

Organizational Memory: the role of Business Intelligence to leverage the application of collective knowledge

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ABSTRACT

Nowadays, the major challenge to organizations managers is that they must make appropriate decisions in a turbulent environment while it is hard to recognize whether information is good or bad, because actions resulting from wrong decisions may place the organization at risk of survive. That is why organizations managers try to avoid making wrong decisions.

In order to improve this, managers should use collective knowledge and experiences shared through Organizational Memory (OM) effectively to reduce the rate of unsuccessful decision making. In this sense, Business Intelligence (BI) tools allow managers to improve the effectiveness of decision making and problem solving.

In the light of these motivations, the aim of this chapter is to comprehend the role of BI systems in supporting OM effectively in real context of crowdsourcing academic initiative called CrowdUM.

INTRODUCTION

Managers are facing a huge challenge of making right decisions in face of turbulent social and economic conditions. Sudden changes in markets, together with the production of big amounts of information inside and outside the organization, make the task of selecting and evaluating information quality hard.

Nevertheless, decisions have to be made and the resulting actions will lead the organization to be in a thriving or declining market position (Barrows and Neely, 2012; The Economist, 2009).

Walsh and Ungson (1991) have proposed one of the first models to conceptualize how knowledge that supports organizational decisions is created and shared. According to these researchers, knowledge is stored in organizational bins forming a shared memory called Organizational Memory (OM). The model focuses on locations and contents. Information for decision-making is then stored as:

- (1) experience in individuals;
- (2) shared experience in culture;
- (3) integrated sets of practices guiding transformation of inputs into outputs;
- (4) structural configurations connecting formal roles played by individuals; and
- (5) physical arrangements of workplace.

These bins, together with information stored in computer-based repositories, shape the kind of decisions organizational agents can make.

OM concept has evolved to account the distributed and reconstructive characteristics of shared memories. Morgeson and Hofmann (1999) proposed a functional view of OM in which the structure of OM evolves by continued interactions between organization members supported by memory artifacts. OM structure is usually linked with interactions, roles, tools, units of memory (individuals and groups), forming a web of resources, processes and connections able to hold past experience and bring it to present organizational activities. Organizational interactions are embedded in processes of probing and sense-making that result in recall past experiences. To support them, OM must display certain functions including:

- (1) adaptation;
- (2) goal attainment;
- (3) integration; and
- (4) pattern maintenance.

Other authors have worked the integrative albeit distributed nature of OM (Kruse, 2003; Feldman and Feldman, 2006; Rowlinson et al, 2010; Schwarz, 2007). This social constructionist view of OM addresses the subjective experience of remembering. The view posits that humans and organizations reconstruct past experience from records and recreate it to deal effectively with present conditions that may be very different from past events. This is not seen as a problem to be avoided but as a core characteristic that enables development of creative solutions for new problems.

OM is the root of collective intelligence (Malone et al, 2010). Collective intelligence in organizations represents: process that will articulate and optimize individual performance (the source of expertise and agents who convey the mission); formal and informal networks; methods of communication; norms; and cultural artifacts. Organizational intelligence is the collective ability to mobilize knowledge of organizational interior and environment to create and make favorable decisions as well as to promote innovation (Boder, 2006).

In this context, Information Systems appear as connectors and supporters of the meaning processors in organizations (humans) operating in specific cultural and political contexts (Stein and Zwass, 1995; Cegarra-Navarro and Sánchez-Polo, 2011).

Business Intelligence (BI) is one of the technologies developed to help decision makers elicit meaning from huge amounts of information to which they have access. BI is an architectural, managerial concept and a set of tools that allow creation and maintenance of a large database, retrieval of information, and the use of information to make effective decisions (Timothy et al, 2009; Turban et al, 2010; Chaudhuri et al, 2011).

This chapter focuses on the role of BI systems to support OM and is an attempt to answer the following question: Can BI systems improve OM to achieve Organizational Intelligence?

To answer this question, this chapter will be structured into three sections:

- section I – presents concepts about OM and OM Information Systems (OMIS);
- section II – describe concepts about BI, BI for OMIS, and BI architecture to support OM / OMIS; and
- section III – presents a description of integration BI with OM in a real context initiative of crowdsourcing called CrowdUM.

Finally, conclusions are presented.

