New Capabilities: Can IT Vendors Leverage Crowdsourcing?

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Abstract Technological advancements enable new sourcing models in software development such as cloud computing, software-as-a-service, and crowdsourcing. While the first two are perceived as a re-emergence of older models (e.g., ASP), crowdsourcing is a new model that creates an opportunity for a global workforce to compete with established service providers. Organizations engaging in crowdsourcing need to develop the capabilities to successfully utilize this sourcing model in delivering services to their clients. To explore these capabilities we collected qualitative data from focus groups with crowdsourcing leaders at a large technology organization. New capabilities we identified stem from the need of the traditional service provider to assume a "client" role in the crowdsourcing context, while still acting as a "vendor" in providing services to the end client. This paper expands the research on vendor capabilities and IS outsourcing as well as offers important insights to organizations that are experimenting with, or considering, crowdsourcing.

Keywords Outsourcing · Crowdsourcing · Capabilities · Qualitative research

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1 Introduction

With increasing globalization and technological advancements outsourcing has become a daily practice for many organizations. Outsourcing implies contracting with a third party (a service provider) not directly controlled by the client organization to accomplish work for a specified length of time, cost and level of service (Lewin and Peeters 2006). Outsourcing is fueled by service providers with strong technological capabilities and access to a global talent pool (e.g., Carmel 2006; Oshri et al. 2007), and by technological advancements that enable new sourcing models such as cloud computing, software-as-a-service (SaaS), and crowdsourcing (Gefen and Carmel 2008; Oshri et al. 2011). While cloud-services, SaaS and other hosted services are perceived as a re-emergence of older models (such as the Application Service Provision (ASP) model), crowdsourcing is a new sourcing model that has created an opportunity for a global workforce to compete with established outsourcing providers. However, organizations engaging in crowdsourcing need to develop the necessary capabilities to successfully manage this new sourcing model.

Crowdsourcing implies outsourcing a job to an undefined, generally large group of people in the form of an "open call" (Howe 2008). This sourcing model is increasingly being adopted and a number of new business ventures have emerged through crowdsourcing (Oshri et al. 2011). Crowdsourcing requires initial investment on a voluntarily basis, as interested parties (individuals or organizations) need to deliver something according to the "open call" and compete with others. Under most crowdsourcing arrangements, only the "winning" idea or contribution is paid.

The growing popularity of these Internet-based sourcing models stimulates a range of reactions and mixed feelings in the outsourcing community. Some service providers do not pay attention to the fact that an "unknown workforce" is delivering jobs that could be contracted to established players. Among those who realize the increasing competition, some attempt to utilize this "unknown workforce" for their benefit. In particular, during the economic downturn, when reducing headcount is seen as one of the obvious solutions to reduce costs, especially fixed costs, a possibility to tap into a global talent pool and employ required skills on an ad hoc basis creates an interesting proposition for established service providers.

While the expected economic benefits of this proposition are significant, it is not clear what efforts are required from established software service providers to be able to successfully realize this opportunity. In particular, in this paper we study the crowdsourcing phenomenon with focus on the capabilities required for service providers to successfully utilize Internet-based sourcing models that enable them to employ crowdsourcing in delivering services to their clients.

2 Capabilities Under Traditional Outsourcing Models

In the literature, outsourcing capabilities have been mainly studied from the client perspective (e.g., Lee 2001; Nicholson and Sahay 2001; Goles 2006; Willcocks and Feeny 2006), focusing on capabilities that clients need to develop in-house to ensure the successful outcomes of the outsourcing arrangement. The most frequently studied capabilities are Business Process Management Capability and Supplier Management Capability (Lacity et al. 2011). The former refers to clients' ability to manage a business process themselves, before outsourcing it. This capability has been associated with greater outsourcing success (e.g., Duan et al. 2009; Saxena and Bharadwaj 2009). The latter implies clients' ability to manage outsourcing providers and encompasses capabilities such as contract management and relationship management (Feeny and Willcocks 1998; Kishore et al. 2003; Rottman and Lacity 2006; Sander at al. 2007). Client sourcing capabilities, which are required to ensure successful delivery of services, are also referred to as "the retained organization" (Oshri et al. 2011; Willcocks and Graig 2008).
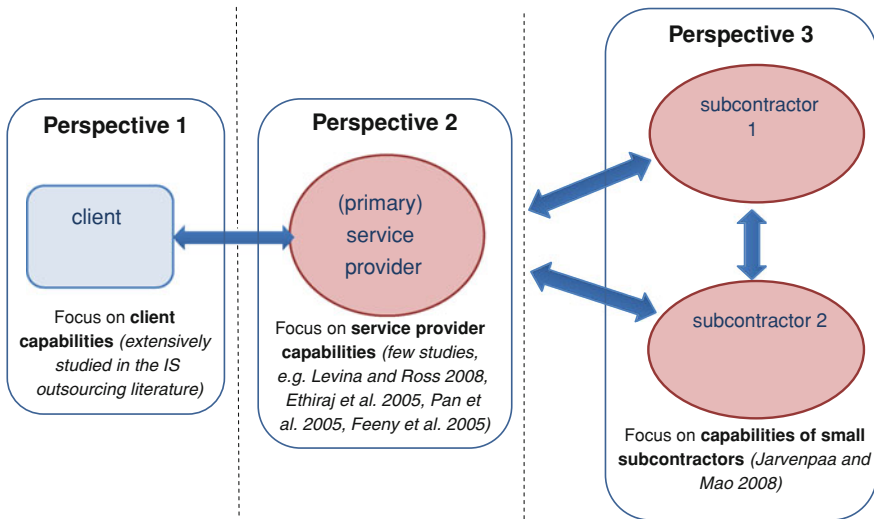
In contrast, service providers' capabilities received limited attention in the literature. The most influential work is by Levina and Ross (2003) who studied large IT vendors[1] and distinguished between three types of operational capabilities, that is, capabilities involved in the provision of a service or a product (Jarvenpaa and Mao 2008):

