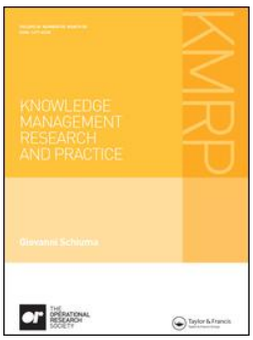

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Knowledge Management Research & Practice

ISSN: 1477-8238 (Print) 1477-8246 (Online) Journal homepage: https://www.tandfonline.com/loi/tkmr20

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To cite this article: Barbara Aquilani, Tindara Abbate & Anna Codini (2017) Overcoming cultural barriers in open innovation processes through intermediaries: a theoretical framework, Knowledge Management Research & Practice, 15:3, 447-459, DOI: 10.1057/s41275-017-0067-5

To link to this article: https://doi.org/10.1057/s41275-017-0067-5

Published online: 19 Dec 2017.

Knowl Manage Res Pract (2017) 15:447–459
DOI 10.1057/s41275-017-0067-5

ORIGINAL ARTICLE

Overcoming cultural barriers in open innovation processes through intermediaries: a theoretical framework

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Received: 10 November 2015 / Revised: 18 April 2017 / Accepted: 14 July 2017 / Published online: 28 July 2017

Abstract Certain cultural barriers, such as insufficient openness, aversion to risk-taking, organizational inertia and specific syndromes could inhibit successful Open Innovation processes. However, how Open Innovation Intermediaries help in overcoming obstacles to successfully achieve Open Innovation processes, has not yet been analysed in depth. This paper aims to fill this gap, relying on extant contributions of Open Innovation processes, Open Innovation Intermediary features and types. Based on the distinction between outside-in, inside-out and coupled Open Innovation processes, the theoretical framework developed here identifies specific cultural barriers affecting each process and suggests which intermediary types could be more suited to sustain firms undergoing these processes. The framework supports firms opening up their internal R&D activities to choose the intermediary type most suitable for adaption to an appropriate culture, as well as overcoming any possible cultural barriers.

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Keywords Cultural barriers · Open Innovation processes · Organizational roles and capabilities · Open innovation intermediaries · Open innovation intermediaries types

Introduction

Open Innovation (OI) has to be understood as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" (Chesbrough and Bogers 2014, p. 27). The essence concerns the opening up of the innovation process outside organizational boundaries, in contrast with traditional "closed" innovation model. Therefore, OI processes entail a higher involvement of external entities in innovative activities and processes, including customers, suppliers, experts, universities, private/public R&D institutions, partners and competitors (Chesbrough 2003).

By adopting an OI approach, organizations can acquire and use knowledge originating from external sources. This allows them to tap into the following processes; accessing and integrating complementary resources, competences and capabilities; generating new ideas for product development; seeking alternative ways of commercially exploiting internal knowledge and Intellectual Property Rights (IPR); increasing innovation profitability and revenues and increasing knowledge base and customer satisfaction (Chesbrough et al. 2006; Helfat 2006; van de Vrande et al. 2009; Dahlander and Gann 2010; Huizingh 2011).

Open Innovation, as defined here, claims to be a shift in corporate mindset, necessary to identify and successfully profit from external opportunities (Chesbrough 2003), as well as to design new *ad hoc* business models (Chesbrough 2006b). In this respect, organizational cultural issues have

to prioritize this "organizational innovation" (Christensen 2006, p. 35). Indeed, several studies have recognized that corporate culture is essential to convert OI initiatives into success, as it is doubly linked with a firm's adopted business model (Chesbrough 2006a). These can be understood "as the cognitive device through which decisions about innovation are evaluated and taken" (Chiaroni et al. 2010, p. 224; Chesbrough 2006a).

In the OI literature, culture has mainly been studied in terms of cultural barriers and of ways to overcome them (Huizingh 2011). Considering these cultural barriers, the most important aspects include coping with decision-making openness (Jespersen 2010; Mortara et al. 2010) and with certain risks linked to openness, facing organizational inertia and overcoming the Not-Invented-Here (NIH) and Not-Sold-Here (NSH) syndromes (Huang and Rice 2009; Boscherini et al. 2010).

Choosing and managing the correct balance of openness is essential to make OI initiatives successful (Jespersen 2010; Mortara et al. 2010). Therefore, firms should identify the optimal level of breadth and depth of openness to success in interacting and collaborating with external parties and internalizing the developed knowledge (Laursen and Salter 2006). Indeed, the degree of openness becomes both a key issue for a firm willing to adopt OI, and one of the most important barriers to OI process implementation (Chesbrough et al. 2006; Huang and Rice 2009; Boscherini et al. 2010).

The opening up of organizational boundaries requires a risk-taking culture (Herzog 2008; Ollila and Elmquist 2011) in that knowledge flows in OI processes also imply that a firm's knowledge will be shared to some extent with partners. In this context, intellectual property (IP) management issue emerges. This issue underlines how important it is to simultaneously protect the firm's strategic knowledge as a source of its competitive advantage and profiting from partners' knowledge (West 2003). Making firms' knowledge accessible to some extent, implies a higher risk when compared to a "closed" innovation model (Almirall and Casadeus-Masanell 2010).

Organizational inertia is 'embedded in' and 'nourished by' organizational routines (Nelson and Winter 1982), and therefore, is difficult to overcome. To implement OI processes effectively sometimes requires overcoming organizational resistance and quickly changing the status quo thanks for example, to the so-called 'jump in' initiation (Kotter 1995).

