



**MARIANA MACIEL DE
MORAES SILVA**

**UTILIZAÇÃO DE REDE SOCIAL PARA FINS DE
CROWDSOURCING**

**USE OF A SOCIAL NETWORK FOR
CROWDSOURCING**



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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Gestão, realizada sob a orientação científica da Doutora Irina Adriana Saur Amaral, Professora Auxiliar Convidada do Departamento de Economia, Gestão e Engenharia Industrial da Universidade de Aveiro

"Este trabalho é dedicado à Rosemary e sua varanda."

o júri

presidente

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palavras-chave

crowdsourcing, rede social, inteligência colectiva, grupos on line

resumo

A crescente utilização das medias sociais chamou a atenção de pesquisadores e organizações. O conhecimento criado e compartilhado dentro do grupo das medias sociais, que é útil para as organizações, é o objecto desta pesquisa. O estudo propõe um modelo conceptual, baseado em revisão de literatura de pesquisas anteriores, a fim de enfatizar os aspectos relevantes que influenciam a comunicação dentro de um grupo online. Uma pesquisa longitudinal empírica foi aplicada em um grupo online, situado na rede social profissional LinkedIn. Um modelo empírico e surgiu uma discussão foi estabelecida ao longo dos componentes mais relevantes em um grupo online, para estimular a comunicação, os aspectos demonstraram-se estar divididos em três grupos principais: membros, característica dos grupos em si e especificações de conteúdo compartilhado.

keywords

crowdsourcing, social network, collective intelligence, online groups

abstract

The increasing use of social network got the attention of researchers and organizations. The knowledge created and shared within the social network group, which is useful to organizations, is the object of this research. The study proposes a conceptual model, based literature review of previous researches in order to emphasize the relevant aspects that influence the communication within an online group. A longitudinal empirical research was applied at an online group, placed at the professional social network LinkedIn. An empirical model emerged and a discussion was established over the most relevant components at an online group, to stimulate communication within, and they appeared to be divided in three major groups: member, the groups' characteristic itself and shared content specification.

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1. Introduction

The usage of social network by individuals is an increasing reality. Inside these networks, the members, system and the information that circulates within, create an environment named by Jashapara (2004) as “cultures of knowledge creations”¹.

The knowledge created and shared within the social network and is possibly useful to organizations, got the attention of researchers. This work, which grew from authors interest in understand how the communication occurs at online communities, forums or discussion groups, intended to execute a longitudinal research at an online group, placed at the professional social network LinkedIn.

To understand **how** and **why** the communication occurs within this context, verify the effectiveness of answers given by members, and identify ways to access this knowledge, a deep literature review served as a basis to compose a model, which components were tested at empirical research.

In Chapter 2 the methodology plan and choices for this research are described. Literature Review procedures plan are explained, in order to access all the relevant and most recent publications approaching the subject. In addition, the empirical study plan, as Netnography process is explained and the survey.

Chapter 3 presents the Literature review, approaching aspects as WEB 2.0, collective intelligence, social networks, on line communities, forums and discussion groups.

A model was constructed based on literature review which demonstrates factors that influence the communication within a social network is presented in chapter 4.

¹ “Our current understanding of developing cultures for knowledge creation is based on the deployment of artefacts, the promotion of certain values, a healthy cultural dialectic and certain prescriptions based on a few case studies.”(Jashapara, 2004)

Chapter 5 presents the description of empirical research, the Netnography method applied, the survey process the group analysis and the difficulties found executing the process of research.

The empirical study and analysis at the on line group resulted at an empirical model, which is compared to the previously proposed model, verifying its confirmations and inconsistency are presented at Chapter 6. Chapter 7 contains the final considerations of this research.

This work aims to be useful for stakeholders that look to source external knowledge of organizations and look to understand how it can be accessed through crowdsourcing, using a global perspective supported by information technology.

2. Methodology

This chapter describes how the research was planned, and the methodological concerns that will be adopted to perform it.

The context in which this research belongs is the current possibility of accessing the knowledge created and shared at the online communities, social networks and forums to be collected and useful to organization. To promote the understanding on how the communication happens within this Internet services, the objectives of the research are:

- To understand how knowledge is created and shared in a discussion group associated with a social network;
- To understand how the process evolves over time, within the same community;
- To understand whether there are specific forms of communication or appropriate behaviour that permits the discussion to generate effective answers for the proposed questions.

In order to orientate the empirical research, a literature review on the subject will be elaborated, to develop a conceptual model to be tested empirically using the Netnography method.

2.1. Literature review

For the literature review² it will be performed the systematic literature review approach. Table 1 shows the steps to be performed in order to ensure the efficiency and quality of the research.

² Chris Hart (2006) defines literature review as *"the selection of available documents [...] and the effective evaluation of these documents in relation to the research being proposed"*.

Table 1. Steps to perform in a systematic literature review (I. Saur-Amaral, 2011, edited by the author)

Systematic literature review	
Planning - Define the topic	<ul style="list-style-type: none"> -Do previous studies to better understand the field and identify alternative ways on how the topic has been previously addressed -Identify keywords and search terms
Planning - Plan the search	<ul style="list-style-type: none"> -Fill in the review protocol, share with peers -Include a conceptual discussion of research problem
Conducting - Searching the sources	<ul style="list-style-type: none"> -Comprehensive, unbiased search, rigorously applying the review protocol and the inclusion/exclusion criteria - Use several reviewers to perform the same search -The output of the search should be the full list of relevant results
Conducting - Ensuring quality of sources	<ul style="list-style-type: none"> -Report in sufficient detail to ensure replicability -Document and explain filtering decisions -Disagreement between reviewers should be explained and consensus should be reached
Reporting	<ul style="list-style-type: none"> -Should be clear and effective -Descriptive analysis of all results -Thematic analysis

Regarding the importance of a well conducted literature review, Saur-Amaral (2011) emphasizes the need to conduct the literature review process following a methodological framework, “*so as to ensure the quality of the conceptual model and to allow researchers to effectively map the field they study and link their research to the relevant schools of thought*” (I. Saur-Amaral, 2011).

The execution of the programmed literature review plan started in July of 2010, with the previous reading of books and articles of the first authors that approached the subject, for better understanding of the field to be researched. These first reading sessions leaded to a major mapping of the subject, and also leaded to unfolding specific points linked to the study.

The keywords were identified at the first sessions and all the process was documented from this point on. One meeting with peers, researchers of other

fields, was conducted in order to discuss the elaboration of the protocol and clarity of conceptual discussion.

The database used was the ISI Web of Knowledge, which centralizes the relevant and numerous publications at the field to be researched and provides efficient filtering tools. The equations of search were built, using inclusion/exclusion criteria. The search for documents was made in December 2010.

The first words/expressions elected for the search at database were: *Crowdsourcing, Linkedin, effective communication, sharing of knowledge, creation of knowledge, discussion groups, online forums, Social media, communication, collective intelligence, social network*. The search was filtered by document type, including 'articles', 'meetings', 'editorials', 'reviews', 'abstract', 'books', and excluding 'patents' and 'news'.

During the search process on the database, other filtering options needs emerged, for e.g., the articles needed to be refined only belonging to the "business and economics" subject area, since some of the key words have many publications in fields with less relevance for the research³, e.g. engineering.

It was given attention to the spelling of the key words to be searched, we included plurals, too e.g. 'group/groups' or 'forum/forums', and took into account the usage of space in the word 'Linkedin', searching also for 'Linked in'.

Table 2 displays the results of the search.

³ In Table 5 can be seen an example of search for the key word "collective intelligence", without the filter "Business and economics".

Table 2. Search results from ISI Web of knowledge (December 2010)

Key word / sentence	Nº of Documents
Collective AND Intelligence	28
Communication AND LinkedIn	1
Creat* knowledge AND LinkedIn	43
Creat* knowledge AND Social Media	212
Crowdsourcing	65
Crowdsourcing AND communication	5
Crowdsourcing AND LinkedIn	0
Crowdsourcing AND Sharing of Knowledge	0
Crowdsourcing AND Social Media	4
Discussion AND groups AND LinkedIn	3
Effective AND Communication AND LinkedIn	0
Forum AND LinkedIn	0
Knowledge AND LinkedIn	2
Knowledge AND Social Media	297
LinkedIn	42
Shar* knowledge AND LinkedIn	0
Shar* knowledge AND Social Media	104
Sharing AND Information AND LinkedIn	1
Social Network AND Forum	174

The documents were exported to EndNote program, with the “abstract export option” enabled. The first search resulted in 981 articles exported, which were organized by subject. The Endnote tool of “find duplicates” was applied and reduced the number of documents.

A transversal reading session of abstracts based the selection of relevant material, checking if the document information was linked with the objectives of this research. This thematic analysis was carefully made, leading to a reduction up to 147 documents, which was the final number of documents that served as a basis for the conception of literature review. All documents were archived and organized using EndNote and further used for citations and bibliography during the report of the literature review.

2.2. Empirical study

The methodological approach for the empirical study will be based on Netnography, which is described by Kozinets as a “*set of methodological guidelines, a disciplined approach to the culturally-oriented study of that technologically-mediated social interaction that occurs through the Internet*” (Kozinets, 2010). The Netnographic approach is appropriate and complete in case of research that focuses on online cultural phenomena, online communities, their members and the interaction within. As the present research analyzes crowdsourcing in online social networks, Netnography is an appropriate method to collect and analyze data from those networks and to respond to the research questions.

The planning of research will follow the steps of Netnography method (see Figure 1).

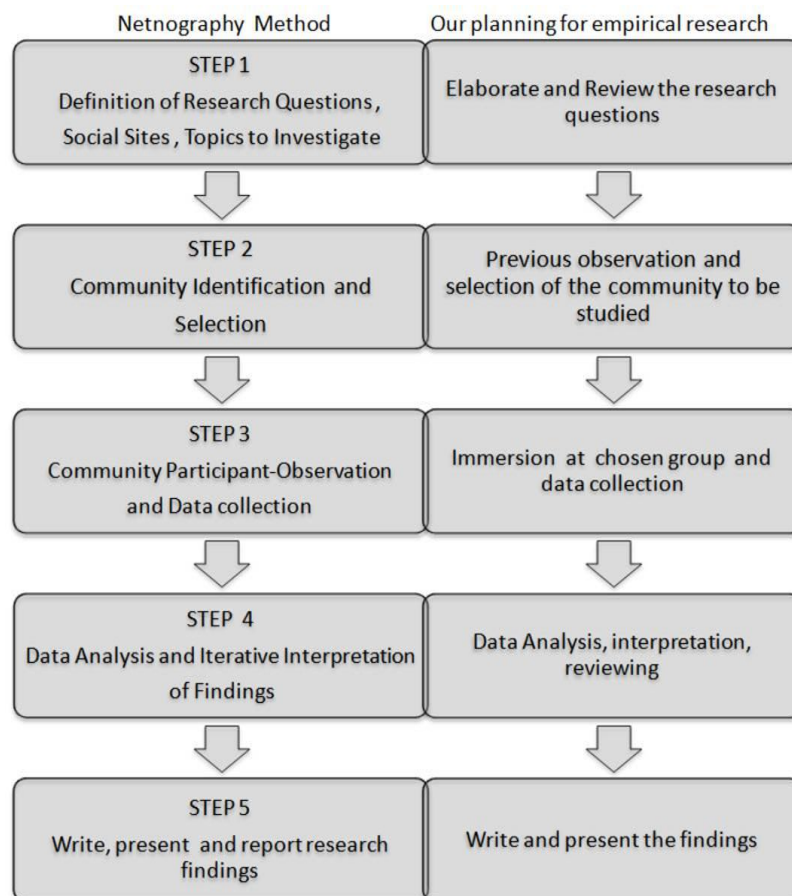


Figure 1. Steps to apply Netnography (Kozinets, 2010, edited by the author)

Based on Ethnographic principles, the Netnography emphasises the immersion, participant interaction and ethical issues⁴ on using the online data of the chosen community to perform a research (Kozinets, 2010).

