ABSORBING KNOWLEDGE FROM CROWDSOURCING: FROM ACQUISITION TO EXPLOITATION, THE KEY ROLE OF INTEGRATION MECHANISMS

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Abstract
Crowdsourcing (CS) for innovation involves outsourcing problem-solving or creative tasks to the crowd. To benefit from CS, absorptive capacities (ACAP) are critical; they can be enhanced by prior knowledge and past experience with a partner. However, for CS, firms open themselves to undefined, anonymous partners, so the development of ACAP is questionable. Prior ACAP literature describes how internal integration mechanisms foster knowledge absorption but does not address the integration of uncommon knowledge. Prior CS literature acknowledges a wider spectrum of influential internal and external mechanisms but does not study their impacts on ACAP development. To fill these gaps, this study identifies relevant integration mechanisms and their influences on different dimensions of the ACAP process, as it relates to CS for innovation. Five case studies reveal that the influence of integration mechanisms is contingent on the nature of the CS activity. When firms implement creative CS, integration mechanisms influence every ACAP dimension; if they use problem-solving CS, these mechanisms only influence the early ACAP development process. This research thus clarifies the influence of integration mechanisms in the less studied context of uncommon knowledge absorption. It shows which mechanisms firms can mobilize to promote the integration of crowd knowledge and how to support ACAP development processes in CS contexts.

KEYWORD : Crowdsourcing – open innovation – knowledge - absorptive capacities – integration mechanisms.

INTRODUCTION

Through open innovation (OI), companies can open their innovation processes to external stakeholders and thereby access new knowledge and resources (Chesbrough, 2003). With the rise of the Internet, companies are opening themselves to not only customers but also communities and even the crowd. As introduced by Howe (2006), crowdsourcing (CS) refers to outsourcing tasks to crowds, through an open call on the Internet. Unlike conventional outsourcing methods, such digital open calls grant firms access to vast numbers of volunteers, increasing their chances of identifying relevant insights (Pénin and Burger-Helmchen, 2012) and fostering 'collective intelligence' (Malone *et al.* 2010). When they implement CS for innovation, firms often gain scarce knowledge and valuable ideas (Schenk and Guittard, 2011; Piezunka and Dahlander, 2015) that they could not otherwise access from internal employees or traditional partners (Afuah and Tucci, 2012). However, such distant cognition and knowledge also can have deleterious effects on innovation efforts (Laursen and Salter, 2006). Accordingly, recent CS studies recommend integration mechanisms (Blohm *et al.*, 2013; Piezunka and Dahlander, 2015) to develop absorptive capacities (ACAP) and thus truly benefit from the crowd's knowledge (Di Gangi and Wasko, 2009; Pénin and Burger-Helmchen, 2012; Blohm *et al.*, 2013).

Absorptive capacities refer to the 'ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends' (Cohen and Levinthal, 1990: 128). Afuah and Tucci (2012) suggest that CS helps firms capture new external knowledge, but they do not describe how such a process occurs. In addition, Pénin and Burger-Helmchen (2012) suggest the difficulty of developing ACAP in a CS context, though without any empirical evidence. According to ACAP literature, developing such capacities requires prior knowledge, trust, and experience with the partner (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Todorova and Durisin, 2007). However, when firms open to the crowd, developing ACAP creates unique and unresolved challenges. Noting these difficulties, Piezunka and Dahlander (2015) refer to the 'crowding effect': When they receive too many solicitations, firms naturally pay more attention to knowledge that seems familiar. To overcome this bias, they suggest extensive mechanisms that support distant search. However, extant research pays little attention to the mechanisms that support ACAP development processes in a CS context.

To begin to fill this gap, we pose a central research question: *Which integration mechanisms support knowledge absorption, and how do they influence the ACAP process when firms implement CS for innovation?* To answer this question, we consider five cases of CS for innovation (based on 47 interviews) and identify integration mechanisms implemented by firms throughout the ACAP development process. In contrast with the rare empirical studies in ACAP literature, our findings indicate that internal integration mechanisms influence the entire ACAP development process in a CS context, especially if firms implement creative task CS. Our study also reveals a key role of external integration mechanisms to deal with the crowding effect at the start of the ACAP development process (Piezunka and Dahlander, 2015). Finally, in revealing which mechanisms firms should implement when, this study suggests new ways to manage the knowledge of the crowd.