1. Client-specific capabilities: These are related to the routines and resources that align the vendor's practices and processes to the client's goals. More specifically, these capabilities are associated with the knowledge that a service provider must have of the client's business model and industry, as well as of the specifics of the client's operations.
2. Process capabilities: These are concerned with task delivery routines and resources that accomplish software design, development, and execution. Six Sigma and the capability maturity model (CMM) are some of the better-known methodologies that aim to improve software development processes.
3. Human resource capabilities: These are related to recruitment, training, and mentoring practices; designing jobs that will expose individuals to a variety of tasks and thus enable them to broaden their skills; and developing performance appraisal and compensation systems.

Levina and Ross (2003) argue that these three operational capabilities are mutually reinforcing and need to be simultaneously present. In the offshoring context, Ethiraj et al. (2005) found that higher levels of client-specific and process management capabilities lead to higher levels of firm performance.

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[1] We use the terms "vendor" and "service provider" interchangeably. We acknowledge that, while practitioners prefer the latter term, in the academic literature, in particular IS outsourcing literature, the term "vendor" is commonly used.

Fig. 1 Outsourcing literature on capabilities: various perspectives

Complementary to these works is a more fine-grained view of vendor capabilities developed by Feeny et al. (2005) that identifies 12 capabilities that service providers could leverage into three competences, as seen through the eyes of the clients: delivery competency that reflects the supplier's ability to respond to the client's ongoing needs; transformation competency indicating the supplier's ability to deliver radically improved service in terms of quality and cost; and relationship competency reflecting the supplier's willingness and ability to align its business model to the values, goals, and needs of the client.

Among the few studies that focused on vendor capabilities, Jarvenpaa and Mao (2008) studied operational capabilities using the mediated outsourcing model (e.g., Ethiraj et al. 2005; Mahnke et al. 2008; Rajkumar and Mani 2001). This model implies a mediating role by one service provider who is working directly with a client (end user/recipient of the service) and as well as with other service providers supplying some services to the primary (or "middleman") vendor. Such an arrangement may take a form of subcontracting (when the primary service provider contracts a third party—one or more service providers) (Jarvenpaa and Mao, 2008) or intermediation (brokering) such as legal services, moderating disparities between client and service provider, or staff augmentation by manpower agencies (Mahnke et al. 2008).

Figure 1 illustrates the focus of extant research on outsourcing capabilities, highlighting the three perspectives discussed above: perspective 1 depicts research on client capabilities (most widely discussed in the literature) in a client-vendor environment; perspective 2 depicts the focus of the few studies on the capabilities of large service providers providing services using their own resources; and
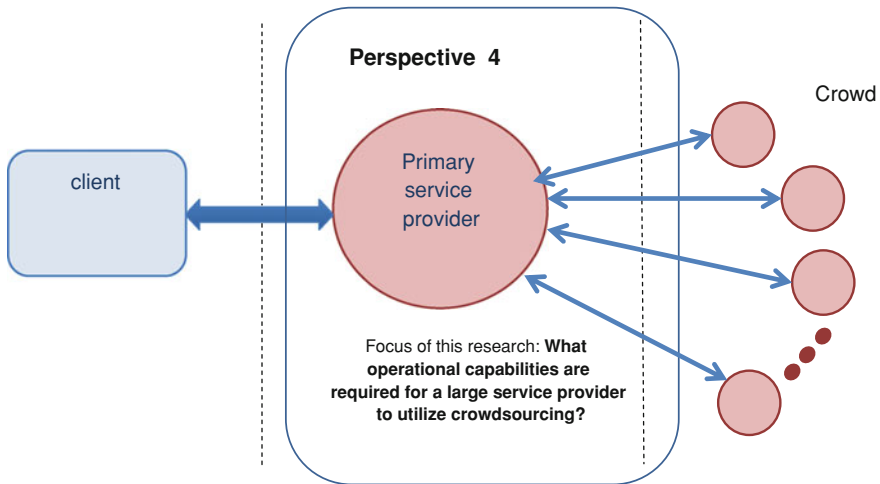
Fig. 2 The focus of this research

perspective 3 illustrates a mediated outsourcing model and focuses on the capabilities of the *subcontractor*.

Yet, none of these perspectives focuses on the *service provider* who is using the crowd as its subcontractors when delivering services to the client. In the mediated model (perspective 3) this would be the primary service provider using the crowd instead of subcontractor organizations. However, the focus of Jarvenpaa and Mao (2008), who studied the mediated model, is not the primary service provider. Instead, they focused on the capabilities of subcontractors in the "subcontractor-primary vendor" relationship. Furthermore, it is likely that the characteristics of the crowd are different to those of organizational subcontractors, studied in perspective 3. Crowd attributes, motivation, composition, and a host of other factors may play a role in defining the capabilities needed to successfully sustain the relationship with the primary service provider.