SECTION I

ORGANIZATIONAL MEMORY

OM concept has been developed for several decades, with contributions from various disciplines, such as Psychology, Sociology, Organizational Behavior and Information Systems (Argote, 2013; Casey and Olivera, 2011; Hodgkinson and Healey, 2008). The objective of this section is to describe this evolution and relating it to the evolution on conceptualizations of OMIS.

OM concept emerged out of the notion that organizations need to use past and present knowledge in collective and individual decisions and actions, and also to do projections to future. To do this, organizations need to preserve present knowledge and to identify gaps that must be addressed through learning (Kransdorff, 1998).

One of the first widely accepted OM conceptualizations is described in Walsh and Ungson's (1991) model. Their model synthesizes many of the previous scientific insights developed about how organizations store and retrieve knowledge. OM is viewed as an aggregate of information useful for decision-making and is stored in organizational bins. This is, therefore, a static conception of shared memory that focuses on locations and contents. Information for decision-making is then stored as: experience in individuals; shared experience in culture; integrated sets of practices guiding transformation of inputs into outputs; structural configurations connecting formal roles played by individuals; and physical arrangements of the workplace. The goal of the Walsh and Ungson's model is to present a comprehensive conceptualization of OM together with guidelines for developing empirical research.

The Walsh and Ungson's model came to support the research efforts in Information Systems field (Nevo and Wand, 2005). The basic idea is that information technology can be used to create a uniform, complete, consistent, up-to-date and integrated pool of knowledge that can then be made available for decision processes at all levels of the organization, this is denominated OMIS.

OMIS started as large databases of complex information and have evolved to more distributed systems developed according the principles of Transactive Memory Systems (TMS) (Brandon and Holligshead, 2004; Lewis et al, 2005; Lewis and Herndon, 2011). In this latter approach, Information Systems is a tool to link repositories of information to individuals seen as repositories of knowledge, and in this way interconnecting distributed repositories across an organization into an integrated memory system. TMS focus structural aspects of OM and ignores cultural and political dimensions of OM. In both approaches, OMIS are extensions of human abilities to capture, represent, communicate and maintain knowledge. OMIS is a framework to define processes of acquisition, retention, maintenance, and search & retrieval knowledge in a faster and more accurate way.

Recognizing limitations of static view of OM that the described approaches endorse, the concept has progressed to include dynamic features. Morgeson and Hofmann (1999) proposed that the structure of OM is defined by continued interactions between members of an organization, supported by memory artifacts. The OM structure is usually linked with interactions, roles, tools, units of memory (individuals and groups), forming a web of resources, processes and connections able to hold past experience and bring it to present organizational activities. The organizational interactions are embedded in processes of probing and sense making that result in the recall of past experience. To support them, OM must display certain functions including: adaptation, goal attainment, integration, and pattern maintenance. This view of OM as having structures and functions, brings in the notion that OM should be seen as a process that enacts memory contents distributed inside and even outside organizational environment. This view is an extension to OMIS concepts and frameworks. The focus is no longer on storing and retrieving

large amounts of information but also on supporting interactions, making them easier as well as informing and supporting by automatic feedback.

Authors working in this more recent view of OM tend to focus on political, communicative, and cultural dimensions of the organizational remembering, as well as the (re)constructive activities by which organizational members give rise to organizational identity (Hirst and Manier, 2008). OM is conceptualized as being present in all activities of the organization and with different levels of influence (Assmann and Czaplicka, 1995; Barnier et al, 2008; Hirst and Manier, 2008; Ricoeur, 2004; Halbwachs, 1992). It integrates resources, practices and technologies that are necessary for organizational actors to understand their activities, the business that renders those activities meaningful and the organization's role in markets where it operates. The process of remembering becomes more important than the content handled in this process.

OMIS are required to retrieve structured and non-structured data, processing it into meaningful ways to the user and bring the results in highly readable formats such as data visualizations. OMIS should support the quick understanding of situations, promote the construction of scenarios, enable integration of different users' manipulations and contributions, all of this to support collective intelligence required to solve complex problems and develop innovative practices (Malone et al, 2010).

SECTION II

INTEGRATION OF BUSINESS INTELLIGENCE WITH ORGANIZATIONAL MEMORY

The term BI was firstly used by Luhn (1958). Dresner of the Gartner Group in 1989 coined and promoted a definition of BI as an umbrella term to describe concepts and methods to improve business decision making by using fact-based support systems (Power, 2007).

BI functions focus mainly on using intelligent information technology tools to support organizational members to making better and faster decisions (Cody et al, 2002). The purpose of these systems is to improve the availability and quality of complex information for decision including strategic decision.

