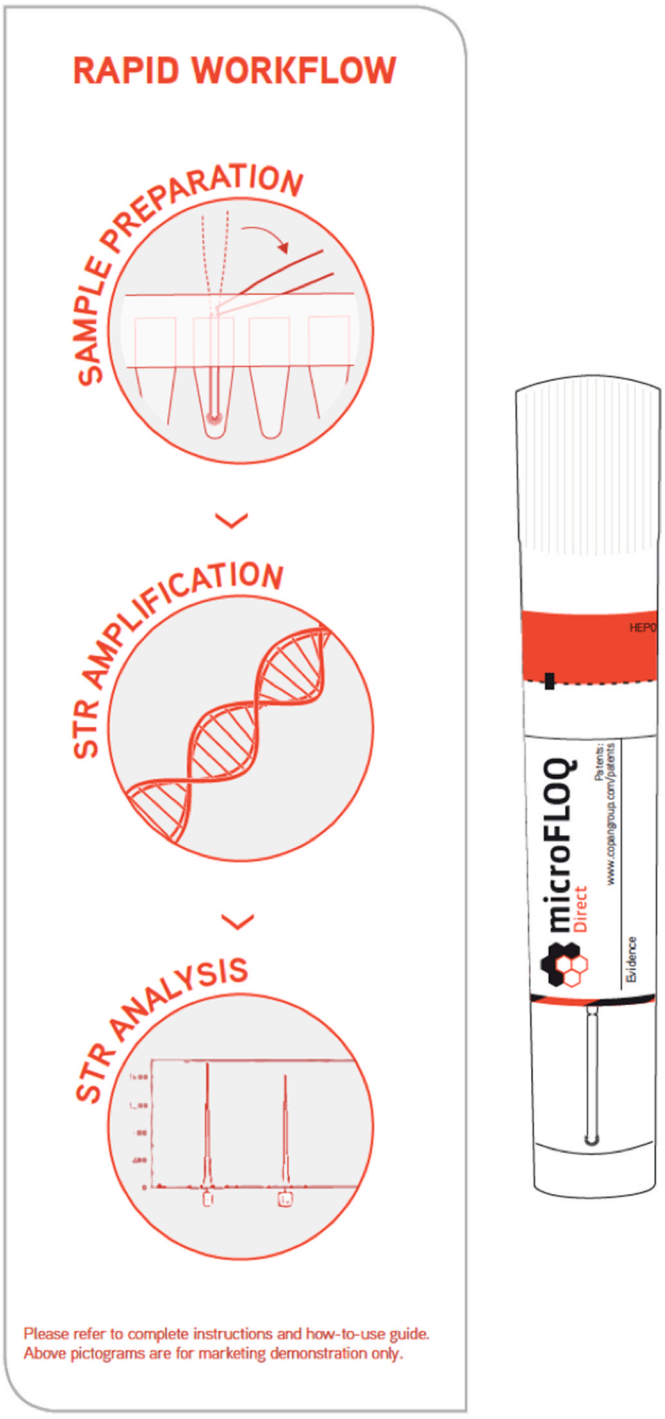
Appendix 1

MicroFLOQ® technology description.



Source: https://mediadelivery.copangroup.com/wp-content/uploads/2021/06/Brochure-microFLOQ.pdf.

Appendix 2

Cyclone™ technology description.

Source: https://mediadelivery.copangroup.com/wp-content/uploads/2021/06/Brochure-Cyclone.pdf.

References

Ambers, A., Novroski, N., Wiley, R., Budowle, B., 2017. Front end DNA analysis enhancements: collection, recovery, sample integrity and improved workflow. Forensic Sci. Int. 277, 145, 145.

Ambers, A., Wiley, R., Novroski, N., Budowle, B., 2018. Direct PCR amplification of DNA from human bloodstains, saliva, and touch samples collected with microFLOQ® swabs. Forensic Sci. Int. Genet. 32, 80–87.

Amit, R., Zott, C., 2012. Creating Value through Business Model Innovation. Special Collection Top 10 Lessons on Strategy. MIT Sloan Management Review. http://marketing.mitsmr.com/PDF/STR0715-Top-10-Strategy.pdf#page=38.

