

Open or proprietary?

Choosing the right crowdsourcing platform for innovation

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Abstract:

Numerous reports have been published concerning the conditions under which a firm should rely on crowdsourcing for its innovation processes. This choice is the first order problem of crowdsourcing. Yet, once the decision to crowdsource has been made, the seeker must still decide whether to proceed internally with a proprietary platform, or to rely on the use of an open, external platform. This is the second order problem of crowdsourcing for which a theoretical analysis is offered in the present study. The conditions under which the use of an open, intermediary platform can be considered more appropriate than an exclusive, proprietary platform are analyzed. In particular, the role of transaction costs, network externalities and internal competencies are examined. Following this analysis, a decision-making model is proposed.

Keywords:

Crowdsourcing, open innovation intermediary, network externalities, transaction cost theory, resource-based view.

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1. Introduction

Since the seminal book of Chesbrough (2003), an expanding volume of research has emphasized the role of openness, both for product innovation (Laursen and Salter, 2006; Felin and Zenger, 2014) and for service innovation (Schueffel and Vadana, 2015; Martovoy and Mention, 2016). With the support of improvements in information technology and social media, a new mode of open innovation, referred to as ‘crowdsourcing’ (hereafter CS), has emerged (Howe, 2006, 2008; Brabham, 2008; Estellés-Arolas and González-Ladrón-De-Guevara, 2012; Bayus, 2013; Mount and Martinez, 2014; Nakatsu et al., 2014; Zhao and Zhu, 2014; Garrigos-Simon et al., 2015; Thuan et al., 2016; Ruiz et al., 2017).

Although CS can embrace very different configurations, depending on the context and type of task to be performed, in the case of innovative activities it essentially takes the form of contests (Brabham, 2008; Boudreau and Lakhani, 2013; Malhotra and Majchrzak, 2014; Thuan et al., 2017). The operation usually takes place as follows: an organization, often referred to as the ‘seeker’, has a problem that it needs to solve. It then presents the problem online, either on its own website or on a dedicated platform, thus inviting the individuals comprising the crowd, often referred to as ‘solvers’, to propose solutions. The seeker then selects the solution it prefers, pays a reward to the inventor, and uses the solution for his/her own purposes.

Until now, the literature has focused on the advantages and disadvantages of CS for seekers, with respect to traditional outsourcing or in-house accomplishment of the task (Afuah and Tucci, 2012; Boudreau and Lakhani, 2013). We label this question *the first-order problem of CS* (to rely, or not to rely on the crowd). The main results of this literature are summarized in Table 1, where five sets of conditions favoring CS are proposed: these conditions relate to the problem to be crowdsourced, the expected solution, the knowledge required to solve the problem, the characteristics of the seeker, and the characteristics of the crowd.

Conditions on:		Impact on CS strategy	Source
The problem			
	Simple, or can be broken down into simple sub-problems (modular)	Enables problem-solving by isolated solvers	Lakhani & Tushman, 2012; Felin & Zenger, 2014
	Easy to specify, delineate and broadcast to the crowd	Minimizes transaction costs	Afuah & Tucci, 2012; Pénin & Burger-Helmchen, 2011)
The solution			
	Easy to transfer, to protect and to evaluate	Minimizes transaction costs	Pénin & Burger-Helmchen, 2011; Afuah & Tucci, 2012
The knowledge needed to solve the problem			
	Distributed	Makes it difficult for a central authority to manage this knowledge	Lakhani & Tushman, 2012 ; Afuah & Tucci, 2012
	Hidden	Makes it difficult for a central authority to manage this knowledge	Felin & Zenger, 2014
	Implicit	Makes it difficult, time-consuming and costly for the seeker to acquire this knowledge	Afuah & Tucci, 2012; Lakhani & Tushman, 2012
	Distant (from the seeker)	Makes it difficult, time-consuming and costly for the seeker to acquire this knowledge	Afuah & Tucci, 2012; Poetz & Schreier, 2012
The seeker			
	Has invested in its absorption capacity	Facilitates the development of solution(s) contributed by external solvers	Ruiz et al., 2016; Pénin & Burger-Helmchen, 2011
The crowd			
	Large and heterogeneous	Maximizes the probability of finding a solution	Surowiecky, 2004; Malhotra & Majchrzak, 2014.
	Interactions among individuals	Effects unclear	Surowiecky, 2004; Kosinetz et al., 2008; Kosonen et al., 2014.
	Motivated	Monetary rewards increase extrinsic motivation, and/or intellectual challenge increases intrinsic motivation	Afuah & Tucci, 2012 ; Boudreau & Lakhani, 2013; Ståhlbröst & Bergvall-Kåreborn (2011).

NB: Conditional variables are not entirely exogenous. The crowd, for instance, can sometimes be shaped and/or selected by the seeker, or the problem can to a certain extent be modularised.