BI tools not only enable managing a large amount of documents within multidimensional views over extended time-frames, e.g., Extraction, Transforming and Loading (ETL), Data Warehousing (DW), Online Analytical Processing (OLAP) cubes, but also facilitate searching and sharing past information among organizational members to support solving new problems or tasks using OLAP and Query-by-Example (QbE) tools and discovering knowledge by analyzing data from different perspectives and summarizing it into useful information by using Data Mining (DM) algorithms. BI tools support the creation of insightful information from stored data. In this way BI tools improve the ability of an organization to remember its past and make sense of its future. This is the main role of memory, namely the OM.

Using DM algorithms such as classifier and clustering DM algorithms, organizational members may function as meaning "processors" of organizational network intelligence. This presents a high potential of classification and mapping suitable information (e.g., documents, projects, comments, feedback) into relevant groups and participants inside organization, for example by using DM's classifier algorithms an organization can provide intelligent solutions for finding and mapping relevant information to suitable users. Users can then integrate that information with their personal information and their past behaviors that have been captured from social network (e.g., Facebook or Twitter) in order to create a deep understanding of how knowledge is created inside organization and how its members nurture internal and external relations.

The BI system can play an important role in supporting a large scale OM functions, which spread from knowledge Acquisition, Retention and Maintenance functions to Search & Retrieval functions. It should be noted that when mentioning the role of BI tools, we are referring the process of storing information, the production of more complex information for decision support and the monitoring of changes in stored information.

Information is the foundation of knowledge creation and Humans when working in organizations produce organizational knowledge with the goal to share it and institutionalize it in organizational routines. OM emerges from this continuous interplay between information and knowledge enabled by using technological tools that mediate action, interaction, co-creation of meaning and decision making in organizations. From this point on, all of those technological tools will be called OMIS and OMIS includes BI tools.

The architecture model, see Figure 1, which is called the BI to OMIS integrated model, is a combination of relevant tools of BI system envisaged as an OMIS component in order to support OM by improving knowledge sharing and effective decision making.

Figure 1 – Framework BI to OMIS Integrated model

The main BI tools that are used in this proposal will be classified into four layers. These layers correspond to the four main functions of the mnemonic layer of OMIS framework. Consequently, the descriptions about BI tools for each layer of the BI to OMIS integrated model will be described as follow:

- **Acquisition Layer** plays an important role in capturing and adapting data as well as information from many resources within OM. There are two tools to enhance acquisition: **Web Crawler** - collects data from web sources such as forums, web sites, online services, etc. Hence, web crawler is an appropriate tool to integrate web data and search relevant information about competitors, customers' trend, and markets segment; **ETL** - extracts, transforms, and loads data from many data sources and classifies, normalizes, and loads data into an organizational repository (e.g., Operational Data Store, DW, data mart) based on defined structures (e.g., meta-data, ontology structures).
- **Retention Layer**, this layer has the responsibility of managing the capability of organizational repository. Thus, this layer mainly focuses on database tools. Moreover, one of the main problems of retention is to store a large historical data over many years. DW and Data Mart are compatible repositories to manage organizational historical data.
- **Maintenance Layer**, in this layer, BI tools will be adapted to enhance, analysis, and classification of stored data, which are stored in organizational repositories such as DW. Like a metaphor of intelligent engine for BI to OMIS integrated model, this layer includes five components of BI system to help the maintenance of information and knowledge in an effective way: **OLAP server** - this allows users to interact with DW. Consequently, information might be filtered, aggregated, and drill-down through multidimensional views. This also allows users to reorganize and calculate massive historical data quickly based on OLAP cubes functions. Users could use OLAP cubes to create their own star schema in various dimensions to speed up the retrieval and query processing from large amounts of data stored in OMIS. **Ranking engine** - this is a database tool to enhance search engine retrieval performance (Fan et al, 2005). Through the ranking function research, authors concluded that "the retrieval performance of these newly discovered ranking functions has been found to be superior to the performance obtained by well-known ranking strategies in the information retrieval literature". In general, the ranking in BI-OMIS system can be assessed by all members of an organization to refine the usefulness of past information stored in the OMIS. **Search engine** - this function supports employees to search