The "Not-Invented-Here" (NIH) syndrome can be defined as "the tendency of a project group of stable composition to believe that it possesses a monopoly of knowledge in its field, which leads it to reject new ideas from outsiders to the detriment of its performance" (Katz and Allen 1982, p. 7). For this reason, when it emerges, it inhibits external ideas to cross organizational boundaries (Chesbrough and Crowther 2006; Mortara et al. 2010).

The "Not-Sold-Here" (NSH) syndrome could develop, thus impeding external commercialization of internal knowledge and represents, in the same way as the NIH syndrome, a misalignment between top management goals and the attitudes/behaviours of the firms' employees (Katz and Allen 1982; Lichtenthaler et al. 2010). Both syndromes need to be overcome to succeed in OI processes, based on knowledge exchange and sharing between firms and their partners.

Cultural barriers are relevant for successful OI process implementation. However, existing research has not clarified which of these barriers occurs more frequently, depending on the OI process in question, and what support can be offered by Open Innovation Intermediaries (OIIs) to seekers (firms seeking innovative solutions in the OI context) and solvers (scientists, professionals, experts, firms, etc.).

OIIs are third parties, which can connect, stimulate and support firms in various ways (Howells 2006). They assume different roles and functions and also provide a wider range of services for both seekers and solvers, thus potentially offering useful innovative solutions (Howells 2006; Sieg et al. 2010; Aquilani et al. 2016). Similarly, they can also stimulate firms, which are interested in purchasing and selling IPR and/or patents, and which have started to operate in the OI arena. Some examples of OIIs include Nine Sigma, Innocentive and Yet2.com.

Even if cultural barriers emerge as being relevant to OI processes, no studies have yet discussed how OIIs could support seekers to overcome them, given the peculiarities of various OII types.

In order to fill this gap, this paper has developed a theoretical framework focusing on how OIIs could help seekers' to overcome cultural barriers in OI processes implementation. Based on the distinction among outside-in, inside-out and coupled Open Innovation processes, the theoretical framework identifies the specific cultural barriers which affect each process as well as the contribution of various OII types to face these emerging cultural barriers. In doing so, the framework can help managers identify which kind of OII could support their firms' OI processes better, overcoming emerging cultural barriers and implementing successfully OI approach.

The paper first focuses on different OI processes and then discusses the main cultural barriers emerging within the OI domain, as well as organizational capabilities, roles and changes for success. It then analyses the role assumed by OIIs in the process of aiding seekers overcome cultural barriers, which have emerged in specific OI processes, by distinguishing different OII types based on the support they provide (contacts or "turn-key" solutions). Finally, the paper presents the developed framework by linking cultural

barriers relevant to the OI process and OII types in order to understand how OIIs can support seekers overcome cultural barriers and successfully implement OI processes. The paper ends with a general conclusion, including limitations and suggestions for future avenues of research.

Open innovation processes and cultural barriers obstructing them

The OI literature indicates that innovation processes can be opened in three different directions: outside-in, inside-out and coupled processes (Enkel et al. 2009). In outside-in innovation processes, organizations develop their own knowledge base through the use of external ideas, knowledge and resources, emphasizing the relevant role of interconnected innovation networks, the form of customer integration (e.g. crowd-sourcing), and the intermediation activity of third parties that facilitate and support interactions and collaboration between heterogeneous subjects (i.e. Innocentive; Enkel et al. 2009).

In inside-out innovation processes, organizations intend to exploit their internal knowledge by taking ideas to the market, selling IPR or licensing mechanisms and taking their own developed technologies to the outside environment. These processes focus on the external allocation and commercialization of ideas and technological innovation derived from internal R&D activities. They underline the relevance of new business models or spin-offs (Chesbrough 2006b), corporate venturing activities (Enkel et al. 2009) and the commercialization of technologies in cross-industry markets (Enkel and Gassmann 2010).

In coupled innovation processes, the concept of co-creation with complementary partners emerges. This concept emphasizes different forms of collaboration with external players from various sectors, which have particular skills and capabilities (Enkel et al. 2009). These external partners can provide ad hoc solutions able to improve the organization's innovation processes or to exploit output developed by the organization itself (Enkel et al. 2009).

The literature on OI processes shows that outside-in processes in general, are the most commonly implemented by firms (Chesbrough and Crowther 2006; Schroll and Mild 2011). Indeed, a recent study carried out in the biopharmaceutical industry, demonstrates how the number of outside-in and inside-out processes in this context are more or less equal, even if the latter generates a higher proportion of the firm's total revenue (Michelino et al. 2015). This demonstrates, on one hand, how important implementing inside-out processes could be (Chesbrough 2003; Chesbrough and Crowther 2006), and on the other, how outside-in and inside-out processes are linked. Indeed, implementing a high number of outside-in OI processes could lead to more innovation developed by the firm through inside-out OI processes (Schroll and Mild 2011; Michelino et al. 2015) or coupled paths. Piller and West (2014) highlights this trend too.

Because of the high revenue derived from successfully implemented OI processes, both cultural barriers inhibiting firms to profit from them and strategies on how to overcome these obstacles, are essential within the OI domain.

Moving from a closed to an open approach of innovation entails a radical change in a firm's organization to the point that "Open Innovation can be considered an organizational innovation" in itself (Christensen 2006, p. 35). Moreover, organizational change within OI is highly pervasive, as it requires a company to intervene both on the 'hard' aspects of its organization as well on the 'soft' ones, such as culture (Lazzarotti and Manzini 2009). As such, certain important cultural barriers emerge, as is amply highlighted in the literature. Some of these can be linked more to certain OI processes than to others, as this paper will discuss.