Table 1: CS feasibility conditions (modified, from Afuah and Tucci, 2012, p. 356)

In particular, many authors have highlighted the potential of the crowd, because of its size and diversity, when it comes to implementing a distant search (Afuah and Tucci, 2012), and finding inventive and creative solutions for innovation-related problems (Jeppesen and Lakhani, 2010; Poetz and Schreier, 2012; Soliman, 2013). By using the crowd, the seeker can benefit from a

large pool of potential contributors (with the world being considered as a reservoir of talent). Furthermore, the diversity of the crowd allows original solutions to be proposed (Chua et al., 2015; Malhotra and Majchrzak, 2014). This may reduce the incremental trap problem, at a considerably lower cost than in the case of internal production (Poetz and Schreier, 2012). Conversely, CS can be inefficient when the seeker fails to correctly specify the problem, and the solution is knowledge-intensive and difficult to transfer, or when intellectual property rights do not contribute to the prevention of opportunistic behavior (Pénin and Burger-Helmchen, 2011).

Although the first order problem of CS has been extensively described in the literature, to the best of our knowledge, a related question has been neglected: should the firm (seeker) making use of CS do this internally with a proprietary platform, or should it rely on an external and open intermediary platform, to access the crowd (solvers)? We qualify this question as *the second-order problem of crowdsourcing*. This extends the analysis of CS platforms proposed by Leicht et al. (2016), who showed that CS intermediaries play a role in task specification, task allocation, task processing, aggregation, selection and task remuneration. In another study published by Colombo et al. (2013), concerning the role of CS intermediaries, a relationship is drawn between the architecture of the web-intermediary and the nature of the innovation problem to be solved. A recent study related to this topic (Mrass et al., 2017) draws a distinction between platforms targeting internal crowd-workers (or employee crowdsourcing), and platforms targeting external crowd-workers ('classical' crowdsourcing). Through a single case study, the authors show that internal platforms can be designed to reach both internal and external crowd-workers. Concerning crowd-intermediaries, it is also interesting to mention the taxonomy of crowdfunding intermediaries proposed by Haas et al. (2014) who showed that crowdfunding intermediaries are situated between capital-seeking and capital-giving agents,

and differ in terms of the funding mechanism, the type of return, and their degree of specialization.

The role of intermediary platforms has thus been studied in the literature. For instance, the possibility for the seeker to rely on an ‘in-house’ proprietary platform vs. an intermediary platform is considered by Kosonen et al. (2014). However, the determinants of the choice of a CS platform have, to our knowledge, never been analyzed. The aim of the present study is therefore to develop and improve previously published analyses, by taking the duality of the CS platform type (the second-order problem of CS) into account, and exploring the determinants affecting the choice of CS platform.

After having defined the second-order problem of CS (section 2), we analyze the conditions under which it is more appropriate to use an open, intermediary platform rather than an exclusive, proprietary one. In particular, we discuss the role of transaction costs (section 3), network externalities (section 4), and internal resources and competencies (section 5). This leads us to propose a decision-making model for the choice of the most adequate platform, i.e. open or proprietary (section 6).

2. Open or proprietary? The second-order problem of CS

A growing body of literature in the field of management science has focused on open innovation intermediaries, i.e. on the advantages and disadvantages of using an intermediary organization when establishing an open innovation strategy (Chesbrough, 2003; Howells, 2006; Agogué et al., 2013; Alexander and Martin, 2013; Barlatier et al., 2017). This question is relevant because it is seldom natural for organizations to open up their boundaries. Thus, the practice of open innovation often relies on the use of intermediaries, which address and mitigate the difficulties that may arise.

In practice, the activities of open innovation intermediaries are highly diverse. These include, for example, consulting activities (Bessant and Rush, 1995), brokering on patents markets (Arora et al., 2001), patent pool (Merges, 2001), and Technology Transfer Office (TTO) that facilitate technology transfers from universities to industry (Barlatier et al., 2017). Co-working spaces (Capdevila, 2015), or social media (Bashir et al., 2017; Mount and Martinez, 2014) can also be considered as innovation intermediaries, since they offer a favorable environment for collective creation and invention, and facilitate networking between the various actors involved in innovation.

Similarly, crowdsourcing is achieved through the use of an intermediation platform, which establishes appropriate connections between the company (the seeker) and the crowd (the solvers). CS platforms can differ with respect to two specific characteristics. Firstly, they can be implemented and controlled by the seeking firm itself, or they can be managed externally by an intermediary service supplier. In other words, platforms can be internal or external to the seeker firm. Secondly, CS platforms can be accessible to many seekers, or be exclusively devoted to a unique seeker. In other words, platforms can be ‘multi-seeker’ or ‘single-seeker’.

