

Dovetailing of Business Intelligence and Knowledge Management: An Integrative Framework

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Abstract

The rapid advancement in Information and Communication Technology is driving a revolutionary change in the way organizations do business. The fast growing capabilities of both generating and collecting data has generated an imperative need for new techniques and tools that can intelligently and automatically transform the processed data into valuable information and knowledge for effective decision making. Business intelligence (BI) plays an important role extracting valuable information and discovering the hidden patterns in internal as well as external sources of data. The main purpose of the BI is to improve the knowledge with information that allows managers to make effective decisions to achieve organizational objectives. However majority of organizational knowledge is in unstructured form or in the minds of its employees. On the other hand, Knowledge Management (KM) encompasses both tacit and explicit knowledge to enhance the organizations performance by providing collaborative tools to learn, create and share the knowledge within the organization. Therefore, it is imperative for the organizations to integrate BI with KM. The purpose of this paper is to discuss the importance of integration of BI with KM and provide a framework to integrate BI and KM.

Keywords: Business Intelligence (BI), Knowledge Management (KM), Scorecard, Dashboard, ETL, Data Mining, OLAP, Tacit Knowledge, Explicit Knowledge

1. Introduction

The rapid advancement in Information and Communication Technology is driving a revolutionary change in the way organizations do business. The fast growing capabilities of both generating and collecting data has generated an imperative need for new techniques and tools that can intelligently and automatically transform the processed data into valuable information and knowledge. Organizations have been spending in technology that will enable them to manage data and information for analysis, which will provide them with a competitive edge. Along with BI, Knowledge Management (KM) has proven to be technique which provides a significant return on investment (Herschel & Jones, 2005). BI can be defined as the process of turning data into information and then into knowledge (Golfarelli, Rizzi, & Cella, 2004). While KM can be defined as a systematic process of finding, selecting, organizing, distilling and presenting information in a way that improves an employee's comprehension in a specific area of interest.

The main objective of the BI is to augment the employees' knowledge with information that helps them to make better decisions to accomplish organizational objectives. However, only a small portion of data exists in structured form while as majority of data is in unstructured form or in the minds of its employees. To exploit both structured as well as unstructured data, organizations need to integrate KM with BI which discovers knowledge from data and information. The purpose of this paper is to discuss the need of integration of KM with BI and provided a framework to integrate both.

1.1. Business Intelligence (BI): Business intelligence refers to the use of technology to collect and effectively use information to improve business effectiveness. An ideal BI system gives an organization's employees, partners, and supplier's easy access to the information they need to effectively do their jobs, and the ability to analyze and easily share this information with others.

“Business intelligence is the process of gathering high-quality and meaningful information about the subject matter

being researched that will help the individual(s) analyzing the information, draws conclusions or make assumptions” (Jonathan, 2000). According to reference (Ranjan, 2008), BI is the conscious, methodical transformation of data from any and all data sources into new forms to provide information that is business-driven and results-oriented. As per reference (Pirttimäki, 2004), BI process concept is understood as a continuous and systematic method of action by which an organization gathers, analyses, and disseminates relevant business information to business activities. Reference (Golfarelli, Rizzi, & Cella, 2004) reasons that BI is the process that transforms data into information and then into knowledge. Reference (Stackowiak, Rayman, & Greenwald, 2007) opine that BI is the process of taking large amounts of data, analyzing that data, and presenting a high-level set of reports that condense the essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions. Reference (Cui, Damiani, & Leida, 2007) argues that BI is the way and method of improving business performance by providing powerful assistance to executive decision maker which enables them to have actionable information at hand. BI is the process of collection, treatment and diffusion of information that has an objective, the reduction of uncertainty in the making of all strategic decisions (Zeng, Xu, Shi, Wang, & Wu, October 8-11, 2006). While reference (Wu, Yu, & Jang, 2005) argues that BI is a “business management term used to describe applications and technologies which are used to gather, provide access to analyzed data and information about an enterprise, in order to help them make better informed business decisions.”

A BI system has evident importance as a communication and information diffusion channel, preferably one that is open, trustworthy, transparent and permanent. In supporting the monitoring and evaluation of business results while maintaining information integrity (Petrini & Pozzebon, 2009).

