Please quote as: Blohm, I.; Köroglu, O.; Leimeister, J. M. & Krcmar, H. (2011): Absorptive Capacity for Open Innovation Communities - Learnings from Theory and Practice. In: 2011 Academy of Management Annual Meeting, San Antonio, Texas, USA.

Absorptive Capacity for Open Innovation Communities - Learnings from Theory and Practice

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ABSORPTIVE CAPACITY FOR OPEN INNOVATION COMMUNITIES – LEARNINGS FROM THEORY AND PRACTICE

ABSTRACT

Potentials of open innovation communities are manifold, but the question of systematically capturing value from these communities has rarely been researched. We therefore develop a value appropriation framework from absorptive capacity theory and apply it to the case of Ubuntu Brainstorm, one of the Internet's biggest open innovation communities. This theory integration contributes to both research streams. Open innovation can be embedded into a broader theoretical context, and a deeper understanding of real absorption processes can be developed. Need for future research and guidelines for practice in regard to improving a company's value appropriation from open innovation communities are offered.

Keywords:
open innovation communities, open innovation, absorptive capacity, value appropriation, Ubuntu Brainstorm

Acknowledgement:

This paper presents outcomes of the research project "GENIE" that is a research project of Technische Universität München and partners. The GENIE project is funded by the German Ministry of Research and Education under contract No. FKZ 01FM07027. For further information please visit: http://www.projekt-genie.de.

INTRODUCTION

In the twentieth century, many leading companies generated and commercialized ideas for innovations mainly through in-house R&D laboratories. Today, companies are increasingly rethinking the ways of managing their innovation activities. Companies, regardless of whether they sell products or services, increasingly open up not only their innovation but also their production and sales process to customers that are seen as one of the biggest resources for innovations (Chesbrough, 2006; von Hippel, 2005). Open innovation is thus gaining recognition in research and practice, and its increasing popularity has led to the rise of various innovation platforms on the Internet, which are an effective means for integrating customers into the innovation process (Ebner, Leimeister, & Krcmar, 2009). Prominent examples include *Dell IdeaStorm* or *MyStarbucksIdea*, which both comprise of more than 15,000 ideas each and demonstrate the enormous potential of this approach.

Current research of open innovation communities (OICs) has predominantly focused on OICs in terms of value creation, e.g., they have been researched as a method of integrating customers into the innovation process (Ebner et al., 2009; Füller, Bartl, Ernst, & Mühlbacher, 2006), as well as how value creating activities are affected by the community member's characteristics and motives (Bullinger, Neyer, Rass, & Möslein, 2010; Jeppesen & Frederiksen, 2006) and their behavior (Fleming & Waguespack, 2007; Franke & Shah, 2003; Hautz, Matzler, Hutter, Rieger, & Füller, 2010; von Krogh, Spaeth, & Lakhani, 2003). Additionally, authors have addressed issues of organizational and technical design of OICs (Leimeister, Huber, Bretschneider, & Krcmar, 2009; Riedl, May, Finzen, Stathel, Kaufman, & Krcmar, 2009). However, little attention has been paid to the question of value appropriation (Teece, 1986) and how the huge amount of information as it is generated in OICs can be incorporated into internal innovation processes of organizations (Di Gangi & Wasko, 2009). In this context, absorptive capacity (AC), i.e., "a firm's ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal,

1990, 19) becomes the pivotal success factor for open innovation and innovation effectiveness (Huang & Rice, 2009; Hughes & Wareham, 2010; Lichtenthaler & Lichtenthaler, 2009; Spithoven, Clarysse, & Knockaert, 2009).

This paper follows the research question of how companies capture value from OICs. To answer this question, we draw on established research on open innovation and OICs, and combine this body of knowledge with a systematic review of AC literature. We develop a theoretical framework for value appropriation in OICs that combines open innovation in terms of OICs with AC theory. In a second step, the validity of this framework is empirically refined in an explorative, qualitative case study of the Ubuntu Brainstorm Community of more than 25,000 participants, more than 19,000 ideas, more than 110,100 comments and more than 2.5 million idea evaluations - one of the biggest OIC on the Internet. In addressing our research question, our paper responds to the recent call of testing and refining established management theories in OICs (von Krogh & Von Hippel, 2006).

This paper is structured as follows: In section 2 the characteristics of OIC are worked out in order to systematically combine AC and open innovation, after which a framework in value appropriation in OIC is introduced in section 3. Following a process-based perspective of AC, we link OICs to absorption processes, process inputs and outcomes, as well as contingency factors influencing the absorption process. In section 4 we empirically test and refine our developed AC framework for the value appropriation framework conducting a qualitative, explorative case study. Finally, theoretical and practical implications, as well as prospective areas for future research of this paper, are highlighted in section 5.

OPEN INNOVATION AND INNOVATION COMMUNITIES

Open innovation is the renunciation of the classic innovation process that can largely be located within a company and that exclusively commercializes ideas developed by the internal R&D department (Chesbrough, 2006). One of the underlying principles of open

innovation is the utilization of the 'wisdom of crowds' (Surowiecki, 2005). According to this principle of collective intelligence, the quality of a decision that is jointly made within a community, involving the contribution of every single member, can be superior to decisions made by single individuals or experts (Leimeister, 2010; Malone, Laubacher, & Dellarocas, 2010). This point is exactly where OICs are rooted in order to integrate customers into innovation development (Ebner et al., 2009; Füller et al., 2006).

Whereas early OICs were mostly operated by end-users of a given product, more and more companies introduce OICs as meaning nodes for innovation development. In this paper we focus on company-operated OICs that are predominantly used to elicit ideas for new products from customers. Although OIC vary widely in their actual occurrences, Riedl et al. (2009) unraveled a set of common characteristics that we shortly pinpoint in order to establish a common understanding of OIC before developing a framework for capturing value from these communities:

- *Toolkits for idea externalization:* OICs use toolkits which encourage users to think about problems with current products, and support them to externalize and to transfer their ideas to the community owner (von Hippel & Katz, 2002). These toolkits provide pre-structured input forms for idea submission, offer guidance through the process of idea generation (Di Gangi, Wasko, & Hooker, 2010), and integrate various means for providing feedback and enabling learning-by-doing (Piller & Walcher, 2006).
- *User Collaboration:* In OIC users interact socially, e.g. by commenting on each other's ideas (Hautz et al., 2010) in order to identify shortcomings within the original idea and jointly develop new innovation ideas (Fleming & Waguespack, 2007; Franke & Shah, 2003; Piller & Walcher, 2006). Some OICs offer wikis to directly improve someone else's idea and enable team submissions. User collaboration promotes the creativity and quality of contributions bringing together customers with different expertises and skills (Blohm, Bretschneider, Leimeister, & Krcmar, 2010; Bullinger et al., 2010).