These two dimensions are clearly related. When a firm invests in the development of its own platform, there is a strong incentive to preserve an exclusive benefit from the platform, in order to capture the value of the crowd. Conversely, a third party investing in the development of an intermediary platform will try to attract many different seekers, in order to increase its return on investment. Single-seeker/internal and multi-seeker/external configurations thus represent the more robust type of platform, which is the reason for which they have frequently been observed and studied in the literature (Table 2). In the remainder of this paper, a platform that is external and multi-seeker is referred to as an ‘open platform’, and a platform that is internal and single-seeker is referred to as a ‘proprietary platform’.

An emblematic example of an open platform is InnoCentive (Lakhani, 2008; Liotard and Revest, 2017), which was created in 2001 as a CS platform where seekers could post problems online, thus gaining access to a large number of potential solvers. As of 2016, more than 2 000 challenges have been offered to more than 375 000 solvers located around the globe. More than 1 500 challenges have been solved, with the total value of rewards exceeding 49 M\$. The rate of challenge elucidation varies between 30% and 85%, depending on the type of challenge and the level of InnoCentive assistance. The rewards offered for solvers range between \$5 000 and \$1 000 000, depending on the complexity of the problem. InnoCentive has several sources of revenue: subscription fees paid by the seekers, commissions on the rewards paid to the solvers, and also partnerships and consulting services. Interestingly, InnoCentive offers services that go beyond the matching of seekers to solvers. The consulting services proposed by InnoCentive include assistance in the formalization of problems (problem definition, challenge formulation, choice of key words...), and in the management of IP-related questions (definition and formulation of contract terms).

	External	Internal
Multi-seeker	<p>OPEN</p> <p>InnoCentive (Lakhani, 2008 ; Liotard and Revest, 2017), eYeka (Roth and Kimani, 2014; Chua et al., 2015), Atizo (Muhdi and Boutellier, 2011; Hallersted, 2013)</p>	
Single-seeker		<p>PROPRIETARY</p> <p>Dell IdeaStorm (Bayus, 2013), Lego Ideas (Schlagwein and Bjorn-Andersen, 2014), Connect & Develop (Huston and Sakkab, 2006), Apple (Bergvall-Kåreborn and Howcroft, 2013).</p>

Table 2: classification of crowdsourcing platforms

An emblematic example of a CS proprietary platform is given by Lego ideas (Schlagwein and Bjorn-Andersen, 2014). Following the severe crisis faced by the Lego company in early 2000, accompanied by the emergence of spontaneously coordinating fans (in particular through the use of web forums), Lego chose to open its product development process. However, rather than relying on an existing external CS platform, Lego developed its own proprietary system. The operating principle of the Lego Ideas platform is quite simple: individuals (within the crowd) can propose new Lego concepts/models. These models are supported (or not) by the community, by means of a voting system. When a project has reached a sufficient number of votes, it enters into the final stage of the development process, during which a dedicated Lego team decides whether or not the model can be developed and marketed. The model creator eventually receives 1% of the revenues generated by the model. By the end of 2015, more than 5 000 models had been offered on the platform, 11 models stemming from this CS process had already been marketed, and 22 projects were under evaluation by the Lego company.

These two examples illustrate the second-order problem of CS, as shown in Figure 1. **For innovation CS contests, should the seeker rely on its own proprietary platform and make exclusive use of it, or should it rely on an external intermediary platform that is open to many seekers?** Note that this second-order problem does not concern the issue of the seeker implementing a specialized unit dedicated to CS, since it is obvious that this is necessary for a CS strategy to be successful. Companies such as Lego and Procter & Gamble, which in the past have chosen to practice CS without using an independent external platform, invested heavily in the development of their own platform. Thus, the issue of the second-order problem lies in the *control* of the CS platform. Should seekers control their own platform, or should they rely on a more open, third-party platform?

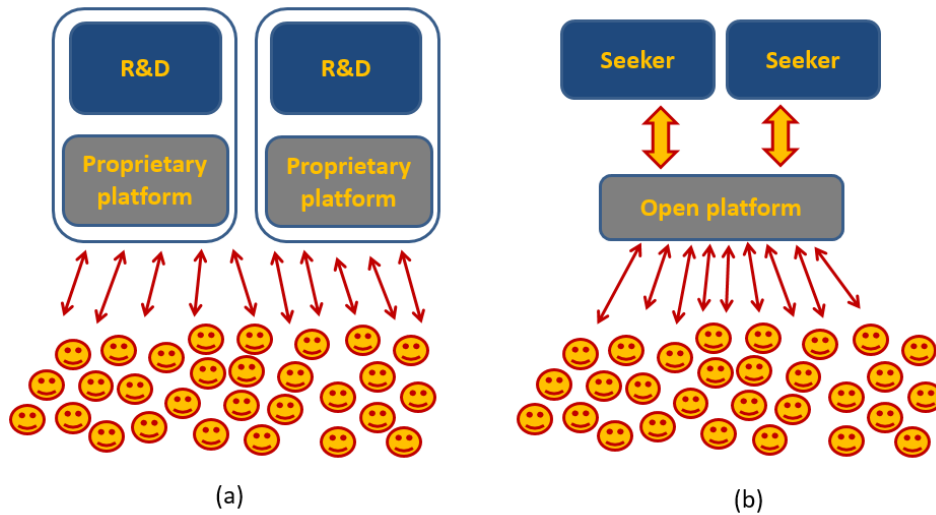


Figure 1: The second-order problem of CS

The question of choosing the most adequate CS platform is complex, and the answer to this is likely to depend upon many factors. In the following sections of this paper we analyze the way in which transaction costs, network externalities, and internal competencies shape the choice of an open versus a proprietary CS platform.