Andriani, P., Ali, A., Mastrogiorgio, M., 2017. Measuring exaptation and its impact on innovation, search, and problem solving. Organ. Sci. 28 (2), 320–338.

Andriani, P., Carignani, G., 2014. Modular exaptation: a missing link in the synthesis of artificial form. Res. Pol. 43 (9), 1608–1620.

Andriani, P., Cattani, G., 2016. Exaptation as source of creativity, innovation, and diversity: introduction to the special section. Ind. Corp. Change 25 (1), 115–131.

Arora, A., Cohen, W.M., Walsh, J.P., 2016. The acquisition and commercialization of invention in American manufacturing: incidence and impact. Res. Pol. 45 (6), 1113–1128.

Arthur, W.B., 2007. The structure of invention. Res. Pol. 36 (2), 274–287.

Baden-Fuller, C., Haefliger, S., 2013. Business models and technological innovation. Long. Range Plan. 46 (6), 419–426.

Barley, S.R., 1990. The alignment of technology and structure through roles and networks. Adm. Sci. Q. 35 (1), 61–103.

Beltagui, A., Rosli, A., Candi, M., 2020. Exaptation in a digital innovation ecosystem: the disruptive impacts of 3D printing. Res. Pol. 49 (1), 103833.

Bonifati, G., Villani, M., 2013. Exaptation in innovation processes: theory and models. In: Handbook of Economic Organization. Edward Elgar Publishing.

Brunswicker, S., Vanhaverbeke, W., 2015. Open innovation in small and medium-sized enterprises (SMEs): external knowledge sourcing strategies and internal organizational facilitators. J. Small Bus. Manag. 53 (2), 1241–1263.