past knowledge. Based on structured data stored in knowledge repositories such as: email searching, document searching, task searching, and best practices finding. Moreover, this function also allows users to retrieve history of data modified via the time line of the document. Thus, this is an effective method to help users to retrieve past knowledge throughout highlight new updated contents, as well as identifying who performed the document. **Reporting server** - provides suitable mechanisms that enable definition, efficient execution and rendering of reports (Chaudhuri et al, 2011). Allows managers to export information from an OLAP cube in dynamic forms or templates, which will facilitate operations of managers in creating, modifying, and presenting a number of reports such as balance sheet, product reviews, or annual financial report without requiring extensive database knowledge. **Data Mining and Text Mining engine** – enable to analyze complex and unstructured problems such as classification, knowledge learning, problem solving, heuristics, etc. Mining methods use algorithms to deduce and propose new knowledge beyond what were saved in DW and OLAP. In addition, data mining engines provide ability for OMIS to forecast new knowledge relies on intensive analysis and synthesis historical data. Text analytic engines helps understand large amounts of text-data contained in organization's documents like business contracts, customer information, annual reports, customer reports, etc. Most popular functions of text mining are to (Turban et al, 2010, p. 289):

- information extraction - identifying key phrases and relationships of text;
 - topic tracking - predicting relevant documents based on user's profile;
 - summarization - proposing the main content;
 - categorization;
 - clustering - grouping similar documents;
 - concept linking; and
 - question answering.
- **Search and Retrieval Layer**, this layer is composed by user interface methods to create an interactive channel. User can operate with all functions in the third layer of the BI-OMIS model via these components. This layer includes the following tools: **Knowledge searching**- this improves the basic search by using e.g., rules and case based reasoning. It gives to the user a friendly interface with search fields and conditions to help users find out the most appropriate information for solving problems. **Spreadsheet** – this is still a useful environment for users to manipulate analytic data (OLAP) and allow users to retrieve data quickly from various dimensions and present it in a drill-down view. **Dashboard** - gives a graphical interface for indicating Key Performance Indicators (KPI's) for OMIS. In addition, dashboard enables decision makers to keep track of the current status of organizational environment with a simple visual view.

SECTION III

BI WITH OM IN A CROWDSOURCING INITIATIVE: CROUDUM

In recent decades, internet gradually is becoming the organization's backbone, not only connects people closely throughout time and locations, but also keeps our workers up to date by immediately sharing their own information.

With the main objective to use internet advantages, appears the idea to connect online community of people, denominated a crowd network, with requesters of services, ideas, or contents in the purpose to enhance the working performance, as well as gaining more profits for participants in the crowd.

The term 'crowdsourcing' is derived from the business area to indicate the process of connecting a large crowd together via internet, then allows seekers to address large projects by using crowd's creativity and talent. For this reason, these projects usually require a large amount of people who have a moderate ability such as students, normal employees, or local residents all over the world.

In a definition, Howe (2006) concluded that "crowdsourcing is the act of taking a job traditionally performed by a designated agent and outsourcing it to an undefined, generally large group of people in the form of an open call". This definition focuses on discriminating traditional job from the crowdsourcing. The author emphasized the role of large groups in selecting jobs through the open call instead of dealing with specific customer directly. As a result, crowdsourcing could create solutions more quickly and cheaply than traditional methods.

Throughout the evolving time of crowdsourcing as well as based on the purpose of each crowdsourcing group, the crowd is often classified into six categories (Bell, 2009; Brabham, 2013) as follows (examples presented are better explained at Additional Reading Section):

- **Crowd wisdom:** crowd wisdom focuses on collecting innovations via asking the crowd, inside and also outside the company, to solve problems, forecast future, or propose a strategy for a specific environment. Then, the best solution is selected. In this way, simExchange, Iowa Elections Market, and Hollywood Stock Exchange are examples of crowd wisdom.
- **Crowd creation:** crowd creation has a little bit difference from crowd wisdom. In this purpose the crowd and requester have to work together to co-create new information/knowledge. For example: NASA's Clickworkers and InnoCentive.
- **Crowd Voting:** voting is a method of inquiry opinions of the crowd to collect their ideologies about designs, campaigns, and trends of a product, technology or something else. The result supports company to modify products before they turn to bulk production. For example: American Idol and Threadless T-shirt company.
- **Crowd Funding:** the crowd funding main objective is to aggregate a group of shareholders, who will build up the funding of projects or creation of assets. The outcome and responsibility of the crowd in this type of crowdsourcing is higher and more important than other types of crowdsourcing. For example: Kiva and Sellaband companies.
- **Crowd Democracy:** this kind of crowd mainly focuses on participants who give decisions of local, regional and national governments.
- **Crowd Review:** crowd review pays attention to available objects such as products, services, or events from requesters (e.g., companies or manufacturers). The crowd shares reviewers' information about their activities while using it, for example: while visiting a monument, while eating at a restaurant, while watching a film, or while trying a service. These reviews then support companies in having a better understanding about the quality of their products.