Figure 2 shows a fourth perspective—that is proposed in this paper and reflects the crowdsourcing model. The focus of this perspective is the primary service provider who faces the client on one side and the *crowd* on the other. Consequently, we place the focus on the capabilities needed by the *primary service provider* (i.e., the middleman), and argue that this service provider needs to combine "vendor capabilities" required for delivery of services to the end client with "client capabilities" required to successfully manage delivery of products/services from the crowd, and integration of these deliverables into the service provided to the end client. Therefore, our main research question is: *What operational capabilities are required for a large service provider to utilize crowdsourcing in service delivery?*

2.1 Crowdsourcing

Supported in large by the public Internet infrastructure, crowdsourcing is commonly conceptualized simply as outsourcing a task to the crowd in the form of an "open call" (Howe 2008). The nature of the task may vary from highly creative tasks to specialized problem-solving to simple labor-intensive tasks (Brabham 2010; Doan et al. 2011; Greengard 2011; Poetz and Schreier 2012; Wexler 2011). The composition and structure of the crowd has also been the focus of several studies, defining it as a network (Brabham 2010), a group (Horton and Chilton 2010), a community (Yang et al. 2008; Whitla 2009), or simply a composite of relatively anonymous and independent individuals (Haythornthwaite 2009).

Crowdsourcing has been studied in many contexts and identified benefits of crowdsourcing include improved problem-solving (Doan et al. 2011), cost reduction (Wexler 2011), and new perspectives of what firms can do (Jouret 2009). From the crowd's perspective, various reasons have been proposed to account for why the crowd engages in crowdsourcing, including monetary incentives (Geisler et al. 2011; Wexler 2011), but also personal and social rewards (Brabham 2010; Cook 2008) and crowdsourcing ideology (Proulx et al. 2011).

To leverage the benefits offered by crowdsourcing, potential customers (individuals and organizations) need to develop new capabilities that are tailored to the unique characteristics of crowdsourcing competitions, the tasks they entail, and the mindset of the "crowd" (to reflect incentives that motivate individuals to participate). Such capabilities would facilitate management of the work completed by the crowd and enable integration with existing practices of the buyer. In this paper we aim to explore such capabilities in one crowdsourcing context.

The crowdsourcing context studied in this paper is software development. We investigate a large technology service provider's venture into crowdsourcing and the lessons learned thus far. The focal organization is a large multinational organization, a leader in software development and provision of IT outsourcing services. It has tremendous outsourcing experience and a highly qualified workforce around the globe. Through focus groups with crowdsourcing leaders within the organization we aim to explore what new capabilities are needed to effectively harness the crowdsourcing model when delivering services to the end client.

3 Research Methodology

This work is phenomenological in nature with the phenomenon investigated being the introduction of crowdsourcing into service providing organizations. The primary purpose of this paper is hence to provide a descriptive account of the phenomenon with its key emerging themes and the behaviors and practices that surround it. These descriptions are provided from the perspective of the primary

service provider, and using multiple focus groups for data collection. Adopting this approach allows us to apply "the scientific attitude" to study "the natural attitude of everyday life" taken by the practitioners (Mårtensson and Lee 2004).

3.1 Focus Groups

To identify the major themes related to service provider capabilities under the crowdsourcing model we collected exploratory qualitative data from focus group sessions. Focus groups are particularly useful when our knowledge of a phenomenon is limited (Klaus and Blanton 2010), and the insights obtained from focus groups are based on consistent patterns of responses of carefully selected participants (Parasuraman et al. 1991). Focus groups are a common exploratory method in IS research (e.g., Jarvenpaa and Lang 2005; Joshi and Kuhn 2007; Otondo et al. 2009).

This research was conducted at a large multinational technology firm that is one of the leading IT service providers (among the top ten worldwide). This organization has extensive outsourcing experience providing services as a primary provider, and recently engaged in several crowdsourcing initiatives. The focus groups were conducted approximately six months after the launch of the crowdsourcing initiative. Four broad and open-ended questions were created (shown in the next section) to develop better understanding of new crowdsourcing capabilities. A total of five focus group discussions, ranging from 6 to 12 members each (48 individuals in total), were conducted via a combination of a teleconference and an online group support software. The majority of respondents were project managers (70 %) or lead architects (16 %) and the remaining participants were business analysts, delivery managers, developers, or IT specialists. Respondents were members of different project teams within the organization and were all involved with crowdsourcing planning and execution. Participants were selected for this study to represent teams with high crowdsourcing success as well as teams with low success, as measured by the organization. This allowed for different perspectives on crowdsourcing capabilities.

Each focus group session lasted approximately 90 min. The discussion began with the facilitator (a senior executive in the organization) describing the first question to participants over the conference line as well as posting it on the virtual discussion board. This was followed by a 15 min period in which each participant typed his or her response on the virtual discussion board. Each group member was able to see all other responses immediately, as they were typed by other focus group participants.

A valuable aspect of the focus group research method is its ability to leverage the interaction among participants to identify common reactions, experiences, and opinions on the focal topic (Jarvenpaa and Lang 2005). Hence, the focus group sessions were designed to support such interactions in two ways. First, group members were able to comment on each other's inputs through discussion threads

on the virtual board. The facilitator tracked responses as they were entered and allowed additional input time if needed. After all responses were entered, the facilitator verified that the answers were meaningful and did not require further clarification, and that all comments from other group members were entered.