- *Popularity Signaling:* Users assess the quality of the submitted ideas using rating functionalities. These ratings are used to estimate user acceptance of ideas and to filter out the best ideas among all submissions for further internal review phases (Di Gangi & Wasko, 2009). The used rating scales in OICs vary strongly in sophistication, ranging from simplistic binary scales to more complex multi-criteria scales (Riedl, Blohm, Leimeister, & Krcmar, 2010).
- *Community Management:* In order to steer OICs, the activities of the community members are actively managed (Fleming & Waguespack, 2007). In terms of company-operated OICs, this is usually done by a team of dedicated employees which perform the site management according to the goals of the community owner (Di Gangi et al., 2010; Preece, 2000). This involves, e.g., updating the community members with news, or activating and stimulating idea submitters through idea contests (Ebner et al., 2009).
- *Terms of use:* Community owners formulate explicit terms of use which define the rules of interaction in the OIC in order to regulate intellectual property transfer (Leimeister, 2010; Sawhney & Prandelli, 2000) which have to be confirmed by the users during registration. With their agreement, idea submitters usually accept that they are not compensated financially for their efforts and that they grant the right of exploitation for their submitted ideas.

Table 1 analyses examples of OIC regarding the characteristics of OIC.

– Table 1 about here –

COMBINING ABSORPTIVE CAPACITY AND OPEN INNOVATION COMMUNITIES

AC is the ability to locate external ideas and to integrate them into internal organization processes influencing a firm's competitiveness and innovation abilities (Cohen & Levinthal, 1990; Zahra & George, 2002). In accordance to Cohen & Levinthal's (1990)

original definition, current research employs a process-based perspective of AC in order to capture its multidimensional nature (Lane, Koka, & Pathak, 2006; Lichtenthaler, 2009b; Todorova & Durisin, 2007; Zahra & George, 2002). In this paper, we follow this perspective and analyze the value customer ideas submitted in OICs may endow from its generation to its implementation and community owners can capture their value as well as from the OIC in general. We develop a framework linking OIC to AC regarding (1) AC processes necessary for capturing the value of OIC, (2) process inputs in terms of customer knowledge that can be obtained from OICs, (3) process outcomes in terms of competitive advantages that derive from OICs, and (4) contingency factors influencing the value appropriation.

In order to develop this framework, we draw on established research on open innovation and combine this with a systematic review of AC literature. We focused our literature search on 14 leading journals in the field of general management and innovation and technology management (cf. Table 2). We included all articles that were published in these journals from 1990 to 2010. We applied a full-text search for 'absorptive capacity,' and found 1,479 articles. In order to reduce these articles to an analyzable number, we focused on articles that integrated the term 'absorptive capacity' in the paper's title, abstract or keywords. This narrowed down our sample to 107 articles. We read them for thematic fit and reduced the number of relevant articles to 23. Finally, we added 4 papers that were thematically highly relevant but not part of the results our journal search obtained. Table 2 provides an overview of our search results.

– Table 2 about here –

Absorption processes

In accordance with the original definition of Cohen & Levinthal (1990), Lane et al. (2006) define AC as a three-dimensional sequential process consisting of explorative, transformative and exploitative learning. While explorative learning characterizes recognizing

and understanding valuable external knowledge, transformative learning describes the assimilation of crucial knowledge into a company's stock of knowledge. During the process of transformation new knowledge is combined with already existing information in order to utilize this already present episteme in an innovative way (Lane et al., 2006; Zahra & George, 2002). Finally, exploitative learning characterizes the commercial application of assimilated and re-combined knowledge, e.g., within the context of new product development.

On the contrary, Zahra & George (2002) distinguish potential and realized AC. Potential AC equates explorative learning and involves the dimensions of acquisition and assimilation, whereas realized AC is in accordance with the phase of exploitation which involves transformation and exploitation of external knowledge. However, this distinction is criticized by Todorova & Durisin (2007), who argue that the phases of assimilation and transformation are more complimentary than sequential. Assimilation is processing new information with already existing mental schemes, whereas transformation involves the creation of new cognitive structures to process information. As the sequentiality of these two dimensions does not hold true, the authors criticize the distinction of potential and realized AC. In fact, Lichtenthaler (2009b) found a three dimensional model consisting of explorative, transformative and exploitative learning to have empirically a higher explanatory power than did a two-dimensional AC construct equaling potential and realized AC.

Generally, three open innovation process archetypes have been identified (Gassmann & Enkel, 2004). The 'inside-out' perspective aims at generating value from ideas and technologies that cannot be applied in-house, e.g., through out-licensing or spin-outs. 'Outside-in' processes refer to accessing external knowledge in order to enhance its own knowledge stock for innovation development and the 'coupled' process is a combination of both processes in strategic R&D alliances. Although only the notion of outside-in directly refers to the context of AC, managing open innovation and AC processes is highly intervened (Lichtenthaler & Lichtenthaler, 2009), and many AC conceptualizations imply outbound

activities through bi-directional connectedness with learning partners (Cockburn & Henderson, 1998; Hughes & Wareham, 2010). Outside-in open innovation processes exceed AC processes, as they aim at externalizing sticky information from customers using specialized knowledge integration mechanisms such as toolkits (von Hippel & Katz, 2002), whereas AC theory assumes that external knowledge is readily available for absorption. However, idea appropriation from OICs requires all AC phases of explorative, transformative and exploitative learning (Lichtenthaler & Lichtenthaler, 2009).

Following a process-based point of view, explorative learning in OICs is mostly performed by community members. Due to the community owner's broadcast search for new ideas, their need and solution information is activated and they start submitting new product ideas using toolkits (Piller & Walcher, 2006; von Hippel & Katz, 2002). After submission, these ideas are refined and discussed by the community. Moreover, the community is involved in recognizing the value of the ideas that apply the voting mechanism to signal idea popularity. Based on this surrogate of idea quality, the community owner can recognize possibilities for knowledge arbitrage and select the best ideas (Hughes & Wareham, 2010). After this acquisition of external knowledge (Zahra & George, 2002), transformational learning starts when ideas are disseminated to the respective business units that are in charge, regarding the product or service that the idea strives to improve (Di Gangi et al., 2010; Matusik & Heeley, 2005). These units then combine the customer ideas with their existing product knowledge incorporating the ideas into their knowledge stock. Finally, the ideas are implemented into new products in case necessary resources are allocated to the idea implementation equating exploitative learning. This OIC specific AC process is pinpointed in Figure 1.