1.2. Knowledge Management (KM): KM through information, collaborative, and communication technologies, is the formalization of organizational memory and learning into an available resource, typically through a knowledge repository. KM is fundamentally the management of corporate knowledge and intellectual assets that can improve a range of organizational performance characteristics and add value by enabling an enterprise to act more intelligently (Wiig, 1993). Knowledge management enables the communication of knowledge from one person to another so that it can be used by the other person (Gray, 1999). Knowledge management transforms data and/or information into actionable knowledge in a format that when it is made available can be utilized effectively and efficiently throughout an organization (Angus, Patel, & Harty, March 16 1998), (Davis, 1998), (Davenport, DeLong, & Beers, 1998), (Skyrme, 1999).

The difference between KM and BI is that BI focuses on explicit knowledge, but KM encompasses both tacit and explicit knowledge. Both concepts promote learning, decision making, and understanding (Herschel & Jones, 2005). Tacit knowledge is typically the domain of subjective, cognitive and experiential learning. It is highly personal as it is inherently linked to the experiences and perception of an individual, thus difficult to formalize. In contrast, explicit knowledge is more objective, rational and technical knowledge which has been or can be formalized, coded and stored (e.g., policies, procedures, documents etc.). Explicit knowledge is therefore, easier to capture, since effective transfer of tacit knowledge requires extensive personal contact and trust (Mclaughlin, Oct 2007), (Debowski, 2006). Like BI, the term KM is often used to resolve problems for which it has never truly been intended. As a result, organizations are implementing large scale KM integration projects that have failed, largely due to a lack of understanding (Chung, Chen, & Nunamaker, 2003), (Cody, Kreulen, Krishna, & Srangler, 2002), (Herschel & Jones, 2005). It is therefore, essential for organizations to have clearly defined objectives when deciding upon the most appropriate approach. If an organization aims to develop competitive advantage from information that it has collected then it is best to implement an integrated BI and KM strategy. BI can be utilized to view not only current action, but also suggest the most suitable direction an organization should take, consequently BI can be an invaluable tool for decision-makers and managers (Dhar & Stein, 1997). However, the success of BI tools depends on the quality of data it uses. Therefore quality data, its transformation to information and extraction of knowledge from it, are essential to a successful BI implementation. As a result, it is vital to explore the techniques that can be implemented to select and analyze organizational data. Knowledge Discovery in Databases (KDD) is one process, which can be explored to ensure the highest quality of data is available for BI applications.

2. Framework for Integration of BI and KM

Organizations need to develop a system that captures disparate data from various sources stores and then analyses and presents it into an easy-to-use, easy-to-locate data delivery service. As a result BI came into existence. BI system

brought the perception of knowledge discovery adopted for active support to decision making processes at all managerial levels. BI tools such as on-line analytical processing and data mining make possible intelligent business decision making in complex banking environment.

This paper presents a framework for integration of BI and KM as shown in fig1. Disparate data is captured from internal sources (organizational intranet) as well as external sources (like suppliers, customers, Government agencies etc.) and stored in operational databases.

Using ETL (Extraction, transformation and loading) relevant data for analysis is extracted from operational databases as well as from external sources (like competitors, Government agencies, internet etc.) and then stored in a DW and/or datamarts. ETL performs the following functions:

Extraction: During data extraction data is acquired from multiple sources including the operational systems well as from external sources. The selected data is consolidated and filtered out from non-relevant data.

Transform. It validates and cleans up the extracted data to correct inconsistent, missing, or invalid values. Data transformation integrates data into standard formats and applies business rules that map data to the warehouse schema.

Load. It loads the cleansed data into the data warehouse/data mart.

Data warehouse is a copy of transaction data specifically structured for query and analysis and is informational, analysis and decision support oriented, not operational or transaction processing oriented (Kimball, 1996). Data marts, or localized data warehouses, are small sized data warehouses, typically created by individual departments or divisions to provide their own decision support activities. Due to some constraints like risk of failure, huge investment, some organizations invest in data marts for a few functional areas like marketing or sales instead of a full-fledged data warehouse. There are some organisations that choose both data warehouse as well as specialized data marts as they considerably reduce the query complexity which significantly reduces the query response time.

