

Knowledge Metamodel For Crowdsourcing Innovation Intermediaries

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Abstract

Open innovation is a hot topic in innovation management characterized by a new form of interacting and collaborating with the external environment of a company to innovate more successfully and with less costs. Chesbrough (2006) advocates that firms can and should use external ideas as well as those from their own R&D departments, and both internal and external paths to the market in order to advance their technology. Crowdsourcing innovation presents as a derivation of this new paradigm taking advantage of the Web 2.0 tools to generate new ideas through the heterogeneous knowledge available in the global network of individuals with easy access to information and technology. So, crowdsourcing innovation brokers facilitate the access to a vast open and global knowledge community, and provide support in integrating contributions, as well as managing and motivating the crowd participants. This paper presents a literature review of open innovation models and innovation intermediaries functions' and proposes a knowledge's metamodel for crowdsourcing innovation intermediaries.

Keywords: Open innovation, Crowdsourcing innovation intermediary, Innovation process, Crowdsourcing innovation.

Introduction

Globalization, the developments of the internet and of the technology in general, is creating new ways for people to communicate and interact. This new world and new markets, in continuous change, are forcing enterprises to pay more attention to costumers needs, opportunity windows, and social complexities, and therefore, to become more competitive and innovative. To face all these challenges, companies can not only depend on their internal skills (Tapscott and Williams, 2008).

Innovation is recognized by academics and practitioners as an essential competitive enabler for any company to survive, to remain competitive and to grow (Chesbrough, 2006; Lee et al., 2010; Tidd, 2001; von Hippel and von Krogh, 2003)

Investments in tasks of R&D have not always brought the expected results. But that doesn't mean that the outcomes would not be useful to other companies of the same business area or even from another area. Thus, there is much knowledge already available in the market that can be helpful to some and profitable to others. So, the ideas and expertise can be found outside a company's boundaries and also exported from within. The selling of internal ideas and technologies can create significant value for the company. This new approach to innovation is called open innovation (Chesbrough, 2003).

The advances of the Information Technologies (IT) and the proliferation of the use of Web 2.0 tools, facilitates communication and collaboration among individuals. Information, knowledge, experience, wisdom is already available in the millions of the human beings of this planet, the challenge is to use them through a network to produce new ideas and tips that can be useful to a company with less costs. This was the reason for the emergence of the area of crowdsourcing innovation. Crowdsourcing

innovation is a way of using the Web 2.0 tools to generate new ideas through the heterogeneous knowledge available in the global network of individuals highly qualified and with easy access to information and technology (Chesbrough, 2006; Howe, 2008; Surowiecki, 2005).

The facilitated network access and all this new technologies of the Web 2.0 allowed the emergence of new actors in the innovation process. These actors have been commonly termed as intermediaries and play the role of middleman between two or more parties providing a service or a product (Howells, 2006).

From reviewing open innovation models along with and innovation intermediaries we propose a knowledge metamodel for crowdsourcing innovation brokers.

The article is organized as follows. Next section presents a literature review on open innovation, crowdsourcing and innovation intermediaries. Based on that review we propose a knowledge metamodel for crowdsourcing innovation intermediaries. Finally some conclusions and the next steps of this research project are presented.

Literature background

Open Innovation

Open innovation is a hot topic in innovation management. Its basic premise is open up the innovation process. The innovation process, in general sense, may be seen as the process of designing, developing and commercializing a novel product or service to improve the value added of a company.

Open innovation was defined by Chesbrough as the opposite of closed innovation where a company generates, develops and commercializes its own ideas. Open innovation represents a completely new way to organize the innovation process. Instead of a company relying exclusively on its own R&D capabilities, it also gets ideas from the outside world and integrates it into the internal innovation process, in order to enhance their potential for innovation (Chesbrough, 2003, 2006).

Open innovation is thought to bring a number of benefits such as faster time to market for products, access to unique knowledge external to the organization, less cost of innovation, better adaptation of products and services to customer needs, commercial utilization of knowledge or technology that otherwise would have been wasted, shared risk in product and service development, and enhanced company image and reputation. The ideas and expertise can be found outside a company's boundaries, internal ideas and technologies can be sold; these in and out flows can create significant value for the company (Wallin and Von Krogh, 2010).