– Figure 1 about here –

Process Inputs

Absorption processes are highly influenced by a firm's knowledge stock, the content and the characteristics of the external knowledge, as well as of the peculiarities of the learning relationship. AC is cumulative and path dependent (Cohen & Levinthal, 1990), i.e., that the absorption of new knowledge is highly dependent on already absorbed knowledge. Without a minimum degree of knowledge in a certain domain, new external knowledge cannot be interpreted, hampering its incorporation. In this regard, Lichtenthaler (2009b) highlights the distinction of market- and technology-related knowledge. Technological knowledge directly relates to the development of new products in terms of product functionalities or production techniques, e.g., a company acquires a new technology that is then incorporated into new products (Cassiman & Veugelers, 2006; Tsai, 2001). In contrast, market knowledge refers to the exploitation and commercialization of this technological knowledge (Van Den Bosch, Volberda, & de Boer, 1999). It provides a firm the insights of which functions and customer needs a given technology may fulfill, and can open new market opportunities for given products and technologies (Lichtenthaler, 2009b). Furthermore, the ability to absorb external knowledge is determined by the tacitness and the complexity of external knowledge (Lane et al., 2006): The higher its degree of codification and the lower its complexity, the better the external knowledge can be understood and absorbed.

Additionally, the ability to absorb external knowledge is determined by the characteristic of the learning relationship (Lane et al., 2006), particularly in cases where several learning partners are involved. In this context, Lane & Lubatkin (1998) define relative AC that describes the ability of one company to better absorb knowledge from other learning partners. This ability is highly determined by the complementarity of the learning partner's knowledge bases (Abecassis-Moedas & Mahmoud-Jouini, 2008).

The dominant idea of the open innovation logic in terms of OIC is to integrate external knowledge sources in order to enhance its own knowledge base (Chesbrough, 2006;

Gassmann & Enkel, 2004). Customers are considered as central knowledge carriers whose knowledge has to be absorbed (von Hippel, 2005). Von Hippel (1994) argues that customers may deliver need and solution information. Whereas need information describes wishes, requirements and needs of customers, solution information contains precise information concerning the implementation of an innovation. Thus, the absorption of need information enhances a company's market knowledge, as it enables the company to apply an existing technological knowledge to develop new products and services. Solution information contributes to the technological knowledge base, as it refers to the realization of innovation ideas. However, especially need information is 'sticky', hard to codify and highly tacit, thus hampering its transferability (von Hippel, 1994).

Lead user theory assumes that a particular group of customers is of higher relevance for innovation development than are other customers, as these lead users are in a suitable cost position to externalize highly relevant, sticky information (Franke, von Hippel, & Schreier, 2006; Lilien, Morrison, Searls, Sonnack, & von Hippel, 2002; von Hippel, 2005). Lead users encounter needs that will become relevant for the majority of customers ahead of the mass market. Moreover, the expected benefits that derive from fulfilling these needs are so high that lead users start to develop innovations on their own. These prototypic realizations of low complexity frequently involve fundamentally new applications leading to radical innovations (von Hippel, 2005). Thus, lead user knowledge inherits a high complementarity to a firm's knowledge base, and has overcome the burdens of sticky information. Thus, applying an AC point of view, companies have a higher relative AC in regard to lead users, who are highly attracted by OICs (Piller & Walcher, 2006; von Hippel, 2005), than to regular customers.

In OICs customer ideas reflect the external knowledge to be absorbed. These ideas are often vague, unspecific, and show a low degree of maturity (Blohm et al., 2010). Absorbing them, a company's existing knowledge stock and its resulting path dependency play a pivotal role. Companies can only absorb ideas that are related to the knowledge stock of the

company, as a certain degree of knowledge of the customer domain is needed in order to interpret and process these ideas (Di Gangi & Wasko, 2009). Due to this path dependency, the already existing knowledge stock determines the search focus of the company, and only ideas that are part of this are considered for absorption (Todorova & Durisin, 2007).

The relationships between AC and OIC in terms of process inputs are summarized in Figure 2. The knowledge stock is pinpointed as the big central circle, and the grey sub areas equate the technological and market-related knowledge a company possesses. The smaller circles reflect customer ideas that consist of need and solution information. The interference of the circles relates to the cumulativeness of AC so that there has to be overlap between the knowledge base of the company and the information that customers may provide. Path dependency accrues so that only those ideas can be absorbed which at least touch the knowledge stock. However, the higher the interference between customers' ideas and knowledge stock, the better these ideas can be absorbed, relating to the notion of relative AC.

– Figure 2 about here –

Process Outcomes

Most researchers addressing AC see competitive advantages derived from new innovations (e.g., Tsai, 2001) and an increase in innovative performance (e.g., Lichtenthaler, 2009b) as the pivotal outcomes of AC (Volberda, Foss, & Lyles, 2010). Lane et al. (2006) distinguish these commercial outputs from knowledge outputs that involve, e.g., interorganizational learning (Lane, Salk, & Lyles, 2001) or an increase in human capital through newly acquired skills and knowledge (Matusik & Heeley, 2005). Moreover, Zahra & George (2002) conceptualize AC as a dynamic capability that is geared towards effective organizational change (Teece, Pisano, & Shuen, 1997). Thus, strategic flexibility (Todorova & Durisin, 2007; Zahra & George, 2002) or expectation formation (Cohen & Levinthal, 1990) can be considered as the third central outcome of AC. Absorbing new knowledge, companies

can better understand and can better evaluate external knowledge, thus enabling them to react and adapt easier to changing environments.

Although open innovation has rarely been related to firm performance directly (Laursen & Salter, 2006; Lichtenthaler, 2009a), scholars argue that open innovation creates competitive advantages from making innovation development more effective and efficient (Chesbrough, 2007; Gassmann & Enkel, 2004). First, in OICs these advantages may result through the exploitation, i.e., the implementation of customer ideas. Using toolkits, customers can better externalize their wishes and requirements than with traditional methods of market research; further, more appropriate products can be developed increasing the effectiveness of innovation development (von Hippel & Katz, 2002). In contrast, solution information offers innovative ways of implementing innovations and reducing time to market and development costs, thus enhancing efficiency of innovation development.

Second, Vanhaverbeke, Cloodt, & Van den Vrande (2007) see the benefits of open innovation in an early engagement in multiple options for innovation development improving strategic flexibility. OICs attract a broad range of experts, lead users and opinion leaders who offer a broad variety of different skill sets and experiences regarding an organization's products. As all communication and interaction of these users is conducted online, new market and customer trends can easily be identified applying netnographic methods (Kozinets, 2002), thus enabling strategic foresight and flexibility.