BI technologies such Online Analytical Processing (OLAP), Knowledge Discovery in Databases (KDD) & other query reporting applications are used to extract valuable information/knowledge from data warehouse, data marts as well as operational databases.

KDD can be defined as the non-trivial extraction of implicit, previously unknown, and potentially useful information from databases. Further to this, in recent years the number and the size of databases across a variety of fields have rapidly increased due to various factors (Witten & Frank, 2005). Knowledge discovery is an area of research that amalgamates several disciplines, including statistics, databases, artificial intelligence, visualization, high-performance and parallel computing (Wu X. , 2004). Since knowledge is the end product of a data-driven discovery (Piatetsky-Shapiro & Frawley, 1991), a well-accepted approach of the KDD process consists of several steps (Fayyad, 1996), (Roiger & Geatz, 2003). Data Mining constitutes one step in the KDD process. It is in data mining step that the actual search for patterns of interest is performed. It is important at this stage to choose the appropriate data mining algorithm (neural networks, linear/logistic regression, association rules, etc.) for the data mining task. The data mining task itself can be a classification task, linear regression analysis, rule formation, or cluster analysis (Imberman & Susan, Dec 2001).

The extracted information/knowledge obtained by applying BI tools must be stored for future use and sharing within the organization. Knowledge repositories are widely recognized as key components of most KM systems used for storing such information/knowledge. They are collection of both internal and external knowledge and seek to capture both tacit and explicit knowledge. Explicit knowledge is that knowledge that has been or can be articulated, codified, and stored in the form of presentations, manuals, documents, reports etc. It is generated with the help of OLAP, Data Mining and other reporting tools. Generated knowledge must be filtered, organized, and stored in a central knowledge repository to make them available efficiently and effectively. Tacit knowledge is the cumulative store of the experiences, mental maps, insights, acumen, expertise, know-how, trade secrets, skills set, understanding, and learning that an organization has that resides in the minds of experts within the organization but has not been put in a structured format. It can be directly captured by KM system from the human experts as shown in the framework (fig1).

Sharing/Collaboration: One of functions of BI and KM is the reporting which defines the process of accessing data, formatting and delivery of information/knowledge. The preferred type of data visualization is graphical

representation. The user can combine different representation of data and different views of the same data set.

Web Portal: Presenting BI on the Web through a portal is gaining considerable momentum. Web-based portals are becoming commonplace as a single personalized point of access for key business information. All major BI vendors have developed components which snap into the popular portal infrastructure. Various data visualization tools are integrated into web portal for ease of access including:

Balanced Scorecards: Balanced Scorecards help the users to put the strategy into practice. This is about a system to measure performances, derived from the objectives and strategy of organization, which reflects the most important aspects of the business.

Dashboards: Dashboards materialize into a user interface which puts together and shows information in an easy and intuitive manner. Practically the desktop is organized so that can offer necessary information, in the most proper way and to assure interactivity with the manager user.

The main reason BI has become so successful is because of the emergence of dashboards and scorecards. These tools take large volumes of information and deliver that information in a natural format which makes it easy to classify and respond to critical, time sensitive events.

Other tools include reporting tools, online analysis tools, Document management, Web content management, enterprise knowledge portal, work flow, groupware and e-learning that support dissemination and sharing of information and knowledge in a collaborative environment.

3. Conclusion

With the use of technology, organizations can improve the performance and acquire the sustainable competitive advantage. BI and KM are the main tools that give wide advantages to organization by providing the environment in which users receive timely, desired and reliable information/ knowledge which results in better and effective decision making to achieve organizational objectives. BI exploits the advantage of huge repositories of data present with and outside the organization. It extracts valuable information/knowledge from various sources of data but the focus is on explicit knowledge. KM helps the organization in capturing both explicit and tacit knowledge. Therefore it is imperative for organizations to have both BI and KM as an integrated system to get full value from both explicit and implicit knowledge. This integration will not only facilitate the capturing and coding of knowledge but also enhances the retrieval and sharing of knowledge across the organization to gain strategic advantage and also to sustain it in competitive market.