In order to know the effectiveness of the answers resulted of discussions at the online group analysed, which is one of the objectives of this research, a survey will be conducted with the members of the group.

Following Kozinets (2010) directions to conduct the survey, a web page will be created with questions and a post will be published at the group, requesting members to contribute and fill the questionnaire. The execution of the empirical study, composed by Netnography and the survey, will be detailed described at chapter 6.

⁴ Kozinets (2010) dedicates the chapter 8 of his book (*Netnography: Doing Ethnographic research on line*) to ethical issues concerning netnographic research.

3. Literature review

3.1. Crowdsourcing

Crowdsourcing is focused on getting and using people outside the organization to add value to organizational processes, products, services or organizational knowledge. In 2006, Jeff Howe listed several contributions with information and work from outside people for various organizations⁵ and named this process as crowdsourcing: *“everyday people using their spare time to create content, solve problems and even do corporate R&D”*⁶ (Howe, 2006).

The concept of people external to organization contributing somehow with work of information is not a recent pattern. The organizations used to promote contests to invite interested people in contributing to enterprise processes in areas such as design, new market plans construction or consumer surveys. All these could be considered as an external contribution of information (Bonabeau, 2009; Vojnovic & Dipalantino, 2010; Vukovic, 2009). What changed from these early crowdsourcing approaches is that organizations started to collect contributions through Internet.

Table 1 shows several explanations for the crowdsourcing concept, all of them referring to the use of web services to access large crowds.

⁵ “The rise of crowdsourcing”, article published on Wired magazine on 2006, listed several examples of cases of crowdsourcing happening, e.g. the Wikipedia and iStockphoto cases.

⁶ R&D is the acronym for Research and Development.

Table 3. The crowdsourcing concept: Perspectives from the literature (Compiled by the author)

Concept	Author	Year
Methods of soliciting solutions to tasks via open calls to large-scale communities have proliferated since the advent of the Internet.	Vojnovic, M., Dipalantino, D. D.	2010
Sampling the opinions or calculations of a large number of users when it is applied to the creation of data which is then accessible and sharable as a web-based service.	Hudson-Smith, A., Batty, M., Crooks, A., & Milton, R.	2009
A way to tap into the "collective" through web based tools in a greater scale.	Bonabeau, E	2009
Overcoming companies' boundaries in order to open up to other sources.	Leimeister, J. M., Huber, M., Bretschneider, U., & Krcmar, H.	2009
Computational resources and data are available beyond their immediate owner, it is now possible to effortlessly reach out to the masses, and open the "function once performed by employees and outsourcing it to an undefined ... network of people in the form of an open call" ⁷ .	Vukovic, M.	2009
A new web-based business model that harnesses the creative solutions of a distributed network of individuals through what amounts to an open call for proposals.	Souza, L., Ramos, I., Esteves, J.	2009

In our opinion, crowdsourcing can be defined as *a set of methods and technologies of reaching external contributions from a large number of individuals through Internet tools.*

The collaborative process of people through the Internet contributing effectively on the development of a project production begun with the open source⁸ software movement (Albors, Ramos, & Hervasa, 2008; Bollier, 2007; Howe, 2008; T. W. Malone, Laubacher, & Dellarocas, 2010; Tapscott, 2008) during the nineties.

⁷ Extended from the Surowiecki concept, published at "The wisdom of the crowds", 2004.

⁸ (<http://www.opensource.org> "Open Source Initiative," 2011)

In early 2000, the Internet evolved to the Web 2.0, i.e., a new participative and collaborative-shaped Internet application. The main difference of Web 2.0 was to allow more elaborated user participation in creating, collaborating, organizing and managing content (Albors, et al., 2008; Shu, Chuang, & Lin, 2009b; Solachidis et al., 2010; Thurzo et al., 2010).

As a difference from the previous model, Web 2.0 allows participative attitude from the user, e.g., static websites of Web 1.0 evolved to more interactive platforms or communities of users. These users have now possibility to input information, content and discuss topics.

Following the emergence of Web 2.0, organizations could reach more easily professionals outside the organizations boundaries. Albors, Ramos and Hervasa (2008) developed a detailed research on the new Internet connections⁹ and concluded, that business models were benefiting with the new Internet interface, *“most variables such as diffusion, learning, collaboration, knowledge access, profits, innovation open models, as well as democratization favor its evolution”* (Albors, et al., 2008).

Thus, there are plenty of media publications¹⁰ of success cases and books have being published in order to promote organizations achievements through the use of crowdsourcing. However, the media coverage for this process consists in an optimistic approach (Yang, Adamic, & Ackerman, 2008), often ignoring the risks of a poorly executed procedure. The empirical based studies are fewer and have being executed at various fields that already use crowdsourcing, in order to identify a method, model, how to leverage and list factors that may influence the process to succeed.

⁹ The study was based on multiple perspective points of view: academic and scientific, business and social, and the conclusion was describing the current situation and identifying possible trends for these diverse perspectives.

¹⁰ To name a few: “Creative Crowds to Deliver Chaordix Crowdsourcing Solutions”(2009) at Reuters magazine, “at Forbes magazine, “The Spending Challenge questions being asked and the crowdsourcing answers being listened to” (2010) at The Guardian.

For better understanding and identification of the possible use of crowdsourcing, we looked into detail. Jeff Howe (2008) divided the concept into four main categories based on the type of contribution, as shown in Table 3. The four categories are: **crowd wisdom**, **crowdcreation**, **crowdvoting** and **crowdfunding**.

Crowd wisdom includes all the actions deployed to use external knowledge, to innovate, take strategic decisions, predict market directions or even get tasks done (Dahlander & Magnusson, 2008; Jouret, 2009; Leimeister, Huber, Bretschneider, & Krcmar, 2009; A. Thayer, 2001; 2006). It requires a specific Internet-based platform, owned by the organization or not, where requests are made and people can post their answers and solutions. Also, Dahlander and Magnusson (2008) concluded that developing and maintaining relationship with the community of contributors, through forums and discussions is one of the factors that positively influences in a effective usage of outside innovation.

Crowd wisdom is related with the organizational capacity to effectively use external knowledge obtained via crowdsourcing initiatives and the organizations have the opportunity to use it to create value. The study of Saur-Amaral and Rego (2010; I. N. Saur-Amaral, I. ; Rego, A., 2010) illustrates a good example of crowd wisdom, the results of their research showed the usage of internet-based discussion groups as a source of solutions for R&D and innovation problems as well, to clarify perspectives and benchmark good practices.

The **crowdcreation** are all initiatives that stimulate or motivate user-generated content¹¹, alone or related to specific organizational products, services or knowledge. A good example of crowdcreation is IStockphoto (Howe, 2008; Kho, 2006), a photography website which grew from an ordinary website where users could upload their photos, to a place where users sell their photos.

Youtube and Myspace¹² websites business can also be used as examples for crowdcreation. Content production is made by users, advertising brings a

¹¹ The content produced by users of Web 2.0.

¹² In the case of bands that upload their new songs.

significant financial return (Almeida, Goncalves, Figueiredo, Pinto, & Belem, 2010; Bernoff & Li, 2008; Buckley & Giannakopoulos, 2010; Han, 2010; Huberman, Romero, & Wu, 2009). Youtube and Myspace home pages show the most popular contents. On each video or profile comments can be used to obtain feedback from viewers, and improve content in the future.

Crowdvoting refers to all actions where users act as a filter (Howe, 2008) ranking and classifying content. Example can be seen at the website IMDb¹³, where users give grades and classify the movies, and these contributions are available for anyone who may be interested (Liu, Huang, Ani, & Yu, 2008; Park & Pennock, 2007). The content of IMDb extends itself on reviews about television programs, actors, producers, soundtracks and it can be considered a current and frequent source of movie research for the young generation.

Other example listed on table 3 of crowdvoting is the website Digg, *“popular social bookmarking website that allows users to share, comment, and rate on diverse online available information”* (Jamali, Rangwala, & Ieee, 2009). In addition to vote, the users make comments about the rated information and start forum and discussions about the subject.

The **crowdfunding** consists in getting financial contributions from the people for a specific project. The first example chosen to illustrate the crowdfunding is the organization Kiva. The mission of the organization at the website emphasizes the use of the Internet to connect lenders and entrepreneurs *“Kiva empowers individuals to lend to an entrepreneur across the globe. By combining microfinance with the Internet, Kiva is creating a global community of people connected through lending.”* (“Kiva.org,” 2011).

The current president of the United States, Barack Obama, also used the Internet to reach voters and supporters. The strategy was to build a relationship through discussions at his campaign in 2008 (Levenshus, 2010; Lipton, 2009). In addition to solidify the Internet as an effective tool at politics campaigns, it also reached funds for the president campaign through the Internet.

¹³ IMDb is the acronym of Internet Movie Database.

Table 4. Types of Crowdsourcing and related studies (Howe, 2008, compiled by the author).

Type of Crowdsourcing	Concept	Cases and Related Studies
Crowd wisdom	The attempt to harness the knowledge of many to solve problems, predict future results or help business strategy.	Innovation (Dahlander, Frederiksen, & Rullani, 2008; Jouret, 2009; Leimeister, et al., 2009; A. Thayer, 2001; 2006), Crowdsourced Tasks (Downs, Holbrook, Sheng, & Cranor, 2010; Vojnovic & D'Alantino, 2010; Yang, et al., 2008), Decisions (Bonabeau, 2009; Rasmussen et al., 2006)
Crowdcreation	To rely on the creative energies of human beings. Business models developed around the concept of "User-generated content".	Youtube, Myspace, Istockphoto (Almeida, et al., 2010; Bernoff & Li, 2008; Buckley & Giannakopoulos, 2010; Han, 2010; Huberman, et al., 2009; Kho, 2006)
Crowdvoting	The capability of the crowd to act as a filter, giving their opinion through voting and classifying.	IMDb (Liu, et al., 2008; Park & Pennock, 2007); Digg (Jamali, et al., 2009; Lerman, 2009; Rangwala & Jamali, 2010);
Crowdfunding	Funding from the crowd.	Kiva.org (Ewalt, 2009); Obama Presidential Campaign (Levenshush, 2010; Lipton, 2009)

From cases and studies used to illustrate the types of crowdsourcing, two emphases can be made:

- As it was described before, the examples require an Internet platform to be classified as crowdsourcing,
- The interaction among users guarantees an improvement on the output. Since the comments, feedback, ratings, reviews and sharing of knowledge are guidelines to what is needed and appreciated by the user's community and by organizations that request or enable the contribution.