Finally, OIC create a huge amount of customer contacts between the community owner and the community members which are highly relevant for both human resource management and marketing. Members of OICs highly identify with the community owner and its products and self-marketing in regard to career opportunities, as the community owner is a dominant motive for participation (Ebner et al., 2009). Thus, OIC may facilitate the process of recruiting highly motivated employees with appropriate skills and knowledge for innovation development. In a similar vein, OICs create a huge number of customer touch-points probably

supporting the community owner's marketing efforts and potentially leading to increased sales, e.g., by improving brand image and customer loyalty (Cothrel, 2000).

Contingency Factors

In regard to open innovation and OIC, four contingency factors influencing AC are of particular high importance: (1) organizational integration routines, (2) feedback loops, (3) boundary spanning and individual agency and (4) regimes of appropriability.

Organizational integration routines are the micro foundations of AC and refer to its collective dimension (Jansen, Van den Bosch, & Volberda, 2005; Lewin, Massini, & Peeters, 2010; Van Den Bosch et al., 1999; Zhao & Anand, 2009). Whereas an organization's AC is highly dependent on its individual employee's AC in terms of their cognitive abilities, it does not equal the sum of those (Cohen & Levinthal, 1990). Collective AC involves absorption processes and routines, communication and coordination mechanism as well as corporate culture, norms and trust that facilitate knowledge exchange (Zhao & Anand, 2009). Thus, a firm's AC is more than the sum of the individual absorptive capacities of its employees.

In this context, Jansen et al. (2005) distinguish system, coordination, and socialization capabilities which describe different mechanisms to build collective AC (Volberda et al., 2010). System mechanisms include instruments promoting formalization and routinization of knowledge. Formalization refers to the degree to which routines, procedures, and more generally implicit 'know-how' is written down, and routinization describes the ease of which single tasks become routines through repetition. System capabilities reduce the need for communication and coordination, as they provide a memory for routine situations so that individuals can work independently from others in order to reach a common goal (Van Den Bosch et al., 1999). In contrast, coordination capabilities enhance communication and interaction across hierarchical and disciplinary boundaries. Coordination mechanisms bring together different sources of expertise and enable lateral knowledge exchange among organization units (Jansen et al., 2005; Teece et al., 1997). Socialization mechanisms

influence social interactions and knowledge processes. They build connectedness and shared meanings among employees and play a major role in the connection of the sequential learning phases (Todorova & Durisin, 2007; Zahra & George, 2002).

The potential of OICs is based on the assumption of collective intelligence. In this regard, not only the sum of the knowledge of the community users is of relevance but also how the individual user knowledge is aggregated (Bonabeau, 2009; Riedl et al., 2010). Thus, capturing value from OICs requires appropriate mechanisms and structures to cope with the dynamic and fuzzy structures of online communities. In this context, system capabilities refer to the design of the interactions between the community members and the community owner. This involves the technical design of the community platform (particularly the design of the toolkit), the popularity signaling mechanism, and communication possibilities, as these design elements highly affect the formalization of implicit customer knowledge. Furthermore, effective terms of use have to be worked out, which, e.g., regulate the transfer of intellectual property rights and regulate the compensation for the idea submitters. Coordination capabilities directly refer to the management of the OIC. Active community management facilitates intermediation and brings the terms of use to life that have been defined by the community owner; it also coordinates the activities within the community with internal R&D and supports the community members in value creation (Sawhney & Prandelli, 2000). Finally, social capabilities refer to community building, i.e., forming a collective from single community members and establishing a community culture with shared meanings, values and norms (Preece, 2000).

Feedback loops refer to the path dependency of AC. Due to the cumulativeness of AC, knowledge already possessed at any point in time eases the absorption of new knowledge in this domain at a later point in time (Todorova & Durisin, 2007). Thus, the absorption of new external knowledge leads to a self-reinforcing cycle, and these positive externalities of AC strongly relate to the dependence of value creation in virtual communities on network effects

(Sawhney & Prandelli, 2000). After a critical mass of participants is reached, the community attracts new members in a self-sustaining manner. Thus, new knowledge and competencies enter the community promoting value generation. Such an increased value makes a community even more attractive for potential new members, leading to a virtuous circle of knowledge creation. However, both virtuous cycles are highly intervened in regard to OICs. The more users participate, the more valuable the OIC will be for the community owner, probably leading to an increased number of implemented ideas. On the one hand, this positive feedback will activate motivation and creativity of the community members, as they see that their effort are treated seriously (Di Gangi et al., 2010). On the other hand, the implementation of ideas will raise the AC regarding the OIC, as processes and routines evolve and the exchange relations between the members of the OIC and the employees of the community owner strengthen. Thus, the community owner will be better able to combine the external customer knowledge with its own knowledge stock (Smith, Collins, & Clark, 2005).

Boundary spanning and individual agency refer to the pivotal role of individuals in absorbing external knowledge. Organizations are social communication systems that route information across business units, positions and individuals (Matusik & Heeley, 2005). In this regard, knowledge absorption is not only made up by the organizational structures and routines for knowledge transfer but also by individuals acting as gatekeepers and boundary spanners controlling the knowledge flow (Cohen & Levinthal, 1990; Jones, 2006). Gatekeepers forward and translate information between different organizational units within companies, whereas boundary spanners control the knowledge exchange with the external environment (Easterby-Smith, Graca, Antonacopoulou, & Ferdinand, 2008; Jones, 2006). Though, these individuals have strong influence on which information enter the organization its application is highly dependent on the recipient's motivation to process it. As external knowledge has to compete against existing structures and mindsets, e.g., in terms of the 'not-invented-here'-syndrome (Katz & Allen, 1982), individual agency is a central driver for the

exploitation of external knowledge. Thus, the exploitation of external knowledge is highly dependent on individuals operating as change agents promoting new ideas from the outside (Jones, 2006). In this regard, appropriate power mechanisms must assert the dissemination and the application of newly absorbed information so that individuals can allocate to the necessary resources for absorbing customer ideas (Easterby-Smith et al., 2008; Todorova & Durisin, 2007).

