

# A Knowledge Management Framework Using Business Intelligence Solutions

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## Abstract

The business environment, as a whole, was changed. It became more dynamic and more complex. Most organizations across the world have realized that in this rapidly changed environment, there is a strong need to become globally competitive and more interactive with the customers. The survival guide to competitiveness is to be closer to customers and deliver value added products and services in the shortest possible time. This, in turn, demands integration of business processes of an enterprise and generate value from the intellectual and knowledge-based assets in order to improve the efficiency of decision making process. Business intelligence (BI) plays an important role by extracting the knowledge hidden in internal as well as external sources of data. On the other hand, knowledge management (KM) enhances the organizations performance by providing collaborative tools to learn, create, and share the knowledge within the organization. The purpose of this paper is to discuss the integration between BI and KM and propose a framework to integrate BI and KM.

**Keywords:** *knowledge Management, Business Intelligence, Data Warehouse, Data Mining.*

## 1. Introduction

It has been observed that the society we live in is gradually turning into a knowledge-based society [1]. 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 had generated an imperative need for new techniques and tools that can intelligently and automatically transform the processed data into valuable information and knowledge [2]. Knowledge management (KM) plays an important role in selecting the right information at the right time from several pertinent resources.

Business intelligence (BI) can be defined as an organization's ability to gather all its capabilities and skills; and transform them into knowledge [1]. BI tools allowing the storage, access, and analysis of data in data warehouses (DW) include reporting, and analysis tools; data

visualization; online analytical processing (OLAP) tools; and data mining.

In order to improve the efficiency of decision making and to adapt to changing environment and markets, KM and BI need to be integrated.

## 2. Knowledge Management

Knowledge is a group of facts, information, intuition and skills attained through education or experience, and intended for theoretical or practical comprehension and problem solving. In combination with wisdom, the knowledge of how to use knowledge, this becomes a valuable asset essential in all spheres of decision making. Knowledge is integrated into the products and processes of a company, found both within the organization and in its environment [3]. The knowledge needs to be managed, and thus a field of management known as knowledge management has arisen.

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. KM 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 [2].

KM is the collection of processes that govern the creation, dissemination, and utilization of knowledge. It is about making sure that an organization can learn, and that it will be able to retrieve and use its knowledge assets in current applications as they are needed [4] (See Figure1). KM is not always about technology, but also about understanding how the people work, brainstorming, identify groups of people who work together and how they can share and learn from each other [5].

Many companies today realize that they must become knowledge-creating companies or learning organizations in order to survive and flourish in a rapidly changing business environment. That means constantly creating new business knowledge, disseminating it within the organization, and quickly building it into new products and services. The knowledge-creating company must find ways to use KM techniques and information technology to encourage employees to share what they know and make better use of accumulated workplace knowledge.

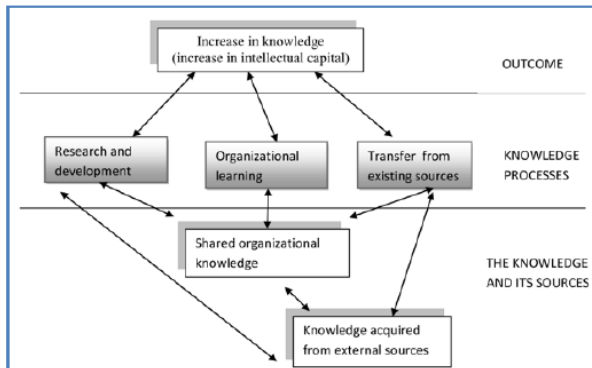


Fig. 1: Knowledge Management

### 3. Business Intelligence

The value of information increases with the number of users who can access that information, multiplied by the number of business areas in which the user works. Companies desperately need timely and relevant information and knowledge. For this purpose, companies are accumulating vast amount of data from disparate internal and external sources such as transaction systems, Web, publications, research results, etc. Problems of capturing different types of structured and unstructured data relate to, filtering, grouping, cleansing, and data enhancement [3].