Second, once all responses and comments were inputted the facilitator initiated a discussion over the conference phone line to elicit further comments and experiences. The facilitator typed these comments on the discussion board during the discussion and ensured that focus group participants reviewed and approved the discussion content. Upon completion of the follow-up discussion the next question was posted on the board followed by another 15 min answer period, and so forth for a total of four questions.

The first author participated (passively) in the focus group discussions by observing the questions and answers but otherwise remaining uninvolved. As the questions and answers were all recorded digitally, it was not necessary to transcribe them prior to analysis.

3.2 Data Analysis

Data were analyzed by two of the authors independently to identify the key themes and descriptions emerging from the focus groups' discussions. At the first stage, the two coders reviewed all comments and inputs by focus group participants to create a single file of all the comments from the five groups. Individual comments were then reviewed by each of the coders separately and assigned individual codes (for example, "involve team" was used to code a comment made about getting team members involved in crowdsourcing events, and "low submissions" was used to code a comment made about the low number of submissions to crowdsourcing competitions). Each coder then reviewed the codes to ensure consistency and uniqueness. At the second stage the two coders compared and discussed their coding of the comments until agreement was reached. During this stage codes that were perceived by the authors as representing the same phenomenon were grouped into higher levels categories that are presented in the tables below. A third author then reviewed and matched the lists of codes and categories again to ensure consistency in the interpretation of the focus groups' data. In addition to the analysis the coders also counted the frequency of each category's appearance in the data to provide some insight on the relative importance of topics.

3.3 Crowdsourcing Initiative: Background

The crowdsourcing initiative at the study organization began internally, as the organization was looking for ways to procure short cycle work without retaining new team members. The initiative was launched in February 2011. Consequently

members of teams across the organization who had free time were encouraged to register for crowdsourcing work. Project managers first identified specific work that was sufficiently componentized and thus perceived as suitable for crowdsourcing. They then put this work out as an open call (internally referred to as an "event") using an online platform and invited developers to compete on the event. In defining events project managers also defined the event's scope, schedule, and compensation. After experiencing crowdsourcing internally the organization expanded the crowdsourcing channel outside organizational boundaries, using a crowdsourcing platform and partner to locate qualified developers for competitions. Similar to the earlier (internal) approach, events were created by project managers with a defined scope, schedule, and compensation and made available for outside developers, through the crowdsourcing platform, to compete on.

4 Findings: Insights from Focus Groups

4.1 Question 1: What Tasks are Best Suited for Crowdsourcing Competitions?

The first question focused on task definition which is the foundation of crowdsourcing events. This question is not related directly to capabilities required to manage crowdsourcing, but it gave us an opportunity to understand the nature of tasks that crowd-management capabilities should focus on. Our analysis reveals that responses from participants focused on two aspects of the task: *type* and *characteristics*. In terms of type, the most common answer was that development tasks are best suited for crowdsourcing, followed by documentation and labor-intensive tasks (such as bug fixes), and finally idea generation. In terms of characteristics, four specific characteristics emerged in the responses to this question: the task has to be a stand-alone task, off the critical path, well-defined, and not requiring domain knowledge. Table 1 provides a summary of the answers given to this question and supporting quotes.

4.2 Question 2: What are the Best Practices Observed thus Far?

The key themes emerging in this question were around proper management and planning of the crowdsourcing initiative. The first theme focused on the need for a team effort in making competitions successful. All team members need to be involved and dedicated roles should be assigned for competition management. The second theme dealt with detailed practices around running events and competitions. Reuse emerged as important with focus group respondents highlighting the benefits

Table 1 Best software development tasks for crowdsourcing

Theme	Categories (frequency)	Exemplary quotes
Task characteristics	Stand-alone task (25 of the 48 participants)	"Stand-alone components that have simple interface with the rest of the application"; "Work for parts of the application which can be easily isolated from the rest of the application"
	Clear definition (14 of the 48 participants)	"You need well-defined specs, with a well-defined spec you can achieve successful development"; "I agree! Clear and well-defined specs are the key to any event!"
	Non-critical path (8 of the 48 participants)	"Low priority 'nice to have' requirements that are not on the project critical path"; "work that is not critical"
	No domain knowledge needed (7 of the 48 participants)	"Those sub-components that require little or no business domain knowledge"; "Tasks where no business knowledge is required to accomplish it"
Task type	Development (17 of the 48 participants)	"New development which is not tightly coupled with existing functionality"; "competitions are best suited for component development and assembly of components"
	Labor intensive (e.g., bug fixes and documentation) (10 of the 48 participants)	"Labor intensive work which is relatively simple to execute requiring basic skills"; "manual tasks which take up developer's time"
	Idea generation (2 of the 48 participants)	"Idea generation—how would you address this problem"

of reusing specifications and collectively managing and planning events. In addition, proper scheduling and tracking were identified as important, underscoring the external nature of crowdsourcing. The third theme focused on managing external crowdsourcing players (specific individuals from the "crowd"), reusing players where possible, and ensuring that proper support is provided (Table 2).