Gassmann and Enkel (2004) identified three archetypes of the core processes in companies following an open innovation approach: the outside-in process, inside-out process and coupled process. In the outside-in process the knowledge of the company is increased by the integration of suppliers, customers and external knowledge (as seeing posts in innovation clusters, applying innovation across, buying intellectual property or investing in global knowledge creation). The main value added activities of this process are represented in **Error! Reference source not found.**

Innocentive, iVillage, Knowledge Express, LiquidGeneration, Move.com, TechEx, UVentures.com, Edmunds, Experts Exchange are some examples of web-based intermediation companies operating exclusively in the outside-in innovation process (Hacievliyagil et al., 2007).



Fig 1. Outside-in innovation process (adapted from (Gassmann and Enkel, 2004; Hacievliyagil et al., 2007))

The inside-out process is about bringing ideas to market by selling intellectual property and multiplying technology by transferring ideas to other companies. The main value added activities of this process are represented in **Error! Reference source not found..**



Fig 2. Inside-out innovation process (adapted from (Gassmann and Enkel, 2004; Hacievliyagil et al., 2007))

The coupled process combines the outside-in with the inside-out processes by working in alliances and collaboration with complementary partners in strategic networks. Idea Trade Network, NineSigma, Yet2.com, 2XFR and Pharmalicensing.com are examples of web-based intermediation companies that support the three types of innovation process.

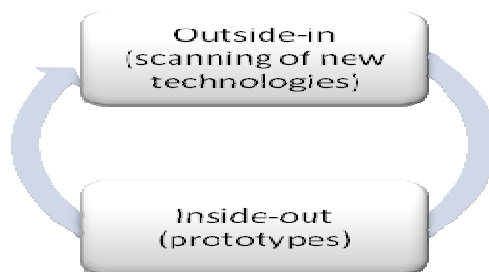


Fig 1. Coupled innovation process (adapted from (Gassmann and Enkel, 2004; Hacievliyagil et al., 2007))

An innovation process broadly follows three main phases: Fuzzy Front End, Product Development, and Commercialization (Fig 2). The first phase encompasses activities of idea generation and evaluation, which results in a set of ideas and a product concept. This will be the input for the new product development phase beginning with product concept development, prototype building and testing. In the commercialization stage predominate activities of market test and launch of the new product (Diener and Piller, 2010). An open innovation strategy can be followed in any phase of the innovation process as a method to get the output of an activity or to innovation process as a whole.

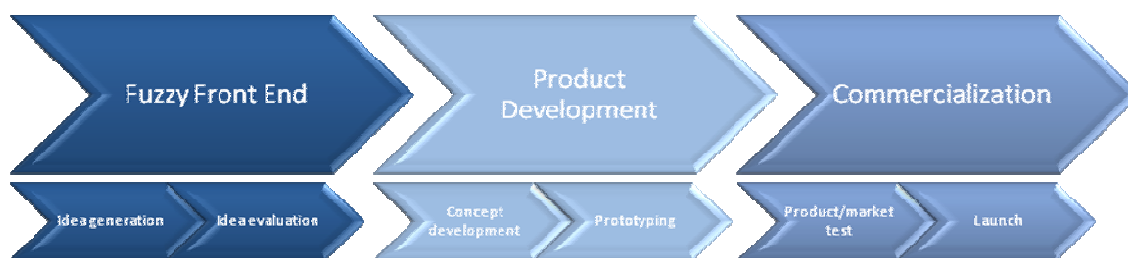


Fig 2. Phases of the innovation process (adapted from (Diener and Piller, 2010))

Literature presents some distinction between innovation models used by companies in an investment base, as described above, and another one that are made by innovators that collaborate to develop a public good, the called open software movement. This movement is motivated by the challenge of solving their own technical problems and freely sharing the innovations without appropriating private returns from selling the software (von Hippel and von Krogh, 2003). This initiative has been the main leverage of the development of collaborative software and the way people interact on the web.

Collaborative software is being used by all kind of people and for all kind of tasks, from entertainment to business. Information, knowledge, experience, wisdom is already available in the billions of the human beings of this planet, the challenge is to use them through a network to produce new ideas and tips that can be useful to a company with less costs. The knowledge within a crowd and its capability to solve problems faster and better than any individual, even an expert, is a subject that has been studied for a long time. There are many examples and demonstrations that the probability of a heterogeneous crowd solving a problem effectively is higher than getting a good solution from an expert in the area (Chesbrough, 2006; Surowiecki, 2005).