Crowdsourcing has advantages in various areas based on the potential of crowd that could reduce the cost and time in solving problems. On the other hand, the crowdsourcing shows several pitfalls that prevent the expansion of crowdsourcing:

- (1) managing a large scale of crowd in order to ensure a big participation of wide variety of experiences coming from jobs, cognitive styles, contact networks, etc.;
- (2) assessing a large numbers of results/solutions returned from the crowd;
- (3) ensuring high quality of work; and
- (4) fostering cooperation among crowd members to solve projects.

To make clear the features of crowdsourcing in a real context, figure 2 indicates the use-case diagram of CrowdUM that relies on the fundamental structure of crowdsourcing. In general, CrowdUM plays a main role in the crowdsourcing model as a brokering service or intermediary. CrowdUM is designed for organizations (the seeker) such as companies, personals, or agencies that have ideas, problems, and requirements that need to be accomplished through simple but creative activities. The crowd (the solver) are able to gain experience, create knowledge and become more entrepreneurial, they are almost the current students and former students of University of Minho. Moreover, this is a dynamic group that could propose more creativeness's in exploring solutions regardless their nominal cost. The third component in CrowdUM appears as a service broker (the intermediary). The intermediary pays attention to finding requirements from seekers, and then spreading them to appropriate solvers. For more detail, figure 3 represents the main functions of crowdsourcing initiative in the form of action diagram to help us comprehend CrowdUM's process. The initiative aims to promote an approximation of entrepreneurs, and potential employers, to academic environment in order to foment a better understanding of skills that students in various disciplines are developing; it also aims to constitute itself as a learning tool in that it favors the development of students' knowledge and skills by solving challenges for real organizations.

Figure 2 – The CrowdUM use-case diagram.

Figure 3 – The CroudUM active diagram.

With the aim to creating intellectual assets and providing creative solutions to existing problems, CrowdUM allows seekers and solvers access to a wide range of skills and collective knowledge via web base platform as an intermediary. Moreover, CrowdUM is a tool for innovation, which if used properly can generate new ideas, reduce time to research and develop projects, lower costs and create direct relationships between seekers and solvers. This phenomenon arose from the perception that many small contributions linked together are more relevant and effective than a single large contribution.

The process execution of CrowdUM is modelled by a workflow diagram. At the beginning, the seeker describes project's requirements with time-limit and budget for the challenge and awaits solutions from solvers. All information is sent by email to every solver registered on CrowdUM. The challenge will be available on CrowdUM for a defined period of time. When a solver chooses a challenge, the solution can be submitted to CrowdUM website from anywhere and anytime. Meanwhile, seekers are available to give indications in order to help solvers to improve quality of final product. The crowd (seekers and solvers) rate and choose the best solutions. Finally, the best solution is selected from all solvers submissions. The best solution owner, the solver, will receive incentives. The major incentive would be a social recognition given by other contributors (the crowd). See figure 4.

Figure 4 – CroudUM workflow model.

With maturation of project scale and the increase of the crowd size over time, CrowdUM showed a lack of an effective management approach to:

- (1) help crowd to be notified of new projects more intelligently based on crowd members' hobbies;
- (2) enhance quality of solutions; and
- (3) manage more effectively projects, solutions, documents, and also business of CrowdUM.

To solve these issues and with incorporation of BI tools to support OM, six useful aspects in this solution arise:

- using BI enables CrowdUM to manage guides, documents, and relevant information produced in the context of continuous interactions among crowd members and between members and the initiative; BI also supports users to share their knowledge with other members. This helps crowd

members to use past knowledge for solving new problems. To develop this feature, ETL will extract and load data and documents content from the CrowdUM database into DW at scheduled time, next the DW and OLAP cubes play a significant role to classifying documents in various dimensions, for example: Time, Geography, Project, Customer (seeker), Problem, Solution, Document and Crowd. These dimensions facilitate users to navigate in the cube, i.e., slice and dice, roll-up, drill-down, etc.

