



UNIVERSITÀ
DEGLI STUDI
DI UDINE

Università degli studi di Udine

Practising Open Innovation: A framework of reference

Original

Availability:

This version is available <http://hdl.handle.net/11390/1119214> since 2021-03-25T11:50:07Z

Publisher:

Published

DOI:10.1108/BPMJ-10-2016-0219

Terms of use:

The institutional repository of the University of Udine (<http://air.uniud.it>) is provided by ARIC services. The aim is to enable open access to all the world.

Publisher copyright

(Article begins on next page)

Pre-print version of

Battistella C., De Toni A. F., Pessot E. (2017)

“Open accelerators for start-ups success: a case study”,

European Journal Of Innovation Management, Volume 23 - 6, Pages 1311-1336.

<https://doi.org/10.1108/BPMJ-10-2016-0219>

PRACTISING OPEN INNOVATION: A FRAMEWORK OF REFERENCE

Cinzia Battistella, Alberto F. De Toni, Elena Pessot

Abstract

Abstract

Purpose - This work provides new insights into possible managerial choices and development directions for practising open innovation (OI) in companies. The purpose of this paper is to explore the different practices, actors and tools adopted for opening up the innovation process, in particular, by small- and medium-sized enterprises (SMEs) that are still facing difficulties in its implementation.

Design/methodology/approach - The paper is based on a literature review and an exploratory survey of a sample of 85 European SMEs.

Findings - The study identifies a total of 23 practices, 20 actors and 11 tools involved in the OI processes of companies. It highlights, through literature and empirical evidence, how different combinations of practices, actors and tools are put into practice.

Research limitations/implications - The developed framework offers new insights both from OI literature and from practitioners' point of view into the supporting decision-making processes regarding which practices to implement, tools to adopt and actors to collaborate with. A wider investigation is recommended to include more variables to define the differences among the combinations of practices, actors and tools in terms of types of innovation (e.g. product, process, etc.), the openness degree and other contextual factors.

Originality/value - This paper is the first to study and link the literature on accelerators, start-ups and open innovation..

Introduction

The open innovation (OI) paradigm has received an extensive number of contributions from different research streams (Gassmann, 2006), taking into account a variety of dimensions such as strategy, leadership and organisational structure (Giannopoulou et al., 2011). The exponential growth of this research field has also led to the publication of numerous reviews, addressing major research streams on different topics. In particular, previous studies have focussed on notions of OI, OI forms (in terms of inbound/outbound/coupled processes, number, type and variety of partners, mechanisms, opened phases of the innovation process, types of innovation, focus), effectiveness (in terms of the firm's general or innovation performance), contextual factors (size of the company, industry/technology intensity) and strategic orientation (leader/follower, leadership and internal culture, business models, impact of appropriability) (see e.g. literature reviews by Elmquist et al., 2009; Huizingh, 2011; Kovacs et al., 2015; West et al., 2014).

Beyond theoretical issues, little research has been conducted to thoroughly investigate effective OI implementation in companies, i.e. practices or modes (Giannopoulou et al., 2011; Spithoven et al., 2013; West and Bogers, 2014). While OI practices adoption has been widely proved in different companies and in different contexts (Huizingh, 2011), scholars (Chesbrough and Brunswicker, 2014; Docherty, 2006; Gassmann, 2006; Giannopoulou et al., 2011) agree that companies are still facing difficulties in implementing them, particularly in terms of organisational and cultural barriers. Moreover, companies interact with various combinations of actors, with different roles and

strength of ties (Lee et al., 2010) and adopt diverse sets of instruments (Rass et al., 2013) in their OI activities.

This is true especially in the case of small- and medium-sized enterprises (SMEs). van de Vrande et al. (2009) find that SMEs are increasingly opening up their innovation process, but they still have to cope with barriers in terms of knowledge acquisition, resource constraints and effectiveness of the innovation process, especially when commercialising with external partners. Spithoven et al. (2013) argue that SMEs have a much higher intensity in practising all types of OI activities than large companies, while larger companies are involved in a higher number of modes, due to a higher level of formalisation and availability of resources for the innovation process.

Moreover, an integrated framework to support companies in decision making on when, how and which OI practices to adopt is still lacking (Huizingh, 2011; Bellantuono et al., 2013).

This paper aims to take a further step towards defining “what is the best way to capture value” (Huizingh, 2011) in opening up the innovation process to external sources. In particular, it focusses on the managerial choices at the project level that are required for effective OI implementation along the innovation funnel. We argue that when deciding to leverage on external inflows and outflows of knowledge (Chesbrough, 2006) for a specific innovation project, companies must identify and properly link the three decision areas identified by Huizingh (2011) as “how” (i.e. practices), “in what way” (i.e. tools) and “with whom” (i.e. actors) to do it. Moreover, the empirical part of the study focusses on SMEs, which are required to choose a set of valuable practices/tools/actors according to their resource constraints, providing further insights for the aim of this study.

Starting from these assumptions, a novel framework is proposed, which integrates and identifies combinations of practices, tools and actors for implementing OI, building on previous literature on this theme and on the results of an explorative survey conducted among 85 European SMEs. The suggested framework aims to represent a reference for managers to look into when they need new understanding of the definition of the key variables – and their linkages – for OI adoption and implementation in a specific innovation project. In this sense, it is a first contribution to OI research that adopts a practical perspective in terms of combinations of managerial choices when developing an innovation project – considering that there is no single best way for doing it (Nambisan and Sawhney, 2007).

The paper is structured as follows: the section “Theoretical background” gives an overview of the previous contributions in literature on OI implementation and on the three blocks of practices, tools and actors for opening up the innovation process. Following the description of the methodology adopted for the study, which combines a systematic literature review and a structured exploratory survey, the section “Framework – conceptual development” presents and defines in detail the proposed framework of combinations by building on previous literature. Results from the investigation of the combinations in the sample of 85 European SMEs are then discussed. The last section of this paper concludes with some research and practical implications to the study and its limitations.

Theoretical background

The valuable advantages of opening up the innovation process to the outside are widely acknowledged (Boudreau and Lakhani, 2009; Docherty, 2006) and have been experienced in different companies and in different contexts (Huizingh, 2011). OI is associated with superior firm performance (Laursen and Salter, 2006; Rass et al., 2013) and higher innovative activity in

companies (Cosh and Zhang, 2011), both in large and small-to-medium-sized ones (Spithoven et al., 2013). This is true in particular: when the technology, design and innovation approaches have yet to be ascertained; when customer needs are highly varied or not yet fully understood; and when companies can separate and outsource distinct parts of the innovation process in order to take advantage of different knowledge and ideas (Boudreau and Lakhani, 2009).