Crowdsourcing Innovation

In June of 2006, Jeff Howe and Mark Robinson introduced the term crowdsourcing, in an article in *Wired Magazine* (Howe, 2006), as a way of using the Web 2.0 tools to generate new ideas through the heterogeneous knowledge available in the global network of individuals highly qualified and with easy access to information and technology. Although, this concept has been used a quite time, the creation of the *Wikipedia* and of many examples of free software, like *Linux*, are examples of crowdsourcing activity. Crowdsourcing is a form of outsourcing not directed to other companies but to the crowd by means of an open call mostly through an Internet platform. Basically, the process is trying to solve a company problem by an open call in the network. The company posts a problem and a vast amount of individuals offers the solution for evaluation. The winning idea is awarded in some way and the company develops the idea. The crowd can be defined as a large set of anonymous and heterogeneous individuals, which may be composed of scientists and experts in various fields, but also of novices (Surowiecki, 2005).

Howe (2008) breaks crowdsourcing into four models, according with the innovation goal: collective intelligence or crowd wisdom – based on the creation of large and diverse networks of people, who often possess unique knowledge, offering them conditions to express that knowledge; crowd creation – content created by users like videos, photos, papers, that can be outsourced by companies; crowd voting – is about using the crowd's judgments to organize vast quantities of information. This can be made by asking the crowd to explicitly vote in something or simply organizing documents according to its popularity among readers; and crowd funding – using the crowd as the source of funds instead of banks or other institutions. Usually the open software projects use this kind of model. Though, it's worth to notice that a successful crowdsourcing project often use a combination of these approaches.

Crowdsourcing wisdom in which innovation challenges are solved by the crowd is called in this paper as crowdsourcing innovation. Crowdsourcing innovation practices give several advantages to all the involved on it - the companies (seekers) and the crowd (solvers) (Adams and Ramos, 2009; Schenk and Guittard, 2011):

- Access to a vast knowledge community outside the usual working environment of the company.
- The low cost for the innovation. Usually, the crowd is composed of individuals with high skills that attend to these initiatives, like scientists, young graduates, students, or professionals that use their spare time or some periods of professional inactivity. The heterogeneity and diversity potentiates the richness of the ideas in an open call, which can enhance the originality and quality of the solution to the problem posted.
- Crowdsourcing can be a way to foster technology adoption and network externalities as became used by more individuals. The social software usage has highly contributed to the increase of users' participation in this phenomenon.
- The dependency risk of companies tends to be lower because they will share some of the risks with the crowdsourcing broker and they don't need to be tied to a contract an outsourced supplier before analyzing the several solutions submitted by the crowd. Usually, high qualified and creative individuals are much motivated to this kind of tasks for the autonomy of work, the challenge of the task and the grant incentive.

Although the wide benefits of the crowdsourcing innovation, there are some challenges that need to be considered (Adams and Ramos, 2009; Schenk and Guittard, 2011):

- The difficulty of getting a sufficient amount of solutions to the innovation challenges posted. Crowdsourcing settles in the voluntary participation of the crowd, so the incentives must be sufficiently attractive to gather enough contributions.
- Problem statement definition must be of major concern. The aim is to produce statements that are clear and objective. The company needs to minimize the number of explanations to the crowd otherwise the management of this process could become unbearable.
- The intellectual property (IP) management issues should also be carefully considered. What is the appropriate reward or price for work done or to share in any IP generated, and what is the best way to transfer the IP rights are aspects that require special attention.

In the next section we are going to review the innovation intermediation process and the functions can be performed by such intermediaries.

Innovation Intermediaries

Innovation intermediaries, in general sense, are organizations that work to enable innovation, that just act as brokers or agents between two or more parties. Usually, they are also engaged in other activities like inter-organizational networking and technology development and related activities (Daziel, 2010).

The innovation intermediation was a natural evolution of technology knowledge brokers. The knowledge intermediation process compasses four basic activities (Fig 3): (1) **Network access** – facilitation of the

relationship between companies or networks of companies that naturally don't interact with each other; (2) **Knowledge absorption** - intensive training and experimentation of specific technologies to assimilate knowledge; (3) **Knowledge integration** - gathering and storage all the knowledge and experiences of past solutions with different perspectives of people, artifacts, and concepts in the organization; and (4) **Knowledge implementation** - application of stored knowledge and old experiences to create new solutions by using analogical thinking and brainstorming procedures (Hargadon, 1998).



Fig 3. Knowledge intermediation activities (adapted from (Hargadon, 1998))

Technology knowledge intermediation potentiates innovation by connecting, recombining and transferring methods, tools and ideas to new context market that otherwise will be disconnected.