Casadesus-Masanell, R., Zhu, F., 2013. Business model innovation and competitive imitation: the case of sponsor-based business models. Strat. Manag. J. 34 (4), 464–482.
Castriciano, S., Rosso, M., Squassina, A., Hubac, S., Mori, M., Pierrini, G., 2017. MicroFLOQ® Device Allows Real Time Crime Scene Investigations. Retrieved Nov 12, 2019, from. https://products.copangroup.com/index.php/educational-center/scientific-studies/2017.
Cattani, G., 2006. Technological pre-adaptation, speciation, and emergence of new technologies: how Corning invented and developed fiber optics. Ind. Corp. Change 15 (2), 285–318.
Cattani, G., Malerba, F., 2021. Evolutionary approaches to innovation, the firm, and the dynamics of industries. Strat. Sci. 6 (4), 265–289.
Cattani, G., Mastrogiorgio, M. (Eds.), 2021. New Developments in Evolutionary Innovation: Novelty Creation in a Serendipitous Economy. Oxford University Press.
Ceccagnoli, M., Graham, S.J., Higgins, M.J., Lee, J., 2010. Productivity and the role of complementary assets in firms' demand for technology innovations. Ind. Corp. Change 19 (3), 839–869.
Ceccagnoli, M., Hicks, D., 2013. Complementary assets and the choice of organizational governance: empirical evidence from a large sample of US technology-based firms. IEEE Trans. Eng. Manag. 60 (1), 99–112.
Chesbrough, H., 2007. Business model innovation: it's not just about technology anymore. Strat. Leader. 35 (6), 12–17.
Chesbrough, H., 2010. Business model innovation: opportunities and barriers. Long. Range Plan. 43 (2–3), 354–363.
Ching, K., 2016. Exaptation dynamics and entrepreneurial performance: evidence from the internet video industry. Ind. Corp. Change 25 (1), 181–198.
Christensen, C.M., 2001. Competitive advantage. MIT Sloan Manag. Rev. 42 (2), 105–109.
Christensen, C.M., 2013. The Innovator's Dilemma: when New Technologies Cause Great Firms to Fail. Harvard Business Review Press.
Cohen, W.M., Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. Adm. Sci. Q. 35 (1), 128–152.
COPAN, 2017. MicroFLOQ roadmap.
COPAN, 2021. COPAN Company Profile, Innovating Together. A history of people-focused innovation.
COPAN Cyclone product video. https://products.copangroup.com/index.php/automation/copan-promotional/item/670-cyclone-copan. (Accessed 12 November 2019).
COPAN WASP product description. https://products.copangroup.com/index.php/products/lab-automation/wasp. (Accessed 12 November 2019).
COPAN WASP product video. https://products.copangroup.com/index.php/automation/copan-promotional/item/653-wasplab-promotional-video. (Accessed 12 November 2019).
COPAN 4N6FLOQSwabs product description. https://products.copangroup.com/index.php/products/genetics/4n6-floqswabs-genetics. (Accessed 12 Nov 2019).
COPAN 4N6FLOQSwabs product video. https://products.copangroup.com/index.php/consumables/copan-educational/item/669-how-to-use-copan-4n6-floqswabs-genetics-4504c. (Accessed 12 November 2019).
COPAN MicroFLOQ product description. https://products.copangroup.com/index.php/products/forensics/microfloq-direct. (Accessed 12 November 2019).
https://www.copangroup.com/news-events/item/53-copan-and-toolsgroup-create-an-ai-driven-supply-chain-to-fight-covid-19, COPAN news-events, 2020–. (Accessed 25 June 2021).
https://www.copangroup.com/events/#00827e, COPAN event portal, 2019–. (Accessed 12 November 2019).
https://www.copangroup.com, COPAN website, 2020–. (Accessed 12 November 2019).
COPAN Cyclone product description. https://products.copangroup.com/index.php/products/lab-automation/cyclone. (Accessed 12 November 2019).
Davis, J.P., Eisenhardt, K.M., 2011. Rotating leadership and collaborative innovation: recombination processes in symbiotic relationships. Adm. Sci. Q. 56 (2), 159–201.
Davis, J.P., Eisenhardt, K.M., Bingham, C.B., 2007. Developing theory through simulation methods. Acad. Manag. Rev. 32 (2), 480–499.
De Reuver, M., Bouwman, H., Haaker, T., 2013. Business model roadmapping: a practical approach to come from an existing to a desired business model. Int. J. Innovat. Manag. 17 (1), 1340006.
Dew, N., 2009. Serendipity in entrepreneurship. Organ. Stud. 30 (7), 735–753.
Dew, N., Sarasvathy, S.D., 2016. Exaptation and niche construction: behavioral insights for an evolutionary theory. Ind. Corp. Change 25 (1), 167–179.
Dew, N., Sarasvathy, S.D., Venkataraman, S., 2004. The economic implications of exaptation. J. Evol. Econ. 14 (1), 69–84.
Easterby-Smith, M., Thorpe, R., Jackson, P.R., 2012. Management Research. Sage.
https://eccellenzedimpresa.it/, Eccellenzedimpresa, 2020–. (Accessed 25 June 2021).
Eisenhardt, K.M., 1989. Building theories from case study research. Acad. Manag. Rev. 14 (4), 532–550.
Eisenhardt, K.M., Graebner, M.E., 2007. Theory building from cases: opportunities and challenges. Acad. Manag. J. 50 (1), 25–32.
Ettlie, J.E., Kubarek, M., 2008. Design reuse in manufacturing and services. J. Prod. Innovat. Manag. 25 (5), 457–472.
Fleming, L., 2001. Recombinant uncertainty in technological search. Manag. Sci. 47 (1), 117–132.
Fleming, L., 2002. Finding the organizational sources of technological breakthroughs: the story of Hewlett-Packard's thermal ink-jet. Ind. Corp. Change 11 (5), 1059–1084.
Foss, N.J., Saebi, T., 2017. Fifteen years of research on business model innovation: how far have we come, and where should we go? J. Manag. 43 (1), 200–227.
Foss, N.J., Saebi, T., 2018. Business models and business model innovation: between wicked and paradigmatic problems. Long. Range Plan. 51 (1), 9–21.