Developing and exploiting innovation activities in collaboration with external parties requires new decisions that should be delineated in: when, how, with whom, with what purpose and in what way (Huizingh, 2011). While previous research studied management challenges for effective OI implementation (see e.g. van de Vrande et al., 2009 for a study on SMEs in this sense), there is still little research on putting OI into practice (Giannopoulou et al., 2011; West and Bogers, 2014), especially in the case of SMEs.

Bellantuono et al. (2013) introduce a framework that supports managers in identifying the OI practices that best fit a specific innovation project. For this purpose they study different combinations of variables related to OI practices – e.g. access mode, degree or formality, etc. – and variables related to a companies' innovation context in terms of knowledge supply – e.g. the level of knowledge they possess. Despite this, they do not provide a list of practices, i.e. they do not explore thoroughly all the possible OI practical approaches. Bianchi et al. (2011) propose a framework that comprises: the main variables of organisational modes for OI, types of partners and phases of the R&D process. They empirically investigate the evolution of relationships between the three variables in the bio-pharmaceutical industry, missing a possible generalisation of results for other industries or company sizes. Pisano and Verganti (2008) consider only collaboration practices for OI, proposing a classification based on the dimensions of the adopted partnership (open or closed) and governance (hierarchical or flat). van de Vrande et al. (2009) focus on the technological dimension of OI practices and distinguish between technology exploitation and technology exploration practices in SMEs. Mortara and Minshall (2011) identify four approaches to OI adoption in large multinational companies – ad hoc practice, precursor OI adopters, OI conscious adopters and OI communities of practice – based on two criteria, i.e. the organisational change due to the introduction of OI and the way the practices were coordinated. Theyel (2013) groups OI practices, limited to the value chain, as joint activities in technology development, product development, manufacturing and commercialisation. Mina et al. (2014) focus on OI practices in business services firms and service-integrated manufacturers, distinguishing between formal and informal OI and selecting among sources of knowledge as market-based (i.e. customers, users and other firms) and science-based (i.e. universities, other higher education and research organisations) partners.

Huizingh (2011) calls for an integrated framework that helps managers to decide at what stage of the innovation process and with which external parties to collaborate to capture value in developing and exploiting innovation activities. OI does not merely require a company to intensify its relationships with external sources throughout its innovation processes (Chiaroni et al., 2010). Companies also need to adopt new practical approaches to cope with openness, to properly access external knowledge and technology and to create competitive businesses (Dahlander and Gann, 2010; Giannopoulou et al., 2011; Battistella et al., 2016).

Boudreau and Lakhani (2009) and Almirall et al. (2014) suggest that in choosing the strategy that best fits their objectives, companies should address: the different types of innovation being developed, the number and diversity of the external actors, their varying motivations and the business model of the core company. These decisions should be taken at the level of a specific R&D

or product development project, rather than aggregated at the entire company level (West et al., 2014).

Developing and exploiting innovation activities in collaboration with external parties then requires new decisions on: when, how, with whom, with what purpose and in what way (Huizingh, 2011). In this sense, starting from the assumption that the type of innovation to develop (i.e. “with what purpose”) is already known, managerial choices for OI adoption and implementation for a specific innovation project converge on the three decision areas mentioned above and identified by Huizingh (2011) as “how” – namely practices, “with whom” – namely actors and “in what way” – that we define in a practical sense as tools. Figure 1 represents the key blocks and the key questions for companies’ managerial choices when deciding to implement OI.

Practices

Practices of OI relate to the process of ‘how to do it’ (Huizingh, 2011). OI itself means “both a set of practices for profiting from innovation, and also a cognitive model for creating, interpreting, and researching those practices” (West et al., 2014, p. 286). In this sense, they include the activities and the approaches – i.e. the ways such activities are conducted – that companies define, adopt and deploy in order to implement OI (Bellantuono et al., 2013; Chesbrough and Crowther, 2006; van de Vrande et al., 2009; Wynarczyk et al., 2013) in an innovation project.

Companies implementing more practices prove to be more open to innovation (Burcharth et al., 2014). Many companies use a combination of strategies for different innovation projects – more or less open ones (Barge-Gil, 2013), but often must find out how to implement OI successfully (Docherty, 2006) and lack awareness of, or have insufficient information about, better, alternative strategies (Barge-Gil, 2013).

In their survey, Chesbrough and Crowther (2006) found that OI practices are not widespread in use, and only the so-called “early adopters” increased their attitude towards searching for external sources of innovation in order to complement their internal R&D activities.

In general, scholars (Bianchi et al., 2011; Chesbrough and Brunswicker, 2014; Chiaroni et al., 2010; West and Bogers, 2014) observe that inbound OI practices are far more commonly used than outbound practices, especially in mature industries, while few studies have focussed on the outbound ones (Greco et al., 2015). In fact, inbound OI represents a crucial strategy to explore new technological areas outside the company’s boundaries and then to create (Brunswicker et al., 2012) and appropriate more value from them (Cosh and Zhang, 2011). However, the three process models of inbound, outbound and coupled can also complement one another (Gassmann et al., 2010).

Tools

Tools refer to instruments, interfaces and technologies supporting the concrete adoption and the implementation of OI in companies.

In particular, information and communication technologies, such as web 2.0 and social networking, are observed mostly enabling companies to interact with different knowledge sources. In fact, they enable new problem-solving processes and novel ways of sharing ideas, with decreased transition costs, larger potential range of participants and reduced uncertainty of outcomes (Dahlander and Gann, 2010; Dodgson et al., 2006; Enkel et al., 2009).

Huston and Sakkab (2006) and Dodgson et al. (2006) highlight the key role played by different types of networks and technologies in assisting the production and application of knowledge and innovation, as well as in facilitating OI strategy in Procter & Gamble's model of "Connect&Develop". Dames et al. (2008) further distinguish between tools for finding external expertise and technologies, tools for facilitating access to innovation networks, tools for managing external collaborations and to assist the innovation process. Igartua et al. (2010) extend the analysis to all innovation management techniques supporting OI strategy, including market intelligence, innovation finance and organisational techniques. Rass et al. (2013) argue that the benefits of OI tools on firm performance are contingent upon the organisational environment in which they are embedded and they group them into the four categories of acquiring, sourcing, selling and revealing activities by Dahlander and Gann (2010).

Actors

The OI paradigm assumes that organisations "must identify, connect to, and leverage external knowledge sources as a core process in innovation" (Chesbrough, 2006, p. 2). Companies implementing OI practices seek to engage in and establish relationships with a wide range of heterogeneous actors, agents and networks (Bianchi et al., 2011; Chesbrough, 2003; Wynarczyk et al., 2013). Collaborating with different subjects implies dealing with both different problems and a number of advantages, and requires specific organisational and managerial approaches (Lazarotti and Manzini, 2009). For instance, Almirall et al. (2014) observed that cities applying OI (the so-called "civic OI") had to face challenges of managing and aligning a high degree of diversity within the community, dealing with scarce resources in terms of money and time and responding to the needs of a large and diverse population – compared to the targeted customers of a company. Lee et al. (2010) look at the role of intermediaries in facilitating linkages and organisation between a SMEs and the innovation network of partners.