- finally crowd members could find relevant documents via dynamic interface of the QbE system to select desirable dimensions, which are based on their demands and priorities. QbE system gives users an ability to search documents by defining filters, for example: Type - 'Urgent', Category - 'Web sites', and Status - 'Finish'. Results could be grouped, for example by Geography dimension as Country or City. Users can save the query result in order to share with other crowd members.
- Using DM to classify the crowd enables supporting the intermediary (CrowdUM Managers) to find a better awareness about user's skills and allows finding the right members in the crowd by classifying user's groups, who have maximum similarity based on their personal information and their usage behaviors. After this is done, appropriate jobs/tasks are sent to suitable groups automatically. BI to OMIS system enables CrowdUM system to comprehend user's demand more accurately by spreading new projects from customers to proper crowd members. Moreover this feature will reduce irrelevant rate of invitation's letter which are automatically send to subscribers when a new project appears.
- Supporting seekers to find the most feasible solution. BI to OMIS support decision in refining the large amount of solutions provided by crowd by improving user's ranking and comment classification. User's ranking focuses on the number of votes from crowd members at each solution. The comment classification is developed from the DM classify functions (e.g., J48 Decision Trees, Naïve Bayes, Support Vector Machines, among others), that classifies comments in each solution into two classes as good assessment and bad assessment, allowing seekers to quickly recognizing the value of the solution based on its good and bad rating. In this way, seekers can reduce cost and time associated with developing a solution and help improving quality of the solutions offered by crowd.
- Members (newbies or not) needed a direct inquiry for special information or difficult issues that are not supported in OMIS. To solve this issue is relevant classify the category of feedback by identifying who do feedback (e.g, supervisors, masters, older workers, etc.) and send answers to members. The role of BI-OMIS system is to classify messages from users and then create a direct connection between members with older CrowdUM workers, who have an important historical knowledge for decision-making support by using DM classify functions.
- Putting in place effective incentive mechanism by using Dashboard component of BI to OMIS model to update the list of best crowd members in each category, i.e., frequent participation and raking by number of award-winning solutions. Incentive mechanisms will promote excellence and encourage members to engage in further projects; incentives also increase motivation for new members to participate in projects. Dashboard component manage several KPI's:
 - Revenue indicator shows the total revenue per year;
 - CrowdUM Status indicator allows managers see the number of documents in CrowdUM's OMIS, total current problems, answers, projects, and crowd members;
 - Incentive mechanism relies on two next indicators to show the most dynamic solvers, and also the most valuable seekers in the CrowdUM. In that, the first indicator shows top five crowd solvers with decrease sort order on their total revenue. And the second indicator shows top five companies (knew as seekers) by their highest payment to CrowdUM. By this way, CrowdUM's managers could put in place effective incentive mechanisms with solvers as well with seekers;

- Managing project's status is the last feature of the OMIS dynamic dashboard. Via three indicators, status of project is presented in three types for instances: (1) total finished project indicates managers how many projects were finished successful, the KPI fluctuate from high to low value of total finished projects. (2) Besides, the total failure project indicates unsuccessful risk of CrowdUM's projects, the value fluctuate from safe to risk value. Risk value indicates there are some urgent problems that need to be fixed right away. (3) Finally, the total ongoing project indicates the number of projects that ending soon.
- Using web platform to support and manage a large scale of crowd members from various places and time. Web platform was connected with a group created on Facebook, through an application designed for this purpose. Therefore it was possible to automatically collect information about members of the crowd registered on Facebook, if they permitted. This information was then used to redirect e-mail alerts to members of the crowd with interests close to those needed to solve a new challenge. By this way, CrowdUM can use a huge resource from social network (Facebook) to collect users' information like hobbies, introduce the concepts for newbies and facilitate sharing the CrowdUM concept through the social network friends via various methods (e.g., posting on user's wall, sending message, sending invitation, etc.), and finally encourage them to be registered at CrowdUM.

The platform was tested for 3 months. Solvers were asked to help the study by answering real and fake tasks (micro-tasks). This enabled to increase online activity and interaction. Information automatically gathered was then analyzed to determine how solvers interacted with each other and what pages were most seen.

Although the initiative is still in its infancy and tools described above are only now beginning to be used, it is possible to verify that the solvers can establish contacts with colleagues from other disciplines more easily by identifying challenges. It also became easier to call solver's attention to new challenges and seekers are now more aware of job profiles that are being developed in several areas of the university.