As the absorption of external innovation, OICs are heavily dependent on individual agency, e.g., open source communities are often formed by enthusiasts (West & O'Mahony, 2008), and collectively performed decisions usually have to be implemented by individuals so that group decisions are followed by individual actions (Malone et al., 2010). Moreover, a small number of highly active community users strongly influences the fortunes of the community. Due to their leading position and the merits they earned due to their high activity (Preece & Shneiderman, 2009), they have great power to accomplish and influence decisions in the community, are central information nodes controlling the information flow and act as opinion leaders (Fleming & Waguespack, 2007; Hautz et al., 2010). Due to their leading position and their knowledge about the OIC they are in close exchange with the community management of the community owner. In the community management's perception, these 'community leaders' speak on behalf of the OIC having considerable power to influence the community management's decisions (Di Gangi et al., 2010). Thus, community leaders strongly affect the appropriation of customer ideas.

Regimes of appropriability refer to the imitability of knowledge and to the extent it may be protected against being copied. Appropriability regimes influence AC in two ways reflecting two sides of the same coin. Cohen & Levinthal (1990) see regimes of appropriability as moderator of the relationship between external knowledge as process input and AC: The easier external information can be understood and imitated, the easier it can be absorbed. Zahra & George (2002), by contrast, assume that regimes of appropriability

moderate the relationship between AC and its outputs, competitive advantages, in a negative manner. In case competitive advantages derived from the absorption of external knowledge are easy to imitate, competitors may profit from spill-over effects, and firms must protect their internal knowledge from leaking out, e.g., through patents (Arbussa & Coenders, 2007). Todorova & Durisin (2007) accept both conceptualizations but note that it has yet to be researched which one is more appropriate.

In regard to OICs, balancing openness and disclosure is seen as one of the biggest challenges (Di Gangi et al., 2010; Füller & Matzler, 2007; Sawhney & Prandelli, 2000), as the submitted customer ideas can rarely be protected from being copied by competitors with traditional value appropriation instruments such as patents. In such market conditions characterized by low efficacy of intellectual property rights and ease of replication, firms may have lower returns to the knowledge absorbed (Todorova & Durisin, 2007), highlighting the need for effective appropriation processes and routines. On the flipside, organizations may even profit from the ease of knowledge spill-overs by free-revealing their innovations (Dahlander & Gann, 2010; Henkel, 2006), as this facilitates establishing de-facto standards and profiting from complimentary assets (Teece, 1986).

Figure 3 adds the contingency factors to the previous theoretical considerations of this paper and combines them to an AC framework for value appropriation in OICs.

– Figure 3 about here –

VALUE APPROPRIATION AT UBUNTU BRAINSTORM

In order to test and to refine our AC framework for value appropriation in OICs, we conducted a qualitative, explorative case study at the Ubuntu Brainstorm Community.

Ubuntu Brainstorm

With more than 10 million users, Ubuntu is one of the most applied Linux distributions (Nixon, 2010). Users have it at their disposal as free open source software. The

Ubuntu project started in 2004 and has been financed by the company, *Canonical*, since then. Canonical's business model is based on offering professional service and consultation to business clients in everything that has to do with the operating system Ubuntu. Today, Canonical employs 350 people in more than 30 countries. As the initiator and sponsor of the Ubuntu community, Canonical influences the further development of the software directly. As a consequence, not only the resources needed for the constant operation of the platform, such as server hardware, are provided, but also software developers and community managers are in part directly paid. With the assistance of the Brainstorm community, new Ubuntu distributions are developed and published by Canonical in intervals of six months. In order to integrate Ubuntu users in innovation development, Canonical launched the Ubuntu Brainstorm innovation community in February 2008. Today, Ubuntu Brainstorm is one of the most frequently used OICs on the Internet with more than 19,000 ideas, 110,000 comments and 2.5 million idea evaluations that have been posted thus far.

Methodology

In order to investigate the validity of our framework, an explorative and qualitative case study design was chosen, as this procedure is apt for complex and new objects of examination for which the state of knowledge is still low (Yin, 2009). We chose the Ubuntu community for three reasons: (1) Ubuntu Brainstorm incorporates all characteristics of OICs as developed in section 2, (2) Ubuntu Brainstorm is one of the most heavily used OICs on the Internet warranting a certain maturity of idea absorption processes and routines, and (3) open firm boundaries and absorption of external knowledge is particularly important in software development (Matusik & Heeley, 2005)

Six semi-structured interviews were carried out. The interviewees were chosen for their knowledge as well as for their job and position in the Brainstorm community. Two Ubuntu users, two software developers and two community managers of the Brainstorm community were independently interviewed to guarantee high internal validity of the results.

One developer and one community manager are paid directly by Canonical, whereas the other participants of the interview work voluntarily for Ubuntu Brainstorm. The community manager working on a voluntary basis is also the developer of the IT platform on which Ubuntu Brainstorm is operated. The interviews were held between the 4th and 30th July, 2009, and each took 72 minutes on average. The interviews were all carried out via the phone in German or English because the interview partners were from Germany, Spain, France and the USA. An interview guideline for the interviews ensured their comparability.

The interviews were transcribed and evaluated with qualitative content analysis (Krippendorff, 2004). The statements analyzed reflected experiences, impressions and assessments regarding the coding scheme. The coding categories were based on the developed AC framework. The external validity of the results was ensured by a consistency check of the single statements (especially interview statements from the same group of people) as well as by a comparison with secondary sources such as the Brainstorm platform and the results of the literature review. We followed the recommendations of Yin (2009, 38) and applied 'analytic generalization.' In contrast to quantitative research, in case study research, generalization of results is not based on principles of statistical interference. A previously developed theory – in our case, the AC framework – serves as basis for analyzing the empirical results. Doing so, case studies can add to the current understanding by identifying new and previously unknown facets that comprise the prevalent aim of case study research. Finally, the transcripts were independently coded by two researchers to increase the reliability of the results. With a Cohen's Kappa of 0.842, the inter-coder reliability can be considered to be very good, as even a 0.7 suggests a sufficiently high congruity (Landis & Koch, 1977). The validity and reliability of our research approach is highlighted in Table 3.

– Table 3 about here –

Results

Absorption processes

Implementing the ideas from the Ubuntu Brainstorm community, Canonical undergoes all three processes of explorative, transformative and explorative learning.