The outside players can improve the company's innovations or exploit solutions already developed by the company (Huizingh, 2011) by adding to or by complementing the company's internal knowledge base (West and Bogers, 2014) and by supporting the innovation effort, which is then distributed amongst the parties concerned (von Hippel, 1988).

Literature reviews on OI implementation

Several different literature reviews have been published from 2003 onwards (see Table I). Some of them have been generally directed towards an overview of the literature of OI, also referring to the main future research streams. Recently, literature reviews have focussed on specific themes (such as performance, technology, outbound OI, platforms, etc. – e.g. Bagherzadeh, 2014; West and Bogers, 2014; Natalicchio et al., 2014), on empirical evidence (e.g. Greco et al., 2015) or on more quantitative methods (e.g. co-citation analysis by Kovacs et al., 2015). We can say that most of the reviews still concentrate on themes and do not highlight and explain practices and their effective deployment and implementation.

Therefore, this work contributes to the existing research on OI by answering the research question formulated as follows:

RQ1. What are the possible choices and combinations of practices, tools and actors when companies implement OI in a specific innovation project?

Research Methodology

Dictated by the objectives of the study and the scope of the research question, the methodology employed is composite and includes a systematic literature review and a structured exploratory survey. The three core blocks of the framework of reference – practices, tools and actors – have been defined in the literature review and then further integrated by results obtained from the empirical investigation.

As regards the first part, the search was conducted using Scopus and ISI Web of Science databases, ensuring a comprehensive coverage of the relevant literature. The review was intended to focus on the specific concept of OI (as coined by Chesbrough in 2003) and its implementation in practice. In this sense, OI practices were analysed in a single company and in particular from the technology user's point of view (Chesbrough, 2003), at project level. We then searched for the keywords “practic* OR practis*”, “approach*”, “method*”, “mode*”, “activit*”, “mechanism*”, “implement*” in combination with “open innovation”. In particular, keywords were derived from the different concepts proposed by scholars regarding the “how” companies open up their innovation process to external contributions. The search on the two databases was limited to the subject area social sciences (Brunswick et al., 2012; Giannopoulou et al., 2010), including a total of 2,341 sources. The following phase of the selection process was limited to peer-reviewed journal articles and books (Giannopoulou et al., 2010; Natalicchio et al., 2014) and to publications clearly relevant for the aim of the study, i.e. focussing on the practical implementation of OI in companies. An initial sample of 204 publications was defined. The research team carefully read the abstracts and the introductions of selected sources to further exclude those outside the scope of the research, e.g. those focussed on specific practices and approaches of a single sector (and not considering managerial issues) or analysing the technological aspects of a specific tool or instrument, and not investigating a set of practices/tools/actors. We then identified 34 relevant sources and added three more by cross-referencing, obtaining the final sample of 37 publications to systematise in the three core blocks of our framework.

The survey was launched in 2014 inside a European project named Collective. It was sent out by the business associations' partners in the project and 85 completed questionnaires were returned, representing an answer rate of 42.5 per cent. Mother tongue interpreters translated the questionnaire in all the required languages (French, Italian, German, Polish and Spanish), starting from a common English version. Questions were available both in English and in native language versions on all the questionnaires distributed in each country. Moreover, questionnaire items and answers were back-translated by other mother tongue interpreters under the project partners' supervision to ensure translation equivalency (Brislin, 1970). Translation was needed since not all SME employees speak and read English fluently. The survey was administered online through free open source software (www.kwiksurveys.com).

The respondents were mainly executives, with the exception of two administrators. Of the 83 executives, 64 were either CEO or managing directors, while the remaining were departmental executives including production, R&D, knowledge management, business development, marketing, and creative executives, amongst others.

The survey was aimed at collecting quantitative and qualitative data on the innovativeness and collaborative capabilities of the companies with particular concentration on the manpower devoted to research and innovation activities and the companies' financial commitment to them. The survey was also used in order to study project management practices focussing on setting the companies' strategies, creative activities and implementation design. The questions were very different in form: they could be open-ended, multiple-choice or Likert-scale 1-4 questions. In fact, SMEs do not often have a clear and well-structured strategy as regard collaboration in innovation process (van de Vrande et al., 2009; Avenali et al., 2013) and we considered worthwhile asking them open-ended questions without limiting them to limited scales.

The survey was organised into five main sections:

1. General information: this section collects general data on the type and location of the company, the employee-base, the propensity to opening up and collaborating, and their innovation performance.
2. OI strategy and process: the questionnaire probes the strategy setting and planning activities of the companies, enquiring into the time frame of their business strategies, the motivation and the achievements. Example questions are: "How far ahead do you plan for your R, D, I activities?" or "What are your main motivations for long-term planning?"
3. OI practices: this section makes enquiries into the decision-making practices followed by the companies in setting up, managing and internalising the results of collaboration. Example questions are: "What procedures were put in place for managing the collaborative project?" or "Which was the effect of practice x in reaching OI project success?"
4. OI tools: this section investigates the most used tools, linking them with practices. An example of question is: "Which of the following on line or web based services were employed to communicate progress to all parties involved in the collaborative project?"
5. OI actors: this section investigates the connections of the company with external actors, linking them with practices and tools. Example questions: "Who initiated the OI project?", "Who led the OI project?" or "Who accepted suitable solutions, integrated them within the business and how?"

Questionnaire items were based on questions, items and results of surveys and empirical studies by Bianchi et al. (2011), Burcharth et al. (2014), Chesbrough and Brunswicker (2014), Cosh and Zhang (2011), Erkens et al. (2014), Hidalgo and Albors (2008), Little (2014), Spithoven et al. (2013) and van de Vrande et al. (2009).

The final sample was checked to see if data for practices, actors and tools were missing, it being found that none of the cases in fact had data missing. SPSS was used to check the normality of the data and to calculate descriptive statistics. In fact, the main use of the questionnaire was connected to descriptive statistics: each practice, tool and actor reported in the literature was coded and checked in terms of availability and each of their combinations was asked for in order to understand if it was present only in the literature or also in analysed samples. The combinations of practices, tools and actors are derived directly from questions to companies: they were first asked to companies. The open questions were used to cross-check the combinations. In fact, thematic analysis technique (Boyatzis, 1998) allowed then to confirm and cross-check these data, comparing theme frequencies and relationships. This means that we analysed the open questions highlighting the recurrence of the words "practice", "tool" and "actor" in order to check if the declared possible

combinations were confirmed also in the open-ended questions (Fereday and Muir-Cochrane, 2006).

The 85 questionnaires returned were completed by companies from France (28), Italy (26), Germany (20), Poland (7) and Spain (4) operating in the sectors of the economic activities outlined in Table II. In this sense, the choice of the sample follows the calls by Keupp and Gassmann (2009) for more cross-national research into OI and by van de Vrande et al. (2009) for deeper research into OI in SMEs.