In the next section, we define CS for innovation and outline theoretical arguments exploring the relation between ACAP and absorption of the knowledge of the crowd, which suggests the influence of integration mechanisms. Then we specify our methods, data sources, and analyses. Finally, we present our results before discussing their theoretical and managerial implications.

THEORETICAL BACKGROUND

Crowdsourcing for innovation: a review

With the concept of OI, Chesbrough (2003) highlights that firms must remain open to external sources of knowledge. Firms long have relied on clearly identified external stakeholders, such as customers and suppliers (Laursen and Salter, 2006), but the digital age of the Internet and IT also has expanded firm boundaries, opening them to unlimited, unidentified actors (Roberts *et al.*, 2012). In line with OI theory and supported by digital advances, CS provides a relevant form of access to new external knowledge (Bogers *et al.*, 2017), because it involves 'the act of taking a job … [and] outsourcing it to an undefined, generally large group of people in the form of an open call on the Internet' (Howe, 2006).

Schenk and Guittard (2011) identify three CS activities: (1) simple tasks, when firms outsource common jobs; (2) problem-solving tasks, such that they outsource a complex problem; and (3) creative tasks, dealing with idea generation to innovate. This article focuses on problem-solving and creative tasks, also known as CS for innovation. Despite their common objective (i.e., innovation), these two types of CS differ. Creative task CS aims to identify new ideas for the firm, and because these solicitations are unexpected, it involves many transactions with the crowd (Pénin and Burger-Helmchen, 2012). Problem-solving task CS instead consists of outsourcing complex problems already identified by firms. It attracts more solicitations than creative task CS, so it involves higher evaluation costs (Afuah and Tucci, 2012).

Prior literature identifies several benefits of CS for innovation (Schenk and Guittard, 2011; Afuah and Tucci, 2012; Piezunka and Dhalander, 2015). It allows firms to access a wide range of knowledge (Schenk and Guittard, 2011; Bogers *et al.*, 2017) that usually would be costly to acquire (Waldner and Poetz, 2015). In addition, CS provides access to unknown knowledge through distant searches (Afuah and Tucci, 2012). However, some studies also note the challenges that firms must overcome to benefit from CS for innovation. First, its implementation calls for organizational change (Bogers *et al.*, 2017), which firms cannot always undertake, due to organizational barriers such as workflow rigidities or a lack of internal commitment (Lüttgens *et al.*, 2014). Second, firms may receive 'too many' solicitations (Blohm *et al.*, 2013), such that they struggle to manage both their quality and their quantity. Third, firms face the crowding effect (Piezunka and Dhalander, 2015), which causes them to attend more to familiar knowledge instead of distant search. To benefit from the knowledge of the crowd, CS literature suggests a key role of ACAP (Di Gangi and Wasko, 2009; Pénin and Burger-Helmchen, 2012; Blohm *et al.*, 2013). However, we know little about the ACAP development process in the specific context of CS for innovation, despite the relevant questions it raises (Bogers *et al.*, 2017).

Developing ACAP in CS contexts: Social integration mechanisms

Cohen and Levinthal (1990) identify three main ACAP dimensions: recognition of the value of new knowledge, assimilation of valuable knowledge, and application to develop new products. Reframing Cohen and Levinthal's work, Zahra and George (2002) split the ACAP development process into two parts: potential ACAP (PACAP), when firms acquire and assimilate new external knowledge, and realized ACAP (RACAP), when firms transform and exploit this knowledge. Todorova and Durisin (2007) also amend some key points of Zahra and George's model. For example, they introduce value recognition as an antecedent of the ACAP and suggest that the assimilation and transformation dimensions are interactive and simultaneous. They thus identify three

alternative ACAP dimensions: acquire, when firms identify valuable new external knowledge; assimilate and/or transform, when firms integrate that knowledge in their own knowledge base; and apply, when they exploit it. This alternative ACAP model has appeared in information system literature (Roberts *et al.*, 2012). Noting the digital characteristics of CS for innovation, we adopt this latter model for our study.