With the Internet proliferation and the increasing number of companies operating in that environment, soon the knowledge intermediation process becomes virtual, appearing the Virtual Knowledge Brokers (VKB). The VKB is based in the traditional technology knowledge broker cycle amplifying its competences by eliminating geographic barriers, providing low-cost and ease-to-use platforms; permitting real-time, bidirectional and low-cost communications; facilitating partnerships and sharing of innovative labor; enabling the development of communities of practice which facilitates assimilation through distributed learning; enhancing the knowledge acquisition from individuals by online tracking, surveys, and user-friendly toolkits; implementing formal and informal mechanisms increasing information distribution; and the availability of the same knowledge to more potential users (Verona et al., 2006).

Verona et al. (2006) analyzed VKBs and argue that these brokers can benefit from creating a public repository of their knowledge and promoting contests to stimulate users to find the best applications for their ideas. They can also transform themselves into marketplaces of ideas, where needs for new applications are directly solicited by some users, and other users with specific knowledge can spontaneously cooperate with the VKBs to identify the required applications. The authors also identified some competences that these virtual brokers still needed, namely, tracking and profiling costumers; managing bidirectional communication channels to create emerging individual customer knowledge; moderating virtual communities to create emerging social customer knowledge; create incentives to enact mechanisms of self-selection from the most involved customers; and deploying content analysis to map and subsequently recombine relevant pieces of customer knowledge.

There are five main intermediation functions or roles that have been the predominant concern of studies (Hargadon, 1998; Hargadon and Sutton, 1997; McEvily and Zaheer, 1999): scanning and information processing; knowledge processing; gatekeeping and brokering; testing and validation; and commercialization.

Howells (2006) study of innovation intermediaries operating in UK concluded that there are five more functions that can be performed in the intermediation of the innovation process, namely, foresight and diagnostics; accreditation; validation and regulation; protecting the results; and evaluation of outcomes, which can be broken down into particular activities that intermediaries may or may not be involved in.

The crowdsourcing innovation intermediaries can be considered a type of VKB as they act exclusively in the Internet environment, promoting the contribution of a wide and heterogeneous group of individuals, leveraging the transference of ideas, tools and methods between different markets.

A crowdsourcing innovation intermediary is an organization that mediates the communication and relationship between the seekers – companies that aspire to solve innovation problems or to take advantage of any business opportunity – and a crowd that is prone to give ideas based on their knowledge, experience and wisdom. The crowd is usually composed by specialists in different areas, such as individual researchers, research teams, labs, post-graduate students and highly qualified individuals.

Ramos et al. (2009) proposed a crowdsourcing innovation brokering model that integrates three modules in the process of creating value – knowledge network (including knowledge community building, knowledge construction and knowledge transfer to the network); innovation brokering (with activities such as knowledge management, intellectual property management and project management); and innovation incubator (which may include consultancy, technology observatory, and funding opportunity tracking). The authors also justified that crowdsourcing innovation brokers can help MSMEs access external ideas and solutions, structured repositories and networking along the value chain. For these types of firms the service must be flexible, accessible, in close proximity to served companies, and trustable.

Knowledge Metamodel for Crowdsourcing Innovation: A proposal

Chesbrough et al. (2006, p. 1) stated that open innovation paradigm is based in the idea that “firms can and should use external ideas as well as internal ones, and internal and external paths to markets, as they look to advance their technology.” They complement this assumption by giving the same importance to internal and external contributions: “this approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths to market”. Though, Gassmann and Enkel, (2004) study shows that each company implements one of the three open innovation strategies (inside-out, outside-in or coupled), and also there are company that chooses one primary process but also integrates some elements of the others.

There is no evidence of an open innovation intermediary that implement functions covering all phases of the innovation process or the three open innovation strategies. Diener and Piller, (2010) report shows that most of the intermediaries combine activities in two stages only including idea generation and evaluation, and product development tasks.

Based on Ramos et al. (2009) crowdsourcing innovation brokering model, on the literature review on open innovation models and on intermediaries, we propose a knowledge metamodel for crowdsourcing innovation that integrates three main value creation processes – knowledge transfer, mediation and community building – composed with eight main functions: diagnostics, brokering, scanning and information processing, network access, evaluation, project management, IP management, and commercialization, represented in Fig 4. These three value creation processes have activities that include all the open innovation strategies: bringing ideas from the crowd to the company (outside-in), taking internal technology to the market (inside-out), and potentiating collaborative developments between companies and the crowd (coupled). It also comprises activities that cover all the main phases of innovation process idea generation and evaluation, product development and commercialization.