Company effort in research, development and design, and in general Innovation activities (RDD&I), is calculated as a percentage of the employees involved in such activities (the average size of the companies in the sample was 28 employees in 2012). On the whole, the sample shows that at least 13.36 per cent of the current staff is involved in such activities and the trend is upward, compared to almost 9 per cent in the previous three-year period.

Data on R&D expenditure are not comparable, although the companies have declared the percentage of their R&D budget invested in collaborative RDD&I activities. In 2012 collaborative innovation activities commanded 15.2 per cent of the companies R&D budget against the 9.6 per cent of four years earlier (Table III).

For the purpose of this study innovation has been defined according to the Community Innovation Survey, as product innovation, services and processes as well as innovation new to the market and/or to the company. All the companies surveyed were involved in some form of innovation before or during the period of the study and, to some extent, successfully introduced it to the market thanks to purposeful collaboration. The percentage of their sales derived directly from these innovations are summarised in Table IV.

For the majority of companies, innovation has contributed to less than 20 per cent of their sales; however, new-to-the-market innovation has a major impact on sales in both the lowest range (less than 20 per cent) and the highest range of 50 per cent or more of the revenue.

Innovativeness in the sample companies helps us in characterising both our sample and their performance comparatively; in fact, some 80 per cent of the companies surveyed carry out RDD&I activities. The data are relevant when compared to CIS Datum, which shows that, in the EU 27, only 51 per cent of companies are carrying out activities aimed at innovation.

Framework – conceptual development

In this section, the three core blocks of the reference framework that will be further developed with empirical evidence from the survey are described. The three descriptive sections of practices, tools and actors for OI are derived from literature review. By grouping them according to underlying similarity in definitions, we identified in total 23 practices, 20 actors involved in the OI process and 11 tools.

Practices

Scholars adopt different concepts to describe the “how” companies put OI into practice, i.e. organisational modes (Bianchi et al., 2011), activities (Chesbrough and Brunswicker, 2014; Wynarczyk et al., 2013), methods (de Backer, 2008) and actions (Greco et al., 2015). Table V reports the different ways in which companies implement OI that resulted from the review of literature on these concepts.

The identified practices are categorised with reference to the three core OI process models (Chesbrough and Crowther, 2006; Dahlander and Gann, 2010; Enkel et al., 2009; Gassmann and Enkel, 2004; Piller and West, 2014; West et al., 2014): outside-in process or inbound OI, e.g. crowdsourcing, which enables expertise to be sourced and acquired from the crowd; inside-out process or outbound OI, e.g. venturing that aims to create new ventures to sell a company’s ideas and resources in the marketplace; and coupled process or coupled OI, which combines knowledge inflows and outflows between actors such as in building R&D collaborations for joint innovation and exploitation.

Approaches can both foster collaborative communities, e.g. informal relationships and technology sharing, while others encourage competitive markets, with more contractual relationships, stronger profit motives and less sharing (Almirall et al., 2014; Boudreau and Lakhani, 2009). As regards this second group, contracting with R&D service providers and IP in-licensing are among the most cited practices. In fact, formal collaborations are associated with greater knowledge transfers (often in both directions), as well as with a greater potential for both risk and reward (West et al., 2014). This is true, in particular, for a peer-to-peer or supplier/customer co-development (Docherty, 2006). For instance, Stoetzel (2012) introduces the concept of mass customisation as a customer-centric OI approach that engages customers in production and in the innovation process, but with the aim of producing single individual products.

Beyond formal cooperation and other contracts, information scouting from different parties also plays a critical role in knowledge transfer, and consequently influences the company’s capacity to innovate (Mention, 2011). A company can also find convenience in crowdsourcing a phase of the innovation process rather than solving the problem internally or contracting it out to a designated supplier (Afuah and Tucci, 2012).

Tools

Table VI summarises the main methods, interfaces and technologies supporting the adoption and implementation of OI.

Intermediary networks should be designed and managed in order to allow mutual technology exploration and exploitation (Brunswicker et al., 2012). Billington and Davidson (2013) further classify them in terms of the degree of codification of the knowledge and in the degree of facilitation of the networks in search engines such as Google, social networks such as Linked-in, orchestrated expert networks such as Gerson Lehrman and seeker-solver networks such as Innocentive. For the purpose of this paper, we refer to the general term intermediary sites/networks/platforms by further specifying their role with reference to the actors involved.

The most often cited tools can be distinguished as instrumental in nature, such as configurators and suggestion box, which provide targeted functionalities for their users (Stoetzel, 2012; West and Bogers, 2014) or as fostering exchange of knowledge among partners, such as workshops and consortia/collaborative projects, which jointly support the sharing of both high levels of uncertainty and risk as well as high potentially valuable benefits among partners (Igartua et al., 2010).

Actors

Actors involved in the OI process can be both the seeker and solver of innovation issues, but also support the effort, and mediate in collaboration (Almirall et al., 2014). In Table VII, actors of the OI process are grouped in subclasses that reflect their link with the main company and their active or intermediary role in the process. In particular, as regards active seekers or solvers of innovation, we distinguish between sources of knowledge belonging to the value chain, i.e. business actors that participate in innovation during the manufacturing and commercialisation phases (Theyel, 2013), and the other external sources according to their prevalent legal status, i.e. public or private, which also might determine the expected outcomes from OI.

Value chain actors such as suppliers and customers appear among the most valued sources of innovation. Chesbrough and Brunswicker (2014) also include final (or not direct) customers or consumer; Stoetzel (2012) and von Hippel (1988) focus in particular on the so-called lead users for their proactive participation in the development process.

The government, policy makers and other political and economic institutions also play a crucial role, since they belong to and create the context of regulation, intellectual property (IP) law, capital markets and industry structure (Chesbrough, 2006), all areas where companies innovate.

Internal employees are mentioned as one of the most critical sources of innovative ideas (Chesbrough and Brunswicker, 2014). Yet they can also play a negative role in the adoption of OI practices, being affected by the so-called “not-invented-here (NIH)” and “not-shared-here or not-sold-here (NSH)” syndromes – and thus showing negative attitudes towards, respectively, the sourcing of external knowledge and the external exploitation of knowledge assets (Burcharth et al., 2014; Chesbrough, 2003). In this sense, a change in a company’s culture, in order to enable OI and then to deal with relations outside the company, is required (Giannopoulou et al., 2011).

Intermediaries now play a direct role in different stages of the innovation process that previously were conducted entirely within the company (Chesbrough, 2006).

Many companies are observed, more and more often, to be involved either directly (as members) or indirectly (by sponsoring) in communities for distributed support throughout the innovation process (Giannopoulou et al., 2011; West and Lakhani, 2008).