3. The role of transaction costs

In an initial step, the relevance of an open intermediary platform can be explored using transaction cost theory (TCT) (Williamson, 1985, 2005), which highlights the role of intermediaries in order to reduce the inherent risks in a transaction. Indeed, given agents' bounded rationality and opportunistic nature, the completion of a transaction always entails a certain cost (especially when the good is highly specific, information is uncertain, and transactions occur only occasionally). TCT justifies therefore the existence of intermediate agents (also called brokers) as a means of reducing transaction costs, and enhancing the performance of the market. Such intermediate agents operate in many economic markets such as real estate, finance, insurance, second hand cars, etc. (Williamson, 2005).

TCT has often been used to explain the organization of innovative activities (Coriat and Weinstein, 2002; Berchicci, 2013; Hsieh et al., 2016; De Beer et al., 2016), although the limits of this theory when it comes to knowledge and innovation are well known (Lundvall, 1990). In particular, TCT can be mobilized to analyze the CS relationship between innovative seekers and solvers. This relationship indeed has potential risks for both parties. For example, intellectual property rights are frequently difficult to enforce on both sides of the CS transaction, thus opening the doors to opportunistic behavior and increasing transaction costs. For example, the use of CS implies that a company discloses information about its strategic innovation projects, to allow anonymous individuals to provide solutions. In such a context, how can the company ensure that solvers do not use this information against it (for instance by offering solutions to competitors)? In addition, how can the solvers ensure that once they have provided a working solution, the company will pay for their contribution (this is the famous Arrow paradox, 1962)?

It is precisely the role of CS intermediaries to limit this type of opportunistic behavior, in particular by contracting relationships and organizing the transfer of intellectual property (De Beer et al., 2016; Liotard and Revest, 2017). As an example, the use of an external platform can allow the seeker to remain anonymous, and thus restrict the information revealed to competitors. Anonymity also reduces the risk that a solver may offer his/her solution to a competitor. On the other hand, the intermediation platform ensures that the solver will be rewarded if he/she provides the most suitable solution. It is indeed essential for platforms to ensure that both the seeker and the solver respect their commitments, since the reputation of the platform is a fundamental characteristic in the development of its business model.

Furthermore, TCT shows that the risks associated with opportunistic behavior are higher when the seeker or solvers do not practice CS on a regular basis, or when there is no continuity in the

relationship. For example, if a company has only one problem it needs to outsource to the crowd, it does not have to worry about its reputation, and is more likely to behave opportunistically. Conversely, in an ongoing relationship, when an organization crowdsources problems on a regular basis, its reputation becomes important, thus reducing the actors' incentive to deviate, and decreasing the need to rely on intermediaries. Our first proposition is thus:

Proposition 1: Open intermediary CS platforms are more relevant when transaction costs are high, i.e. when (i) CS is practiced occasionally by the seeker, and (ii) intellectual property rights are costly to enforce for seekers and solvers.

4. The role of network externalities

Since it is a web-driven phenomenon, CS typically displays network effects (also called network externalities). In particular, it can be viewed as a two-sided relationship (Parker and Van Alstyne, 2005): on the one hand, seekers are willing to benefit from a large crowd with a high potential for diversity (Jeppesen and Lakhani, 2010; Poetz and Schreier, 2012), in order to increase the chances of success and the 'distant search' effect of CS. On the other hand, potential solvers are willing to visit a platform that offers a large variety and number of challenges, and for which they are more likely to find a problem matching their individual experience and skills.

An immediate consequence of this two-sided relationship is that open intermediary platforms are more likely to induce a critical mass of solvers and seekers. Indeed, relying on an open platform can allow a seeker to access a considerably larger and more heterogeneous crowd than via a proprietary platform. Among other reasons, an open platform offers a greater number of

challenges and therefore attracts more solvers. As a consequence, there is a self-enforcing mechanism leading both seekers and solvers to be attracted to open platforms, thereby boosting the network effect (Katz and Shapiro, 1994; Shapiro and Varian, 1999). Conversely, the use of a proprietary platform is limited mainly to large, prominent firms, which are well positioned to attract a large number of solvers. Among other factors, brand adhesion within the user community (Muniz Jr. and O'Guinn, 2001) affects the ability of a single firm to attract a large crowd on the basis of its own name. This explains why firms such as P&G (Huston and Sakkab, 2006), Lego or Apple (Bergvall-Kåreborn and Howcroft, 2013), which enjoy the following of a strong brand community (Muniz Jr. and O'Guinn, 2001), are more likely to attract a large crowd on their own CS platforms. This observation leads to our second proposition:

Proposition 2: Due to network effects, open intermediary platforms are more relevant when seekers do not possess a large brand/user community.