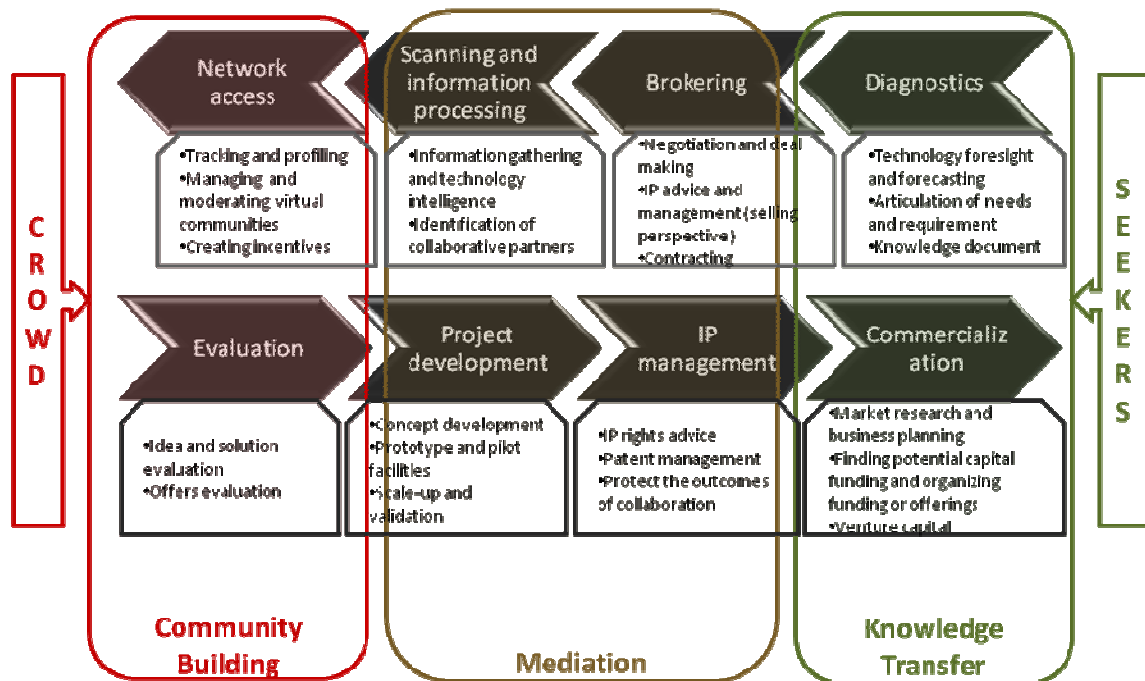


Fig 4. Knowledge metamodel for crowdsourcing innovation intermediaries

Knowledge transfer value creation stage – this process is the main interface with seekers, at the beginning with the Diagnose function which provides activities for helping a company to identify innovation problems and needs and helping to specifying them in the format of an open call. From other side provides activities of technology foresight and forecasting presenting opportunities and advising on what the company should be doing in the future to better react to the changing market in an open innovation inside-out perspective. At the end of the intermediation process, this module provides a Commercialization function to seekers by doing market research and business planning for the innovative projects selected from the crowd, or finding potential capital funding and organizing funding or offerings or venture capitals to finance the projects.

Mediation value creation stage – the mediation value creation process is composed by four functions: brokering, scanning and information processing, project development, and IP management, of which each one can be break down in several activities. The brokering function concern is advising the seeker company in selling technology produced indoor and managing the resultant intellectual property and other tasks related with negotiating, contracting and collaborative deals making for seekers and between seekers and solvers. Scanning and information processing is about knowledge processing, generation and recombination involving some knowledge modification in order to best post the problem or opportunity to sell technology in the market and/or to identify potential collaborative partners interested in the same research/business area, also selecting, clearing and helping to combine knowledge of two or more partners. The project management phase has as input a set of ideas and new projects that will be prospect in a concept development and by prototype building. It can be also made scale-up modeling and validation of the prototype. The IP management stage includes tasks to protect the intellectual property of the solver and patent management to the seeker as well as protecting some IP outcomes occurred of any collaboration work.