Foss, N.J., Stieglitz, N., 2015. Business model innovation: the role of leadership. In: Foss, N.J., Saebi, T. (Eds.), Business Model Innovation: the Organisational Dimension. Oxford University Press, Oxford.
Garud, R., Gehman, J., Giuliani, A.P., 2016. Technological exaptation: a narrative approach. Ind. Corp. Change 25 (1), 149–166.
Garud, R., Gehman, J., Giuliani, A.P., 2018. Serendipity arrangements for exapting science-based innovations. Acad. Manag. Perspect. 32 (1), 125–140.
Gassmann, O., Frankenberger, K., Csik, M., 2013. Revolutionizing the business model. In: Gassmann, O., O, Schweitzer, F. (Eds.), Management of the Fuzzy Front End of Innovation. Springer International Publishing, Switzerland.
https://www.giornaledibrescia.it/economia/oscar-dei-bilanci-le-6-aziende-bresciane-premiate-1.3646534, GDB, 2021–. (Accessed 3 December 2021).
Gould, S.J., Vrba, E.S., 1982. Exaptation - a missing term in the science of form. Paleobiology 8 (1), 4–15.
Grant, R.M., 1991. The resource-based theory of competitive advantage: implications for strategy formulation. Calif. Manag. Rev. 33 (3), 114–135.
Grigoriou, K., Rothaermel, F.T., 2014. Structural microfoundations of innovation: the role of relational stars. J. Manag. 40 (2), 586–615.
Grimpe, C., Sofka, W., 2009. Search patterns and absorptive capacity: low-and high-technology sectors in European countries. Res. Pol. 38 (3), 495–506.
Hargadon, A., Sutton, R.I., 1997. Technology brokering and innovation in a product development firm. Adm. Sci. Q. 42 (4), 716–749.
Henderson, R.M., Clark, K.B., 1990. Architectural innovation: the reconfiguration of existing. Adm. Sci. Q. 35 (1), 9–30.
Ho, Y., Fang, H., Hsieh, M., 2011. The relationship between business-model innovation and firm value: a dynamic perspective. World Acad. Sci. Eng. Technol. 77 (5), 63.
Hoffmann, W.H., 2007. Strategies for managing a portfolio of alliances. Strat. Manag. J. 28 (8), 827–856.
Hubac, S., Mori, M., Dominguez, R., Pierrini, G., 2016. GendSAG/MicroFLOQ™: an innovative DNA collection tool on crime scene for direct and fast analysis. Retrieved Nov 12, 2019, from. https://products.copangroup.com/index.php/educational-center/scientific-studies.
Hubac, S., Robvieux, F., Tesio, P., 2018. Consume Less and Obtain Directly More: the Innovative microFLOQ® Breaks Forensic DNA Profiling Codes. Retrieved Nov 12, 2019, from. https://products.copangroup.com/index.php/educational-center/scientific-studies.
Jacobides, M.G., Winter, S.G., 2012. Capabilities: structure, agency, and evolution. Organ. Sci. 23 (5), 1365–1381.
Jick, T.D., 1979. Mixing qualitative and quantitative methods: triangulation in action. Adm. Sci. Q. 24 (4), 602–611.
Johnson, M.W., Christensen, C.M., Kagermann, H., 2008. Reinventing your business model. Harv. Bus. Rev. 86 (12), 57–68.
Kapoor, R., Adner, R., 2012. What firms make vs. what they know: how firms' production and knowledge boundaries affect competitive advantage in the face of technological change. Organ. Sci. 23 (5), 1227–1248.
Keen, P., Qureshi, S., 2006. Organizational transformation through business models: a framework for business model design. In: Proceedings of the 39th Annual Hawaii International Conference on System Sciences, vol. 8. IEEE, p. 206b, 206b.
King, G., Keohane, R.O., Verba, S., 1995. The importance of research design in political science. Am. Polit. Sci. Rev. 89, 475–481.
Kirzner, I.M., 1999. Creativity and/or alertness: a reconsideration of the Schumpeterian entrepreneur. Rev. Austrian Econ. 11, 5–17.
Kirzner, I.M., 1979. Perception, Opportunity, and Profit. University of Chicago Press, Chicago.
Kogut, B., Zander, U., 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. Organ. Sci. 3 (3), 383–397.
La Porta, C., Zapperi, S., Pilotti, L., 2020. Understanding Innovation through Exaptation. Springer.
Lee, S.M., Olson, D.L., Trimi, S., 2012. Co-innovation: convergenomics, collaboration, and co-creation for organizational values. Manag. Decis. 50 (5), 817–831.
Leuffen, D., Shikano, S., Walter, S., 2013. Measurement and data aggregation in small-n social scientific research. Eur. Polit. Sci. 12 (1), 40–51.
Lindgreen, A., Hingley, M., Stavros, C., Westberg, K., 2009. Using triangulation and multiple case studies to advance relationship marketing theory. Qual. Mark. Res. Int. J. 12 (3), 307–320.
Lindgren, P., 2012. Business model innovation leadership: how do SME's strategically lead business model innovation? Int. J. Bus. Manag. 7 (14), 53–66.
Markides, C., Charitou, C.D., 2004. Competing with dual business models: a contingency approach. Acad. Manag. Perspect. 18 (3), 22–36.
Marks, G., 2007. Editorial. Introduction: triangulation and the square-root law. Elect. Stud. 26, 1–10.
Mason, K., Spring, M., 2011. The sites and practices of business models. Ind. Market. Manag. 40 (6), 1032–1041.
Massa, L., Tucci, C.L., 2013. Business model innovation. Oxf. Handb. Innovat. Manag. 20 (18), 420–441.
Mastrogiorgio, M., Gilsing, V., 2016. Innovation through exaptation and its determinants: the role of technological complexity, analogy making & patent scope. Res. Pol. 45 (7), 1419–1435.
McGrath, R.G., 2010. Business models: a discovery driven approach. Long. Range Plan. 43 (2–3), 247–261.
McMullen, J.S., Shepherd, D.A., 2006. Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. Acad. Manag. Rev. 31 (1), 132–152.
Merton, R.K., Barber, E., 2004. The Travels and Adventures of Serendipity. Princeton University Press.
Morris, M., Schindehutte, M., Allen, J., 2005. The entrepreneur's business model: toward a unified perspective. J. Bus. Res. 58 (6), 726–735.