Future Research Directions

A better integration of Data Warehouse and Data Mining technologies is needed to empower the retention and retrieval features of OMIS. Data Warehouse was used to save documents' information, meanwhile Data Mining was used to classify and link relevant documents together via classification functions. A solution could be a semantic web definition to enable a creation of a large network space of linked documents that keeps track the relationship between documents throughout multidimensional views of Data Warehouse (e.g., geographic, key terms, categories, or time dimension). With this purpose, OMIS will allow users to easily expand search results with nearby documents on different dimensions, which will be adapted from visual graphic interface of semantic web tool. Besides, documents' correlation coefficient will be analyzed by Data Mining functions to decide the relationship between one document and others' documents.

A first study to evaluate the effectiveness of the proposed framework to understand the role of BI tools to improve OMIS was made by integrating those tools in the crowdUM initiative web platform. Some improvements in the crowd and seekers knowledge and decision were detected. However further studies are required to explore how BI tools can be used to improve collective and distributed functions of OMIS.

Conclusion

This chapter proposed a conceptualization of BI tools as components of an OMIS. OMIS is seen as a broader concept which assumes that the computer-based systems of an organization have an inherent role in support organizational memory. Organizational memory emerges from interactions needed to accomplish organization's mission. This collective and distributed memory holds the memory functions of acquisition, retention, maintenance and retrieval of organizational knowledge. Although organizational memory exists because of individuals that constitute the organization, it transcends and expands individual memories and persists after individuals leave.

In this chapter it is assumed that knowledge is created by Humans and requires the existence of information, namely the one that is transmitted in dialogues. It was also assumed that too much information inhibits knowledge creation since Humans have limited capabilities of information processing. BI tools expand this capacity by pre-processing information in a way that makes the resulting information closer to the needs of knowledge creation which support organizations' intelligence. OMIS that integrate also BI tools holds functions of Information Acquisition, Retention, Maintenance and Retrieval. BI tools enhance in particular functions of information acquisition and retrieval. BI play an important role in supporting OM by automatically collecting and updating knowledge, identifying the useful information for decision making, and thus providing an effective support to OM.

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ADDITIONAL READING SECTION

- American Idol - the public (the crown) votes to elect the best artist, there are three applications to support community: Idol Nation, Idol Nation Fan Wall with forums, polls, social all-stars, social scene, and finally Forums with a lot of topics been discussed (AmericanIdol, 2013).
- Clik Workers - NASA Clickworkers was developed to help scientists and researchers build an extensive database of landforms from data captured by Mars Reconnaissance Orbiter's (MRO) High Resolution Science Experiment (HiRISE). It began as a pilot study in 2000 to determine whether or not online volunteers would be interested in contributing, and if they could produce good data that can be used to answer interesting science questions. As a clickworker you will learn about various landforms on Mars (and on Earth), how they are formed, and what scientists can learn from them. You can experience firsthand what it's like to be an active participant in the scientific process (ClikWorkers, 2012).
- Hollywood Stock Exchange® (HSX®) – HSX is the world's leading entertainment stock market. At HSX, visitors buy and sell virtual shares of celebrities and movies with a currency called the Hollywood Dollar®. The Company's Virtual Specialist® technology allows an unlimited number of consumers to trade thousands of virtual entertainment securities in a fair and orderly, supply and demand based market. HSX syndicates the data collected from the Exchange as market research to entertainment, consumer product and financial institutions and as original content to radio, television and print media. HSX was founded in 1996 (HSX, 2012).
- Iowa Electronic Markets (IEM) - IEM are operated by faculty at University of Iowa Henry B. Tippie College of Business as part of researching and teaching mission. These markets are small-scale, real-money futures markets where contract payoffs depend on economic and political events such as elections. It intends to use markets in classes as a pedagogical tool by gaining experience with real-world markets. As a research tool, the markets provide an unparalleled laboratory in which study individual trading behavior as well as market level performance (IEM, 2012).
- InnoCentive - InnoCentive is the global leader in crowdsourcing innovation problems to the world's smartest people who compete to provide ideas and solutions to important business, social, policy, scientific, and technical challenges. Using a global network of millions of problem solvers, proven challenge methodology, and cloud-based innovation management platform combine to help clients transform their economics of innovation through rapid solution delivery and the development of sustainable open innovation programs. For more than a decade, leading organizations such as AARP

Foundation, Air Force Research Labs, Booz Allen Hamilton, Cleveland Clinic, Eli Lilly & Company, EMC Corporation, NASA, Nature Publishing Group, Procter & Gamble, Scientific American, Syngenta, The Economist, Thomson Reuters, and several government agencies in the U.S. and Europe have partnered with InnoCentive to rapidly generate innovative new ideas and solve problems faster, more cost effectively, and with less risk than ever before (InnoCentive, 2012).