The second highlight introduces to the concept of collective intelligence, as the interaction among people and sum of their ideas generate useful intelligence. We classify this concept in the following section.

3.2. Collective Intelligence

The notion of *collective intelligence* implies that a group of human beings can carry out a task as if the group, itself, was a coherent, intelligent organism working with one mind, rather than a collection of independent agents (Zaccaro, 1996). As this is group action, as a whole, it exists since as humans started to live in communities, e.g. families, companies, countries, armies (Bollier, 2007; Thomas W. Malone, Laubacher, & Dellarocas, 2009).

Collective Intelligence has been intensively studied in diverse fields of science. We performed a systematic search on Isi Web of Science, in January 3, 2011 using the following search equation: 'Collective' and 'intelligence' in topic in Social Science database and 769 results were found. These results include articles, journal publications, books, conference reports to among others.

We illustrate in Table 3 displays top-10 fields that were most representative among our results.

Table 5. Descriptive statistics on Subject distribution of results (ISI web of knowledge, December, 2010)

Subject Area	Record Count
COMPUTER SCIENCE	274
ENGINEERING	106
AUTOMATION & CONTROL SYSTEMS	58
PSYCHOLOGY	56
BEHAVIORAL SCIENCES	51
ROBOTICS	50
MATHEMATICS	48
TELECOMMUNICATIONS	34
BUSINESS & ECONOMICS	28
ENVIRONMENTAL SCIENCES & ECOLOGY	23
Total	958

The total sum on the table is higher than the number of results found (i.e., total sum = 958, results found = 769) for the reason that one publication may be labeled as more than one subject area. These top ten areas show how representative these fields displayed are, among the publications approaching Collective Intelligence.

Possibly, the high number of publications labeled as Computer Science followed by the label Engineering is related to the fact that various projects on these fields are collectively produced, and the number of collective projects increased with the Internet possibility of connection.

There are few studies labeled as Business & Economics, and as this work aims to provide results on how collective intelligence usage can benefit organizations, this work fits at the Business and Economics label.

Table 4 shows definitions for Collective Intelligence concept. A good definition was advanced by Surowiecki (cited in Bonabeau, 2009; Hudson-Smith, Batty, Crooks, & Milton, 2009; Leimeister, et al., 2009; Nguyen, 2008), this author says that a large group of people is more intelligent than just a few individuals. Malone et al. (2009) said collective intelligence are “*groups of individuals doing things collectively that seem intelligent*”. Researchers as Scarlat & Maries (2009), Singh, Gupta, & Ieee (2009a), Yuan, Chen, Wang, & Du (2008) approach the concept to the intelligence that emerges from the collaboration, coordination and behaviors of groups of individuals.

Table 6. The concept of Collective Intelligence (Compiled by the authors, 2011)

Concept	Author	Year
Collective intelligence is a shared intelligence that emerges from the collaboration of individuals.	Scarlat & Maries	2009
Collective Intelligence is a form of intelligence which emerges out of collaboration and coordination of many individual agents.	Singh, Gupta, & Ieee	2009
Collective Intelligence is the emergence of group behaviors	Yuan, Chen, Wang, & Du	2008
Groups of individuals doing things collectively that seem intelligent.	Thomas W. Malone, Laubacher, & Dellarocas	2009
A large group of people is most intelligence than a few.	Surowiecki, cited by Bonabeau; Hudson-Smith, Batty, Crooks, & Milton; Leimeister, et al.; Nguyen.	2008, 2009

To sum up, in our understanding collective intelligence is *the intelligence resulted from the interaction and collaboration within a group of individuals.*

At the early 2000 decade the studies restricted to a philosophic debate of conceptualization of the concept of Collective Intelligence (Bosse & Treur, 2006; Luo, Xia, Yoshida, & Wang, 2009; Szuba, 2002; Szuba & Szpyrka, 2004).

Through the advent of Internet and its development into WEB 2.0, the firms increasingly took advantage of the collective Intelligence. ("MIT. Center of Collective Intelligence," 2011). Empirical researchers leaned to the process, to examine the motivation that leads the collective to contribute, and the risks involved on the process.

The advantages for people who contribute voluntarily on the construction of collective intelligence vary from professional reputation improvement, prizes, financial rewards, possibility to learn, the will to transfer knowledge, peers and community recognition, a sense of civic duty, contributing to a cause or for the simple enjoyment of performing an activity (Albors, et al., 2008; Bonabeau, 2009; Leimeister, et al., 2009; Thomas W. Malone, et al., 2009; Vojnovic & Dipalantino, 2010).

As risks, research was found related to complexity, generated by the large amplitude of the collective intelligence and the possibilities of users to create content (Lancieri, Bonnel, & Stumme, 2001; T. W. Malone, et al., 2010; Solachidis, et al., 2010; Zettsu & Kiyoki, 2006). The ability to manage the information and deal with complexity is considered one of the challenges that hinder the use in a large scale of the collective Intelligence.

The openness to the collective, also make the organizations hesitate, fearing the loss of control, (T. W. Malone, et al., 2010), "*some people may have the*

intention to also harm and disturb” (Bonabeau, 2009). Downs et al., (2010) at their research, proposed a reliable method of selecting the most effective and engaged participants and contributors of an Internet crowdsourcing platform to identify who is likely to perform poorly the tasks and contribute unconsciously.

Other risk is biased information and low quality work, that may come from people interested more on the payments and prizes, damaging and leading to poor quality results (Downs, et al., 2010).

The inconsistency of the knowledge of the collective intelligence was studied by Nguyen (2008), and developing a calculating model this author concluded that “the knowledge of a collective is more proper than the knowledge of its members” (Nguyen, 2008).

Even though there are restrictions, as possible eventual biases, if well conducted the organizations can harness the collective intelligence in order to amplify the intelligent bases of knowledge and turn this into competitive advantage.

The risks attributed to openness and lack of a model (T. W. Malone, et al., 2010) to guide organizations to implement collective intelligence effectively seems to be the main gap that between theory and practice that prevents organizations to adopt the collective knowledge source.

3.3. Collective Intelligence – a framework

According to Malone and colleagues (2010) the use of collective Intelligence has less utilization by firms because of the difficulty in understanding. “To unlock the potential of collective intelligence, managers instead need a deeper understand of how this systems work” (T. W. Malone, et al., 2010). Also, there is lack of studies to guide how to measure the results of utilization of the collective Intelligence.

Malone and colleagues (2010) proposed a framework, presented in Figure 2, that includes guidelines to leverage an effective use of Collective Intelligence. ("MIT. Center of Collective Intelligence," 2011).

This concept was developed based on the observation of 250 organizations that have implemented successfully the wisdom of collective intelligence.

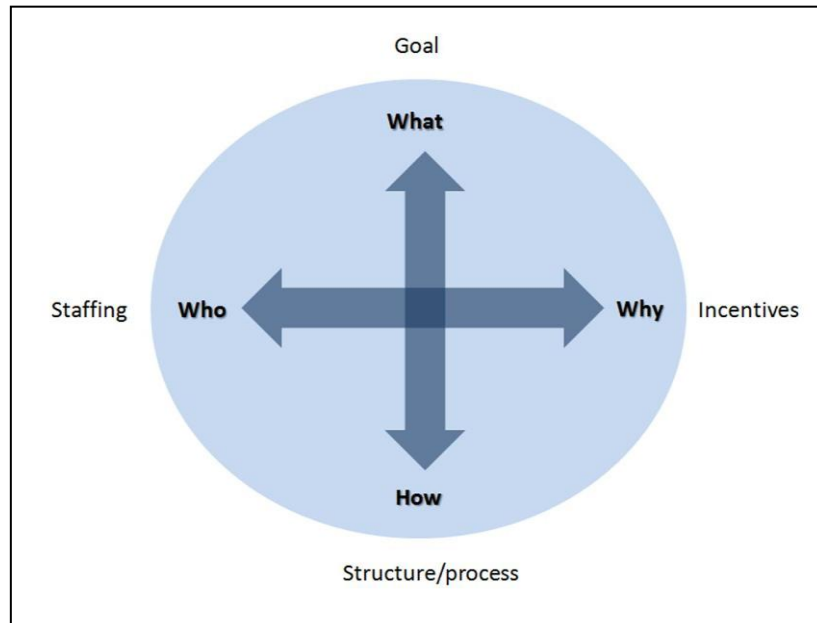


Figure 2. The four dimensions of Collective intelligence (T. W. Malone, et al., 2010)

Table 7. The four dimensions of Collective intelligence (adapted from T. W. Malone, et al., 2010)

Topic	Concept	Variations
What	Objectives, what needs to be done	Create
		Evaluate
Who	People involved on the process	Hierarchy
		Crowd
Why	Motivations	Money
		Love
		Glory
How	How the contributions will be done	Collections
		Collaboration

The framework is composed by four topics, shown on Table 5.

At the authors' design **What**, refers to the objectives. Is to define what needs to be done. Furthermore, this aspect is divided by creating and deciding, which empowers the contributors to create content and evaluate them. The authors recommend to apply them both, "in the full genome for doing a job you usually need at least one of each"(T. W. Malone, et al., 2010) .

Who, refers to the actors that are performing the production and in this aspect there are two divisions: *Hierarchy* and *Crowd*. The *Hierarchy* refers itself to the selection the firm can operate, in choosing which contribution will be put forward. The *Crowd* has the complete openness to contribute, the work can be made "by *anyone in a large group who chooses to do so*, without being assigned by someone in a position of authority"(T. W. Malone, et al., 2010). These authors reinforce the statement that trust on the crowd has to be on the basis of the openness process.

However, the authors left clear that the *hierarchy* actor has to know when take action to manage, in cases of noticing possible sabotage, "there must be mechanisms in place to protect against people gaming or sabotaging the system"(T. W. Malone, et al., 2010).

The **Why** aspect approaches the motivations. The firm organization must know what motives the contributors, in order to promote this reward. Even though the authors recognized the simplification of the human motivations, they divided the motives into three categories: *Money*, *Love* and *Glory*. The *Money* refers to the financial payment. The authors make reference to refer that often actors may prefer the enhancing of professional reputation or improve their skills. The *Love* aspect may be composed by three situations that lead to contribution: intrinsic enjoyment, socializing with others and contributing with a cause. The *Glory*, refers to the recognition by peers for their contribution.

The authors admit the complexity of choosing the right combination of motivational aspects, emphasizing that even though their genome was not tested in scientific bases, their background knowledge led to hypothesize that motivational factors chosen improperly were the most weighted error usually executed by failures on applying the Collective Intelligence process in use.

At the **How** topic the authors list several possibilities of applying the model of utilization of Collective Intelligence. The authors divided this topic in two groups, according with the nature of the task: Create and Decide.

At the *Create*, there are two options of actions: *Collections* and *Collaboration*. *Collection* the contributors produce content independently. One example of this aspect is the *Contest*, where contributors compete in order to have the work chosen by the organization. The *Collaboration* topic the contributors work together and their work have an interdependent condition.

At the *Decide* there are two subtopics: Group decisions and individual decisions. What distinguishes them is the fact that in group decisions, the decision has to represent the whole group's choice. When the group is far heterogenic and the decision results have only implications to one individual then the Individual Decision is recommended.

Group decisions covers the subtopics *Voting*, *Consensus*, *Averaging* and *Predicting market*. At *Voting* the users can vote¹⁴ themselves the content.