The OI literature has mainly referred to culture as 'cultural barriers' and has focused on ways to overcome them. However, OI studies do not clarify exactly which barriers occur more frequently in the various types of OI processes and what support OIIs can offer to both seekers and solvers. Starting from decision-making openness, this is a key issue in the OI domain. Firm openness can be defined as, "the way firms go about organizing search for new ideas that have commercial potential" and studied referring to the concepts of 'breadth' and 'depth'(Laursen and Salter 2006, p. 131).

Openness is particularly important in implementing OI processes. Opening up means that whoever is responsible for a project has to involve partners during new product development. Involving partners with innovative views sometimes distant from the dominant ones, enables the firm to give more innovative contents to the new product (Jespersen 2010). Openness enables them to avoid *functional fixedness*, occurring when people involved in new innovation process cannot assume a different perspective beyond the actual use of a product/service (von Hippel 1986; Rossi 2011; Zynga 2013).

Regarding openness, one of the main difficulties is the level of openness a company needs to adopt. Maximum openness is not always the best solution. This decision might depend on company strategy, its organization and managerial context, balancing costs and benefits (Dahlander and Gann 2010).

Due to its nature, openness is a cultural barrier, which emerges from each OI process. It shapes, along with resources, competences, costs, benefits, and so on, the intensity of OI adoption in respect to "close" innovation processes. It is also important in benchmarking, as each innovation project, the two alternative models of innovation;

internal R&D processes do not disappear whenever a firm decides to adopt OI for any of its processes (Dahlander and Gann 2010).

When different partners are involved in OI processes, openness is related to trust, as well as to the reliability of partners and consequently to the risk of opening up (Westergren and Holmström 2012). In particular, the role of trust emerges when OI processes involve consumers. In this respect, Romero and Molina (2011) suggest combining trust with information transparency, while other authors (Rossi 2011) suggest associating trust with reliability.

As a result, OI requires a risk-taking culture (Herzog (2008)) and trust in this domain has a key role even if little is known about it in innovation processes. According to Sztompka (1999, p. 25), "trust is a bet about the future contingent actions of others" and, "others might be individuals, organizations, or technologies". Based on this definition, Westergren and Holmström (2012) illustrate how trust and risk are intrinsically associated. They show how OI projects tend to increase their co-dependencies given that inter-organizational knowledge sharing requires mutual trust, and maintaining trust can lead to better risk management. Their study presents empirical evidence underlining the idea that the role of trust in network ties is crucial for OI.

Given that firms are normally relatively adverse to risk, as risk in OI entails losing full control of innovation processes, it is possible to argue that a risk-taking culture is important in all OI processes. However, the type of risk firms have to evaluate varies according to the OI processes. In outside-in processes, risk can be seen in contacting sources of knowledge, whose contribution, for example, is not expected or able to lead to successful innovation. In inside-out processes, risks may be associated with contacted partners interested in buying technologies and/or IPR when after some time, they decide to exit the relationship, as they understand the proposed output will not suit their needs. By this time, the basic technology knowledge or IPR has been transferred and the firm could lose the opportunity to sell its output to the market unless a suitable IP management has been put in place (Chesbrough and Ghafele 2014).

Organizational inertia is one of the most challenging barriers towards effective adoption of OI (Armenakis and Bedeian 1999). Adopting OI approach is an organizational change requiring a continuous process of experimenting, adapting and learning in order to proactively define its context. This change necessarily requires flexibility, agility and adaptability (Burnes 1992; Chiaroni et al. 2010). As such, facing organizational inertia means developing organizational routines and practices suitable to efficaciously involve external partners and to internal and external competences and capabilities. Although OI processes require a relevant change in organizational structure to open up towards external partners and to renew the internal teams involved in open projects, many cultural barriers block this change due to the lack of adequate skills and managerial styles.

In the OI domain, established organizational units perceive the increasing power of the OI team as a threat to their survival and fear the risk of dangerous spill-overs (Mayer 2006). However, the case studies reported in Boscherini et al. (2010) demonstrate that a countermeasure to this resistance is primarily sought outside the firm. This is an attempt to counter-balance internal inertia by applying more pressure from external actors. Successfully combining internal and external sources is essential in OI as well as an ambidextrous mentality (Vanhaverbeke et al. 2008). Excessive ambidexterity can be tackled with sound relationship management (He and Wong 2004), as well as a sound leadership to navigate successfully from creation to commercialization (Harryson 2008). Therefore, relationship management is essential to deal with relationships inside and outside the firm (Fredberg et al. 2008; Harryson 2008). Recommendations are given in an OI contexts to ensure inspired participation (Füller et al. 2008) and feelings of trust, offering fun and space for creativity (Bughin et al. 2008) and sometimes incentives (Herzog 2008).

The NIH syndrome is defined here as "the tendency of a project group of stable composition to believe that it possesses a monopoly of knowledge in its field, which leads it to reject new ideas from outsiders to the detriment of its performance" (Katz and Allen 1982, p. 7). As this syndrome inhibits external ideas getting within the boundaries of an organization, it is one of the main obstacles to OI. This represents the most important challenge to embrace OI (e.g. Chesbrough and Crowther 2006). Many studies have focused on the diverse approaches required by managers to contrast NIH in different functions (e.g. Mortara et al. 2010), which emerge mainly in the outside-in processes and in coupled ones. Regarding this cultural barrier, it is important to note that looking at both internal and external knowledge might compromise the company's innovative performances. As shown by Schroll and Mild (2011) in a recent study, when outside-in processes increase they substitute the internal R&D activities.