Initially, in the phase of *explorative learning*, all submitted ideas are collected in the 'Idea Sandbox.' In this section of the Brainstorm community all ideas are reviewed by at least two merited Ubuntu users. When ideas are confirmed as being valid, they are forwarded to the section 'Popular Ideas' where all users can assess each idea's solution positively, neutrally or negatively. If a solution is assessed positively, its quality score is raised one unit, if assessed negatively it is reduced by one. Invalid ideas, e.g., bug reports do not enter the popularity signaling phase and are deleted, or forwarded to the bugtracker, a software tool for collecting bugs. In both sections, ideas can be discussed using comments, frequently triggering the submission of new ideas. During knowledge arbitrage recognition, the popularity signaling mechanism is pivotal. Ideas for implementation are selected based on the community rating that serves as an attention filter:

> *"Due to the idea rating system [...] you have sort of a bubble effect. That means that the most important things are always on top" (Ubuntu Developer 2).*

Transformative learning consists of several sub-processes as software development, i.e., the exploitation of the customer ideas is performed in two ways. The development is not only centrally controlled by Canonical, but it is also run decentrally by independent Brainstorm developers. In the development conducted by Canonical, the community managers regularly select and forward the ten most popular ideas of each thematic category, in which the ideas are organized on Ubuntu Brainstorm, to the respective developers. Simultaneously, developers independently pick ideas from Ubuntu Brainstorm and start to develop them on their own. Ideas are then discussed, improved, and combined with the

developments made independent from Ubuntu Brainstorm, e.g., source code that has been committed by software developers not using Ubuntu Brainstorm, at a biannual developer meeting. At this 'Ubuntu Developer Summit' all external inputs are transformed to a comprehensive concept for the next Ubuntu distribution. Idea assimilation and transformation is supported by the 'Launchpad,' a software tool in which the selected ideas are clearly defined as programming specifications. This corresponds to a recodification of the user ideas as well as to a combination with the knowledge of the developers.

Exploitative learning refers to the actual implementation of the ideas, i.e., the coding of the blueprint specifications and the integration of the software modules into the next Ubuntu release. These activities are predominantly done independent from each other by single developers in their preferred software developments. Finally, new Ubuntu releases are distributed via Canonical servers and distribution partnerships with computer manufacturers such as *Dell*.

Process Inputs

Currently, Ubuntu Brainstorm has more than 25,000 users of which 7,000 visit the community at least once a month, and it is momentarily acquiring about 20 to 40 new users daily. On average, Ubuntu Brainstorm's users generate about 20 new ideas a day. The process of idea generation is highly dependent on the used toolkit. In Ubuntu Brainstorm, ideas consists of a 'rationale' containing the idea description and the 'solution' covering a possible implementation. Thus, need and solution information are collected separately from customers. Moreover, one 'rationale' can have several 'solutions' so that these are merged under a single idea reducing idea duplicates that are a major challenge in OICs (Di Gangi et al., 2010).

In order to be able to recognize possibilities for knowledge arbitrage and to interact with the community, Canonical employees dealing with the OIC require a comprehensive knowledge regarding the Ubuntu software. However, community managers and software developers interacting closely with the OIC have a usually a technical background in software

development. In this regard, Ubuntu Brainstorm complements this knowledge stock with the necessary market knowledge that is necessary to develop successful innovations:

> *Ubuntu Brainstorm "allows the developers to realize the needs of the customers and what hinders them. In other words, it prevents the developers from just seeing their developers' view of things." (Ubuntu Community Manager 1)*

Although need and solution information is codified independently, Ubuntu ideas are often immature and unspecific. Thus, community managers and software developers had to build up a sufficient knowledge stock to interpret these ideas with the users' eyes as well as to learn the 'language of the community' in order to identify useful information that may enhance future releases of the Ubuntu software.

Process Outputs

In total, about 3% of the more than 19,000 ideas have been implemented. Although this seems to be as a small fraction only, this is considerably higher than in other OICs, e.g., MyStarbucksIdea. The community managers condense similar ideas to single development projects that basically reflect unrealized needs and requirements and exceed single user ideas. In a similar vein, users often make prototype visualizations (mock-ups) for a better portrayal and comprehensibility of their ideas, which are regularly screened to deduce new needs and requirements for the development of the graphical user interface. Aggregating ideas and user designs, the community managers can identify shifts in the demands of their users quickly so that Canonical can adapt to it in short cycles. Moreover, the OIC is considered as a vehicle for recruiting new employees constituting a pool of highly motivated and capable employees Canonical can recruit from, e.g., both paid interviewees were recruited online.

> *"So really the idea for Brainstorm [...] is to bring in people who might have the skills to implement the ideas but don't know how." (Ubuntu Community Manager 1)*

In total, the exploitation of the input of the Ubuntu Brainstorm Community has highly contributed to the continuous development of highly innovative features for, and quality enhancement of, the Ubuntu operating system that are regarded as the central driver of Ubuntu's success in regards to other free-of-charge Linux distributions.

Contingency factors

Organizational integration routines: The IT platform that Ubuntu Brainstorm is running on has been further developed after its launch, pinpointing the high relevance of organizational integration routines for harnessing the collective intelligence of Ubuntu Brainstorm. For instance, the systemization of knowledge has been improved by revising the toolkit for idea externalization in order to collect need and solution information separately. Doing so, the quality of the submission could be raised as the already existing solutions reduced idea duplicates, and promoted the creativity and collaboration of the idea submitters. Now, competing solutions are often crystallization points of intense discussions, leading to stepwise refinement of ideas. Moreover, dedicated fields for developer commentaries were introduced in order to trigger idea submitters to refine their ideas by the developers and the community management. In terms of coordination capabilities, Canonical employs a very active community management that provides community members with feedback about their ideas, prevents flaming, mediates disputes, and continuously activates the community members in order to collaborate and generate ideas. Moreover, community management is spreading news about the actual development status of ideas and the next Ubuntu releases. Thus, motivation in the community is held high, warranting a continuous inflow of new ideas. The analysis of the Ubuntu case revealed that socialization is two-pronged. On the one hand, socialization refers to building a community of the single community users, e.g., through establishing rules for interaction, shared rituals, and a common understanding. For instance, Ubuntu Brainstorm is successfully running a 'leaderboard' on which the submitters of the most popular ideas are ranked. Its actualizations are eagerly awaited spurring intense

discussions among members and creating a common ground for further collaboration as members get to know each other. On the other hand, Canonical tries to integrate Ubuntu Brainstorm into the internal development process so that software developers become aware of the OIC and its possibilities. For instance, Ubuntu brainstorm is highly intervened into developer mailing lists and internet relay chats (IRCs), so that the developers become aware of the Brainstorm community and start socializing with its members.