Developing ACAP through these dimensions depends on prior knowledge, which enables firms to identify valuable external knowledge (Cohen and Levinthal, 1990; Todorova and Durisin, 2007), as well as trust and past experience with the partner (Lane and Lubatkin, 1998; Zahra and George, 2002). However, CS for innovation requires openness to unidentified, anonymous actors, so the ACAP development process may differ in this context.

To absorb new external knowledge, social integration mechanisms are critical and can foster ACAP development (Zahra and George, 2002; Todorova and Durisin, 2007). Two main internal capabilities constitute social integration mechanisms: coordination[1] and socialization[2] (Jansen *et al.*, 2005; Roberts *et al.*, 2012). Zahra and George (2002) suggest that these mechanisms occur between PACAP and RACAP. For Todorova and Durisin (2007: 781), 'social integration mechanisms influence all components of the absorptive process … this influence can be either negative or positive.' Empirical studies of social integration mechanisms are scarce. In the financial services sector, Jansen *et al.* (2005) find that internal coordination capabilities are pertinent at the beginning of the ACAP process (acquisition and assimilation), but socialization capabilities only affect the end of the process (transformation and exploitation).

In a CS context, to benefit from distant search and avoid overly narrow attention to prior knowledge, Piezunka and Dahlander (2015) suggest the need for extensive mechanisms to prioritize solicitations of distant knowledge. The integration of uncommon knowledge requires strong social integration mechanisms, supported by activities that promote interactions with multiple external sources (Nag and Gioia, 2012). In this open digital context, Blohm *et al.* (2013) emphasize the importance of integrating the CS platform into existing organizational processes and structures, by encouraging internal involvement. External coordination thus exerts a powerful influence through two main mechanisms. First, common values and norms between the crowd and firms' employees facilitate information exchange and data evaluation and dissemination (Blohm *et al.*, 2013). Second, collaboration among crowd members can enable identifications of the most relevant knowledge that people submit (Malhotra and Majchrzak, 2014).

Thus, extant ACAP literature offers a fine-grained description of how internal integration mechanisms affect the ACAP development process but does not address external mechanisms. Although CS literature highlights a wider spectrum of mechanisms, it does not study their impacts on the ACAP development process, despite the key role of these capacities. This study tries to fill this gap by identifying the central mechanisms and investigating how they support ACAP development processes in a CS for innovation context.

[1] These capabilities rely on three main dimensions: job rotation, cross-functional interfaces, and participation in decision making (Jansen *et al.*, 2005).
[2] Jansen *et al.* (2005) operationalize this concept as high levels of connectedness and common socialization capabilities (e.g., cohesion, shared language, shared goals and experiences).

METHOD

To address our research question, we adopt a case study design (Yin, 2013). This qualitative research method is particularly appropriate when little is known about a new and complex phenomenon (Miles and Huberman, 1994), such as CS for innovation.

Sampling and data collection

The selection of cases followed a two-step strategy. First, we collected information from prior literature to identify relevant industries for a study of CS for innovation. Second, we applied a theoretical sampling strategy (Eisenhardt, 1989) to balance similarity with variety, which supports cross-comparison analyses and strengthens the study findings. We focused on large firms to insure a good level of similarity and identified five French industrial firms that have adopted and implemented an internal platform of CS for innovation. These firms have invested heavily in R&D and focus on the development of new products or services. To insure variation, we studied different industrial sectors and both types of CS for innovation, namely, problem-solving and creative tasks (Table 1).