4.3 Question 3: What are the Key Challenges you have had to Overcome?

Three themes emerged when challenges to crowdsourcing were discussed. The majority of respondents brought up the resource constraint, highlighting the cost and time-consuming nature of setting up and managing events. An important challenge concerned the fit of crowdsourcing with existing methodologies, in particular agile (cf. Cao et al. 2009), and with existing applications. Specifically,

Table 2 Best practices for software development crowdsourcing

Theme	Categories (frequency)	Exemplary quotes
Team management	Involve team (11 of the 48 participants)	"We are getting more team members involved to help manage their own events, which spreads out the effort across a larger group of people"; "We have a weekly meeting as a team to discuss what's worked, what hasn't and what's coming up"
	Dedicated staff/manager (8 of the 48 participants)	"Getting someone to create and manage the events"; Have dedicated team members to support and manage competitions for a project"
Competition management	Collective management (7 of the 48 participants)	"When preparing for a 'series' of events, we prepare all the event documentation at one time so we don't repeat that same action over and over again"; "Create a month's worth of competitions at once. Players get more involved when they see a long stream of continuous employment"
	Reuse (specifications) (10 of the 48 participants)	"Reuse specifications from previous successful competitions as a baseline when creating new competitions"; "Reusable templates for specifications allow team members to write specifications more quickly"
	Scheduling (9 of the 48 participants)	"When scheduling events, leave 'white space' between the end of one competition and the beginning of the next to account for delays in completion/final fix"; "Strong emphasis on intelligent scheduling of Contest deliverables to assure success and avoid penalties"
	Track progress/status (9 of the 48 participants)	"Centralized tracking makes it easier to see overall progress, and then actions could be taken afterwards"; "In order to improve the successful completion of events, I check on the status of each event daily so that my team does not miss any phase deadlines"
	Good specifications (8 of the 48 participants)	"Specification document should be very clear and expected output should be clearly mentioned"; "Quality of the specification is key"
Players' management	Reuse (players) (3 of the 48 participants)	"Nurture relationships with players. Create a pool of return players. Notify them in advance of upcoming work"
	Communications & support (4 of the 48 participants)	"Communicating with the players and answering most of queries"
	Encourage participation (3 of the 48 participants)	"Give a catchy Headline for the requirement which will attract the audience"

Table 3 Challenges

Theme	Categories (frequency)	Exemplary quotes
Resources	Cost and time (18 of the 48 participants)	"Creating sufficient technical documentation to describe the problem and solution can often take more time than actually doing the work itself"; "Crowdsourcing is not cheap, there are fixed costs and then there is the cost of your architect to build and answer questions and the developers who have to put the pieces together. Our customers are experiencing severe budget cuts. The combination is not pleasant"
Fit	Fit with methodologies (8 of the 48 participants)	"As the Client gets used to Agile life cycle, it's hard to define complete stories in advance"; "Completion of events in Agile iterations is not achievable"
	Fit with applications (10 of the 48 participants)	"Existing applications are difficult to decompose to remove dependencies and focus on a specific problem"; Enterprise applications are not a good fit due to licensing agreements, the tightly coupled transport system for moving code from development to test, the expense to the clients of having two dev and test environments"
State of Submissions	Quality of submissions (8 of the 48 participants)	"Some of our winning submissions have been just marginally acceptable"; "Receiving solutions that are not acceptable"
	Skill availability (4 of the 48 participants)	"Technical skills not available in the market"
	Number of submissions (7 of the 48 participants)	"Competitions launched which rare skills don't get many submissions and tend to fail"; "You can expend a lot of time and money and get no responses"

the fast-paced nature of agile was seen as critically mismatched against the careful planning requirements of crowdsourcing. Finally, a "state of the submissions" theme emerged when the focus groups discussed the quality and availability of skills and of resulting submissions (Table 3).

4.4 Question 4: What Changes are Recommended Going Forward?

The final question asked focus group participants to reflect on how they would change existing work practices to better fit crowdsourcing. Here, convergence on three specific themes reflected many of the challenges and suggestions highlighted in previous responses. Focus group participants raised three important change categories that can improve the crowdsourcing experience: design for crowdsourcing, plan for crowdsourcing, and stakeholder buy-in (Table 4).

Table 4 Suggested changes for how to better fit crowdsourcing

Theme	Categories (frequency)	Exemplary quotes
Design for crowdsourcing	(13 of the 48 participants)	"During design—look to compartmentalize your code better"; "Try to make new applications more modular"; "Develop a component model in concept phase, plan to develop some components using competitions as part of project very early in the cycle"; bring crowdsourcing into the lifecycle earlier—see where it will be able to fit in"
Plan for crowdsourcing	Project (12 of the 48 participants)	"When planning project and costs—need to estimate in the cost of crowdsourcing to overall project costs"; "Recognize event managing as a specific skill and role when planning"; "Ensure that the budgets allow for the cost of crowdsourcing"
	Competition (7 of the 48 participants)	"Allow additional time between the end of a 'parent' competition and the start of any 'child' competitions to allow for delays"; "Plan the event well in advance so that we have sufficient time to use the outcome in project"
Stakeholders buy-in	Customers (6 of the 48 participants)	"Ensure customer buy in"; "Work closely with your customer to ensure they have a sufficient backlog of requirements to avoid having to send must haves through competitions"
	Team (3 of the 48 participants)	"Ensure the teams which will support the systems after it is deployed are involved in the process to ensure a smooth knowledge transfer"; "Share the crowdsourcing vision to team"; "Get more buy-in from the existing team"