BI refers to various software solutions, including technologies such as data warehouse, data mining, OLAP, ETL and other reporting applications needed to acquire the right information necessary for the business decision-making with the major purpose of enhancing the overall business performance [6] (See Figures 2&3).

#### 3.1 Data Warehouse

Data warehouse is an integrated collection of the summarized and historic data, which is collected from internal and external data sources [7]. DW collects relevant data into a repository, where it is organized and validated so it can serve decision-making objectives [6].

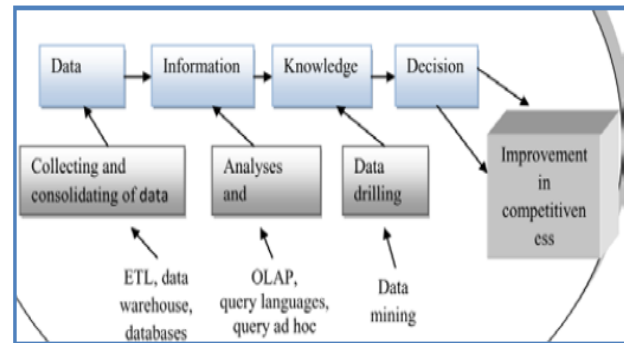


Fig. 2: Business Intelligence

To understand and locate data in the data warehouse users need information about the data warehousing system and its content. This information known as metadata, data about data, includes format, encoding/decoding algorithms, domain constraints, and definitions of the data. It also includes business definitions, data quality alerts, organizational changes, business rules and assumptions, as well as other items of business interest. Metadata help the business user to understand what is available, how to access it, what it means, which data to use, when to use them, etc. Metadata browsers provide an easy to understand view of the data warehouse [8].

#### 3.2 Data Marts

Data marts or localized data warehouses are small sized data warehouses, typically created by individual departments or divisions to facilitate their own decision support activities. For example, a data mart can be created for specific products or functions, like customer management, marketing, finance etc. [8].

#### 3.3 Data Mining

Data mining is a process of discovering patterns, correlation and trends by modifying through the large amount of data, which stored in the warehouse. Recognition technologies, statistical and mathematical techniques are normally used in Data Mining technology[4].

#### 3.4 Extraction Transform Load (ETL)

ETL is set of actions by which data is extracted from numerous databases, applications and systems, transformed as capture, and loaded into target database.

ETL performs the following functions: [2]

**Extraction:** During data extraction data is acquired from multiple sources including the operational systems and

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.

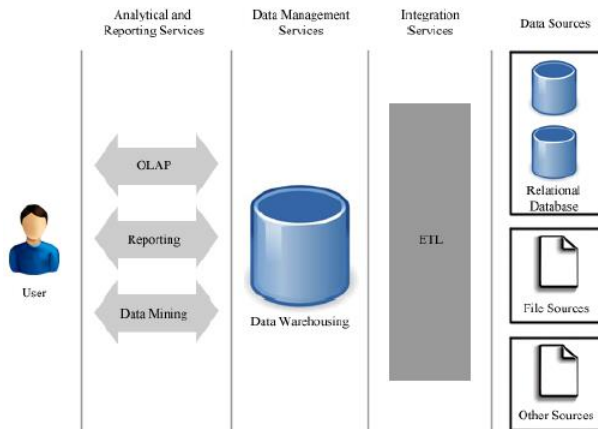


Fig. 3: Business Intelligence Architecture

### 3.5 On-Line Analytical Processing (OLAP)

OLAP refers to technology that enables the user to interact and present the data in the DW. OLAP is used essentially to query the DW, and the response to these complex queries is precalculated by the software in order to respond to requests [9].

OLAP tools are a combination of analytical processing procedures and graphical user interface. The key features of an OLAP application are: multidimensional views of data, calculation intensive capabilities and time intelligence [8].

## 4. Integration Between KM & BI

BI and KM have shown significant value in promoting decision-making and hence organizational performance. They are the indispensable tools for modern companies. However, BI and KM both use knowledge to improve decision-making. There has been some confusion as to whether KM is part of BI or BI is part of KM. The lack of clarity is seen to be, in part, dependent on how the two concepts are defined. BI focuses on explicit knowledge, but KM encompasses both tacit and explicit knowledge. Both

concepts promote learning, decision-making, and understanding [10].