As regards networks, Laursen and Salter (2006) identify two descriptive: the search breadth, defined as the number of external sources or search channels that companies rely on, and the search depth, namely the extent to which companies draw from these sources. They show that companies that increase both search breadth and depth are able to implement inbound OI. Companies in general are observed exploiting their existing knowledge network during the first phases of opening the innovation process, then creating an exploration network, and finally addressing the establishment of long-term forms of collaboration within the established network (Chiaroni et al., 2010).

Finally, start-ups and new entrepreneurs also leverage a combination of internal knowledge and external resources (Presutti et al., 2011) allowing them to reach the end of the innovation funnel and grow into mature businesses (Kirschbaum, 2005).

Combinations

We argue that the three core blocks of the framework are linked, i.e. companies preferably choose a set of specific triads of practices (i.e. activities and approaches), tools (i.e. instruments to support

the carrying out of activities) and actors (i.e. external sources directly involved in inflows and outflows of knowledge and technologies), when they implement OI in an innovation project. This observation is endorsed by Rass et al. (2013), who suggest that OI tools are associated with some forms of interaction with external partners and, mutually, companies interact with external partners via OI instruments. Möslein and Bansemir (2011) argue that OI activities are facilitated by the adoption of multifaceted tools and the involvement of different types of participants. Other scholars focus their studies on the link between practices and the actors who develop them. For example, Theyel (2013) studies the adoption of OI practices with customers and suppliers, i.e. partners along the value supply chain, revealing that OI implementation depends on right practices and partner choice (Wynarczyk et al., 2013). Other scholars find that specific actors require consequent specific practices and tools. Among them, Keupp and Gassmann (2009) identify archetypes of OI users and they argue that companies conduct targeted OI activities with different intensity of collaboration with them.

Results from empirical analysis and discussion

This study investigated companies' managerial choices of practices, tools and actors to implement OI and their possible combinations. The literature review identified a list of these three core decision areas. In order to explore them empirically, these choices were studied in a sample of 85 SMEs to determine their links. In fact, the three domains are interrelated and interdependent, since respectively, the choice of how to practically implement OI influences the choice of the tools to use and the actors to collaborate with; the choice of which tools to use to open up the innovation process determines the way (i.e. the practice) and the source of innovation selected; and the choice of the external sources of knowledge (i.e. actors) is further linked to the "how" and "in what way" to collaborate with them.

Results of the empirical analysis and evidence of the combinations identified are reported in Table VIII, differentiating among combinations identified only in literature and combinations found both in the literature and in the analysed sample. In particular, for each intersection between practices and actors, we indicated the tool/tools used or the application of the practice by the actor with any tool (highlighted with an x). In the following, results are interpreted by analysing first the data aggregated by practices and then data aggregated by actors involved in the innovation process.

Practices

As regards practices for OI implementation, the results confirm previous literature (Bianchi et al., 2011; Chesbrough and Brunswicker, 2014; Chiaroni et al., 2010; West and Bogers, 2014) by showing that inbound practices are more present than outbound ones and that they involve a wider variety of actors and tools. In particular, practices such as crowdsourcing, external networking and scouting information from external sources involve the majority of external sources of knowledge through the application of two to three different tools targeted for sourcing and acquiring valuable knowledge and expertise from each actor involved. These tools can be instrumental in nature, such as configurators and suggestion box, or they can foster an exchange of knowledge, such as workshops and innovation platforms.

Among outbound OI practices, we identified both in literature and in our sample only the practice of commercialising market-ready technologies. This one is connected to specific actors: directly to customers (and more often lead users) or to intermediaries of innovation as well as technology brokers to test their reliability and market fitness. In particular, companies implement this kind of

practice through participation in innovation-related events (e.g. industry-related fairs) and in intermediary platforms.

As regards IP management and licences, results from the sample demonstrate that companies give priority to acquiring the rights to use a new technology or product rather than selling the rights for use of an innovation they have discovered and developed; the latter would require leaving the exclusivity of the right (Bogers et al., 2012). In particular, four companies in-licenced from their suppliers or from other companies. The two practices of in- and out-licencing require an IP protection system as the only tool for implementing them, which can be targeted to all the possible actors that might be involved.

Coupled processes were observed mostly when interacting within established partnerships (Rohrbeck et al., 2009). Specifically, sample companies were observed collaborating mostly for product and service co-development with direct customers and suppliers, and in some cases with companies belonging to other sectors as well as universities (providing expertise in complementary fields – Abramo et al., 2013, 2014). Meanwhile, only close to 12 per cent of them were able to build long-term strategic alliances with other companies, suppliers and R&D service providers. In general tools allowing this kind of collaboration require long-term and sustainable involvement and are collaborative projects, subscriptions to innovation platforms (Battistella and Nonino, 2012) and the use of technologies supporting different activities during the innovation process such as simulation and modelling.

These considerations allow the formulation of the following propositions:

P1. Companies can benefit from purposeful inflows of knowledge by implementing OI practices such as crowdsourcing, external networking and scouting information from the outside, through the use of instrumental tools and tools fostering exchange of knowledge. These tools are targeted to the direct or indirect involvement (through intermediaries and technology brokers) of a variety of actors from the value chain (customers, suppliers and other companies) and from the public (such as communities and universities) and the private sector (such as consultants).

P2. Companies combine knowledge inflows and outflows from external sources in their innovation process by practising joint co-creation or co-development, joint ventures or R&D alliances with partners from established collaborations (e.g. direct customers, suppliers and universities), requiring tools for long-term and sustainable involvement such as collaborative projects, subscription to innovation platforms and the use of technologies supporting the innovation process.

Actors

By analysing data aggregated by actors involved in the innovation process, it was found that the majority of the sample companies communicate to their partners directly and without intermediation, while they draw upon intermediaries and technology brokers to gain access to a wider knowledge base (i.e. crowd) to implement crowdsourcing, external networking, collecting

information and commercialising market-ready products. In particular customers, lead users, other companies and suppliers are among the main sources of innovation, requiring a wider variety of practices and tools to collaborate together. In particular, lead users are the most involved customers, generally collaborating through targeted instrumental tools, such as configurators, idea development contests, suggestion boxes and toolkits. These kinds of tools are implemented by more than 50 per cent of the sample. A purposeful exchange of knowledge with suppliers and other companies (mostly from the same sector) is instead supported by tools fostering collaborative environments such as collaborative projects and workshops, determining the governance of the collaboration, such as IP protection system and adopted technologies.

Finally, the majority of sample companies were observed to benefit from new knowledge acquired and sourced both during internal foresight workshops with not R&D internal employees and collaborative projects (e.g. those founded by the European Commission) implemented with universities and other research institutes and policy makers. Start-ups and entrepreneurs are presented as one of the main sources for OI processes in literature (see e.g. Chesbrough, 2006) and they can be involved through a variety of practices and tools (e.g. idea and start-up competitions for minority equity investments and venturing), yet they do not appear as main partners in the analysed sample.