At *Consensus* all users or most percentage of them must have the same option at certain content. *Averaging* is identified as the frequent rating web based information, when users give their rate and the rate displayed is the average of all contributions. *Predicting Market* may be used when marketing predictions are needed. The crowd can give share their wisdom to help organizations predict future trends.

¹⁴ The authors consider, *seeing* and *buying* as an important action, since several web sites, rank their content based on the users most views or buys.

For *Individual decisions* there are two subtopics: *Markets* and *Social network*. At *Market*, the individual purchase may lead to consumptions trends. At *Social network*, individuals chose weight and interact with groups or other individuals by his choice.

3.4. Online Communities

As the crowdsourcing initiatives require Internet-based platforms for people to contribute, and collective intelligence requires people sharing interests and interacting to each other, it is important to approach the subject of online communities.

This concept brings together internet-based platforms communities and place, location¹⁵, where a group of people get together and their behaviour and actions about a subject.

“Virtual communities are cyberspace platforms backboneed by computers and Internet technology. Their members share similar interest and goals, discussing specific topics. Members share information and create content collaboratively (Shu, et al., 2009b).

Shu et al. (2009a) while discussing the concept of virtual community, also approach the location (area) on the internet, and they stated that it is one of the distinctive features of the concept, “members of virtual communities communicate in cyberspace and by means of Internet technology” (Shu, et al., 2009a).

In addition, related to online community concept, researches referred the importance of *support and trust among members* and *shared innovation within* (Albors, et al., 2008; Dahlander & Magnusson, 2005; Ebner, Leimeister, & Krcmar, 2009; Skopik, Schall, & Dustdar, 2010).

¹⁵ Cardoso and colleagues (eited by Lytras,2009) at their work “Open Innovation communities...or should it be “networks”?” approach to the concepts “place” and “space” of online communities, concluding that an online community is based at a cyberspace, which is a common ground where the community develops its relation.

Kavanaugh et al. (2003) and Lytras et al. (2009) emphasizes the sense of belonging felt by the community members as an important motivational aspect on the composition of an online community. Values can be considered cohesive element (Albors, et al., 2008) and the core support for collaboration within the communities (Dahlander & Magnusson, 2005).

Preece (2000, cited in Ebner, et al., 2009) built a four pillars concept as is shown on Table 8:

- 1) *people*, who belong to the community and participate on its activities;
- 2) *a shared purpose*, among its participants, which is the reason for the existence of the community;
- 3) *policies*, build by the communities' rituals, assumptions, rules and laws that will guide the relations and communications within the community;
- 4) *computer systems*, that allow the mediation, interaction and the sense of union.

Table 8. Online communities (Preece, cited in Ebner, et al., 2009, compiled by the author)

Composition of Online Communities	Description
People	Who interact socially as they strive to satisfy their own needs or perform special roles, such as leading or moderating.
A shared purpose	Such as an interest, need, information exchange, or service that provides a reason for the community.
Policies	In the form of tacit assumptions, rituals, protocols, rules, and laws that guide social interactions
Computer systems	To support and mediate social interaction and facilitate a sense of togetherness

As a conclusion, from our perspective, online communities are cyberspaces composed by *members* that belong to the community and share interests and values, with *policies and norms* that guide communication/interaction, and a *platform* with tools that allow the sense of union among members and enable the communication within.

Online community plays the role of a fertile ground, which may allow, among other results, the sprout of collective intelligence and crowdsourcing initiatives. These online communities can have their own domain on the internet, but they are frequently hosted at the social networks website, which concept is approached at the following topic.

3.5. Online Social Networks

“As more people use the Internet, chances increase that they will experience part of their social lives online” (T. Coenen, 2006).

Coenen, as many other authors, researched aspects approaching the use of social networks on the Internet as a complement or extension of the offline social lives. On the 2nd of February 2011, the Isi Web of Knowledge database listed 1.270 publications with the words “online” + “social” + “network” on the topic, and 76% of them were published on the last 3 years, period within the years 2008 to 2010.

According to Bhatnagar et al. study (edited by Lytras, et al., 2009), the online social network is based on the concept of traditional social networks which are *“structures made of nodes (the individuals or organizations) that are tied by one or more specific types of relations”*(Lytras, et al., 2009).

Thus, connecting people (Boyd & Ellison, 2008; Brasoveanu, Nagy, Mateut-Petrisor, & Urziceanu, 2010; Cheung & Lee, 2010; T. Coenen, Kenis, Van Damme, & Matthys, 2006; Makridakis et al., 2010) appears to be the primary intention of the Internet-based social networks.

Boyd & Ellison (2008) listed three steps related to the connection aspect of social networks.

“Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system.”(Boyd & Ellison, 2008)

Plenty of sites with different purpose of *connecting* emerged, as LinkedIn, promoting business connections, Facebook promoting connection with family

and friends¹⁶ , social network as Couchsurfing¹⁷ connecting travellers, and many other types of connections are all now available on the Internet (Boyd & Ellison, 2008; T. Coenen, et al., 2006).

However, the development of the Internet allowed these sites to aggregate functions to the connections, as research collaboration, (Makridakis, et al., 2010) recommendation (Brasoveanu, et al., 2010), possibility to learn (Cheung & Lee, 2010), form opinion (T. Coenen, et al., 2006) exchange ideas, ask for advice and many other possibilities¹⁸ of actions and interactions appear daily on these sites.

The ease of sharing and exchange information turned “sharing” into a trend (Shu, et al., 2009b). Specific spaces are frequently used to share information and opinion used as forums to enable discussions, inside or not a group, within the social network.

As this work intend to comprehend how the knowledge is shared and created at a social network, recent studies approaching the subject, and their findings will be referred to guide the composition of the proposed model.

Related with knowledge sharing attitude, Shu and colleagues (2009a, 2009b) researched the motivations to share the knowledge in social networks. They found that *expected return* has no influence on the knowledge sharing attitude¹⁹, the *absorptive capacity* of receiver of knowledge influence the sharing attitude, and *self esteem* of the participants as well influence the attitude of sharing knowledge into social network sites.

¹⁶ And also connect with “friends-of-friends”, as is possible and easy to visualize a user’s list of connections. As well, Facebook connects people with the same interest, reachable by the sites’ search engine.

¹⁷ Couchsurfing is a social network that promotes connection between travelers around the world. www.couchsurfing.org

¹⁸ Due to the current technological advances on this area, it is hard to list and to predict the innovations of the social network tools.

¹⁹ The authors found this conclusion counterintuitive and raised the question if was not about finding the essence of modern business strategy. Although, the return comes for the more engaged participants.

Coenen and colleagues (2006; 2006) also researched knowledge sharing at social network. These authors described three patterns, listed on Table 9, which according to their findings can enable the sharing of knowledge within social networks. The patterns are related: 1) with the stimuli to knowledge sharing, through the decision of closing or opening the discussion group membership, 2) with the organization of the discussions, content and knowledge through the tagging system²⁰ and 3) with the understanding of discussion context in order to clarify it to enable an effective discussion using also the tagging system.

Ma & Yuen (2011) developed a study to understand the knowledge sharing over social networks in order to improve online learning and their main findings showed that firstly the “need to belong” and secondly the “will to develop and maintain relationships” proved to have direct influences on the promotion of knowledge sharing.

Table 9. Patterns for Knowledge sharing at social networks (T. Coenen, 2006, compiled by the author)

Pattern	Context/Issues	Proposed solution
Creating Group Boundaries	Previous studies found that messages are exchanged 3 times more frequently on closed groups, which are the groups that need permission of the moderators to allow a participant of social network to become a member.	On the creation of a group, moderators must consider the possibility of a closed or open membership. All users must be able to chose to apply or not to the group admission.
Tracking Content	Too much content are shared, in such a variety of types and in a high pace. How to keep track of heterogeneity?	The authors propose the tagging system, which allows the possibility of members to aggregate content by their own taxonomy, based on their own language.

²⁰ The tagging system consists in labeling and classifying content using key words. “The tagging functionality provides metadata which will allow subsequent development of more advanced features, like the matching of content to users, the matching of users to each other and the development of bottom-up ontologies” (T. Coenen, et al., 2006)

Pattern	Context/Issues	Proposed solution
Grasping Perspectives	At the knowledge sharing, grasping the perspective and understanding the context is an important issue at the effectiveness of the process. How could this grasp of perspective be generated to facilitate the understanding scheme that represents the communication process, for people to search, reach and understand the discussion context.	The tagging system is also suggested on this topic, following the same principles listed on the previous pattern solution.

Approaching knowledge creation, as it was referred before on the chapter approaching collective intelligence, from the interaction among people emerge a knowledge which is greater than its separated contributions. (Scarlat & Maries, 2009; Singh, Gupta, & Ieee, 2009b; Yuan, et al., 2008).

As conclusion of knowledge creation on the context of social networks, it will be assumed that through the shared knowledge, which is aggregated, organized and commented by members of social networks, it is created a new knowledge itself.

3.6. Internet-based forums and discussion groups

Internet-based forums are the platforms that appeared with WEB 2.0 and allow individuals to interact and discuss approaching a specific subject (Ma & Yuen, 2011), and, consequently, share knowledge.

With the rise of the social networks, discussion groups were created within these platforms with the same purpose. Several authors make no differentiation between the concept of Internet-based forums and discussion groups, frequently mixing the nomenclature as online discussion forums, online forums, social media forums (Dahlander & Magnusson, 2005; Kane, Fichman, Gallagher, & Glaser, 2009; Ma & Yuen, 2011).

As the previous chapters approached, it is known that the discussions may construct knowledge, may enable crowdsourcing initiatives, and may promote other interesting results.

A question that arises is why various groups achieve these objectives and demonstrate a frequent interaction and others do not provide the same results? Also why some groups fail on attracting contributions?

Jones et al. (2004) led a deep empirical research to study the effectiveness of the discussion groups, approaching the behaviour aspects and concluded that:

“...(1) users are more likely to respond to simpler messages in overloaded mass interaction; (2) users are more likely to end active participation as the overloading of mass interaction increases; and (3) users are more likely to generate simpler responses as the overloading of mass interaction grows.(Q. Jones, et al., 2004)”

Although these authors recognize the rules cannot be extended to all types of group discussions, the results highlight important issues that may be considered when studying a group interaction.

Approaching to language patterns, the study developed by Fayard & DeSanctis (2005) used a model²¹ to approach and list the guidelines for promotion of effective contributions at professional forum:

1) “**Build a Conversational Rhythm Early On**”, which the authors highlight the importance of making effort to keep the first discussions live at the beginning of the group, to set the basis for its development, as context , behavior and trust. At this stage, the core roles are come from the moderator or facilitator of the group, who set patterns for greetings and closings for example; and also from an active group to promote lively rhythm, interaction and relationship management.

²¹ The model proposed by Wittgenstein's (1953, 1969, cited in Fayard & DeSanctis, 2005) analyse three dimensions of the forum's language: roles, social identity, and linguistic style.

2) **“Create a context to facilitate and support interactions”**, which consists in clarifying the communicative practices and tone used at the discussions. In addition to providing a sense of coherence and setting a model, this practice reinforces the sense of common identity and clarifying the aims expected when participating at the forum.