Thus, even if many studies agree that firms' R&D intensity is complementary to external search 'breadth' and 'depth' in shaping innovative performance (Cohen and Levinthal 1989, 1990; Laursen and Salter 2006), behavioural response induces a substitution relationship between external sources and internal R&D. On the contrary, going beyond the NIH syndrome and combining external and internal R&D, has a positive impact on a firm's innovative performance. More precisely, looking for external sources of knowledge initially increases the innovative performance

of a firm. After reaching its peak, performance decreases due to limitations and risks related to external search. Laursen and Salter (2006) underline the relationship emerging between an external search strategy and innovative performance, by examining companies operating in all the main industrial sectors in the United Kingdom.

Even though these studies show more risks than the benefits associated with external search in OI processes, recent contributions have revealed different trends. Ju et al. (2013), investigating the relation between OI processes, entrepreneurial orientation and firm performance, highlight how the best innovative and financial performances are associated with outside-in processes.

Despite the recent increase in outward knowledge transfer, most industrial firms focus on their own product business. Thus, their experience in external knowledge exploitation is relatively limited (Teece 1998; Chesbrough 2007). Many firms therefore lack sufficient skill to achieve external knowledge exploitation opportunities (i.e. Rivette and Kline 2000). The capability to manage outward knowledge transfer is essential because of the limited transparency of knowledge markets, which causes high transaction costs (Caves et al. 1983; Teece 1998). Moreover, companies may refrain from external knowledge exploitation because of market failures and the risks of outward knowledge transfer (Silverman 1999; Gans and Stern 2003). The focus on intellectual property protection is often consistent with a firm's strategy to ensure a competitive advantage in its core business (Davis and Harrison 2001; Teece 2006). However, understanding OI processes, knowledge is often simultaneously exploited inside and outside the firm because of strategic motives for knowledge transfer. For example, licensing a technology in order to sell additional complementary products (Grindley and Teece 1997; Rivette and Kline 2000). In line with recent developments in dynamic capabilities theory, the extent of external knowledge exploitation may be influenced by protective employee attitudes to knowledge transfer (Chesbrough 2006b; Helfat et al. 2007), known as NSH tendencies, according to Chesbrough (2003).

In line with the NSH syndrome, firms are convinced that if they do not sell something, nobody else should sell it either. This approach derives from the idea that if one's own company is not able to give value to a specific technology, then neither will anyone else's. In order to face off the NSH syndrome, it is necessary to consider both the people involved in new product development processes and investment supporting innovation (Chesbrough et al. 2006). This cultural barrier mainly emerges in inside-out and in coupled processes.

As shown by Lichtenthaler et al. (2010), facing this cultural barrier first requires the involvement of employees on antecedents and consequences of NSH. Their empirical findings, conducted on a sample of 152 firms spanning multiple firms, showed that NSH tendencies exist in organizations and that they are a major barrier for the implementation of external knowledge commercialization strategies. Furthermore, NSH attitudes significantly contribute to explain the variance in external knowledge exploitation activity.

In contrast to the widespread view that culture, intended as cultural barriers, is an obstacle to OI implementation, Mortara and Mayer (2006) and Minshall (2011) observed how internal cultural heritage may sometimes facilitate OI adoption. In their study, despite the need for ambidexterity, firms with a strong tradition of closed innovation concentrated solely on outside-in activities. Companies with similar need for ambidexterity, but with a more traditionally 'extroverted' culture, implemented both inside-out and outside-in activities. As a result, firms may reconsider originally open and flexible attitudes in favour of a more controlling approach to innovation processes.

In order to successfully implement OI processes and to overcome all these cultural barriers, including the OI processes to which they are related to, changes are required in the organization structure as well as managerial capabilities and new internal firm roles.

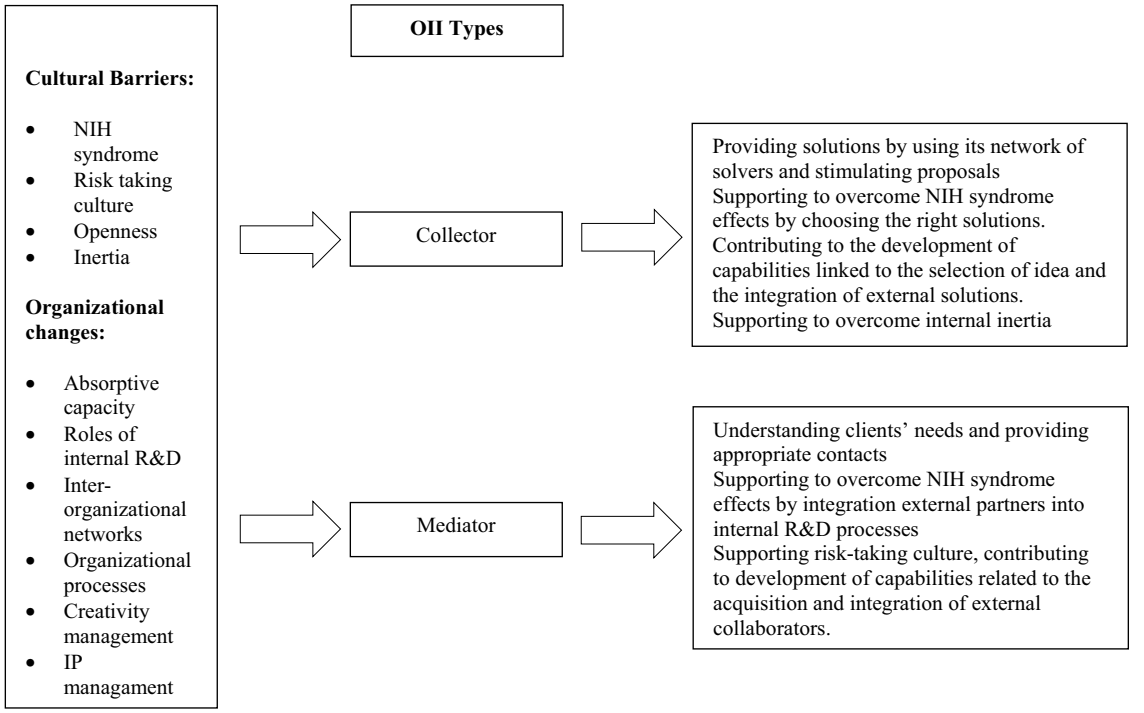
Organizational capabilities, roles and changes in OI processes