We then formulate another proposition as follows:

P3. Interacting and collaborating with a multitude of actors while opening up the innovation process requires companies to select appropriate tools for each external source. For instance, knowledge flows to and from customers and lead users can be exploited and revealed with different combinations of targeted instrumental tools. Collaborations with suppliers and other companies require tools fostering and disciplining a collaborative environment.

Finally, many combinations of the three core blocks appear unfeasible or rather unsuitable, since a correspondence both in literature and/or in the analysed sample is missing.

Conclusion

This work contributes both to advancing knowledge in OI research and to supporting managerial choices for OI implementation in companies. It attempts to contribute to OI research by providing new insights in possible combinations and development directions for practising OI in companies.

From a research point of view, it follows the call of Huizingh (2011) for a “cookbook” for OI and it offers an integrated framework based on practices, actors and tools that managers can refer to when deciding how (with whom and with which tool) to deploy the different practices.

This study has also important practical implications. It involved 85 SMEs across a wide range of sectors and analysed their OI implementation approaches. The questionnaire provided aimed at investigating which practices they implemented in opening up their innovation process, which tools they used and which external sources they collaborated with. Considering that there is no single best way for doing OI (Nambisan and Sawhney, 2007), the developed framework represents a support for the decision-making process in OI, giving the opportunity to choose the most appropriate elements from among the core blocks – practices, tools and actors – and their combinations in order to reach some specific innovation goals.

The managers involved can indeed apply it to enhance awareness of, and determine possible development paths for, the future open orientation of their company. The choice of the most adequate tools with which to perform a practice and the most valuable actors to work with, impact each consequent phase of the OI process and in turn the innovation outcomes.

This study has also some limitations that require further research contributions. The proposed research was exploratory and involved 85 SMEs, thus requiring a generalisation of the results obtained to a larger number of companies of different sizes, i.e. also involving large enterprises. In any case, the framework is an important result, because it is developed from a rigorous systematic literature analysis. Further research is needed not to modify it, but to empirically examine which and how many combinations of practices/tools/actors are actually used and if, for example, these combinations vary in terms of dimension. The specific perspective on SMEs is important because, given their problems with limited resources, SMEs choose a set of valuable practices/tools/actors. Furthermore, the resulting framework does not consider possible differences in OI practices implementation in terms of industry and of phase of the innovation process (or product lifecycle) involved. Further empirical research – e.g. longitudinal studies – for purposeful insights into these two aspects is needed.

Finally, there is a lack of evidence of how companies actually combine different approaches, with considerations of how a choice of a practice affects other practices and similarly in which ways tools and actors can be integrated.

References

Abramo, G., D'Angelo, C.A. and Murgia, G. (2013), "The collaboration behaviors of scientists in Italy: a field level analysis", Journal of Informetrics, Vol. 7 No. 2, pp. 442-454.

Abramo, G., D'Angelo, C.A. and Murgia, G. (2014), "Variation in research collaboration patterns across academic ranks", Scientometrics, Vol. 98 No. 3, pp. 2275-2294.

Afuah, A. and Tucci, C.L. (2012), "Crowdsourcing as a solution to distant search", Academy of Management Review, Vol. 37 No. 3, pp. 355-375.

Almirall, E., Lee, M. and Majchrzak, A. (2014), "Open innovation requires integrated competition-community ecosystems: lessons learned from civic open innovation", Business Horizons, Vol. 57 No. 3, pp. 391-400.

Avenali, A., Battistella, C., Matteucci, G. and Nonino, F. (2013), "A mechanism for supporting collective innovation: the open contract-based challenge", Information Systems and e-Business Management, Vol. 11 No. 4, pp. 541-568.

Bagherzadeh, G. (2014), "Licensing in outbound open innovation: literature review", Proceedings of the 24th International Business Information Management Association Conference – Crafting Global Competitive Economies: 2020 Vision Strategic Planning and Smart Implementation, Milan, 6-7 November, pp. 561-569.

Barge-Gil, A. (2013), "Open strategies and innovation performance", Industry and Innovation, Vol. 20 No. 7, pp. 585-610.

Battistella, C. and Nonino, F. (2012), "Open innovation web-based platforms: the impact of different forms of motivation on collaboration", Innovation: Management, Policy and Practice, Vol. 14 No. 4, pp. 557-575.

Battistella, C., De Toni, A.F. and Pillon, R. (2016), "Inter-organisational technology/knowledge transfer: a framework from critical literature review", The Journal of Technology Transfer, Vol. 41 No. 5, pp. 1195-1234.

Bellantuono, N., Pontrandolfo, P. and Scozzi, B. (2013), "Different practices for open innovation: a context-based approach", Journal of Knowledge Management, Vol. 17 No. 4, pp. 558-568.

Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F. and Chiesa, V. (2011), "Organizational modes for open innovation in the bio-pharmaceutical industry: an exploratory analysis", *Technovation*, Vol. 31 No. 1, pp. 22-33.

Billington, C. and Davidson, R. (2013), "Leveraging open innovation using intermediary networks", *Production and Operations Management*, Vol. 22 No. 6, pp. 1464-1477.

Bogers, M., Bekkers, R. and Granstrand, O. (2012), "Intellectual property and licensing strategies in open collaborative innovation", in de Pablos Heredero, C. and López, D. (Eds), *Open Innovation at Firms and Public Administrations: Technologies for Value Creation*, IGI Global, Hershey, PA, pp. 37-58.

Boudreau, K.J. and Lakhani, K.R. (2009), "How to manage outside innovation", *MIT Sloan Management Review*, Vol. 50 No. 4, pp. 69-76.

Boyatzis, R.E. (1998), *Transforming Qualitative Information: Thematic Analysis and Code Development*, Sage Publications, Thousand Oaks, CA.

Brislin, R.W. (1970), "Back-translation for cross-cultural research", *Journal of Cross-Cultural Psychology*, Vol. 1 No. 3, pp. 185-216.

Brunswick, S., Hutschek, U. and Wagner, L. (2012), "'Exploration' in the open innovation front-end: the role of technologies", *International Journal of Technology Intelligence and Planning*, Vol. 8 No. 1, pp. 1-15.

Burcharth, A.L.D.A., Knudsen, M.P. and Søndergaard, H.A. (2014), "Neither invented nor shared here: the impact and management of attitudes for the adoption of open innovation practices", *Technovation*, Vol. 34 No. 3, pp. 149-161.

Chesbrough, H. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston, MA.

Chesbrough, H. (2006), "Open innovation: a new paradigm for understanding industrial innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *Open Innovation: Researching a New Paradigm*, Oxford University Press, Oxford, pp. 1-12.

Chesbrough, H. (2012), "Open innovation: where we've been and where we're going", *Research Technology Management*, Vol. 55 No. 4, pp. 20-27.