Parida, V., Westerberg, M., Frishammar, J., 2012. Inbound open innovation activities in high-tech SMEs: the impact on innovation performance. J. Small Bus. Manag. 50 (2), 283–309.
Patton, M.Q., 1990. Qualitative Evaluation and Research Methods. SAGE Publications.
Read, S., Sarasvathy, S.D., 2005. Knowing what to do and doing what you know: effectuation as a form of entrepreneurial expertise. J. Private Equity 9 (1), 45–62.
Rosso, M., Squassina, A., Castriciano, S., 2018. MicroFLOQ® Direct Conveys an Alternative Forensic Workflow for Paternity, Kinship and Reference Sample Testing. Retrieved Nov 12, 2019, from. https://products.copangroup.com/index.php/educational-center/scientific-studies/2018.
Saebi, T., Foss, N.J., 2015. Business models for open innovation: matching heterogeneous open innovation strategies with business model dimensions. Eur. Manag. J. 33, 201–213.
Sarasvathy, S.D., 2001. Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency. Acad. Manag. Rev. 26 (2), 243–263.
Schweisfurth, T.G., Raasch, C., 2018. Absorptive capacity for need knowledge: antecedents and effects for employee innovativeness. Res. Pol. 47 (4), 687–699.
Shakir, M., 2002. The selection of case studies: strategies and their applications to IS implementation case studies. Res. Lett. Inf. Math. Sci. 3, 69–77.
Siggelkow, N., 2007. Persuasion with case studies. Acad. Manag. J. 50 (1), 20–24.
Smith, K.G., Collins, C.J., Clark, K.D., 2005. Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. Acad. Manag. J. 48 (2), 346–357.
Sofka, W., Grimpe, C., 2010. Specialized search and innovation performance–evidence across Europe. R D Manag. 40 (3), 310–323.
Spieth, P., Schneckenberg, D., Ricart, J.E., 2014. Business model innovation – state of the art and future challenges for the field. R D Manag. 44 (3), 237–247.
Stoker, L., 2011. Triangulation. In: Badie, B., Berg-Schlosser, D., Morlino, L. (Eds.), International Encyclopedia of Political Science. Sage, Thousand Oaks, CA, pp. 2660–2671.
Tang, J., Kacmar, K.M.M., Busenitz, L., 2012. Entrepreneurial alertness in the pursuit of new opportunities. J. Bus. Ventur. 27 (1), 77–94.
Teece, D.J., 1998. Capturing value from knowledge assets: the new economy, markets for know-how, and intangible assets. Calif. Manag. Rev. 40 (3), 55–79.
Teece, D.J., 2010. Business models, business strategy and innovation. Long. Range Plan. 43 (2–3), 172–194.
Teece, D.J., 2018. Business models and dynamic capabilities. Long. Range Plan. 51 (1), 40–49.
Toh, P.K., Polidoro, F., 2013. A competition-based explanation of collaborative invention within the firm. Strat. Manag. J. 34 (10), 1186–1208.
Van de Ven, A.H., 1993. Managing the process of organizational innovation. In: Organizational Change and Redesign: Ideas and Insights for Improving Performance, pp. 269–294.
Van de Vrande, V., De Jong, J.P., Vanhaverbeke, W., De Rochemont, M., 2009. Open innovation in SMEs: trends, motives and management challenges. Technovation 29 (6–7), 423–437.
Vanhaverbeke, W., 2017. Managing Open Innovation in SMEs. Cambridge University Press.
Von Hippel, E., Von Krogh, G., 2016. Crossroads—identifying viable "need–solution pairs": problem solving without problem formulation. Organ. Sci. 27 (1), 207–221.
Vossen, R.W., 1998. Relative strengths and weaknesses of small firms in innovation. Int. Small Bus. J. 16 (3), 88–94.
Yin, R.K., 1994. Discovering the future of the case study. Method in evaluation research. Eval. Pract. 15 (3), 283–290.
Yin, R.K., 2003. Case Study Research: Design and Methods. Sage Publications.
Zahra, S.A., 2005. Entrepreneurial risk taking in family firms. Fam. Bus. Rev. 18 (1), 23–40.
Zahra, S.A., George, G., 2002. Absorptive capacity: a review, reconceptualization, and extension. Acad. Manag. Rev. 27 (2), 185–203.
Zott, C., Amit, R., 2007. Business Model Design and the Performance of Entrepreneurial Firms. Organization Science18 (2),, 181–199.
Zott, C., Amit, R., Massa, L., 2011. The business model: recent developments and future research. J. Manag. 37 (4), 1019.