As a premise, it is worth noting that activity revising organizational structure and managerial competencies in order to break down cultural barriers to OI processes, can radically change from one OI process to another. Following Gassmann and Enkel (2004), outside-in processes require action leveraging *absorptive capacity* (Cohen and Levinthal 1990), while inside-out and coupled processes need to improve, respectively, *multiplicative capability* and *relational capability*.

Thus, starting from the outside-in innovation process (see Fig. 1a), it is clear that the first cultural barrier to be considered is the NIH syndrome (for example, patents purchased from solvers). Furthermore, openness and a certain degree of risk are necessary to access OI and to overcome inertia. In these processes, the ability to listen to the external environment is essential. Here, absorptive capacity is crucial because of the increasing complexity, breadth and cost of creating and implementing new technological knowledge.

The role of internal R&D to enable outside-in activity is crucial. Indeed, for example, several authors have suggested the adoption of an ambidextrous organization (i.e. Ferrary 2008, 2011)—an exploration team acting outside the firm as an open window that both the firm and its

(a) OII – Outside-in Process



(b) OII – Inside-out Process

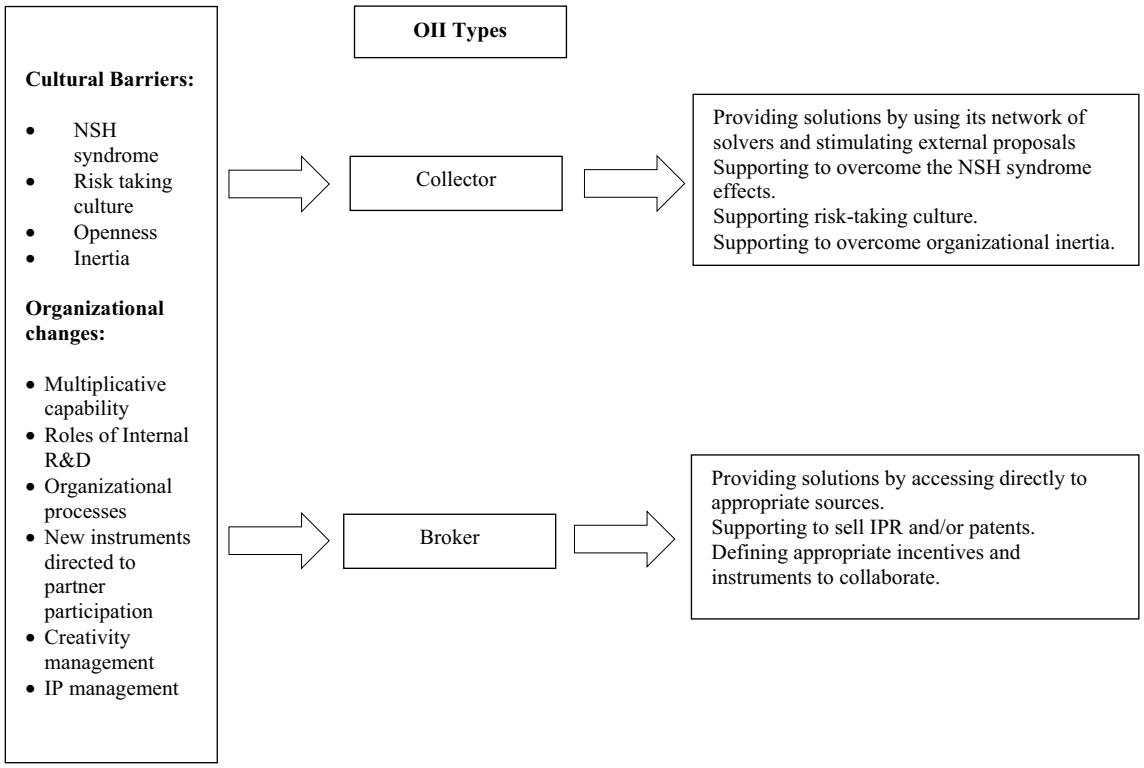


Fig. 1 The theoretical framework. **a** OII—outside-in process. **b**—OII inside-out process. **c** OII—coupled