Chesbrough, H. and Bogers, M. (2014), "Explicating open innovation: clarifying an emerging paradigm for understanding innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford University Press, Oxford, pp. 3-28.

Chesbrough, H. and Brunswicker, S. (2014), "A fad or a phenomenon? The adoption of open innovation practices in large firms", *Research-Technology Management*, Vol. 57 No. 2, pp. 16-25.

Chesbrough, H. and Crowther, A.K. (2006), "Beyond high-tech: early adopters of open innovation in other industries", *R&D Management*, Vol. 36 No. 3, pp. 229-236.

Chiaroni, D., Chiesa, V. and Frattini, F. (2010), "Unravelling the process from closed to open innovation: evidence from mature, asset-intensive industries", *R&D Management*, Vol. 40 No. 3, pp. 222-245.

Cosh, A. and Zhang, J.J. (2011), *Open Innovation Choices – What is British Enterprise Doing?*, UK Innovation Research Centre, Cambridge.

Dahlander, L. and Gann, D.M. (2010), "How open is innovation?", *Research Policy*, Vol. 39 No. 6, pp. 699-709.

Dames, M., Robson, D., Smith, M. and Tumulty, T. (2008), "Beyond open innovation: leveraging social capital", *Proceedings of FITCE Congress, London, 21-24 September*, pp. 63-70.

de Backer, K. (2008), *Open Innovation in Global Networks*, OECD Publications, Paris.

Docherty, M. (2006), "Primer on 'open innovation:' principles and practice", *PDMA Visions*, Vol. 30 No. 2, pp. 13-17.

Dodgson, M., Gann, D. and Salter, A. (2006), "The role of technology in the shift towards open innovation: the case of Procter & Gamble", *R&D Management*, Vol. 36 No. 3, pp. 333-346.

Duarte, V. and Sarkar, S. (2011), "Separating the wheat from the chaff – a taxonomy of open innovation", *European Journal of Innovation Management*, Vol. 14 No. 4, pp. 435-459.

Elmquist, M., Fredberg, T. and Ollila, S. (2009), "Exploring the field of open innovation", European Journal of Innovation Management, Vol. 12 No. 3, pp. 326-345.

Enkel, E., Gassmann, O. and Chesbrough, H. (2009), "Open R&D and open innovation: exploring the phenomenon", R&D Management, Vol. 39 No. 4, pp. 311-316.

Erkens, M., Wosch, S., Luttgens, D. and Piller, F. (2014), "Measuring open innovation – a toolkit for successful innovation teams", Performance, Vol. 6 No. 2, pp. 12-23.

Fereday, J. and Muir-Cochrane, E. (2006), "Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development", International Journal of Qualitative Methods, Vol. 5 No. 1, pp. 80-92.

Gassmann, O. (2006), "Opening up the innovation process: towards an agenda", R&D Management, Vol. 36 No. 3, pp. 223-228.

Gassmann, O. and Enkel, E. (2004), "Towards a theory of open innovation: three core process archetypes", paper presented at the 2004 R&D Management Conference, Lisbon, 6-9 July, available at: www.alexandria.unisg.ch/EXPORT/DL/20417.%20pdf (accessed 24 July 2015).

Gassmann, O., Enkel, E. and Chesbrough, H.W. (2010), "The future of open innovation", R&D Management, Vol. 40 No. 3, pp. 213-221.

Gianiodis, P.T., Ellis, S.C. and Secchi, E. (2010), "Advancing a typology of open innovation", International Journal of Innovation Management, Vol. 14 No. 4, pp. 531-572.

Giannopoulou, E., Yström, A. and Ollila, S. (2011), "Turning open innovation into practice: open innovation research through the lens of managers", International Journal of Innovation Management, Vol. 15 No. 3, pp. 505-524.

Giannopoulou, E., Yström, A., Elmquist, M., Fredberg, T. and Ollila, S. (2010), "Implications of openness: a study into (all) the growing literature on open innovation", Journal of Technology Management and Innovation, Vol. 5 No. 3, pp. 162-180.

Greco, M., Grimaldi, M. and Cricelli, L. (2015), "Open innovation actions and innovation performance: a literature review of European empirical evidence", *European Journal of Innovation Management*, Vol. 18 No. 2, pp. 150-171.

Hidalgo, A. and Albors, J. (2008), "Innovation management techniques and tools: a review from theory and practice", *R&D Management*, Vol. 38 No. 2, pp. 113-127.

Huizingh, E.K.R.E. (2011), "Open innovation: state of the art and future perspectives", *Technovation*, Vol. 31 No. 1, pp. 2-9.

Huston, L. and Sakkab, N. (2006), "Connect and develop: inside Procter & Gamble's new model for innovation", *Harvard Business Review*, Vol. 84 No. 3, pp. 58-66.

Igartua, J.I., Garrigós, J.A. and Hervas-Oliver, J.L. (2010), "How innovation management techniques support an open innovation strategy", *Research-Technology Management*, Vol. 53 No. 3, pp. 41-52.

Keupp, M.M. and Gassmann, O. (2009), "Determinants and archetype users of open innovation", *R&D Management*, Vol. 39 No. 4, pp. 331-341.

Kirschbaum, R. (2005), "Open innovation in practice", *Research Technology Management*, Vol. 48 No. 4, pp. 24-28.

Kovacs, A., Van Looy, B. and Cassiman, B. (2015), "Exploring the scope of open innovation: a bibliometric review of a decade of research", *Scientometrics*, Vol. 104 No. 3, pp. 951-983.

Kutvonen, A. (2011), "Strategic application of outbound open innovation", *European Journal of Innovation Management*, Vol. 14 No. 4, pp. 460-474.

Laursen, K. and Salter, A. (2006), "Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms", *Strategic Management Journal*, Vol. 27 No. 2, pp. 131-150.

Lazzarotti, V. and Manzini, R. (2009), "Different modes of open innovation: a theoretical framework and an empirical study", *International Journal of Innovation Management*, Vol. 13 No. 4, pp. 615-636.

Lazzarotti, V., Manzini, R. and Pellegrini, L. (2010), "Open innovation models adopted in practice: an extensive study in Italy", *Measuring Business Excellence*, Vol. 14 No. 4, pp. 11-23.

Lee, S., Park, G., Yoon, B. and Park, J. (2010), "Open innovation in SMEs – an intermediated network model", *Research Policy*, Vol. 39 No. 2, pp. 290-300.

Little, A.D. (2014), "Global open innovation survey 2014", available at: www.adlittle.com/fileadmin/editorial/microsite/openinnovation/2014-Global_Open_Innovation_survey-English_version-vf.pdf (accessed 10 March 2014).

Mention, A. (2011), "Co-operation and co-opetition as open innovation practices in the service sector: which influence on innovation novelty?", *Technovation*, Vol. 31 No. 1, pp. 44-53.