The data collection lasted for a two-year period (2014–2016), such that we obtained longitudinal data to describe and understand the influence of integration mechanisms on the ACAP development process. Our research is based on both primary and secondary data from five different sources (Yin, 2013). Specifically, we relied on 47 in-depth interviews that were recorded and fully transcribed (each lasted about 60 minutes), participant and non-participant observations, documentation, and archival data. The data collection also involved a two-step process. First, from October 2014 to October 2015, we conducted eight exploratory interviews with the CS teams, focused on the adoption and implementation of CS for innovation, using general questions to gain a deep understanding of each case (e.g., Why did the firms adopt CS for innovation? What were the main barriers they faced?). We also collected secondary data and made observations. Second, from November 2015 to March 2016, we conducted 39 semi-structured interviews with various actors (CS for innovation teams, R&D teams, marketing teams, top management), with a more focused question guide, oriented toward the process of transforming the crowd's knowledge into a product or service.

Table 1: Data sources and case descriptions

Firms	Industry	Number of interviews	CS activity	CS adoption	Interviewee profile
A	Gas	12	Problem-solving CS Creative task CS	2012	CS team, R&D team, other open innovation users, top managers
B	Nuclear energy	7	Problem-solving CS Creative task CS	2013	CS team and ex-employees, communication manager
C	Small domestic appliances	13	Problem-solving CS	2014	CS team, R&D team
D	Telecommunications	9	Creative task CS	2014	CS team, other open innovation users, internal customer, crowd
E	Automotive	6	Creative task CS	2013	Communication team, R&D team, marketing team, top managers

Case descriptions

Company A supplies industrial gases to medical, chemical, and electronics manufacturers. In 2012, top management decided to create a lab to implement new innovation methodologies, including CS. The lab consistently launches challenges to find solutions to problems the group is facing or to collect new ideas and identify future markets.

Company B is a multinational group specializing in nuclear power and renewable energy. At the time of our study, it was facing a difficult situation. As a public company, it had agreed to participate in a governmental initiative in 2013, to improve its relations with small and medium-sized enterprises (SMEs). It thus needed to implement a CS platform on which SMEs could respond to challenges or submit spontaneous ideas.

Company C, an international firm with numerous geographical locations, produces small appliances for various brands around the globe. In 2014, the Innovation Process Director suggested creating a CS platform to find solutions to complex problems, seeking to appeal to doctoral students and scientists. At the time of the interviews, the CS platform was migrating to a new business unit, in response to an organizational reconfiguration.

Company D is a multinational telecommunications corporation. It has a strong OI strategy, spanning various internal and external programs. In 2014, it implemented a CS platform to take people's needs into consideration more clearly. Anyone can submit an idea that fits the topic of the ongoing campaigns.

Company E is a multinational automotive supplier, providing a wide range of products to auto manufacturers. In 2010, a new manager joined the group and implemented a wide OI strategy, creating a worldwide CS challenge for engineering students in the hopes of eliciting technological ideas for connected cars.

Data analysis and operationalization of concepts

The data coding was based on an iterative content analysis (Miles and Huberman, 1994), following a three-step process: data reduction, data display, and conclusion drawing and verification. To reduce the data, we coded all of them according to a thematic analysis (three rounds of data coding, using Nvivo 11). In this initial step, we performed within-case analyses to identify the different dimensions of the ACAP development process in the CS context, actions implemented by the firms at each stage, and factors influencing this process. The textual data were cut and categorized into units of meaning, using an abductive approach (Eisenhardt and Graebner, 2007).

Following prior literature, we coded the internal integration mechanisms as either coordination or socialization. Coordination mechanisms consist of three theoretical components (Jansen *et al.*, 2005; Van de Ven *et al.*, 1976): cross-functional interfaces, job rotation, and participation in decision making. Socialization mechanisms are operationalized as discourses related to dense interactions in networks or about shared values, objectives, and experiences (Jansen *et al.*, 2005; Todorova and Durisin, 2007; Blohm *et al.*, 2013). Then the external integration mechanisms were coded according to two main categories identified in CS literature: direct external coordination with the crowd (Blohm *et al.*, 2013) or the mobilization of the sharing and interaction capacities of crowd members (Malhotra and Majchrzak, 2014).

Next, we grouped the units of analysis identified in each case according to these concepts. Adopting a cross-case analysis (Eisenhardt, 1989), we finally compared the concepts across all cases. We sought to identify similarities between cases, then group the concepts

into the three main dimensions of Todorova and Durisin's (2007) ACAP framework; we coded the secondary data according to this framework too. To strengthen the internal validity of our study (Miles and Huberman, 1994), we used both data and methodological triangulation to deal with saturation, and we presented our initial findings to experts, other researchers, and the interview participants.