Feedback loops: From its very beginning the Ubuntu Brainstorm Community was a success story. The first weekend after its launch 7,000 ideas were submitted by Ubuntu users, and since then Canonical was able to sustain the activity in the OIC, as the critical mass of users was instantly reached. Although this success has enabled a continuous collection of new customer ideas until today, it hampered idea absorption in the beginning. Canonical was overwhelmed and paralyzed by the number of ideas and expectations generated by the Ubuntu Brainstorm community. No existing organizational structures existed, and the knowledge stock to elicit the crucial need and solution information from customer ideas had still to be developed. Canonical was suffering from the two virtuous cycles being asynchronous. Whereas the cycle of value creation accelerated from its beginning, the cumulativeness of its AC developed at a much slower pace.

Boundary spanning and individual agency: The implementation of single customer ideas is highly dependent on the efforts of the community management. As the fraction of Canonical employees and software developers engaged in Ubuntu Brainstorm is rather small, the community management acts as the boundary spanner routing the information from the OIC to Canonical and the voluntary software programmers, e.g., by distributing the most popular ideas on developer mailing lists or forwarding particular ideas to appropriate developers. The development team is very cohesive with considerably close boundaries. Community managers have to break through these walls and have to take care that customer ideas are considered during the planning and implementation of the next Ubuntu distribution.

Moreover, paid and voluntary developers can decide on their own which ideas or development projects they want to pursue. Thus, they have a high degree of power regarding the enhancement of the software (Easterby-Smith et al., 2008), and community management frequently acts as key influencer in their decisions of individual resource allocation.

Regimes of appropriability: The Canonical business model is based on offering complementary services for the software it develops. It distributes Ubuntu free-of-charge and freely reveals its source code in order to promote its distribution. Canonical does not protect its ideas from being copied by its direct competitors, e.g., other Linux developers competing for professional customers such as *red hat* or *Suse.* However, knowledge spillovers are limited, as the value appropriation arises due to a magnitude of close interactions with its customers in the OIC and not due to the mere exposure to the OIC. Although the ideas are codified, the social interactions surrounding idea appropriation make the knowledge transfer from the OIC to the community owner a rather informal process:

> *"There is no formal process existing. In fact, quite a lot around Ubuntu is informal" (Ubuntu Community Manager 1).*

For stemming these magnitude of interactions Canonical had and still has to develop integration routines, those development is highly path dependent (Eisenhardt & Martin, 2000). Moreover, the informal interactions create lock-in effects as customers see their efforts being implemented, and even submit source codes to promote the implementation of their ideas in the next Ubuntu releases. This bonds community members to the Ubuntu software, improving customer loyalty and strengthening Canonical's installed customer base.

CONCLUSION AND IMPLICATIONS

In this paper a framework for value appropriation in OIC which combines AC and OIC has been developed and empirically refined. Following a process-based perspective of

AC, we linked open innovation in terms of OIC to knowledge absorption processes necessary for appropriating value from OICs, process inputs in terms of customer ideas containing need and solution information, and process outputs in terms of competitive advantage evolving from this value appropriation. We investigated contingency factors such as integration routines pinpointing the collective dimension of capturing value from OIC, feedback loops as interplay of critical mass and path dependence of knowledge absorption, the role of boundary spanning and individual agency in idea appropriation, as well as appropriability regimes for protecting the value obtained from OIC against being copied.

Theoretical implications

The theoretical contribution of this paper is combining open innovation and AC theory using OICs as an example. This theory integration has various implications extending both theories. The roots of open innovation research are in the description and explanation of a phenomenon of entrepreneurial practice. Current research about OICs predominantly focuses on the community itself, as well as the motivation, characteristics and behavior of its members (e.g., Franke & Shah, 2003; Füller & Matzler, 2007; von Hippel, 2005). In contrast to this focus on value creation, this paper complements this body of knowledge and investigates how the information obtained in OICs is processed inside the organization in terms of value appropriation. In this regard, AC is a dynamic capability that influences the nature and the sustainability of a firm's competitive advantage (Zahra & George, 2002). In terms of the resource-based view, they are a combination of limited resources enabling superior market performance (Barney, 1991; Eisenhardt & Martin, 2000). Thus, the combination with AC helps to embed open innovation into a broader theoretical context and to better integrate organizational structures, competences and resources that may contribute to developing a comprehensive theory of open innovation.

AC research has been criticized for being too abstract, and thus suffering from diminishing practical relevance (Lane et al., 2006). Researching open innovation than a real

example of external knowledge absorption, may thus be an opportunity to overcome this criticism (von Krogh & Von Hippel, 2006). In this paper, we have developed and empirically tested an AC model that is specific for value appropriation from OICs. This framework may help to create a holistic and indulgent understanding of real absorption processes, for which several authors have been calling (Easterby-Smith et al., 2008; Lane et al., 2006; Lichtenthaler, 2009b). Moreover, our work does extend existing research in regards to the management of AC and external knowledge flows (Escribano, Fosfuri, & Tribó, 2009; Jansen et al., 2005; Lewin et al., 2010). We identify new OIC specific integration routines in the domains of system, coordination and social capabilities, such as popularity signaling mechanisms for recognizing opportunities for knowledge arbitrage or user innovation toolkits for idea externalization, and highlight their importance in absorbing information from customers on the Internet.

Practical implications

The framework in our paper highlights the relevance of AC for successfully conducting open innovation. However, a firm's AC regarding OIC is limited (Di Gangi & Wasko, 2009) so that managing AC and corresponding integration processes and routines are of high practical relevance in order to maximize value appropriation. The case of Ubuntu Brainstorm shows the high relevance of the community management for both sustaining value creation in the community as well as the appropriation of this value. In particular, regarding the implementation of ideas, it has to act as change agent breaking up existing structures within the firm. As they are the central boundary spanners controlling the information flow into the organization, their limited resources should be leveraged with appropriate technical and organizational means. For instance, valid and reliable idea filter systems enables community members to express their true evaluation of idea quality, and thus facilitates knowledge arbitrage. However, our case shows that these systems contain more than a simple binary rating scale that it is used in most OIC (Riedl et al., 2010). Moreover, as community

management represents the knowledge stock of the company interacting with the community, it should consist of interdisciplinary teams with different knowledge backgrounds (Jansen et al., 2005). Key users of OIC should be involved in community management enabling self-governance of the OIC. Doing so, their social capital could be used to steer the community according to the goals of the community owner more effectively, thus enabling community management of promoting idea implementation within organizations.