While open platforms are able to leverage network externalities, proprietary platforms have an advantage, namely the fact that in some cases the solvers can develop a closer relationship with the seeker. The main reason for which solvers connect to open platforms resides in their network externality, i.e. they want to have access to many different challenges, irrespectively of the identity of the firms that post them. On open platforms, solvers are not likely to share values or areas of interest with the seekers. On the other hand, the solvers who use a proprietary platform deliberately choose to address the innovation problem of a specific firm, with whom they are likely to share the values, problems, areas of interest, thus implying a tighter relationship between the solver and the seeker.

Therefore, although the size of the crowd that can be accessed through a proprietary platform might be lower, the relationship between seeker and solvers is likely to be reinforced. In some cases, this attachment between seeker and solvers can make a difference, for instance in terms

of solver motivation or when the attachment of solvers makes them more likely to propose adequate solutions (Kosonen et al., 2014). This is illustrated by the case of Lego, where the solvers are mostly fans, thus more likely to adhere to the Lego philosophy and provide the firm with relevant concepts. Conversely, in cases where the problems are essentially technical, and can more easily be decontextualized from the seeker's situation, they can be tackled without any personal attachment between seeker and solvers. Open platforms are more appropriate under these circumstances, since they make it possible to implement a distant search (Afuah and Tucci, 2012). This leads to our third proposition:

Proposition 3: Open intermediary platforms are less relevant when brand attachment is required for successful CS. Conversely, open platforms are more relevant when a distant search is essential for the success of a CS activity.

5. The role of resources and competences

The choice between a proprietary and an open platform also depends on the skills needed to CS a given problem. The success of a CS project requires the seeker to have the internal resources needed to implement the process (Afuah and Tucci, 2012). If the seeker possesses these resources, it may be relevant to 'crowdsource' the problem via its own proprietary platform. If not, it may need to rely on the services of a specialized intermediary platform.

In order to develop a CS strategy, the seeker must be able to modularize and delineate a complex problem, which is unlikely to be resolved by isolated individuals, into a sum of sub-problems (Natalicchio et al., 2017). In addition, CS requires the seeker to have the ability to express and specify the problem in simple terms, in order to target as large a population as possible, including non-experts (Afuah and Tucci, 2012). Lastly, the successful implementation of CS requires skills related to the CS process itself (Malhotra and Majchrzak, 2014), motivation of

the crowd (Ståhlbröst et al., 2011; Kosonen et al., 2014), and the selection and classification of ideas (Hoornaert et al., 2017). In practice, it is often difficult for a seeker to acquire these competences. For instance, a seeker is very often locked into his/her own vision of the problem, thus preventing him/her from specifying the requirements in a broader and more accessible format, for uninitiated solvers.

Open and intermediary platforms have thus developed considerable expertise relevant to these aspects of CS, and have numerous skills related to the formulation and specification of problems. Many of these platforms do not view themselves as networking actors, which only connect people, but as suppliers of competency. They offer skills related not only to problem formulation, but also to the transfer of intellectual property rights, drafting of contracts, etc., to seekers who require support in their CS activity (see the example of InnoCentive, described in section 2).

Although these competencies are critical, it can understandably take time for them to be acquired by seekers. The main implication is that, again, a seeker who frequently relies on CS solutions is more likely to develop the specific skills and competencies needed for the success of this strategy, and is thus more likely to rely on its own proprietary platform. Conversely, a seeker who uses CS on a case-by-case basis only is unlikely to have the required expertise, and will need to rely on the services of an external, open platform.

Proposition 4: Open and intermediary platforms are more relevant when the seeker does not have the skills (the ability to formulate and specify the problem, to deal with intellectual property issues, etc.) required for completion of the CS process.

While intermediary platforms can offer seekers the skills and knowledge needed to enable the implementation of CS, they also contribute to loosen the relationship between seekers and

solvers (see proposition 3). A crowd that is accessed via an intermediary platform cannot be considered by the seeker to be a specific resource, since this crowd is also available for other firms at a similarly low cost. Some authors have thus gone so far as to argue that, today, the crowd can be viewed as a ‘fixed institution available on demand’ (Boudreau and Lakhani, 2013, p. 67).