FINDINGS

Our results exhibit the contingent effects of integration mechanisms on the ACAP development process, according to the type of CS for innovation activities. Therefore, we present the two sets of results separately.

ACAP development process for creative task CS: Permanency of integration mechanisms

Creative task CS entails identifying ideas that are new to the firm so that it can innovate. The unknown character of the crowd's solicitations affects the integration mechanisms required to absorb this new external knowledge. In particular, for creative task CS, both coordination and social mechanisms influence every dimension of the ACAP development process. Internal mechanisms also influence the entire process, spanning identification/acquisition, assimilation/transformation, and application/exploitation. This steady influence reflects the very nature of creative task CS, as the following interview quote makes clear:

> *Creative task CS requires more internal mechanisms and effort throughout the entire CS campaign, because we don't know what ideas people will submit,… we then need to identify internal evaluators, but we cannot anticipate, and we finally need to identify and convince internal customers, who are not obviously the same people within the firm. (Company B, CS team employee)*

Because the firm cannot anticipate the nature of the knowledge that the crowd will submit, CS teams must develop internal mechanisms to support the ACAP development process. However, not every internal mechanism may be required; it appears that cross-functional interface is the only one that gets mobilized throughout the ACAP process. As explained by an interviewee, the main challenge of creative task CS is to identify relevant employees who can support each dimension of the ACAP development process. Cross-functional involvement is thus a key mechanism:

> *The key success factor of our CS platform is that we work together: communication, innovation, marketing, etc. People involved in our campaigns are from varied functions. This helps to then identify and involve people, find internal evaluators, convince internal customers, etc.* (Company E, Communication Director)

The two social integration mechanisms (connectedness and shared meanings and experiences) also influence all dimensions of the ACAP. As the CS manager of firm D explained, even though firms cannot anticipate which employees will support the CS campaign, they try to socialize as much as they can during every CS campaign to foster more coordination. For the firms that implemented creative task CS in our study, the socialization process was not easy. For each new CS campaign, CS teams must constantly develop and strengthen their socialization mechanisms. Firm A has sought long-run solutions to be able to allocate more time and resources to these internal mechanisms:

> *I work part-time for the CS team and still part-time in the innovation team. I still have an office there, I am a kind of link between people and teams.… On the last challenge, this position helped me involve both [CS team] and R&D to work together.* (Company A, lab/ R&D employee)

In contrast, external integration mechanisms concentrate on the first dimension of the ACAP development process, that is, identification/acquisition. This finding aligns with the indications by all the firms studied that they are afraid of failing to attract a crowd. The success of each CS campaign depends on the firm's capacity to attract people—and their knowledge. They devote efforts and resources to coordinating with the crowd, especially at the beginning of each CS campaign:

> *We concentrate most of our efforts just after launching the challenge, because we need to attract people.* (Company D, CS team employee)

However, firms A and B struggled to attract crowds by themselves. We thus identified another external mechanism that also tends to appear mainly at the beginning of CS campaigns, namely, coordination with other external partners:

> *We need to rely on intermediaries that can attract people, such as clusters, Chambers of Commerce and Industry, incubators, etc. With their support, the number of contributions increases, because they reach the crowd.* (Company B, CS manager)

In addition attracting a crowd, most firms try to create a community to foster the integration of the knowledge of the crowd. In other words, firms attempt to support connections among the crowd:

> *We let people share together, and we encourage it. It supports the emergence of 'snowball ideas'. Someone shares an idea with the community, and people contribute, improve, make it clearer, etc.… An idea we don't understand or that seems bad can turn into a relevant idea, thanks to the snowballing effect of the community.* (Company D, CS manager)

Table 2: Integration mechanisms supporting the ACAP development process in the creative task CS context