We have thus far discussed our insights obtained from the focus groups and characterized the crowdsourcing phenomenon and its implications to software service providers. We identified key themes in the responses for each question and provided supporting quotes and frequencies of occurrence. In the following section we discuss these findings using the foundations introduced earlier from the literature on service providers' capabilities under different sourcing models. We compare our findings with those of previous studies and identify the new capabilities emerging from the crowdsourcing model

5 Analysis and Discussion of Findings

We have compared themes that emerged from the focus groups with client and vendor capabilities identified in the outsourcing literature (as discussed earlier in the paper). In Table 5 we discuss outsourcing capabilities identified in the literature through the lens of a particular case of a large service provider attempting to

Table 5 New capabilities for service providers using crowdsourcing

Capabilities under traditional models (as identified in the literature)	Capabilities in a crowdsourcing model
Client-specific capabilities	This capability is expanded when service provider is using crowdsourcing, as the client specific knowledge must trickle down to the crowd
• Routines, resources and knowledge that a service provider must have of the client's business model and industry, as well as of the specifics of the client's operations	The service provider is now responsible for ensuring that crowdsourcing players (who participate in competitions) have two layers of client-related knowledge in the domains that the "crowd" is responsible for:
	1. Knowledge of the end client and their needs
	2. Knowledge of the service provider organization and the project as a whole
	While the first layer is similar to the previously identified capability, the second layer is introduced by the addition of the crowd as a subcontractor. Since work is split between the primary service provider and the crowd, crowd members now require "provider-specific" skills
	It is the responsibility of the primary service provider to ensure that such knowledge exists within the crowd or, alternatively, to select crowdsourcing events that do not require vendor-specific knowledge
Process capabilities	The nested nature of crowdsourcing work, which presents a project within a project, requires fit between internal and crowdsourced components of the work. Hence another level of planning is required to ensure such fit
• Task delivery routines, resources and methodologies that help to accomplish software design, development, and execution	The service provider's process capabilities are thus expanded to include, not only the primary process vis-à-vis the client, but also the secondary process of the crowdsourced work
	Managing the crowdsourcing process requires that:
	1. The proper technology infrastructure is made available to crowdsourcing players
	2. Careful planning for crowdsourcing ensures resources and schedules are appropriate
	3. The design of the project takes crowdsourcing into account to ensure that work is componentized and suitable for crowdsourcing
	4. Fit exists between internal methodologies and crowdsourcing to ensure limited friction

(continued)

Table 5 (continued)

Capabilities under traditional models (as identified in the literature)	Capabilities in a crowdsourcing model
	at the interface between internal and crowdsourced work
Human resource capabilities • Recruitment, training, and mentoring practices; designing jobs that will expose individuals to a variety of tasks and thus enable them to broaden their skills; and developing performance appraisal and compensation systems	Though the original human resource capabilities introduced by Levina and Ross (2003) referred to the internal staff within the vendor organization, when a service provider employs the crowd these human resource capabilities should be extended to external human resources (from the "crowd")
	In particular, the service provider should be able to locate and manage crowd members who are of value to the organization (i.e., individuals that have unique skills that the service provider wants to utilize in the future) and be able to:
	1. Ensure that the crowd skills complement, rather than interfere with, internal skills
	2. Broaden these skills to accommodate better fit with the context in which the service provider operates
	3. Motivate skilled crowd members to remain loyal to the service provider and continue bidding for new crowdsourcing work
Supplier management capabilities • A *client's* ability to manage outsourcing providers. This encompasses capabilities such as contract management and relationship management	Using crowd as subcontractors puts a primary service provider in the position of a "client" who needs to manage their suppliers. Thus the notion of "supplier management capabilities" introduced in the outsourcing literature also applies to service providers who engage in crowdsourcing, in particular:
	1. Internal team members are required to accommodate crowdsourcing delays and problems. Team members' involvement in all stages of the crowdsourcing lifecycle is crucial to facilitate workflow
	2. The crowd represents a new stakeholder group that the service provider needs to manage. The service provider needs to invest in building relationships with individuals from the crowd and reuse players as possible
Architectural capabilities • A *client's* architectural and design knowledge of the service (Willcocks and Graig 2008)	In the crowdsourced model this capability requires the service provider organization to componentize work so that it can be effectively and seamlessly crowdsourced

utilize crowdsourcing in service delivery. This is followed by a broader view discussion of the implications for capabilities required for a primary service provider that aims to utilize crowdsourcing when delivering services to the clients.

Overall, the combination of capabilities discussed in Table 5 would enable a service provider to manage the three stakeholder groups that play an important role in crowdsourced projects:

1. The client who is ultimately the most important stakeholder, with client buy-in needed to ensure their satisfaction. Not all clients that contract a specific organization may agree to have their work crowdsourced.
2. Internal team members who need to design, facilitate and manage crowdsourced work, as well as integrate crowdsourced deliverable into the services delivered to the end client.
3. The crowd who needs to have appropriate support (e.g., infrastructure) from the primary service provider, as well as to be motivated to respond to crowdsourcing calls.