“Sophisticated online crowdsourcing platforms are making it ever simpler to manage and support distributed workers. In essence, the crowd has become a fixed institution available on demand”

(Boudreau and Lakhani, 2013, p. 67)

In other words, open intermediary platforms do not allow seekers to appropriate the crowd, and thus do not allow it to become a source of sustainable competitive advantage for any given company. This is an important limitation of the use of open intermediary platforms. Indeed, the crowd is not, by definition, the ‘property’ of the company. It has been clearly pointed out in the literature that a necessary condition for a resource to become a source of sustainable competitive advantage is that it is not easily reproducible, or usable by competitors (Wernerfelt, 1984; Barney, 1996). In this sense, our analysis suggests that it may be advantageous for a seeker to invest in its own CS platform, because it allows him/her to appropriate the crowd (or part of the crowd), that is to say to transform the crowd into a community with whom the seeker has developed a specific or advantageous relationship. Seekers may be tempted to build and control their own CS platform, in order to transform the crowd into a resource that is very difficult for competitors to reproduce. This observation leads to our last proposition:

Proposition 5: Open intermediary platforms are less relevant when the seeker wants to transform the crowd into a specific, hardly reproducible resource, namely into a community.

6. A decision making model for the second-order problem of CS

In the previous sections, various propositions concerning the relevance of open vs. proprietary CS platforms have been described, with respect to three main dimensions: transaction costs, network effects, internal resources. Thanks to this analysis, a decision-making model for the second-order problem of CS can now be proposed. The model (which is schematically represented in Fig. 2) is based on the results described in the previous section, i.e. that open and intermediary platforms are more relevant when:

- Transaction cost issues are predominant (proposition 1).
- Network externalities are critical, e.g. because the seeker does not have the advantage of a well-known brand name, or because a very large or diverse crowd is required (propositions 2 and 3).
- The seeker lacks the internal competencies needed for a CS process to be successful (proposition 4).
- The seeker does not want or need to transform the crowd into an appropriable resource (proposition 5)

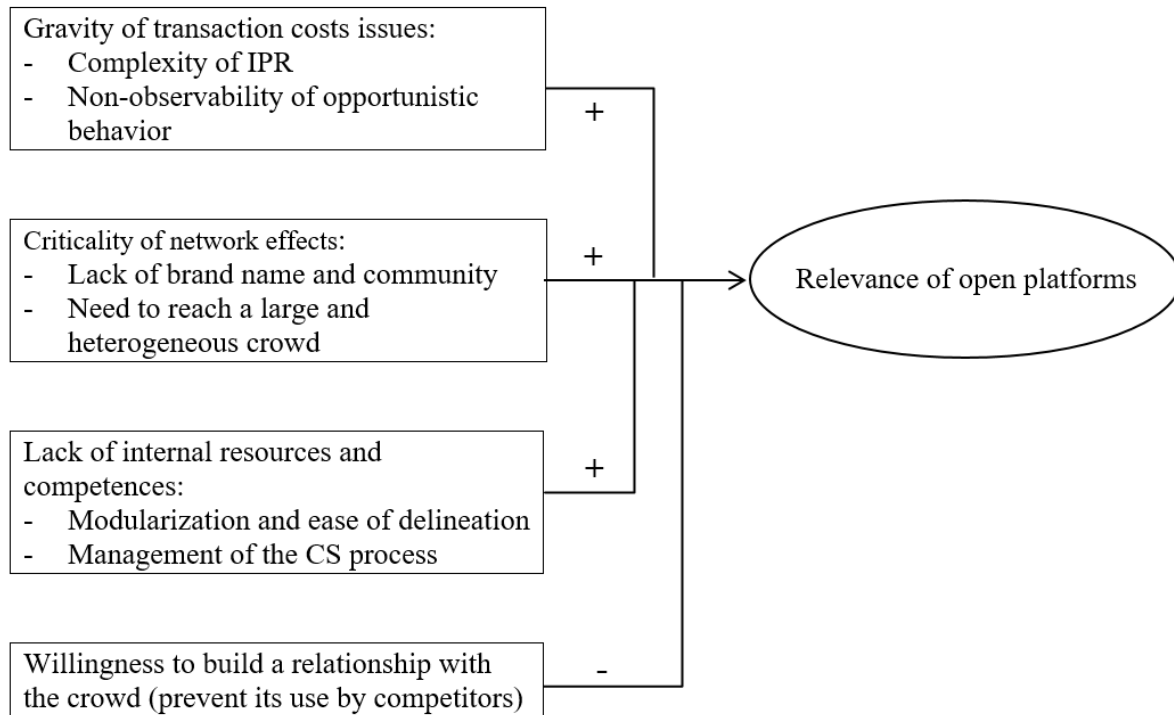


Figure 2: Influencing the variables of the second-order problem

In this model, a distinction is made between strategic and operational variables, which are under the control of the decision maker, and context variables, which are largely exogenous in the short term (see Table 3).