	ACAP dimensions		
	Identify/Acquire	Assimilate/Transform	Apply/Exploit
Internal coordination mechanisms			
Cross-functional interfaces	*** (15)	** (5)	***(12)
Participation in decision making	-	-	-
Job rotation	*(2)	-	-
Internal social integration mechanisms			
Connectedness	****(22)	***(15)	****(18)
Shared meanings and experiences	****(21)	***(13)	***(13)
External coordination mechanisms			
Coordination with crowd	**(8)	*(2)	*(2)
Mobilize sharing capacities of crowd members	***(12)	**(5)	*(3)
Coordination with other external partners	***(17)	*(2)	-

Notes: The number of stars represents the relative weight of each coded variable, according to the number of verbatim comments obtained that referred to each ACAP dimension. The maximum is 4 stars, and the minimum is 1 star. The absence of variable is indicated by —. We performed a double coding, and the inter-rater agreement index (Kappa) between the two coders was satisfactory (.68).

ACAP development process for problem-solving task CS: Integration mechanisms at the start of the process

Unlike creative task CS, problem-solving task CS theoretically provides firms with more control over the knowledge they solicit. Firms submit a well-defined problem that they cannot solve to the crowd. The submitted brief is less flexible and open; rather, it is more precise than calls for creative task CS. However, in this case, firms face confidentiality issues. The CS teams submit a problem already identified by another business unit, so internal coordination and socialization mechanisms do not have the same influence. As one respondent explained, when firms outsource a complex problem to the crowd, internal mechanisms concentrate at the beginning of the ACAP development process:

> *When we do problem-solving CS, we concentrate our efforts at the beginning, because internal evaluators will be internal customers, the same that will launch the challenge. So, we focus on attracting these internal customers at the beginning.* (Company B, CS team employee)

When firms implement problem-solving task CS, cross-functional interfaces are also key coordination mechanisms. Most of the CS teams noted the challenge of identifying internal problems to outsource:

> *I have to fight to identify problem to outsource through the platform. Most R&D employees don't want to admit that they have a problem, and when they do, they don't want to expose it, due to confidentiality issues.…* (Company B, CS manager)

The cross-functional interface mechanism is particularly important, because exposing complex problems to the world through the Internet is not something R&D teams particularly prefer to do. Communication among the different functions involved in CS activities, especially between the CS team and the innovation teams, can help encourage R&D employees to use the platform:

> *At the beginning, I did not know G., who is responsible for the CS platform. I never saw him. He is located at headquarters while I am at [city] site. But he wanted me to tell him my problem. It was complicated. Now I know him, I feel more comfortable using the platform to launch challenges, and I have integrated it in my working process.* (Company C, R&D employee)

In the firms we studied, coordination mechanisms also are supported by social mechanisms. The CS teams usually are separate from innovation efforts, so R&D teams do not know CS managers, and it can be difficult to participate in activities led by unknown others:

> *It is easier for R&D teams to identify me, rather than thinking that they will deal with another department. I need to be known by R&D teams and to be close to them.* (Company C, CS manager)

Thus, for complex problems submitted directly to the crowd by innovation teams, we observed that internal integration mechanisms concentrate at the beginning of every CS challenge. Creative task CS require constant efforts to involve employees to evaluate and exploit the crowd's knowledge; problem-solving task CS needs the CS team to identify and interact strongly with internal customers mainly at the start of each challenge.

But firms implementing problem-solving task CS face also must attract the crowd. The CS teams we interviewed worried not about failing to attract anyone but rather about being able to attract the right external experts. The problems they submit are usually difficult to resolve, so firms need to attract people with specific skills and knowledge:

> *When you do problem-solving CS, attracting quickly the right people is essential if you want to find the relevant solution to your problem.* (Company A, Head of the scientific CS challenge)

However, attracting experts is challenging. For example, firm C explained that the CS manager looks for specific knowledge but sometimes does not understand the solutions offered by the crowd. He thus lost credibility many times when trying to attract external experts:

> *When the challenge is just launched, I have to spend a lot of time and efforts to attract experts. If I don't, I will receive irrelevant solutions from people that don't have the expertise to solve our problems.* (Company C, CS manager).