Anna Paola Codini is Associate Professor of Management at the Department of Economics and Management of the University of Brescia (Italy) where she teaches Innovation and Operations Management and International Business. Her research interests refer to innovation management and sustainable consumption. On these issues she has published a book, chapters in national and international books, and papers in journals, as Knowledge Management Research and Practice, Journal of Business and Industrial Marketing, International Journal of Consumer Studies and European Business Review. She has been involved, as presenter and chairman, in several national and international conferences and in several national/international research projects.

Antonio Messeni Petruzzelli is Professor of Innovation Management at the Politecnico di Bari. He is the author of more than 90 international publications and three international books on the topic of innovation management. His studies on this issue have been published in leading journals, as Research Policy, Entrepreneurship Theory & Practice, Academy of Management Perspectives, Journal of Management and Long Range Planning. He belongs to the editorial team of Journal of Knowledge Management and Technological Forecasting and Social Change and serves as guest-editor for various journals. Finally, his studies have recently been awarded the Nokia Siemens Network Award in Technology Management for Innovation into the Future.

Tindara Abbate is Associate Professor of Business Economics and Management at the University of Messina (Italy). She teaches Territorial Marketing and Finance. Her research interests refer to open innovation, market orientation, and territorial marketing. On these issues she has published books, chapters in national and international books, and papers in journals, as Knowledge Management Research and Practice, International Small Business Journal, Journal of Business and Industrial Marketing. She has been involved, as presenter or chairman, in national and international conferences. She has been also involved in national and international research projects, as member and scientific coordinator.