Network externalities depend on a firm's ability to attract a large crowd on the basis of its own name. They are the outcome of a long-term investment in the brand's reputation, and can be viewed as exogenous in the short term. Transaction costs are related to the ease with which the author of an invention can be identified, and the invention can be distinguished from existing anteriority. The ease with which the invention can be imitated is also an important factor. Like network externalities, transaction costs can therefore be viewed as largely lying outside the scope of short-term decision making, otherwise referred to as **context variables**.

Unlike these two context variables, the firm's willingness and/or need to build a strong relationship with the crowd is related both to its business model and to a high-level decision-

making. It is thus a **strategic variable**, which is internal to the firm but situated at the level of upper management decisions. Finally, CS process managers (the head of R&D, the project leader, ...) are in a position to make investment decisions that can lead to the development of internal resources, or to the externalization of some components of the CS process to a third party. Hence the availability of CS competencies can be considered as an **operational variable**.

Parameters	<i>Network effects</i>	<i>Transaction costs</i>	<i>Crowd appropriation/brand community</i>	<i>Internal competencies</i>
Type	Context	Context	Strategic	Operational
Locus	Exogenous	Exogenous	Internal, high level	Internal, operational
Determinants	Brand reputation, customer loyalty, market share, local or global reach, existing user community, etc.	Ease of identification of inventor and invention's anteriority, knowledge codification and transferability, ease of imitation, etc.	Willingness to build a strong customer/client relationship	Competencies required for delineation and modularization, management of IP issues, selection of ideas, etc.

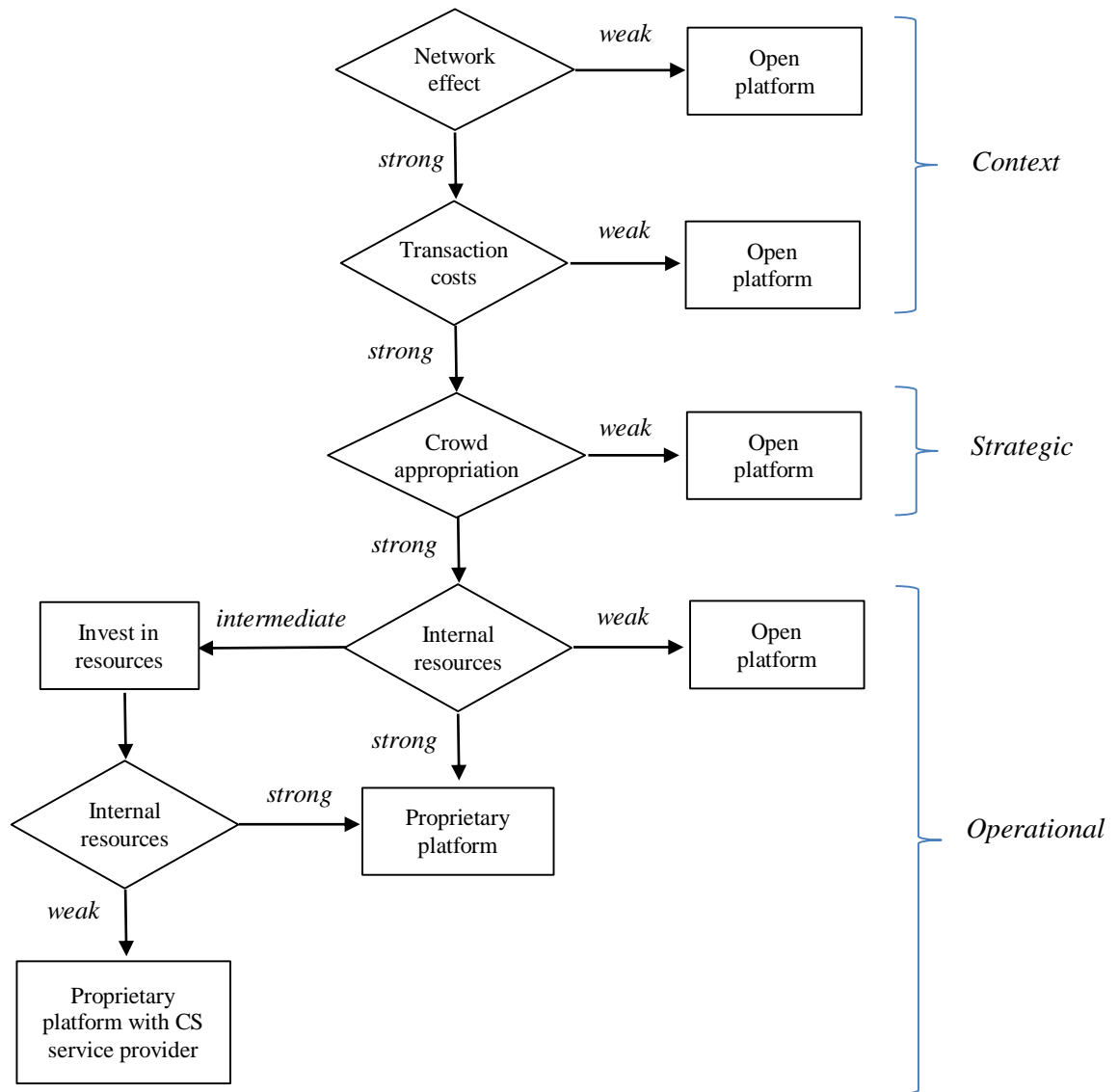
Table 3: Context, strategic and operational variables of the second-order model