3) **“Develop strong sociability criteria”**, this topic approaches the discourse style and level of sociability, achieved through expressions of politeness and gratitude. This topic highlights that the fact of being informal, friendly and positive create the sense of sociability and belonging, which important (Albors, et al., 2008; Ma & Yuen, 2011) as it was described at previous chapters of this literature review.

4) **“Know how to avoid conflict escalation”**, this topic approaches the need from the moderator act as a manager in cases of conflict, mediating the discussions and exposing the groups policies, making clear with the language, the positive behavior. Also the moderator can ignore inappropriate attitude, and members keep the regular flow following the moderator. 5) **“Support embodiment”**, this topic approaches the need of promoting offline meetings, enabling the possibility of face-to-face meetings or teleconferences and through this suggest “that there may be benefit to creating “physical” structure to “ground” the online community and support interactions” (Fayard & DeSanctis, 2005).

As a conclusion, the management established by the moderator and followed by the members has a core importance at the effectiveness of an online forum. The politeness, objectiveness and simplicity of the communication and the friendly attitude, the clear definition of the context and objectives, the management of the conflicts and the promotion of extra boundaries meetings approaching the subject of the forum may allow the success of the interaction.

4. The Conceptual Model: Crowdsourcing and effective communication

Based on the literature review, the author designed a conceptual model, which proposes relevant characteristics an internet group should contain, in order to enable effective communication within. The model is composed by characteristics presented at previous studies and also the personal guess of the author, based on her experience as a member of web based groups herself.

Figure 3 presents the model, which is divided in three major sections:

- Web based group
- Members
- Posts/Shared information.

Each section has its own characteristics and shared characteristics, which are presented in the intersections of the main sections.

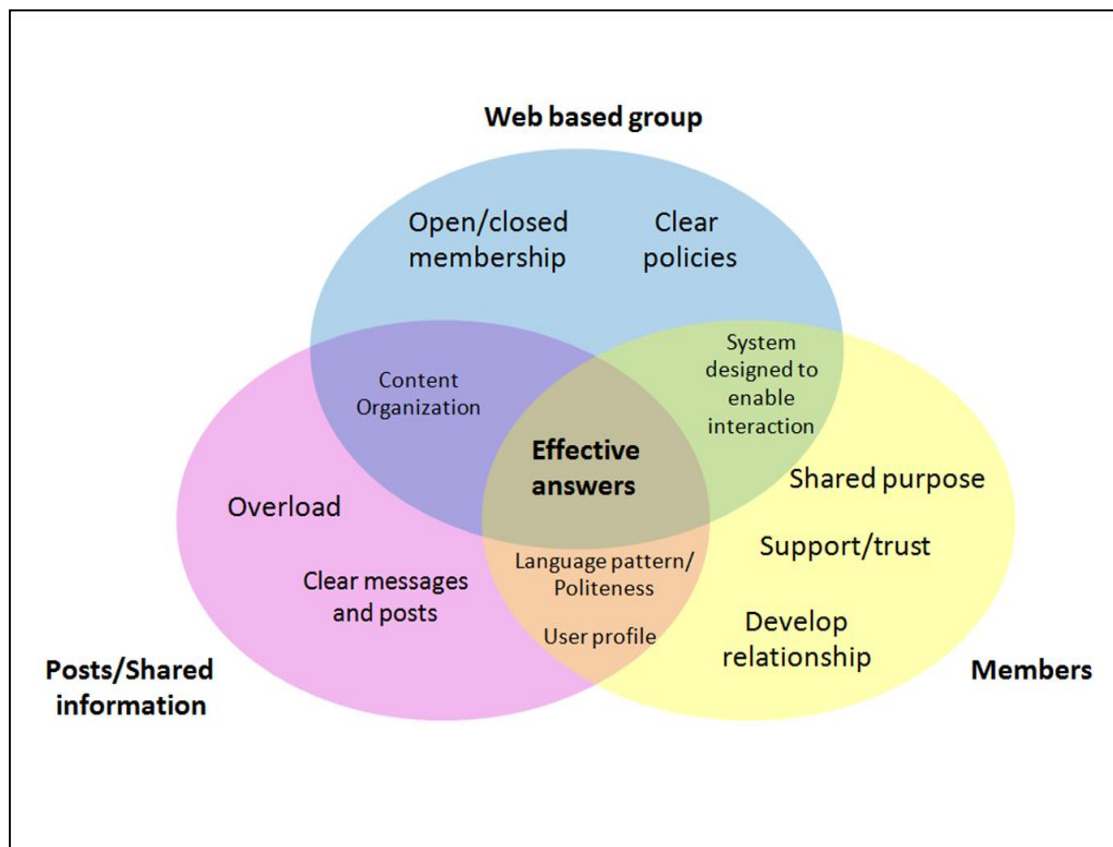


Figure 3. Conceptual model of Crowdsourcing and effective communication

Next, the key sections of the conceptual model are described in detail.

1. **Web based group** - The places where communication and exchange of information happens. The proposed characteristics for the internet group are:

- **Open/Closed membership** - The openness of membership is related with the sense of belonging. The fact of subscribing at an Internet group in order to be able to participate motivates the potential users; they want to contribute at something they belong to.(Albors, et al., 2008; T. Coenen, et al., 2006; Ebner, et al., 2009; Kavanaugh, et al., 2003; Ma & Yuen, 2011)
- **Clear policies** – The group should have rules and policies, created by the group manager or by the members themselves. Policies guide new users and are remembered in cases of discussions or posts out of the core of the group.(Ebner, et al., 2009; Fayard & DeSanctis, 2005; T. W. Malone, et al., 2010)

Intersection with **Members** section

- **System designed to enable interaction**– The group's technologic system should contain tools to facilitate comments at posts and discussions, creating an interactive and dynamic interface, to stimulate knowledge sharing process.(Ebner, et al., 2009; Fayard & DeSanctis, 2005; Q. Jones, et al., 2004)

2. **Members** – Some member's characteristics and behaviours create a pleasant environment within the group, which is positive for the communication.

- **Shared purpose** – All members having interest for the main subject of the group, is the basic principle of the sharing and contributing attitude.(Ebner, et al., 2009; T. W. Malone, et al., 2010)

- **Support/Trust** – Members feel comfortable in share, comment, discuss and contribute if they trust other members, if they support and help each other, giving for example, feed back at posts and projects.(Albors, et al., 2008; Dahlander, et al., 2008; Ebner, et al., 2009)
- **Develop relationship** – Relationships created at web based groups is referred at previous studies as a motivation to contribute. It can turn, for example, into future work possibilities.(Albors, et al., 2008; Bonabeau, 2009; Leimeister, 2010; Ma & Yuen, 2011; T. W. Malone, et al., 2010; Vojnovic & Dipalantino, 2010)

Intersection with **Posts/Shared information** section

- **Language pattern/politeness** – The group has a pattern of communication, a way of posting and making comments. Communication is fluid when the pattern is followed, and, on the contrary, if the pattern is not respected the message probably will not have visibility of any reply. Politeness and kindness is appreciated. Kind and polite messages are more alike to receive feedback.(T. Coenen, 2006; Fayard & DeSanctis, 2005; Kozinets, 2010)
- **User profile** – The user profile of the member that posts a message has influence at the attention the message will receive. If e.g. the member is a popular and appreciated figure at the group or social network, the post will receive a large number of replies and comments, or a member make numerous contributions in order to conquer peer recognition and respect within the group. (T. W. Malone, et al., 2010; Thomas W. Malone, et al., 2009)

3. **Posts / shared information** – Relates with content shared within the group.

- **Clear messages and posts** – The message and posts have more chance of getting other members appreciation and interest when they are well written and are clear.(Fayard & DeSanctis, 2005; Q. Jones, et al., 2004)
- **Overload** – The overload of posts, information shared and messages was proven to have influence at member's actions: the more overload, the less interaction.(T. Coenen, et al., 2006; K. S. Jones, 2006; Q. Jones, et al., 2004)

Intersection with **Web based group** section

- **Content Organization** – The content should be searchable and organisable e.g. search on the archives or the TAG system, previously mentioned as solution for the organization of content.(T. Coenen, et al., 2006)

5. Empirical research

5.1. Netnography and Survey

Empirical research followed Netnography plan, as Figure 4 presents. The questions of empirical research were the same as the objectives of this research, which were:

- To understand how knowledge is created and shared in a discussion group associated with a social network;
- To understand how the process evolves over time, within the same community;
- To understand whether there are specific forms of communication or appropriate behaviour that permits the discussion to generate effective answers for the proposed questions.

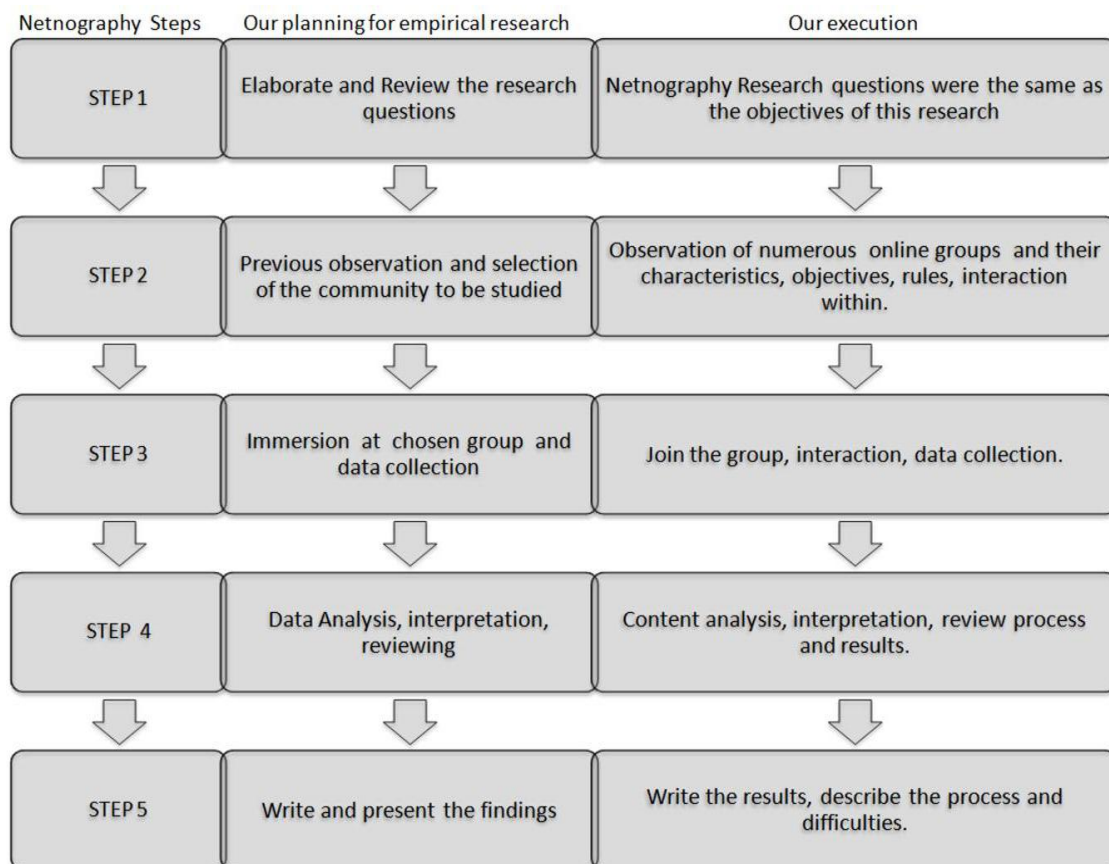


Figure 4. Empirical research execution

The social network chosen to perform the research was LinkedIn, which has the core business to connect professionals worldwide (Boyd & Ellison, 2008; T.