Rapid technology development is building a bridge between KM and BI, and their integration will deepen and broaden the search for knowledge and information, in the meantime it will increase the value, movements and investment returns of intelligence [11].

In order to improve the efficiency of decision making and to adapt to changing environment and markets, we need to integrate BI and KM by transforming data into useful information and KM techniques are utilized to manage such information and to support decision making and other applications including providing individualized service, sharing of tacit knowledge and so on [12].

The benefits of integrating of BI with KM are 1) Ensure a real support in deploying successful business across the organization by smoothly managing multicultural teams of employees in providing highest quality products and global services to multicultural customers. 2) End-user preference and experience can be included in BI implementation, 3) provide better understanding on business context, interpretation results and training to the end-user. Even though both of them differ in their objectives and technologies used to develop them, together BI and KM can improve the organizational performance. BI and KM integration assists today's managers for improved/optimized decision making process by sharing data and information across the organization, getting the details from internal and external sources, forecasting the future trend and taking better decision [6].

## 5. The Proposed Framework

In the proposed framework, BI tools such as data warehousing, data mining, reports and graph components are used. These components interact with each other to furnish users with comprehensive output.

Input is generated by the operational layer in the data storage phase and that input is passed to data warehouse where data is processed according to the underlying input. With the help of data mining, useful information is mined out from raw collections of data.

The data is passed to the KM component of the framework in the shape of reports and graphs to get the user feedback.

It can be argued that there exists an interaction effect between KM activities/processes and BI tools and technologies.

The KM-BI framework is divided into 3 phases:

- (1) Data Storage Phase.
- (2) Processing & Analysis Phase.
- (3) Presentation Phase

Figure 4 shows the diagram that represents the three phases of the proposed framework. Through the following section, an explanation will be given to describe the 3 phases of the framework. Inputs, outputs, and description will be indicated for each phase.

### 5.1 Data Storage Phase

**Inputs:** Internal data about the organization & External data about suppliers and customers.

**Outputs:** Cleansed data that loaded into the data warehouse.

**Description:** Disparate data is captured from internal sources (organizational intranet) as well as external sources (like suppliers, customers, Government agencies etc.) and stored in operational systems/databases.

Operational systems include a mixture of manual and automated systems such as production, inventory control, sales, marketing, CRM, ERP, and SCM systems. Operational systems are used to process daily transactions within an organization.

These systems are designed in such a way that daily transactions are performed competently and the integrity of transactional data is also preserved. Sometimes, such systems are referred as transaction processing systems, operational databases or online transaction processing systems.

Using ETL technology relevant data for analysis is extracted from operational databases and then stored in a DW.

### 5.2 Processing & Analysis Phase

**Inputs:** Cleansed data from data warehouses.

**Outputs:** Extracted, filtered, and organized knowledge.

**Description:** This phase integrates key functions of KM and BI tools. It helps to the comprehensive analysis and exchange of enterprise data, information, and knowledge.