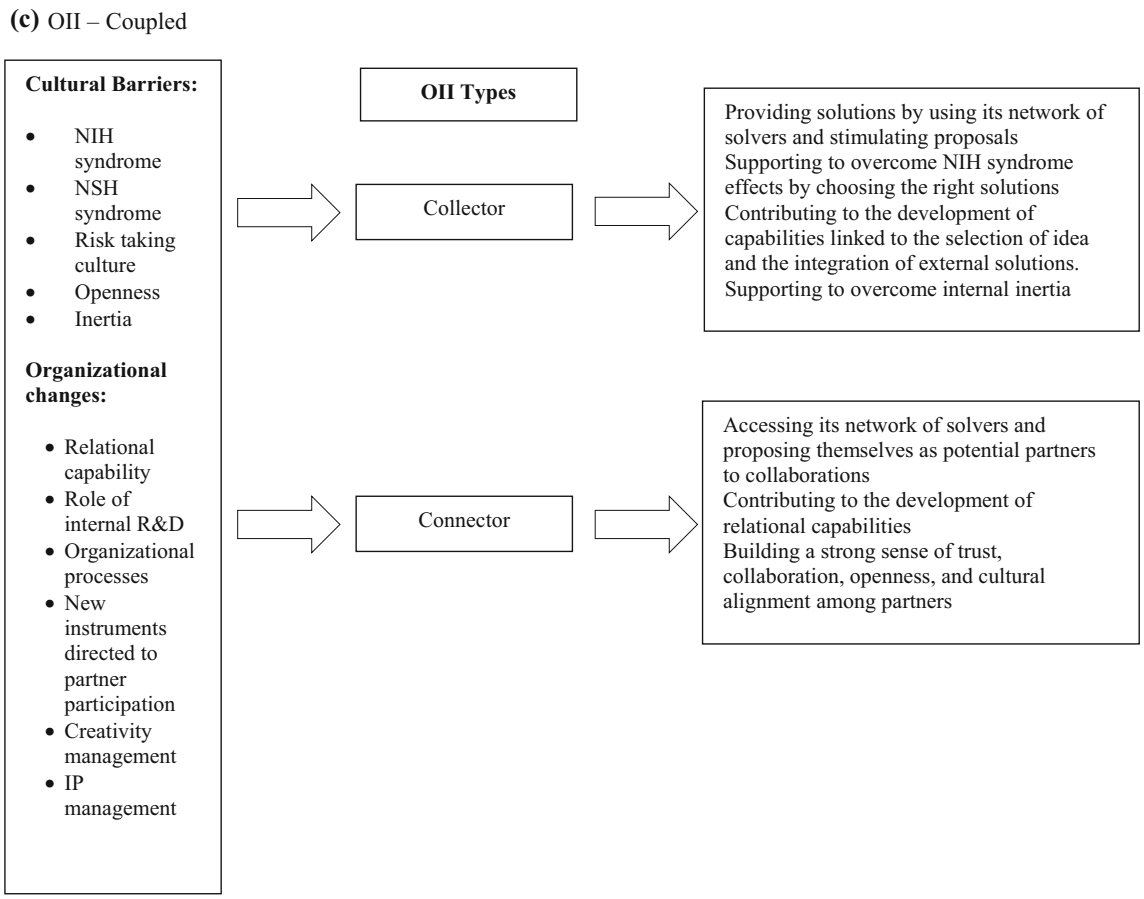


Fig. 1 continued

partners can use to cooperate can be an alternative (Burns and Stalker 1961; Benner and Tushman 2003; O'reilly and Tushman 2004; Ferrary 2008, 2011).

An alternative is the creation of inter-organizational networks supported by new roles and practices. The first role here is the *idea scout*, a sort of "antenna" creating new ideas from the most interesting scientific and technological developments from the external environment. This specific role can be assumed by an internal employee, who has the adequate competences to move at a global level (Whelan et al. 2011).

The second role is the *idea connector* (Whelan et al. 2011), a sort of hub in the internal network, who knows perfectly who does what within the organization and consequently, who is able to quickly identify personnel suitable for exploiting any technological or scientific opportunities.

The *integration experts* (Dodgson et al. 2006; Petroni et al. 2012), defined also as *T-men*, are able to select and integrate external knowledge so as to manage complex organizational structures.

Technological gatekeepers (Gemünden et al. 2007) act within the organization, creating a network to exchange information and communication, selecting information and assembling information from external and internal sources and delivering them to the organization and its teams.

Finally, the *champion of innovation* (Gemünden et al. 2007) is responsible for leading an innovation process. Their characteristics are as follows: enthusiastic and confident, persistent and able to gather the right people to work together. Their ability is to increase the probability of success of new products and project development.

As in the case of the introduction of new roles in the firm facing outside-in processes, the *Open Innovation arena* implementation (Ollila and Elmquist 2011) requires the support of internal R&D in order to be successful. Indeed, the Open Innovation Arena—defined as "the management of an actor trying to enable open innovation within a specific field of expertise, while at the same time seeing itself as a key player in the field" (Ollila and Elmquist 2011, p.274)—needs the support of management to select participants. Balancing business development with the loss of control is also crucial in managing this specific means of implementing OI.

In the inside-out processes, the *multiplicative capability* rather than *absorptive capacity* is crucial. This is first related to the ability of a firm to multiply and to transfer its

knowledge outside the firm's boundaries (Gassman and Henkel 2004). At the same time, strategic selection of partners who can multiply knowledge, ideas and technologies is also essential. As for the outside-in process, internal R&D has a strategic role in this task when supported by new organizational roles such as *promoters* (Witte 1977).

The literature defines promoters as people acting directly and supporting strongly innovative projects (Witte 1977). Gemünden et al. (2007) identified four different categories of promoters according to the kind of innovation they are going to support, while focusing on radical innovation. According to this categorization, promoters could be *power promoters*, *expert promoters*, *process promoters* and *relationship promoters*. The last is crucial in outside-in processes because of their strong relationships with external partners, indeed which are stronger even than relationships developed with internal members of their organization.

Finally, managing inside-out processes requires small changes to the organizational structure, while quickly identifying partners interested in buying what the firm cannot sell alone, becomes crucial. At the same time, negotiating with partners to benefit from the exchange is a strategic ability to succeed in these processes. Here, it is necessary to distinguish the sale of Intellectual Property Rights from a start-up or spin-off creation. Moreover, even considering the start-up or spin-off solutions, many differences might emerge, bringing changes to the management of specific solution (Chesbrough and Winter 2014).