Coenen, et al., 2006; I. Saur-Amaral, Nugroho, & Rego, 2011), according with the website description, based in data from November 3rd of 2011, “LinkedIn is the world's largest professional network on the Internet, with over 135 million users in over 200 countries and territories” (“Linkedin,” 2011).

Inside LinkedIn, many groups were observed, in order to find a group with frequent discussions, to provide data to be analysed and the group chosen was “Crowdsourcing for Entrepreneurs and Investors”. The choice was made because the group had a consistent exchange of messages (6.2 messages per day) and because the group’s objectives described activities linked with crowdsourcing practices and this could influence the knowledge built.

Data collection occurred between 21st of April and 20th of May 2011. All 195 discussions and 63 comments posted at this period were copied and pasted into an Excel spreadsheet.

On the 6th of May, 2011, 500 surveys were sent by email through LinkedIn tool, to active members of the group. The members were asked to answer three questions:

- *How did your participation in “Crowdsourcing for Entrepreneurs and Investors” discussion group help you to improve your professional activity?*
- *Think about people you know that are doing the same function as you do. What benefits could they obtain from participating in this specific group?*
- *Think about other LinkedIn discussion groups where you participated. Are there any other benefits you have not mentioned before, that helped you improve your professional activity as participant in those groups?*

Within a month, 64 members responded.

Content analysis, discussions and survey, based the identification of proposed model components at the LinkedIn group. The results of the analysis are described in following chapter.

5.2. Group Analysis

The group analysis started with the clear understanding of the proposed model components, in order to identify these characteristics at the group, or not.

Table 10. Group analysis: Data collection overview

	Crowdsourcing for Entrepreneurs and Investors
Open/Closed membership	√
Clear policies	√
System designed to enable interaction	√
Shared purpose	√
Develop relationship	√
Support	√
Language Pattern/Politeness	√
User profile	√
Overload	√
Content Organization	√
Clear messages and posts	√

Concerning **Open/closed membership**, the studied group is a *closed group*, which means the member has to require membership and gets inside the group after approval of the group manager. Based at the literature review, this aspect is important to confirm the sense of belonging and the member feels more comfortable to contribute and discuss. The interest in belonging appeared at survey answer, as a member stated: “*Gives sense of community, allows quick answers...*” when asked about the participation at the group.

The group has **clear policies and guidelines**, as are shown at Figure 5. These rules are easy to access, at the main menu, on the top of the group’s page.

A few housekeeping points to keep this group usable for everyone....

SPAM: it will be deleted on sight and offenders will be blocked.

JOBS: we have activated the "Jobs" Tab: If you're looking for a partner, a team member, or an advisor with a specific skill-set, please describe it in detail in the jobs section of the group. This will allow others to see it quickly and engage you.

PROMOTIONS: if you want to tell us anything about your company, a conference, any funding requirements or anything that is not "core group business" please use the "Promotions" tab.

INTERESTING BUT UNRELATED DISCUSSION THREADS WILL BE DELETED: As group moderators, we will use our best judgment in doing so and give leeway where ever possible. We do not mean to offend anyone by deleting content, or to imply that it did not have value. We simply need to keep the group "on topic".

Thanks again for joining.

Figure 5. Rules of the discussion group (2011)

The system is **designed to enable interaction**, although the member must have some practice at internet forums. The follow up of the discussion is stimulated, since when a member makes a comment, he has the option to receive other member replies by email.

The **shared purpose** among members are related with the group's objectives and purpose, which are accessible at the link *group profile*, as presented on Figure 6. The main objectives of the group are "leverage skills and contacts".

This group leverages the skills and contacts of our members along with a variety of crowdsourcing tools to:

- i. develop local, national, and international startups,
- ii. create jobs from our startups,
- iii. provide investment opportunities with our startups.

We invite you to join!

If you have business experience, are innovative, or are just willing to get 'stuck in' in some way - we would welcome you to the group.

Figure 6. Objectives of the group (2011)

The Linked in, as mentioned before, is a social network with the purpose of enable professional connections and recruitment. It is assumed that a person subscribes this specific social network to make contacts at professional field and **build relationships**.

At survey answers, some members stated that the building of relationships is the greatest benefit on participation at group: *“Personally I see this group as a great networking tool as it allows people to share ideas, receive feedback, and become involved in projects they feel passionate about”* ; *“I made some good contacts - it's a great way to meet people who can help your business”* and *“Networking with like-minded individuals”*.

The **support** can be noticed at posts labelled as *information request, idea debate, solution to a specific problem and polls*. These posts received replies, differently of what happens at posts labelled as *advertisement and sharing of public knowledge*.

In order to identify a **language pattern** and **politeness** at the group, discussions and replies were classified, labelled and reviewed. The classification followed Saur-Amaral & Rego (2010), as Table 11 presents. For 195 discussions, 63 discussions received replies.

Table 11. Discussion Analysis. Adapted from Saur-Amaral & Rego (2010).

Type of discussion	Discussions
Sharing public knowledge	75
Advertising	57
Thematic Spam	35
Other	10
Invitation to join initiative	8
Idea debate	6
Tangible crowdsourcing problem	4

The first pattern noticeable at 35 discussions²² with replies on this group is informal approach on the message. Members start the discussions with informal greetings and clear messages, which is other characteristic of the model. The request or discussions start with simple greetings as these two following examples: *“Hi. I'm Alice from the micro outsourcing service CookNice²³. We've recently launched our site...”* , *“Hello. I'm getting started with a unique*

²² Of 63 commented discussions, 28 were classified as **thematic spam** which are not related with the core objective of the group, and **advertising**. These two classifications presented standard messages and none were written at the patterns detected at the analysis.

²³ The name of member and enterprise were changed in order to ensure ethical issues.

virtualization and cloud technology company and could use some advice or strategies / tools to help me get started”.

Other language pattern is to post a discussion proposing a challenge or question.

From the 35 replied discussions, 14 presented a question format as the following examples: *“Hi Guys. What is the best options for my YOGA class start-up idea?”*, *“Are business plans important?”* and *“How do I stimulate innovative creativity?”*. At the discussions collected for this research, none can be considered impolite or triggered exalted replies.

In order to analyse if the **user profile** influence contribution, the collected data showed that the 195 comments were made by 137 members. These numbers shows that the activity is distributed, even though; three members posted more than 10 discussions.

From the 63 commented discussions, the total number of replies was 151 made by 85 members and these numbers show centralization of responses. Linked in has a rank of “Most influential members of the week”, to feature members with more activity during the week within the group.

Even if the quality of the shared information is not evaluated, there is a status to be reached in contributing at the group and this sustains the previous studies which revealed that *status* and *peer recognition* are key motivators for members to contribute.

Regarding the **overload** aspect, that refers to the relation of increase at the amount of posts and decrease of interaction. In the analysed group, at the month the data was collected, the average number of posts was 6.2/day. Taking the number of members, it cannot be considered overload.

It is important to mention that, even if the average number of posts at low, the number of *advertisement* and *thematic spams* posts are majority within the groups' posts.

At survey, members complained about the quality of posted discussions, as this following statement: *"I think that these 'discussions' should be moderated much more and the endless new discussions should be limited. There is simply too much noise. Quality should be first priority."*

The **content organization** consists at the accessibility to archives and previous discussions and posts.

The group has search engines that makes possible look for posts and filter required information among discussions in different ways, as "discussions posted by the member", "discussions commented by the member". It is also possible to "follow" a discussion, as previously mentioned, and receive updates by *e-mail*.

The survey content served to compose analysis, in order to clearly identify the model characteristics at group, based on the answer of members. In addition, the survey measured member's satisfaction with discussions.

From the 64 surveys responded, 32 members (50% of responses) affirmed having benefits at their professional activity from the participation at group. 15 members (23% of responses) said not having benefits at all, at their professional activity by participating at group.

Among these members that did not notice improvements at their professional activity 7 members complained about the amount of advertising and spam messages. 6 members (9% of responses) declared themselves *"not yet benefited"* by information shared, not discarding the hypothesis of having

benefits if the increase of participation, and 6 members (9% of responses)²⁴ declared themselves as “*not active enough to notice*” the benefits.

²⁴ One response could not be labelled as none of the classifications described above, since the member answered the question with another question.

6. Discussion and Research Limitations

The group studied belongs to the LinkedIn platform, which provides tools to clearly describe and specify the components present at the model, as a place to describe rules, the content organization and search engines, the possibility to close the group membership or make it open, the system itself, designed to enable interaction among members.

This providence by LinkedIn makes the group functionality fluid and facilitated the observation and data collection for this research. Through the content analysis and survey answers, an empirical model is presented, as Figure 7 presents.

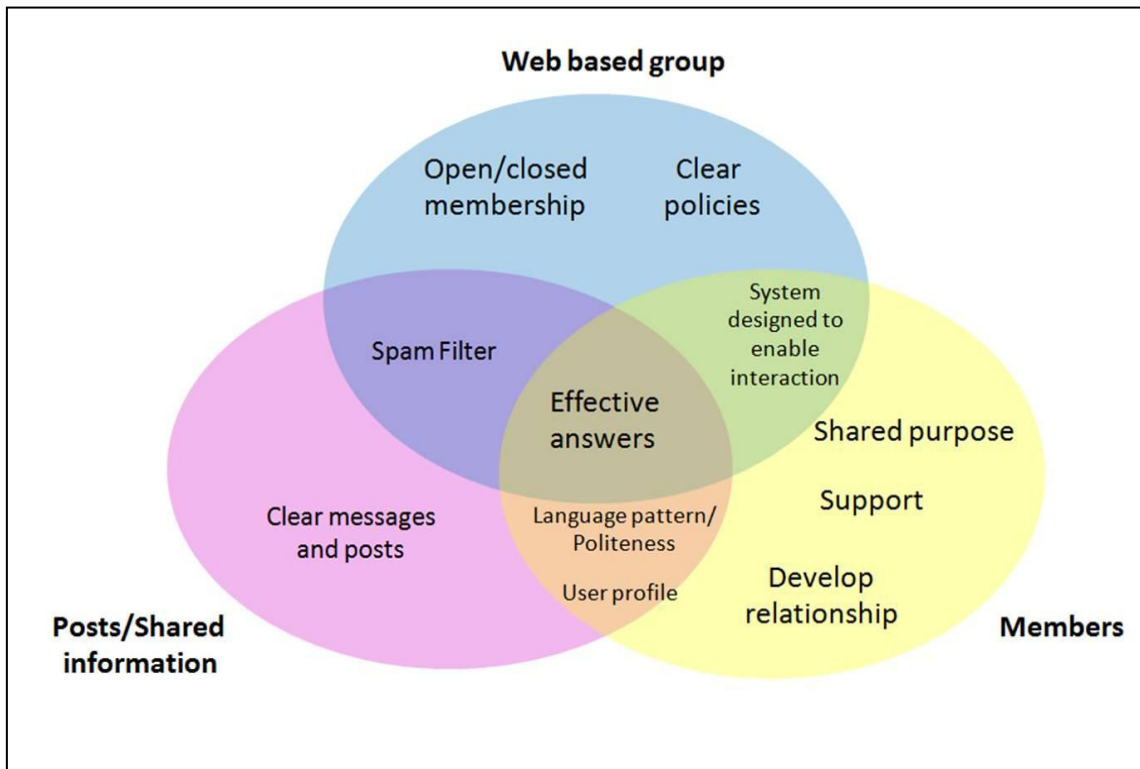


Figure 7. Empirical Model

The majority of components from literature review based model were identified at the researched online group.