Mina, A., Bascavusoglu-Moreau, E. and Hughes, A. (2014), "Open service innovation and the firm's search for external knowledge", *Research Policy*, Vol. 43 No. 5, pp. 853-866.

Mortara, L. and Minshall, T. (2011), "How do large multinational companies implement open innovation?", *Technovation*, Vol. 31 Nos 10-11, pp. 586-597.

Möslein, K.M. and Bansemir, B. (2011), "Strategic open innovation: basics, actors, tools and tensions", in Hülsmann, M. and Pfeffermann, N. (Eds), *Strategies and Communications for Innovations. An Integrative Management View for Companies and Networks*, Springer, Berlin and Heidelberg, pp. 11-23.

Nambisan, S. and Sawhney, M. (2007), "A buyer's guide to the innovation bazaar", *Harvard Business Review*, Vol. 85 No. 6, pp. 109-118.

Natalicchio, A., Messeni Petruzzelli, A. and Garavelli, A.C. (2014), "A literature review on markets for ideas: emerging characteristics and unanswered questions", *Technovation*, Vol. 34 No. 2, pp. 65-76.

Oliveira, R.S.M. and Alves, J.L. (2014), "The next frontier: open innovation and prospecting of knowledge in highly complex environments – towards value creation in high tech industries", *African Journal of Business Management*, Vol. 8 No. 8, pp. 270-282.

Piller, F. and West, J. (2014), "Firms, users, and innovation: an interactive model of coupled open innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford University Press, Oxford, pp. 29-49.

Pisano, G.P. and Verganti, R. (2008), "Which kind of collaboration is right for you?", *Harvard Business Review*, Vol. 86 No. 12, pp. 78-86.

Presutti, M., Boari, C. and Majocchi, A. (2011), "The importance of proximity for the start-ups' knowledge acquisition and exploitation", *Journal of Small Business Management*, Vol. 49 No. 3, pp. 361-389.

Rass, M., Dumbach, M., Danzinger, F., Bullinger, A.C. and Moeslein, K.M. (2013), "Open innovation and firm performance: the mediating role of social capital", *Creativity and Innovation Management*, Vol. 22 No. 2, pp. 177-194.

Remneland Wikhamn, R. and Wikhamn, W. (2013), "Structuring of the open innovation field", *Journal of Technology Management and Innovation*, Vol. 8 No. 3, pp. 173-185.

Rohrbeck, R., Hölzle, R.K. and Gemünden, H.G. (2009), "Opening up for competitive advantage – how Deutsche Telekom creates an open innovation ecosystem", *R&D Management*, Vol. 39 No. 4, pp. 420-430.

Schroll, A. and Mild, A. (2012), "A critical review of empirical research on open innovation adoption", *Journal für Betriebswirtschaft*, Vol. 62 No. 2, pp. 85-118.

Schweisfurth, T., Raasch, C. and Herstatt, C. (2011), "Free revealing in open innovation: a comparison of different models and their benefits for companies", *International Journal of Product Development*, Vol. 13 No. 2, pp. 95-118.

Simard, C. and West, J. (2006), "Knowledge networks and the geographic locus of innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *Open Innovation: Researching A New Paradigm*, Oxford University Press, Oxford, pp. 220-240.

Spithoven, A., Vanhaverbeke, W. and Roijackers, N. (2013), "Open innovation practices in SMEs and large enterprises", *Small Business Economics*, Vol. 41 No. 3, pp. 537-562.

Stoetzel, M. (2012), "Engaging mass customization customers beyond product configuration: opportunities from the open innovation field", *International Journal of Industrial Engineering and Management*, Vol. 3 No. 4, pp. 241-251.

Theyel, N. (2013), "Extending open innovation throughout the value chain by small and medium-sized manufacturers", *International Small Business Journal*, Vol. 31 No. 3, pp. 256-274.

van de Vrande, V., de Jong, J.P.J., Vanhaverbeke, W. and de Rochemont, M. (2009), "Open innovation in SMEs: trends, motives and management challenges", *Technovation*, Vol. 29 Nos 6-7, pp. 423-437.

von Hippel, E. (1986), "Lead users: a source of novel product concepts", *Management Science*, Vol. 32 No. 7, pp. 791-805.

von Hippel, E. (1988), *The Sources of Innovation*, Oxford University Press, New York, NY.

Wang, K. (2013), "Collective innovation: a literature review", *Proceedings of PICMET'13 on Technology Management in the IT-Driven Services (PICMET)*, IEEE, pp. 608-615.

West, J. and Bogers, M. (2014), "Leveraging external sources of innovation: a review of research on open innovation", *Journal of Product Innovation Management*, Vol. 31 No. 4, pp. 814-831.

West, J. and Lakhani, K.R. (2008), "Getting clear about communities in open innovation", *Industry and Innovation*, Vol. 15 No. 2, pp. 223-231.

West, J., Salter, A., Vanhaverbeke, W. and Chesbrough, H. (2014), "Open innovation: the next decade", *Research Policy*, Vol. 43 No. 5, pp. 805-811.

Wynarczyk, P., Piperopoulos, P. and McAdam, M. (2013), "Open innovation in small and medium-sized enterprises: an overview", *International Small Business Journal*, Vol. 31 No. 3, pp. 240-255.

Xu, Y. and Zheng, J. (2012), "Open innovation: literature review and outlook", *Proceedings of the 2012 IEEE ISMOT*, IEEE, pp. 558-562.

Ye, J. and Kankanhalli, A. (2013), "Exploring innovation through open networks: a review and initial research questions", *IIMB Management Review*, Vol. 25 No. 2, pp. 69-82.

Zhao, S., Sun, Y. and Xu, X. (2016), "Research on open innovation performance: a review", Information Technology and Management, Vol. 17 No. 3, pp. 279-287.

Ziegler, N., Gassmann, O. and Friesike, S. (2014), "Why do firms give away their patents for free?", World Patent Information, Vol. 37, pp. 19-25.

Corresponding author

Elena Pessot is the corresponding author and can be contacted at: elena.pessot@uniud.it

About the authors

Cinzia Battistella is an Associate Professor of Innovation Management at the University of Siena (Italy). Previously, she worked in the field of Management Engineering at the University of Bolzano, University of Udine and University of Padua. Her research interests are in the areas of foresight, collaborative innovation and business models. She published in different academic journals, as Technological Forecasting and Social Change and Journal of Engineering and Technology Management.

Professor Alberto Felice De Toni, PhD, is the Rector of the University of Udine where he is a Professor of Complexity Management. The main scientific interests are operations, strategic and innovation management, and management of complex systems. His publications have appeared in various international journals, such as International Journal of Operations and Production Management, International Journal of Production Research, International Journal of Production Economics, Omega and Technovation.

Elena Pessot is an Information Engineer and a PhD Candidate in Management Engineering at the University of Udine. Her scientific interests are in the areas of project management, strategic and innovation management, management of complex systems.