Indeed, in coupled processes, a *relational capability* (Dyer and Singh 1998) is crucial as the capability of creating and maintaining long-term relationships with partners. In these processes, joint project development within strategic alliances is obviously the most critical (Johnson and Sohi 2003). The coupled processes being a combination of outside-in and inside-out processes, we need to remember these processes to describe the role assumed by internal R&D to enable outside-in and inside-out activities, respectively.

Furthermore, the role assumed by internal R&D and other organizational processes when establishing partnerships should be considered as affecting all types of OI processes.

First of all *selective revealing* is the mechanism allowing the creation or modification of a partners' network which can open up highly involved cooperation (Harhoff et al. 2003; Henkel 2006; Alexy et al. 2013). As a collaboration enabler, this obviously supports all OI processes, but most specifically coupled ones (Alexy et al. 2013).

The *evaluation process* in OI assumes a critical role in supporting both external scanning activity (van de Vrande et al. 2006) and the identification of different forms of external knowledge integration (Keil 2002; Chiaroni et al. 2010). *Defining new and suitable instruments* to motivate, support and incentive partners participation is a strategic ability especially for outside-in and coupled processes (Lampel et al. 2012; West and Gallagher 2006).

As *creativity management* is essential in innovative processes in general, it can be considered crucial in OI processes too (Anderson et al. 2014). Finally, *IP management* is obviously crucial in OI processes (Chesbrough and Ghafele 2014).

Focusing on these processes, IP management is really difficult. This is initially so because by looking for the right technology suitable for the firm, it is necessary to know perfectly the opportunities existing on the market which has various related problems (Chesbrough 2006b; Chesbrough and Ghafele 2014). These include first of all, when looking for a new technology, a firm needs to understand it, but if this is really well known, why pay for it? Secondly, if a firm wants to develop an existing technology owned by another company, how can this contribution be balanced?

Based on IP management-related issues, it appears that there are no risk-free solutions, even considering the specifics of the business where the partners act. This supports the idea that OIIs could assume a strategic role in supporting firms looking for the most suitable IP solution as well as avoiding the creation of new internal organizational structures and roles to manage OI processes.

Open Innovation Intermediary types and their role in OI processes

As the demand for OI grows and external sources of ideas are sought, the need for companies to find solution-providers is indisputable (Giannopoulou et al. 2011). OII roles (Sieg et al. 2010), functions (Howells 2006) and services (Aquilani et al. 2016) have already been studied clarifying that OIIs essential role is to help innovators use external knowledge and inventors to find a market to sell their ideas (Lee and Lee 2009). OIIs bring all the benefits of openness, such as monetizing value for sellers as well as providing market transparency for buyers (Lee and Lee 2009).

OIIs can be viewed, from a seeker's point of view, as a way of receiving support to overcome cultural barriers affecting OI processes and a source of complementary knowledge, competence and experience in managing OI processes. To understand how they can act on behalf of OI processes, Colombo et al. (2014)'s classification needs to be considered. These authors propose four different OII types based on two key dimensions of the intermediary process: 'access' and 'delivery'. 'Access' deals with the way in which OIIs interact with their network in terms of sources (knowing exactly who has the right sources) and proposals (posting the

Table 1 OII types in OI processes *Source* Our elaboration

OI process/OII type	Outside-in process	Inside-out process	Coupled
Broker	–	X	–
Mediator	X	–	–
Connector	–	–	X
Collector	X	X	X

query to their entire network). 'Delivery' considers the method OIIs use to support seekers in their innovation processes, distinguishing among OIIs able to provide 'turn-key' solutions (Hargadon and Sutton 1997, 2000; Hargadon 1998; Jeppesen and Lakhani 2010) and those only required to provide contacts (Colombo et al. 2014).

Using these two dimensions, it is possible to identify the following types: (i) 'Collectors' supporting access through proposals and delivering solutions; (ii) 'Brokers' providing solutions, but using already known sources; (iii) 'Mediators', using known sources, only to provide contacts; (iv) 'Connectors' able to provide contacts using proposals. Considering OI process classification, as well as OII types, we suggest that different types of OII could intervene more effectively, depending on the specific OI process type to be carried out (see Table 1).

In outside-in innovation processes, all OII types can support seekers in various ways ('delivery') using different modes to identify the right solver ('access'), since the seekers' goal in these processes is to access, combine and integrate complementary external sources of knowledge.

In inside-out innovation processes, the seeker's first goal is to establish the right contact with a firm potentially interested in sharing and/or acquiring knowledge sources and/or patents, which the seeker then makes available outside its boundaries. Therefore, 'connector' and 'mediator' OII types could have a key role in supporting these OI processes and in successfully achieving them. However, for OII types that deliver solutions, it is important to distinguish between 'sources' and 'proposals', since 'brokers', "do not solicit ideas […]from their network of knowledge sources" (Colombo et al. 2014, p. 130). In inside-out innovation processes, the seeker has not yet fully defined which knowledge source it will make available outside its boundaries, and so it has to find the way to develop its OI process. As a result, suggestions collected by the OII on the market are important. It can, therefore, be stated that OII type suitability depends on the seekers' innovation problem and on how well this is outlined.

Finally, coupled OI processes lead to co-creation activities, in which each partner is directly and fully involved in an ongoing process. This is because it can be assumed that OII intermediation could only be engaged in finding contacts in whichever way, involving both 'connectors' and 'mediators'.