One topic was removed from proposed model based on literature review, since they did not appear to be relevant for discussions. One topic, not listed on the literature review model, emerged from empirical research.

Table 12 shows the comparison of the literature review model and empirical model.

Table 12. Literature Review Based Model versus Empirical model

Literature Review Model	Authors	Empirical Model
Open /Closed Membership	Albors, et al., 2008; T. Coenen, et al., 2006; Ebner, et al., 2009; Kavanaugh, et al., 2003; Ma & Yuen, 2011	Open /Closed Membership
Clear Policies	Ebner, et al., 2009; Fayard & DeSanctis, 2005; T. W. Malone, et al., 2010	Clear Policies
System designed to enable interaction	Ebner, et al., 2009; Fayard & DeSanctis, 2005; K. S. Jones, 2006	System designed to enable interaction
Shared purpose	Albors, et al., 2008; Dahlander, et al., 2008; Ebner, et al., 2009; T. W. Malone, et al., 2010	Shared purpose
Support	Albors, et al., 2008; Dahlander, et al., 2008; Ebner, et al., 2009; Leimeister, 2010; Skopik, et al., 2010	Support
Develop relationship	Albors, et al., 2008; Bonabeau, 2009; Leimeister, 2010; Ma & Yuen, 2011; T. W. Malone, et al., 2010; Vojnovic & Dipalantino, 2010	Develop relationship
Language Pattern	T. Coenen, 2006; Fayard & DeSanctis, 2005; Kozinets, 2010	Language Pattern
User profile	Malone (2010; 2009)	User profile
Clear messages	T. Coenen, 2006; Q. Jones, et al., 2004	Clear messages
Overload	T. Coenen, 2006; Q. Jones, et al., 2004	-
-		Spam Filter

Regarding the **Open/Closed membership**, studies affirmed that the fact the group is closed influences participation, as the sense of belonging influences the contribution (Albors, et al., 2008; T. Coenen, et al., 2006; Ebner, et al., 2009; Kavanaugh, et al., 2003; Ma & Yuen, 2011).

This sense of belonging was noticed at content analysis and survey, by declarations of members. Comments of members were frequent satisfied for being invited to join and offering their knowledge and help to other members.

The **policies** at empirical studied group are clear, and have a specific and easy to access place at the website, provided by LinkedIn. Authors stated that policies are important to maintain discussions focused at the main objective of group (Ebner, et al., 2009; Fayard & DeSanctis, 2005; T. W. Malone, et al., 2010). It was noticed that, even the rules of maintaining focus at the objective of group, the majority of posts were advertising.

The system designed to promote **interaction** among members (Ebner, et al., 2009; Fayard & DeSanctis, 2005; K. S. Jones, 2006) was noticed as important at empirical findings, to maintain the discussions fluid and stimulate conversations. The LinkedIn group page features the latest discussions in order to keep members updated when enter groups' page.

Shared purpose (Albors, et al., 2008; Dahlander, et al., 2008; Ebner, et al., 2009; T. W. Malone, et al., 2010) is confirmed at empirical model as it influences the contributions.

The members who were satisfied at survey mentioned the will to be in touch with peers. The group studied had members profile professional activity alike, 42% of members who posted discussions and replied are entrepreneurs and seemed willing to exchange knowledge on this field.

The **Support** (Albors, et al., 2008; Dahlander, et al., 2008; Ebner, et al., 2009; Leimeister, 2010; Skopik, et al., 2010) could also be seen at empirical research and appears at empirical model.

Discussions requesting feedback about ideas, websites, and polls had comments and replies. Even the survey post by authors for this research received support and incentive from members.

Develop relationships is one of the main objectives of social networks (Albors, et al., 2008; Bonabeau, 2009; Leimeister, 2010; Ma & Yuen, 2011; T. W. Malone, et al., 2010; Vojnovic & Dipalantino, 2010) and appears at the empirical model as influences the communication within the group. Survey declarations and discussions clearly exposed this topic as important to empirical model.

Language pattern (T. Coenen, 2006; Fayard & DeSanctis, 2005; Kozinets, 2010) was noticed at analysis content of discussions as important to be present at empirical model, even if a difficult language pattern was not detected.

What appeared was an informal greeting and simple writing message, and this must be somehow considered when a member wants to post a discussion.

User profile appears at empirical model as it influences the discussions and replies. Malone (2010; 2009) stated that fame and peers recognition influences the contributions at groups.

This is linked with the “most active members features” at the LinkedIn group, is something some members may look for, to see their profile featured at that section.

Content organization (T. Coenen, 2006) seems to be an important tool to be present at an on line group, as some members at survey mentioned they search through archives to look for previous posts. However, it does not influence answers and communication.

Clear messages and posts (T. Coenen, 2006; Q. Jones, et al., 2004) was considered a pattern the clear, simple and objective communication at this specific group studied. The messages with replies were built with clear questions and affirmations.

The **overload** of messages (T. Coenen, 2006; Q. Jones, et al., 2004) does not appear at empirical model. The studied group had medium 6.2 messages per day and during the month of collected data, it had not great variation on that, so

it could not be proved that the increase of posts would influence the communication within the group.

One component, not proposed at the literature review model, emerged from data analysis and survey answers.

This emerging component is a **spam filter**, provided by the **groups system**, enabled by **members**, to classify the **posted and shared information**, as spams and advertising not related with the group's objectives, in order to ensure effectiveness of discussions.

Regarding the research questions, they were responded, and complimentary study is proposed in order to solidify the model filling the research limitations detected.

1) How knowledge is created and shared in a discussion group associated with a social network?

The proposed empirical model suggests the basics components an online group should contain to enable knowledge creation through discussions and the sharing of knowledge within.

Research and publications approaching this theme are numerous, and the usage of social network is still changing and evolving rapidly.

One question arises for future studies, regarding the usage of social network: *is there a general model that may be applied to all social networks in order to understand the creation of knowledge within?*

2) How the process evolves over time, within the same community?

The data collected for a period of a month, and on this period no variation of number of discussions or effectiveness of answers was detected. Maybe this

period is not enough to understand evolution of discussions, or even the influence of the age of the group at discussions, as Saur-Amaral & Rego (2011) proposed the need of understand the influence of maturity of online group regarding evaluation of discussions.

3) Are there specific forms of communication or appropriate behaviour that permits the discussion to generate effective answers for the proposed questions?

The components of proposed model appeared to be relevant to an online group dynamic, even though a weight should be applied on them, to develop one or more components over the others, according with the groups need and objectives, as Malone et.al. (2010) proposed at their Collective Intelligence Genome model.

7. Final considerations

Crowdsourcing initiatives and individuals' collaborations through social network are increasing and frequently seen nowadays. The crescent number of social networks, the wide area on internet and the numerous possibilities of accessing users and their contribution may confuse academy and organizations interested in identify patterns at this promising field.

Combined models that link a specific social network, users motivators to contribute, and appropriated system tools seems to be the success factor yet to be tested. The link between academy and organizations should now be closer than ever, since the speed of changes at Web 2.0.

What is unquestionable for organizations interested in applying crowdsourcing, is that this practice is no longer restricted to crowdsourcing platforms, it is happening all over social networks and it is an available low cost resource of knowledge, waiting for the proper management to be effective useful.

Bibliography

- Albors, J., Ramos, J. C., & Hervasa, J. L. (2008). New learning network paradigms: Communities of objectives, crowdsourcing, wikis and open source. *International Journal of Information Management*, 28(3), 194-202.
- Almeida, J. M., Goncalves, M. A., Figueiredo, F., Pinto, H., & Belem, F. (2010). On the Quality of Information for Web 2.0 Services. [Article]. *Ieee Internet Computing*, 14(6), 47-55.
- Bernoff, J., & Li, C. (2008). Marketing - Harnessing the power of the oh-so-social web. [Article]. *Mit Sloan Management Review*, 49(3), 36-+.
- Bollier, D. (2007). *The Rise Of Collective Intelligence: Decentralized Co-Creation of Value as a New Paradigm of Commerce and Culture* (Report). Washington: The Aspen Institute.
- Bonabeau, E. (2009). Decisions 2.0: The Power of Collective Intelligence. *Mit Sloan Management Review*, 50(2), 45-+.
- Bosse, T., & Treur, J. (2006). Formal interpretation and analysis of collective intelligence as individual intelligence. *Multi-Agent-Based Simulation VI*, 3891, 58-74.
- Boyd, D. M., & Ellison, N. B. (2008). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210-230.
- Brasoveanu, A., Nagy, M., Mateut-Petrisor, O., & Urziceanu, R. (2010). The Avatar in the Context of Intelligent Social Semantic Web. *International Journal of Computers Communications & Control*, 5(4), 477-482.
- Buckley, S., & Giannakopoulos, A. (2010). *Sharing Knowledge in a Knowledge City Using CoPs*. Nr Reading: Academic Conferences Ltd.
- Cheung, C. M. K., & Lee, M. K. O. (2010). A theoretical model of intentional social action in online social networks. *Decision Support Systems*, 49(1), 24-30.
- Coenen, T. (2006). *Knowledge sharing over social networking systems*. Vrije Universiteit Brussels, Brussels.
- Coenen, T., Kenis, D., Van Damme, C., & Matthys, E. (2006). Knowledge sharing over social networking systems: Architecture, usage patterns and their application. *On the Move to Meaningful Internet Systems 2006: OTM 2006 Workshops, Pt 1, Proceedings*, 4277, 189-198.
- Dahlander, L., Frederiksen, L., & Rullani, F. (2008). Online Communities and Open Innovation: Governance and Symbolic Value Creation. *Industry and Innovation*, 15(2), 115-123.
- Dahlander, L., & Magnusson, M. (2008). How do Firms Make Use of Open Source Communities? *Long Range Planning*, 41(6), 629-649.
- Dahlander, L., & Magnusson, M. G. (2005). Relationships between open source software companies and communities: Observations from Nordic firms. *Research Policy*, 34(4), 481-493.
- Downs, J. S., Holbrook, M. B., Sheng, S., & Cranor, L. F. (2010). Are Your Participants Gaming the System? Screening Mechanical Turk Workers. *Chi2010: Proceedings of the 28th Annual Chi Conference on Human Factors in Computing Systems, Vols 1-4*, 2399-2402
- 2641.
- Ebner, W., Leimeister, J. M., & Krcmar, H. (2009). Community engineering for innovations: the ideas competition as a method to nurture a virtual community for innovations. *R & D Management*, 39(4), 342-356.
- Ewalt, D. M. (2009, Nov). Low-Dose Capitalism. *Forbes* Retrieved 12/02/2011, 2011, from <http://www.forbes.com/forbes/2009/1102/thought-leaders-loans-poverty-low-does-capitalism.html>
- Fayard, A. L., & DeSanctis, G. (2005). Evolution of an online forum for knowledge management professionals: A language game analysis. [Article]. *Journal of Computer-Mediated Communication*, 10(4).
- Han, S. (2010). Theorizing New Media: Reflexivity, Knowledge, and the Web 2.0. *Sociological Inquiry*, 80(2), 200-213.
- Hart, C. (2006). *Doing a literature review: Releasing the social science research imagination*: Sage.
- Howe, J. (2006). The Rise of Crowdsourcing. Retrieved December, 26th, 2010, from <http://www.wired.com/wired/archive/14.06/crowds.html>
- Howe, J. (2008). *Crowdsourcing: Why the Power of the Crowd is Driving the Future of Business*. Lisboa: Actual Editora.
- Huberman, B. A., Romero, D. M., & Wu, F. (2009). Crowdsourcing, attention and productivity. *Journal of Information Science*, 35(6), 758-765.