As the influencing variables of the second-order model are not equally controlled by the seeker, they should be assessed sequentially (see Fig. 3). Context parameters (network effects and transaction costs) are exogenous, and should be assessed beforehand, since they cannot be directly modified in the short term. A decision maker must firstly evaluate network effects, which are relatively 'easy' to observe: if the seeker has a weak position in terms of network externalities (for instance if it does not have a significant brand notoriety), the choice of an open intermediary platform becomes relatively obvious. Transaction cost issues can be evaluated in a second step, by applying the following rule: high transaction costs (due for example to difficulties in the enforcement of intellectual property rights) will argue strongly in favor of an open intermediary platform.

Strategic parameters, which are the outcome of a firm's high-level decisions, should be assessed in a third step. If the seeker's strategic management considers that it is critical to establish a

strong relationship with the crowd, then it must envisage the development of its own proprietary platform. If it considers that this is not a critical issue, it can rely on an open external platform.

Finally, when the positions concerning context and strategic parameters tend to favor the use of an internal platform, the decision maker should assess the availability of internal resources. The required resources may be readily available, or they may be inaccessible unless reasonable investments (including time) are made, or they may be inaccessible even if reasonable investments are made. In the latter case, CS should be implemented via an open platform. If the resources are not available, but could become accessible at a reasonable cost, CS could be implemented via a proprietary platform, provided the firm invests in resources (e.g. through the hiring of competent people), or calls on the assistance of service intermediaries (e.g. intellectual property experts).



Note: The terms *weak* and *strong* refer to the firm's situation with respect to the various parameters. For example, the presence of a large user community and a well-known brand can be ensure that the firm has a strong position in terms of network externalities.

Figure 3: A decision-making process for the second-order problem of CS

7. Conclusion

This study provides a theoretical analysis of the second-order problem of CS: should the relationship with the crowd be achieved through the use of an exclusive proprietary platform, or through the use of an open intermediary platform? Theoretical propositions concerning the

advantages and drawbacks of open, versus proprietary CS platforms, have been constructed, and a decision-making model has been proposed for the second-order problem. This is designed to assist CS managers in their choices.

This analysis thus makes a further contribution to the existing literature on CS and open innovation intermediaries, by considering the use of a CS platform to be the result of an explicit decision made by the seeker. Indeed, while the role of crowd-intermediaries has been the topic of recent studies (Colombo et al., 2013; Haas et al., 2014; Leicht et al., 2016; Mrass et al., 2017), the decision as to whether a proprietary or an open CS platform should be implemented has not been analyzed. In particular, the present research shows that the effect of an open intermediary platform can be twofold. On the one hand, it can reduce transaction costs, induce network externalities, and provide the seeker with the required competencies to CS its problem. On the other hand, intermediary platforms tend to relax the relationship established between the seeker and the crowd, meaning that the latter is unlikely to become a specific and non-appropriable resource for the seeker.

This study should pave the way for further research into the role played by crowd-intermediaries or platforms. An obvious extension of this work would involve the comparison of different types of crowd-mediation platforms. Indeed, our work has specifically targeted the case of CS for innovative activities. It could therefore be important to verify that the conclusions of the present study are also valid for different types of crowd use, such as crowdfunding, CS of routine work, crowd-voting, etc. Secondly, this study has explicitly focused on the contrast between open and proprietary CS platforms. It could therefore be interesting for further research to analyze hybrid cases, such as single-seeker/external and multi-seeker/internal platforms. To the best of our knowledge, such hybrid configurations do not exist in the real world. Future studies could try to explain why they do not exist, and propose specific contexts under which

these hybrid configurations could emerge. Thirdly, this study has not considered the possibility of competition between different CS platforms. However, since competition could affect the choice of an open versus a proprietary platform, the literature dealing with competition between intermediary platforms in two-sided markets might be used to understand the extent to which competition between CS platforms can influence the results. Fourthly, the model described here does not consider the possibility of seekers working hand-in-hand with open and intermediary platforms, in an effort (for example) to enable the nurturing of brand and user communities on intermediary platforms. Nevertheless, such an approach could be beneficial for open CS platforms, through the reinforcement of their competitive position. Lastly, the theoretical approach developed here clearly calls for future empirical testing.

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