Selecting the open intermediary type most suited to overcome cultural barriers in different OI processes: the Theoretical Framework

Regarding the four types of OIIs, which support outside-in processes, their contribution to overcome cultural barriers and help firms to manage the required organizational changes and/or to adapt internal structures and roles mainly depends on the strength of the seeker's organization as well as the management ability in coping with them.

The NIH syndrome is more likely to occur when OIIs provide solutions. In this case, 'collectors' provide specifically 'turn-key' solutions that are clearly not invented within a company. However, they do allow their clients to have many different solutions from members/experts of their large network and consequently, to choose the best solution(s). In doing so, these intermediaries share with their clients any solutions derived from external experts/network and contemplate any potential benefits, cost-effectiveness and the level of novelty.

Furthermore, 'mediators' are more likely to be involved in overcoming any possibly emerging NIH syndrome effects. Providing 'contacts' can be ubiquitously interpreted since helping seekers to find the right partner can be aimed at either finding sources of knowledge to be integrated into internal R&D processes or purchasing an IPR or a patent. These activities can more easily lead to a NIH syndrome effect for the seeker organization.

Openness in outside-in processes must be higher in our opinion, than in inside-out processes. This is when a firm aims to sell IPR or patents because the outside-in process requires the seeker's organization to accept and integrate external knowledge that will become part of its own knowledge storage. In this regard, 'collectors' "allow their clients to think outside the box" (Colombo et al. 2014, p. 138), contributing to the development of their specific capabilities and linked to the selection of ideas/solutions and to the implementation of external solutions.

Even if OIIs always support a risk-taking culture in seeker organizations, to some extent, this process mainly involves reassuring and supporting seekers in developing their own OI processes. Indeed, they can select the most appropriate partners from whom the seeker can then choose the most suitable one in terms of knowledge, competence and professional experience. Indeed, 'mediators' assume and elaborate their clients' problems and select the most suitable source of knowledge, therefore connecting their clients with appropriate knowledge experts and sustaining

the development of capabilities related to the acquisition and integration of external collaborators.

Finally, it can be argued that 'collectors' providing solutions or better IPR and/or patents could be more appropriate to support firms overcome internal inertia. Indeed, IPR and patents can be understood as 'ready parts of innovation', more readily accepted and integrated and also perceived as being less risky. This is because they normally involve, at least at the beginning, fewer changes that are simpler to introduce into organizational paths.

In the inside-out innovation process (see Fig. 1b), the NSH syndrome could be the greatest cultural barrier to overcome. This syndrome may be linked to lack of openness and OIIs could intervene in finding the right partners or in selecting the most suited partner for 'sold' knowledge, IPR and patents, providing either solutions or contacts mainly depending on what the seeker firm would like to externalize.

'Collectors' and 'brokers' may be better suited to 'sell' knowledge, contributing to deliver suitable and profitable solutions based on their scouting activities, competences and intermediary experience.

This is particularly so in regards to risk issues because selling a complete IPR or patent is often less risky than externalizing knowledge developed and already in use inside the firm. This is true even if legal and economic issues related to IPR emerge in both cases, opening up a new domain for OIIs—collectors and brokers—and their supporting activities.

In the inside-out innovation process, inertia can lock under-utilized or un-utilized IPR or patents within a firm and the collector intermediary could intervene, striving to change the way the firm operates and makes profits. In this respect, the issue of trust between seekers and OII emerges as a strong element influencing the OII's effectiveness in disrupting ongoing routines.

In coupled innovation processes (see Fig. 1c), all parties are normally fully involved and OIIs are best used to find the right partners for collaboration and co-creation rather than in providing solutions that partners would normally develop and/or exchange directly with counterparts. Specifically, connectors "know perfectly how to connect their clients with experts active in different technological and industrial domains" (Colombo et al. 2014, p. 138) and are oriented to work and collaborate with a well-defined innovation problem. Additionally, they contribute to develop relational capabilities within the organizations because they allow them to continually interact with individuals and companies from different backgrounds and experience, trying to obtain the maximum value from each.

All types of cultural barriers can arise in this domain. The way for OIIs to intervene is by trying to build a strong sense of trust, collaboration, openness and goal alignment among partners.

Conclusions

Firm culture is essential when converting OI initiatives into success, even if the role of culture in OI processes, whether supported by OIIs or not, has not yet been fully studied.

As a result, this paper contributes to OI and OII literature in various ways (i) by identifying and discussing the main cultural barriers emerging depending on the OI path; (ii) recognizing the organizational capabilities, roles and changes necessary to succeed in OI processes; (iii) classifying OII types according to the OI processes; (iv) discussing how different OII types could support seekers in overcoming cultural barriers emerging in the different OI processes; (v) building a new framework linking OI processes, OII types and their activity in supporting seekers overcoming cultural barriers.

In addition to the theoretical contribution, this paper also aims to give a managerial contribution. Indeed, the theoretical framework developed can support managers to improve their knowledge about OII roles in overcoming cultural barriers, which can emerge in different OI processes. It can also help to identify the main characteristics an OII should have to support them better in opening up their organizational boundaries. This again would depend on their structure, organization and existing culture as well as potentially emerging cultural barriers.

The main limitation of this paper is the lack of empirical validation of the proposed framework, which is the next planned step of this research. Therefore, our subsequent analysis will include multiple case studies regarding firms involved in OI processes supported by OII. This second phase will collect both points of view—the OII's and the firm's one—in order to review or validate the contents of the theoretical framework we have developed here. Multiple case studies analysis will be necessary in order to include different kinds of OI processes (outside-in, inside-out and coupled) in the analysis, as well as the different roles assumed by OIIs (brokers, mediators, connectors and collectors).

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