- Hudson-Smith, A., Batty, M., Crooks, A., & Milton, R. (2009). Mapping for the Masses Accessing Web 2.0 Through Crowdsourcing. *Social Science Computer Review*, 27(4), 524-538.
- Jamali, S., Rangwala, H., & Ieee. (2009). *Digging Digg: Comment Mining, Popularity Prediction, and Social Network Analysis*. Los Alamitos: Ieee Computer Soc.
- Jashapara, A. (2004). *Knowledge Management: an Integrated Approach*: Pearson Education Limited.
- Jones, K. S. (2006). Collective intelligence: It's all in the numbers. *Ieee Intelligent Systems*, 21(3), 64-65.
- Jones, Q., Ravid, G., & Rafaeli, S. (2004). Information Overload and the Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration. *Info. Sys. Research*, 15(2), 194-210.
- Jouret, G. (2009). Inside Cisco's Search for the Next Big Idea. *Harvard Business Review*, 87(9), 43-+.
- Kane, G. C., Fichman, R. G., Gallagher, J., & Glaser, J. (2009). Community Relations 2.0. [Article]. *Harvard Business Review*, 87(11), 45-+.
- Kavanaugh, A., Reese, D. D., Carroll, J. M., & Rosson, M. B. (2003). *Weak ties in networked communities*. Dordrecht: Springer.
- Kho, N. D. (2006). iStockphoto stocks up on video. [News Item]. *Econtent*, 29(8), 12-12.
- Kiva.org. (2011). Retrieved 10/02/2011, 2011, from <http://www.kiva.org/>
- Kozinets, R. V. (2010). *Netnography. Doing Ethnographic Research Online*: Sage Publications Ltd.
- Lancieri, L., Bonnel, N. B., & Stumme, L. (2001). To exploit the collective intelligence thanks to the Co-operative replication. *2001 International Conferences on Info-Tech and Info-Net Proceedings, Conference a-G*, D186-D191.
- Leimeister, J. M. (2010). Collective Intelligence. *Business & Information Systems Engineering*, 2(4), 245-248.
- Leimeister, J. M., Huber, M., Bretschneider, U., & Krcmar, H. (2009). Leveraging Crowdsourcing: Activation-Supporting Components for IT-Based Ideas Competition. *Journal of Management Information Systems*, 26(1), 197-224.
- Lerman, K. (2009). Dynamics of a Collaborative Rating System. In H. Zhang, M. Spiliopoulou, B. Mobasher, C. L. Giles, A. McCallum, O. Nasraoui, J. Srivastava & J. Yen (Eds.), *Advances in Web Mining and Web Usage Analysis* (Vol. 5439, pp. 77-96). Berlin: Springer-Verlag Berlin.
- Levenshus, A. (2010). Online Relationship Management in a Presidential Campaign: A Case Study of the Obama Campaign's Management of Its Internet-Integrated Grassroots Effort. [Article]. *Journal of Public Relations Research*, 22(3), 313-335.
- Linkedin. (2011, November 3rd, 2011). Retrieved November 3rd, 2011, 2011
- Lipton, J. D. (2009). FROM DOMAIN NAMES TO VIDEO GAMES: THE RISE OF THE INTERNET IN PRESIDENTIAL POLITICS. [Article]. *Denver University Law Review*, 86, 693-708.
- Liu, Y., Huang, X. J., Ani, A. J., & Yu, X. H. (2008). Modeling and Predicting the Helpfulness of Online Reviews. In D. Gunopulos, F. Turini, C. Zaniolo, N. Ramakrishnan & X. D. Wu (Eds.), *Icdm 2008: Eighth Ieee International Conference on Data Mining, Proceedings* (pp. 443-452). Los Alamitos: Ieee Computer Soc.
- Luo, S. L., Xia, H. X., Yoshida, T., & Wang, Z. T. (2009). Toward collective intelligence of online communities: A primitive conceptual model. *Journal of Systems Science and Systems Engineering*, 18(2), 203-221.
- Lytras, M. D., Damiani, E., & Pablos, P. O. (Eds.). (2009). *Web 2.0 The Business Model* (1 ed.): Springer.
- Ma, W. W. K., & Yuen, A. H. K. (2011). Understanding online knowledge sharing: An interpersonal relationship perspective. *Computers & Education*, 56(1), 210-219.
- Makridakis, A., Athanasopoulos, E., Antonatos, S., Antoniadis, D., Ioannidis, S., & Markatos, E. P. (2010). Understanding the behavior of malicious applications in social networks. *Network, IEEE*, 24(5), 14-19.
- Malone, T. W., Laubacher, R., & Dellarocas, C. (2010). The Collective Intelligence Genome. *Mit Sloan Management Review*, 51(3), 21-+.
- Malone, T. W., Laubacher, R., & Dellarocas, C. N. (2009). Harnessing Crowds: Mapping the Genome of Collective Intelligence. *SSRN eLibrary*.
- MIT. Center of Collective Intelligence. (2011). Retrieved 3rd, January, 2010, from <http://cci.mit.edu/>
- Nguyen, N. T. (2008). Inconsistency of knowledge and collective intelligence. *Cybernetics and Systems*, 39(6), 542-562.
- Open Source Initiative. (2011). Retrieved December, 26th, 2010, from <http://www.opensource.org>
- Park, S. T., & Pennock, D. M. (2007). *Applying Collaborative Filtering Techniques to Movie Search for Better Ranking and Browsing*. New York: Assoc Computing Machinery.

- Rangwala, H., & Jamali, S. (2010). Defining a Coparticipation Network Using Comments on Digg. [Article]. *Ieee Intelligent Systems*, 25(4), 36-44.
- Rasmussen, S., Mangalagiu, D., Ziock, H., Bollen, J., Keating, G., & Ieee. (2006). Collective intelligence for decision support in very large stakeholder networks: The future US energy system. *2007 Ieee Symposium on Artificial Life*, 468-475.
- Saur-Amaral, I. (2011). Towards a Methodology for Literature Reviews in Social Sciences.
- Saur-Amaral, I., Nugroho, Y., & Rego, A. (2011). Innov@tion Intelligence: Advances in Understanding Knowledge Sourcing in Social Networks.
- Saur-Amaral, I., & Rego, A. (2010). Innovation intelligence: crowdsourcing in a social network. *International Journal of Technology Intelligence and Planning*, 6(3), 288-299.
- Saur-Amaral, I. N., I. ; Rego, A. (2010). Innov@tion Intelligence: Advances in Understanding Knowledge Sourcing in Social Networks.
- Scarlat, E., & Maries, I. (2009). INCREASING COLLECTIVE INTELLIGENCE WITHIN ORGANIZATIONS BASED ON TRUST AND REPUTATION MODELS. *Economic Computation and Economic Cybernetics Studies and Research*, 43(2), 61-72.
- Shu, W., Chuang, Y. H., & Lin, C. S. (2009a). Knowledge Sharing Investigation in Social Networks. *Proceedings of the Eighth International Conference on Information and Management Sciences*, 8, 67-77.
- Shu, W., Chuang, Y. H., & Lin, C. S. (2009b). Knowledge Sharing with Online Social Networks. *Proceedings of the 10th European Conference on Knowledge Management , Vols 1 and 2*, 802-811.
- Singh, V. K., Gupta, A. K., & Ieee. (2009a). Agent Based Models of Social Systems and Collective Intelligence. *Iama: 2009 International Conference on Intelligent Agent & Multi-Agent Systems*, 51-57.
- Singh, V. K., Gupta, A. K., & Ieee. (2009b). From Artificial To Collective Intelligence: Perspectives and Implications. *Saci: 2009 5th International Symposium on Applied Computational Intelligence and Informatics*, 535-539.
- Skopik, F., Schall, D., & Dustdar, S. (2010). Modeling and mining of dynamic trust in complex service-oriented systems. *Information Systems*, 35(7), 735-757.
- Solachidis, V., Mylonas, P., Geyer-Schulz, A., Hoser, B., Chapman, S., Ciravegna, F., et al. (2010). Collective Intelligence Generation from User Contributed Content. *Advances in Data Analysis, Data Handling and Business Intelligence*, 765-774.
- Szuba, T. (2002). Universal formal model of collective intelligence and its IQ measure. *From Theory to Practice in Multi-Agent Systems*, 2296, 303-312.
- Szuba, T., & Szpyrka, M. (2004). Theory of Collective Intelligence provides formal relations between intelligence, life, and evolution. *Intelligent Information Processing and Web Mining*, 151-160.
- Tapscott, D. W., A. (2008). *Wikinomics: How Mass Collaboration Changes Everything*. London: Atlantic Books.
- Thayer, A. (2001). Lilly launches challenging site - InnoCentive seeks to lure researchers into solving posted chemical problems. *Chemical & Engineering News*, 79(27), 7-7.
- Thayer, A. M. (2006). Innocentive opens research doors. *Chemical & Engineering News*, 84(26), 24-25.
- Thurzo, A., Stanko, P., Urbanova, W., Lysy, J., Suchancova, B., Makovnik, M., et al. (2010). The WEB 2.0 induced paradigm shift in the e-learning and the role of crowdsourcing in dental education. *Bratislava Medical Journal-Bratislavske Lekarske Listy*, 111(3), 168-175.
- Vojnovic, M., & Dipalantino, D. D. (2010). Patent Number: US2010293026-A1. Microsoft Corporation Report Patent.
- Vukovic, M. (2009). *Crowdsourcing for Enterprises*. New York: Ieee.
- Yang, J., Adamic, L. A., & Ackerman, M. S. (2008). Crowdsourcing and Knowledge Sharing: Strategic User Behavior on Taskcn. *Ec'08: Proceedings of the 2008 Acm Conference on Electronic Commerce*, 246-255.
- Yuan, W. Y., Chen, Y., Wang, R., & Du, Z. C. (2008). Collective intelligence in knowledge management. *Research and Practical Issues of Enterprise Information Systems II, Vol 1*, 254, 651-655.
- Zaccaro, S. J. (1996). Collective intelligence in computer-based collaboration - Smith,JB. *Contemporary Psychology*, 41(11), 1102-1103.
- Zettsu, K., & Kiyoki, Y. (2006). Towards knowledge management based on harnessing collective intelligence on the web. *Managing Knowledge in a World of Networks, Proceedings*, 4248, 350-357.