This search for specific external experts partially explains why firms implementing problem-solving task CS develop fewer external mechanisms than firms implementing creative task CS. That is,

> *When we launch a challenge with a specific complex problem, the quantity of solicitations does not matter. One relevant solution can fit our problem. So, the challenge is to communicate the brief to the relevant people. When we launch a creative campaign, this is different: we want more solicitations, because we don't precisely know what we are looking for.* (Company B, CS team employee)

Table 3: Integration mechanisms supporting the ACAP development process in the problem-solving CS context

	ACAP dimensions		
	Identify / Acquire	Assimilate / Transform	Apply / Exploit
Internal coordination mechanisms			
Cross functional interfaces	*** (20)	** (5)	**(5)
Participation in decision making	-	-	-
Job rotation	*(3)	-	- (1)
Internal social integration mechanisms			
Connectedness	****(21)	*(3)	*(4)
Shared meanings and experiences	****(20)	*(2)	*(2)
External coordination mechanisms			
Coordination with crowd	***(12)	*(2)	*(2)
Mobilize sharing capacities of crowd members	*(3)	-	-
Coordination with other external partners	**(9)	*(2)	-

Notes: The number of stars represents the relative weight of each coded variable, according to the number of verbatim comments obtained that referred to each ACAP dimension. The maximum is 4 stars, and the minimum is 1 star. The absence of variable is indicated by —. We performed a double coding, and the inter-rater agreement index (Kappa) between the two coders was satisfactory (.68).

DISCUSSION

Whereas CS literature mainly focuses on open digital calls that attempt to capture the knowledge of the crowd (Afuah and Tucci, 2012), the current research takes an unprecedented look at the integration mechanisms required to absorb this knowledge, in the specific context of CS for innovation. Depending on the potentially uncommon knowledge or ideas gathered from the crowd, which can foster knowledge innovation (Zhou and Li, 2012), firms may lack sufficient prior knowledge, which would undermine their absorptive capacities (Cohen and Levinthal, 1990). Therefore, by integrating ACAP literature, this study provides an extended view of the role of integration mechanisms in a specific, digital, OI context. Unlike the few empirical studies dealing with this topic,

our findings suggest that the influence of some of these mechanisms depends on the type of CS activity. The results demonstrate the contingent effect of the integration mechanisms on ACAP development processes. In turn, this article makes several theoretical and practical contributions.

Theoretical Contributions

Our contributions to ACAP literature are twofold. First, we identify an alternative, empirical effect of internal integration mechanisms on the ACAP development process. Zahra and George (2002) argue that social integration mechanisms support the shift from PACAP to RACAP. Our results, obtained from a CS context, add more nuance by acknowledging the influence of the type of CS activities implemented by firms. For problem-solving task CS, the mechanisms should be developed mainly early in the process. However, creative task CS requires these mechanisms throughout the process (Todorova and Durisin, 2007). Furthermore, internal coordination capabilities are likely required during the entire ACAP development process, to absorb creative ideas. Whereas Jansen *et al.* (2005) find a fragmented effect of social and coordination mechanisms for financial services, we show that in the creative task CS context, knowledge and ideas are highly tacit and require cross-functional teams, frequent communication, and experienced members (Subramaniam and Venkatraman, 2001). In line with Nag and Gioia (2012), these findings suggest that the mobilization of alternative internal integration mechanisms depends on the nature of the knowledge that needs to be absorbed.

Second, we provide empirical evidence of the role of external coordination mechanisms (Todorova and Durisin, 2007). In a CS context, internal integration mechanisms are not sufficient, especially to deal with the crowding effect, so they should be combined with relevant external integration mechanisms. Prior CS literature (e.g., Piezunka and Dahlander, 2015) has identified some significant hurdles to acquiring and assimilating the knowledge of the crowd, and we extend this stream, by showing that the mobilization of both direct and indirect external coordination mechanisms allows firms to filter and evaluate the new external knowledge. Similar to Sieg *et al.* (2010), we identify the difference between firms and the crowd (e.g., distinct codes, routines, language) that might hinder the ACAP development process. When strong external interaction ties are mobilized (mostly for creative task CS), they can help firms translate their external ideas into concrete insights. As suggested by prior studies (Todorova and Durisin, 2007; Jansen *et al.*, 2005), external linkages may play a key role in the development of ACAP.