5.1 Implications for Capabilities in a Crowdsourcing Model

Vendor capabilities identified and studied in earlier literature (e.g., Ethiraj et al. 2005; Jarvenpaa and Mao 2008; Levina and Ross 2003) need to be adjusted in the crowdsourcing model to reflect the need for the primary service provider to manage the crowd. Because the crowd is not a typical subcontractor, the responsibility to deliver to client expectations and, consequently, the burden of ongoing management of service delivery (for both primary service provider as well as the crowd) falls on the primary service provider organization. This means that the service provider is responsible for communicating relevant client knowledge to the crowd, as well as coordinating the process to seamlessly integrate crowdsourced work.

Our table above discusses how the three formerly identified vendor capabilities of (1) client-specific capabilities, (2) process management capabilities, and (3) human resource capabilities, should be modified under the crowdsourcing model. Specifically, the service provider now needs to open its infrastructure to crowdsourcing players, to incorporate crowdsourcing in the design and planning of projects, and to ensure fit between different development methodologies. Furthermore, human resource capabilities need to be extended to include external individuals from the crowd and to nurture their unique skills and motivate them to engage in future crowdsourcing work. The service providers also needs to *select crowd players with "organization-specific" skills,* so that both the crowd and the primary service provider can understand each other in a similar way as a primary service provider can understand the end client.

Beyond the above capabilities, a primary service provider needs to adopt capabilities traditionally associated with a client in prior literature, in order to
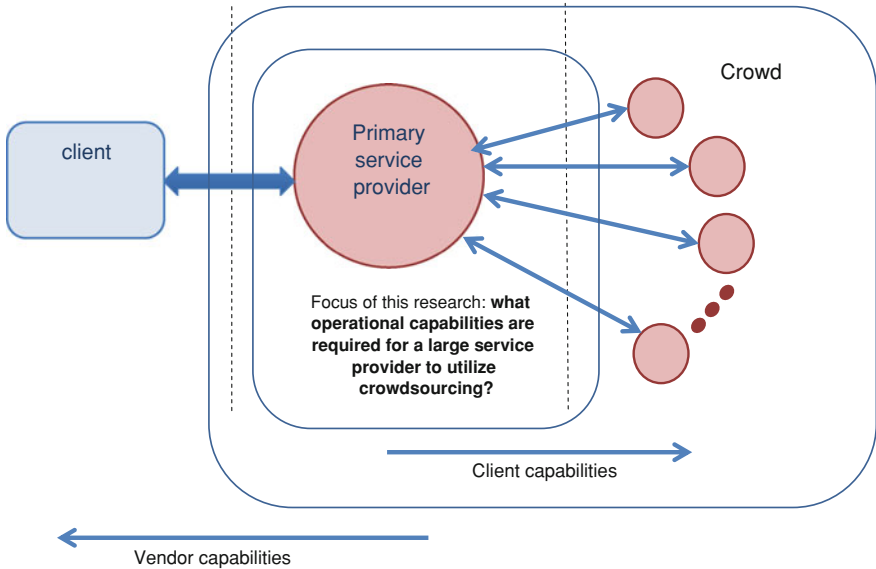
Fig. 3 The crowdsourcing perspective

accommodate the service provider's new role as a client in the crowdsourcing market. However, these capabilities take a slightly different shape when considered from a primary service provider perspective. In particular *supplier management capabilities* which encompass contract management, relationship management, and service provider development (Feeny et al. 2005; Willcocks and Lacity 2009) are imperative for the primary service provider's success in the crowdsourced model. These capabilities are particularly important if the service provider wishes to develop longer-term relationships with successful crowd players. In addition, similar to the above "process management capabilities", the primary service provider needs to have strong *architectural and design knowledge* (Willcocks and Graig 2008) to be able to componentize work so that it can be easily crowdsourced.

The above discussion is broadly illustrated in Fig. 3 below, which is an adaptation of Fig. 2. In Fig. 3 we show the crowdsourcing model with its two layers. The internal relationship is the one between the primary service provider and the crowd, in which the service provider assumes the role of the client facing the crowd, and requires the two client capabilities discussed in the above paragraph and in Table 5. The external relationship is between the primary service provider and the end client, and in this relationship the service provider requires the vendor capabilities discussed in Table 5 and the following paragraphs.

5.2 Dealing with Uncertainty: A New Capability

A very important aspect of crowdsourcing models is the element of uncertainty introduced by the nature of dealing with the crowd. Participants in our focus groups discussed uncertainty around things such as the skills available within the crowd, the number of submissions and their quality and timing. This problem brings up an interesting trade-off that merits further attention in studying the crowdsourcing phenomena. On the one hand the appeal of crowdsourcing is that it harnesses the "wisdom of the crowd" and opens the organization to new skills not always available within. On the other hand, the crowd is largely unknown. In a software development project where "on time and on budget" are key performance indicators it is not clear that the organization can bear such degree of uncertainty. Focus group members in our study mentioned problems that arise when the submissions at the end of a specific crowdsourcing competition do not deliver what was expected, which ultimately delay the project as a whole.

Looking at how organizations can address this problem, our focus group participants mentioned establishing relationships with strong crowd players and reusing players between competitions. While this helps alleviate the uncertainty problem it also potentially reduces the crowd to subcontractors and possibly eradicates some of the benefits expected from the crowdsourcing model.

There are definitely many unanswered questions as to how organizations should deal with the uncertainty inherent in crowdsourced work and future research should explore this topic in more depth.