OICs are often neglected by organizations, as ideas can rarely be protected from being copied by competitors due to weak regimes of appropriability. However, applying an AC perspective, this fear might be overly exaggerated, as competitive advantage does not evolve from the mere exposure to the OIC, but from the skills and knowledge that are created with opening up to its customers. The appropriation of the value generated in the OIC evolves due to a high number of social interactions between the community and the community owner, and the path dependent development of integration mechanisms that are necessary to absorb the ideas. These interactions frequently spur tacit, and not codified, insights within the boundaries of the community owner. In this regard, AC as a dynamic capability is hardly imitable by competitors. Thus, investing in AC organizations can harness the full potential of OICs, despite weak regimes of appropriability. Moreover, spillovers are likely to occur as an increase in the AC regarding OICs will probably enhance the ability to incorporate information from other external knowledge flows (Escribano et al., 2009).

Finally, firms should not only think in OIC in terms of ideas for innovation development. The potentials of OICs for human resources and marketing should also be considered and actively managed in order to capture the full value OICs may endow.

Limitations and future research

Although our case study provides first evidence for the validity of our OIC value appropriation framework, our results needs to be replicated in additional case studies and/or quantitative research. Moreover, our results could be biased due the fact of Ubuntu being

open source software that can be considered as an extreme form of conducting open innovation. Thus, our findings may vary in other OIC, such as Dell IdeaStorm.

A prospective area for future research may aim at enhancing the limited AC of firms applying the collective intelligence of community members. In this regard, filter mechanism for community-based idea evaluation should be developed. Existing research shows that more complex multi-attribute scales with several assessment dimensions, such as novelty and market potential are superior to binary rating scales as frequently used in OICs (Riedl et al., 2010). Moreover, the use of alternative assessment methods, such as idea markets (Soukhoroukova, Spann, & Skiera, 2011), could also be of advantage. However, the knowledge about mechanisms regarding community-based idea assessment and their relative performance is very limited (Leimeister et al., 2009; Riedl et al., 2010).

Moreover, further research should be conducted in toolkit design for idea externalization. In Ubuntu Brainstorm explorative learning, transformative learning and exploitative learning are carried out with different tools that suffer from a conceptual gap between them. For instance, many potential innovators are lost in the phase of transformative learning due to media discontinuity and the technical design of the 'Launchpad.' With tools enabling community users not only to submit ideas but also to engage in idea transformation, the quality of the ideas could be enhanced and the absorption capacity of the community increased through a higher 'fit' to the innovation system of the community owner.

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TABLE 1:
Characteristics of open innovation communities (Adapted from (Riedl et al., 2009))

Name	Toolkit	User Collaboration	Rating mechanism	Community Management	Terms of use
SAPiens (www.sapiens.info)	Title, Short description of idea, Idea description, Categories, Tags	Comments, Wiki, Team Submissions	Thumbs up	Dedicated employees, Newsletter, Blog, Idea contests	Mandatory agreement, right of exploitation
Ubuntu	Title, Rationale, Solution, Categories, Tags	Comments	Positiv, Neutral, Negativ	Dedicated employees & self-governance,	Mandatory agreement, right of exploitation
Starbucks	Title, idea description, category	Comments	Thumbs up / Thumbs down	Dedicated employees, Blog, Newsletter	Mandatory agreement, right of exploitation
Dell	Title, idea description, category	Comments	Thumbs up / Thumbs down	Dedicated employees, Newsletter, Idea contests	Mandatory agreement, right of exploitation
Google	Idea description	Comments, Team Submissions	Thumbs up / Thumbs down	Dedicated employees, Blog,	Mandatory agreement, right of

				Idea contests	exploitation

TABLE 2:
Search results of the literature review

Journal	**Results (full text)**	**Results (abstract, title, key words)**	**Selected for review**
Administrative Science Quarterly	23	2	1
Academy of Management Journal	85	4	3
Academy of Management Review	78	5	3
Management Science	53	6	1
Organization Science	87	11	5
Journal of Industrial Economics	1	1	0
Entrepreneurship: Theory and Practice	3	3	0
Management Learning	332	2	2
Strategic Management Journal	214	15	3
Journal of Product Innovation Management	35	1	1
Journal of Management	60	1	1
R&D Management	60	9	1
Journal of Business Venturing	67	5	0
Research Policy	381	42	2
Other			4
∑	**1479**	**107**	**27**

TABLE 3:
Validity and reliability of the research approach (adapted from Yin (2009, 38))

Construct validity	• Insight into the interview protocols by the interviewees
Internal validity	• Selection of different stakeholders (Ubuntu Brainstorm end user, software developer, community management) as interviewees • Comparison of the interviewees' statements (especially within the different stakeholder groups)
External validity	• Analytic generalization of results in regard to absorptive capacity theory
Reliability	• Recording, transcription and coding of the interviews • High degree of intercoder reliability (Cohen's Kappa = 0.842)

FIGURE 1:
Absorptive capacity processes in open innovation communities

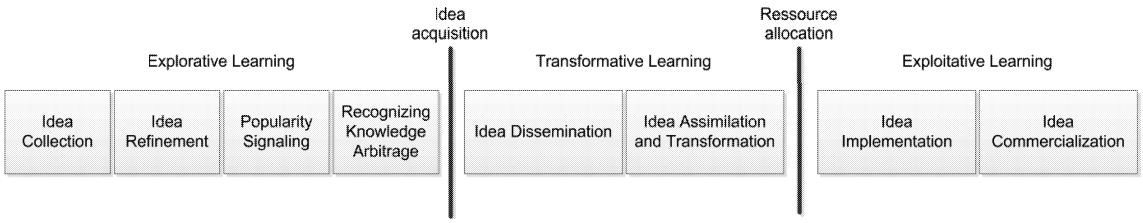

FIGURE 2:
Companies' existing knowledge stock and customer ideas

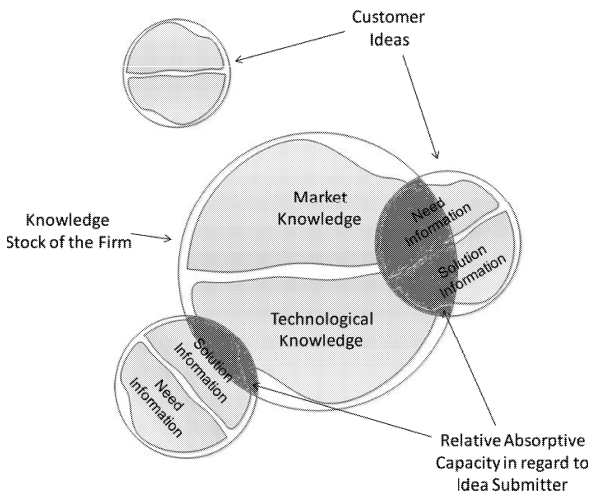

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FIGURE 3:
Absorptive capacity framework for value appropriation in open innovation communitie