For CS literature, we also offer two main contributions. First, previous literature highlights the key role of absorptive capacity in a CS context (Di Gangi and Wasko, 2009; Pénin and Burger-Helmchen, 2012) but does not provide empirical evidence about how to integrate or exploit the knowledge of the crowd (Blohm *et al.*, 2013), despite the clear and relevant challenges associated with doing so (Bogers *et al.*, 2017). We contribute to this under-researched but essential topic by providing fine-grained descriptions of the prevalent integration mechanisms that emerge throughout the process. In line with research that identifies a key role of internal and external mechanisms to implement CS (Blohm *et al.*, 2013; Malhotra and Majchrzak, 2014), we show that the various mechanisms need to be mobilized intensively at the beginning of the absorptive process. But unlike previous research on user knowledge sourcing (Foss *et al.*, 2011), the intensive, external exchange of information does not appear in our results as an antecedent of internal integration mechanisms. One explanation may be that the crowd is characterized by unidentified actors, so it becomes necessary to rely on internal integration practices early in the ACAP development process.

Second, in line with Afuah and Tucci's (2012) recommendations to study both problem-solving and creative task CS, we specify that the different types of CS involve different integration mechanisms. Problem-solving task CS seems less costly to coordinate (internally and externally) than creative task CS, probably due to the specificity of the problem-solving briefs. At the start of such tasks, firms generally know how to transform and exploit the solutions they are likely to receive from the crowd, because they already have identified internal customers who submit the problem to be outsourced. Thus, in the final stages of the ACAP development process, when firms receive relevant solutions, few coordination mechanisms are required, assuming that the brief provides sufficient quality. In a problem-solving CS context, external mechanisms also are restricted to coordination with specific external experts that firms try to attract. As an extension of Afuah and Tucci's (2012) work, this result provides empirical evidence of which organizational designs can best support problem-solving task CS.

Managerial Contributions

This study also has important managerial implications; transforming the knowledge of the crowd into business outputs is essential for firms (Blohm *et al.*, 2013). In line with literature on co-innovation (e.g., Ebner *et al.*, 2009), we note that internal involvement in all the integration mechanisms is key when firms implement CS for innovation. Specifically, we find that both internal and external involvement support the entire ACAP development process in a CS context. Therefore, firms should implement internal and external integration mechanisms as soon as possible, to overcome any organizational barriers. As a primary internal coordination mechanism, CS managers should initiate cross-functional teams immediately, even before implementing the CS, to promote the platform, avoid internal competition, and attract internal customers. This recommendation challenges the way firms conventionally decide to adopt CS for innovation. We find that internal coordination mechanisms, such as participation in decision making, largely are missing. In our sample, the decision to implement CS for innovation mainly came from the firms' top management, such that it gets imposed on R&D teams. To achieve the needed internal involvement, and avoid the 'not-invented-here' syndrome, firms should make the process more participative.

The difference between problem-solving and creative task CS revealed by our findings also suggests that firms might start with problem-solving CS, to reduce their risk, then progressively develop internal and external design capabilities to foster the absorption of the knowledge of the crowd. Following this initial experience, they can rely on an expert community and mobilize it for creative task CS. Thus, firms can more readily and effectively refine their integration mechanisms, especially those related to socialization tactics.

Limitations and Research Avenues

This research has limitations that open several avenues for further research. First, we only studied French firms. We cannot determine if some French cultural specificities might influence ACAP development (Vance and Paik, 2006) when firms adopt CS for innovation. Second, most of the companies we studied had only adopted CS for innovation within the past four years. It would be interesting to investigate more mature CS platforms, to determine the role of time and learning in the ACAP development process. These relatively recent efforts also involved dedicated, isolated CS projects, so we cannot specify which mechanisms might support ACAP in other organizational configurations. Third, an interesting advancement would be to provide a more explicative perspective. For example, a comparative analysis method (Ragin, 2008) might establish

which class of mechanisms explain the most effective use of the knowledge of the crowd to support innovation.

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