6 Discussion: Lessons Learned

This paper explored the crowdsourcing phenomenon as a new sourcing model for software projects and the capabilities required from service providers engaging in crowdsourcing. Unlike prior studies on vendor capabilities the focus of this paper was on the primary service provider (or the vendor) but in a unique environment which includes not only the client but also the crowd. There are several interesting lessons learned from the crowdsourcing case explored in this paper. First, the fact that the crowd is not working directly with the end customer, but through the mediation of the primary service provider, resulted in a nested model in which the primary service provider requires client capabilities for dealing with the crowd together with vendor capabilities for dealing with the end client. Further, there is some degree of uncertainty regarding what tasks should be included in the crowd competitions and what the outcome of the competition will be. Therefore, in comparison to past studies that investigated the crowdsourcing phenomenon and reported benefits of crowdsourcing such as improved problem-solving (Doan et al. 2011) and cost reduction (Wexler 2011), in the case of crowdsourcing when a primary service provider is subcontracting to a crowd, the benefits were realized

only under specific conditions, such as well-specified stand-alone non-critical tasks that do not require domain (business) knowledge, and can be easily integrated with the rest of the application/system.

Furthermore, the service provider discovered that setting up and managing crowdsourcing competitions required significant effort in terms of the amount of internal resources and their time. Poorly planned competitions (e.g., if not enough preparatory work was done internally to select and/or specify the task advertised as an event for crowdsourcing competition) did not get enough quality bids, which meant wasted time for the organization.

Last but not least, because crowdsourcing is limiting potential buyers and the participating crowd to online interactions, the processes enabling and supporting the crowdsourcing life cycle need to suit the tasks (open calls) advertised to the crowd, which further limits the type of tasks that can be crowdsourced. This means that tasks that require some degree of flexibility or involve fuzzy requirements are not suitable for crowdsourcing. One of the problems that the service provider in our study faced was related to lack of fit between internal methodologies and processes, and agile software development practices with processes supported by the online crowdsourcing platform. In particular, the lack of flexibility of the crowdsourcing processes embedded in the platform reduced opportunities for the primary service provider to benefit from crowdsourcing. Some of the problems reported referred to the strict duration of specific steps (e.g., the length of time when an "event" is open to receive responses from the crowd) which prevented the service provider team from extending the deadline to receive additional bids in situations when not enough bids were submitted; or deadlines falling on weekends or holidays when the service provider team was not available to evaluate bids. Among other problems reported, the quality of the online platform was mentioned, as sometimes it was not available (because of some technical issues), which meant a complete "blackout" between the service provider team and the subcontractors who could not get in touch outside the platform.

Many of the problems identified in this crowdsourcing initiative are very similar to the problems reported in the early days of outsourcing, when clients were looking for quick ways to reduce costs, but then discovering that, to receive quality service from their service provider, they needed to make a significant investment into setting up correctly their outsourcing engagement (Cullen et al. 2005), which included conducting detailed analysis of processes and systems suitable for outsourcing (Aron and Singh 2005), evaluating sourcing models (Oshri et al. 2011), selecting service providers (Feeny et al. 2005) and being willing to invest the resources to manage the outsourcing engagement.

Interestingly, today, when many client organizations have learned the basic lessons of how to outsource successfully, and service providers have moved up the value chain and developed extensive experience in delivering high-value knowledge-intensive services (Carmel 2006), we observe similar patterns when new sourcing models emerge. In this study we observed a primary service provider assuming classical "client" behavior when engaging in crowdsourcing. Therefore, as shown in this study, adopting some of the "client capabilities" and extending

those critical "vendor capabilities" would help service providers to be more successful in engaging in crowdsourcing models. Furthermore, the added complexity due to the higher extent of uncertainty that characterizes the crowd makes it more difficult for the service provider to manage both relationships (with the end client and with the crowd) and merits further investigation in future studies.

7 Conclusion and Contributions

Our paper makes several important contributions to IT outsourcing literature which, so far, has been very limited on reflecting the vendor's perspective on outsourcing. Our major contribution lies in studying capabilities of a primary service provider that uses crowdsourcing for subcontracting work. Using crowdsourcing has become a popular trend in outsourcing practice. Therefore, assuming that service providers are using only in-house resources for delivering outsourced work (as reflected in the existing literature on vendor capabilities) is far from today's reality. An important contribution this paper makes is to the IS outsourcing literature where we (i) explore the phenomena of crowdsourcing that is increasingly becoming a popular sourcing model from the eyes of the service providing organization, and (ii) revise existing theoretical frameworks on vendor and client capabilities to develop a framework of new vendor capabilities for crowdsourcing. We build on the literature on client and vendor capabilities to develop an integrated understanding of capabilities required for a primary service provider to successfully utilize crowdsourcing. Furthermore, within the IS outsourcing literature, to our knowledge, our research is the first to consider the perspective of a primary vendor who needs not only to deliver services to a client, but also to manage subcontractors. Existing literature on mediated sourcing models have focused on the subcontractor perspective only (e.g., Jarvenpaa and Mao 2008) and did not incorporate the crowd as a unique and new entity.

This paper also has practical relevance, in particular for organizations that are experimenting with, or considering, crowdsourcing. Findings from the focus groups reported in this paper can be used as a guide for setting up and managing crowdsourcing initiatives.

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