Community building value creation stage – this process represents the ultimate interface with the crowd. The network access involves all the issues related with develop and manage the virtual community of solvers like tracking and profiling, moderating, potentiate idea generation, making available learning and socialization opportunities in order to sustain a sense of a learning community and creating incentives adequate to best interests of the crowd. The evaluation phase is about providing methods to analyze and evaluate solvers contribution in simple ideas or more structure solutions as well as offers to bring new technology to the market.

The knowledge metamodel for crowdsourcing innovation intermediary represents a systematization of present scientific knowledge in the literature review done by the authors of this paper. This metamodel will facilitate the development of a structured and integrated knowledge repository (KR) that allows managing information and knowledge created by the three value creation processes: knowledge community building, mediation, and technological knowledge transfer. A KR can be defined as an integrated, virtual holding area where tool-independent view of all kind of data from a variety of heterogeneous sources within an organization, could be related and accessed (Kwan and Balasubramanian, 2003; Lemon and Sahota, 2004; Staniszkis et al., 2004; Tannenbaum, 2002).

Conclusion

Open innovation paradigm is based on the premise of opening up the innovation process benefiting from existing knowledge and ideas beyond the borders of the company.

Crowdsourcing innovation stems from this new paradigm using the principle of opening the innovating process to a crowd in common through web 2.0 infrastructures.

Innovation intermediaries are emerging as a novel but challenging business activity that takes advantage of the powerful Web 2.0 technologies, growing expertise and user practices across the global web.

Several existing innovation brokering services have emerged, such as Innocentive, yet2.com, Nine Sigma, IdeaWicket, IdeaConnection and YourEncore and others. However, the existent knowledge about their operating functions focuses mainly on idea generation and evaluation, and product development (Diener and Piller, 2010).

On the other hand, there is no evidence of a crowdsourcing innovation intermediary that enclose all the three value creation processes (knowledge transfer, mediation, community building) and the three open innovation strategies (inside-out, outside-in, coupled).

In this paper we propose a knowledge metamodel for crowdsourcing innovation intermediary that integrates the three value creation processes: knowledge transfer stage, intermediation stage and community building stage, that were broken down in several functions to address the three strategies of open innovation: bringing ideas from the crowd to the company (outside-in), taking internal technology to the market (inside-out), and potentiating collaborative developments between companies and the crowd (coupled).

The knowledge metamodel is an integrative systematization of present knowledge on crowdsourcing innovation intermediaries and will enable the design of a structured and integrated KR which will be the support of the community's collective memory and the repository of the explicit knowledge captured and exchanged in the various learning and social activities online. It will capture explicit knowledge created and exchanged in the activities of intermediation, such as contract negotiation, project management, IP

commercialization. Knowledge created and made explicit in the business process of technology transfer will also be stored in the KR supporting the intermediary.

Many authors have emphasized that while KR can store large amounts of knowledge representations, adequate retrieval technologies must be developed to make the access to that knowledge more effective and adequate to the moment-to-moment needs (Bojārs et al., 2008; Gruber, 2008). Thus, appropriate visualization and search tools must be developed that can help gaining access and pre-processing large amounts of knowledge representations according to the specific needs of the different user's roles: community's members as they participate in the various activities online; broker's collaborator supporting the mediation and technology transfer activities.

Crowdsourcing innovation is a very recent topic that needs to have some consensus in terms and concepts used in order to enhance sustainable development of this body of knowledge.

Ontologies are presented as a conceptual model for the knowledge systematization and formalization in a particular area. This conceptualization is rendered concrete with the definition of terms and concepts from the domain of knowledge in analysis, their relationships, organization and hierarchy, and allows the sharing and reuse by different people and systems of such knowledge (Fensel, 2004; Gasevic et al., 2006; Gruber, 1993; Hepp, 2007). Ontologies provide an explicit conceptualization that describes the semantics of the data which will enhance the interoperability between heterogeneous machines and systems.

Future research will be the development of a crowdsourcing innovation ontology, beginning with the definition of a taxonomy focus on intermediaries activities and functions. The taxonomy is a hierarchical classification or categorization of entities in the domain of an ontology, which should be in a machine-readable and machine-processable form in order to allow interoperability. The knowledge metamodel proposed in this paper will contribute to identify the main activities and functions that can be used by a crowdsourcing intermediary and the relationship and dependencies between them.

Finally, the development of this ontology will be an instrument increase the understanding of the crowdsourcing innovation phenomenon, and will also be a facilitator for the emergence of such intermediaries.

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