Kiva - Kiva is a non-profit organization with a mission to connect people through lending to alleviate poverty. Leveraging the internet and a worldwide network of microfinance institutions, Kiva lets individuals lend as little as \$25 to help create opportunity around the world. All 100% of every dollar lend on Kiva goes directly towards funding loans. The Kiva process has four following steps. Step 1: Make a loan on Kiva. Step 2: Get updates, throughout the life of the loan, Kiva informs of progress by email. Step 3: Get paid back, as the borrower repays the loan, the money becomes available to borrower. This is called Kiva Credit. Step 4: Repeat the process, i.e., the borrower can now fund another loan, donate it to Kiva, or withdraw it to spend on something else (Kiva, 2013).

Sell a band - Sell a Band works through seven following steps. Step 1: discover music by browsing the site, looking at the Charts, using the Search or listen some songs. Step 2: support your favorite artist by buying a part and helping them to raise the funds for a new music project (a new album, tour or the promotion of their music). Step 3: "I'm with the band" by be connected with your favorite artists on their way to reach their funding goal. Promote them, stay in touch with them and help them. 4. Change your mind, before the Fund raising goal has been reached it is possible to withdraw money from a Music Project and move it to another project. Step 5: Artist reaches target, once an artist has reached his/her goal the doors are closed, meaning that no new "Believers" can come on board and it is no longer possible withdraw money. 6. Make magic happen, the artist will use the funds raised to complete his/her Music Project. Step 7: Get rewarded, receive free downloads and other goodies artists might offer like exclusive CDs, t-shirts, free lunches etc. And artists might even let the "Believer" get a cut of their revenues (Sellaband, 2013).

SimExchange - The SimExchange uses the wisdom of crowds to predict the upcoming bestselling and top rated video games. The SimExchange works like a stock market for video games and uses virtual money. The crown use this virtual money to buy stock in games that they believe will sale more than currently predicted and they can sell stock in games that they think will sell less than predicted (SimExchange, 2006).

Threadless - Threadless T-shirt company fosters artists from around the world to submit original ideas and designs to products, like a t-shirt, hoody, iPhone case, or any of our other products. This is a hardest part to do, but the artist could use Threadless Forums to collaborate with others artists on improvement a design or asking for a critique. The Threadless community scores each design for seven days and the best of the best are printed and sold, the most successful artists on Threadless are encouraged to submit more designs, even they received negative comments, they can use them as constructive fuel to make their designs even stronger. New designs are chosen for print every single week and the winning artists see their name up in lights, and they are paid handsome royalties and they take at home big cash prizes (Threadless, 2013).

KEY TERMS AND DEFINITIONS

Business Intelligence (BI): is a key enabler for increasing value and performance to organizations and it is a process that includes two primary activities: getting data in and getting data out (Watson and Wixom, 2007).

Collective Knowledge: collective knowledge is a complex and difficult notion, but there are three conceptualization of collective knowledge (Hecker, 2012): as shared knowledge; as complementary knowledge; and as knowledge embedded in collective artifacts.

Crowdsourcing: this term is derived from the business area to indicate the process of connecting a large crowd together via the internet, which allows seekers to address almost large projects by using crowd's (solvers) creativity and talent to solve these challenges. Howe (2006) define crowdsourcing as an act of taking a job traditionally performed by a designated agent and outsourcing it to an undefined, generally large group of people in the form of an open call.

Organizational Memory (OM): is an intellectual asset that is unique to every company - probably the most important constituent of any institution's durability (Kransdorff, 1998). Walsh and Ungson's (1991) viewed OM as an aggregate of information useful for decision-making and stored in organizational bins.

Organizational Memory Information Systems (OMIS): enables to retrieve structured and non-structured data, processing it into meaningful ways to the user and bring the results in highly readable formats such as data visualizations. OMIS should support the quick understanding of situations, promote the construction of scenarios, enable the integration of different users' manipulations and contributions, all of this to support the collective intelligence required to solve complex problems and develop innovative practices (Malone et al, 2010).

Seeker: is the sponsor of the initiative, which aims to see solved an issue.

Solver: is the crowd able to participate in the initiative with creativity, talent or resources.