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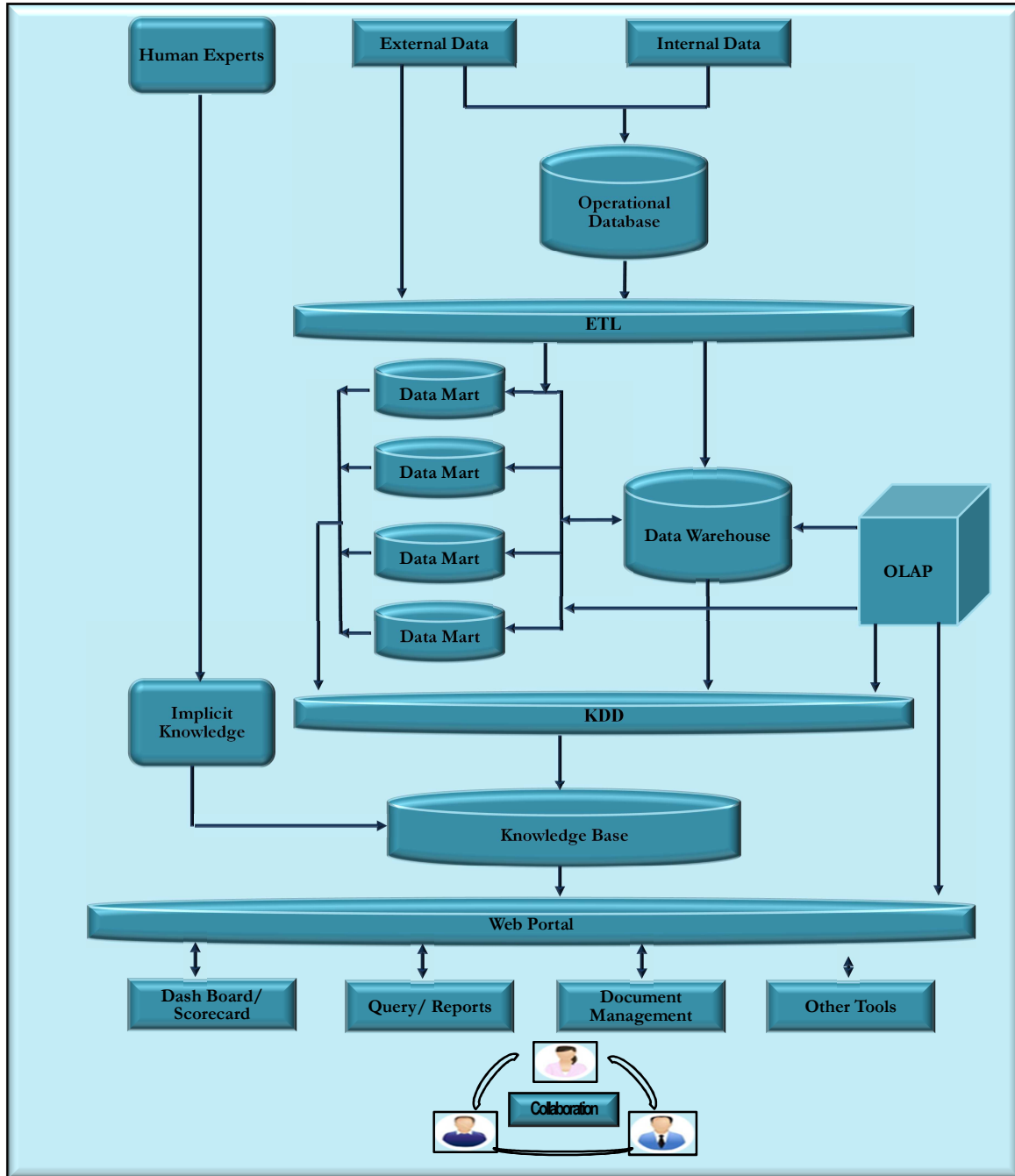
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Fig1. KM & BI Framework



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