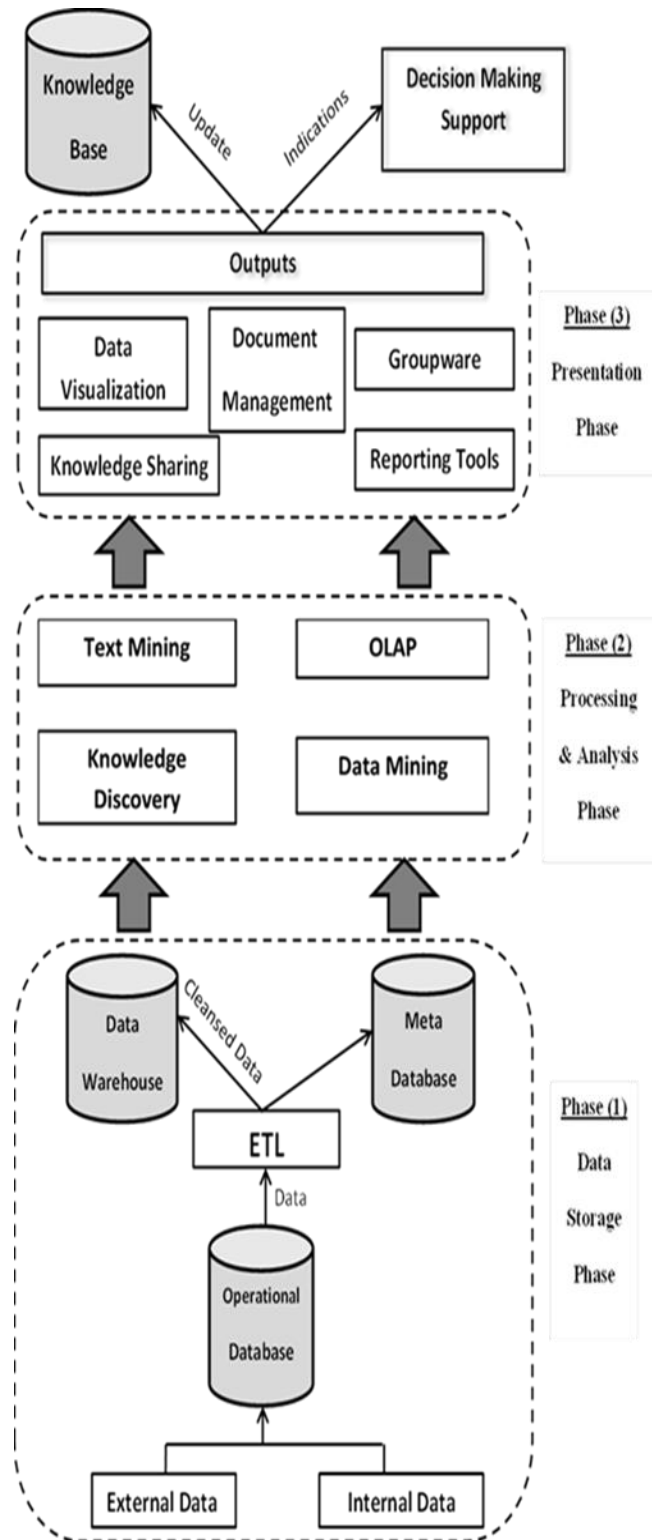


Fig. 4: The Proposed KM-BI Framework

This phase is an important phase as sorting, filtering, advanced search and query generation are all done within it. In this phase, information is extracted and processed according to the user requirements while passing through different phases.

BI technologies such as OLAP, data mining, and other query reporting applications are integrated with KM processes such as knowledge discovery and KM technologies such as text mining in order to extract valuable information/knowledge from data warehouse.

DM constitutes one step in the knowledge discovery 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 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 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 can be directly captured by KM system from the human experts.

### 5.3 Presentation Phase

Inputs: Extracted, filtered, and organized knowledge.

Outputs: The end result of this phase is provided as an output to the user in the form of summary reports and analytical graphs.

Description: This phase represents the interface of the user with the system. In this phase some of KM and BI technologies are integrated with each other in order to provide more convenient information and knowledge service for decision making and management.

Users can easily query and acquire knowledge in the knowledge base in order to share and exchange knowledge, and they can constantly enrich and update the knowledge base to achieve knowledge re-use and innovation.

The used technologies in this phase include data visualization tools (such as: dashboards and balanced

scorecards), reporting tools, document management, web content management, and groupware that support dissemination and sharing of information and knowledge in a collaborative environment.

## 6. Conclusions

Organizations are moving towards BI applications for staying competitive, promoting businesses and retaining customers. On the other hand, organizations are also implementing KM systems to gain or retain the competitive edge. When BI and KM are combined together, they increase the efficiency and productivity of the concerned organization. In this paper, a framework is proposed that integrates KM and BI together. The integration between KM and BI can maximize user productivity, provide customers with the best service, improve the quality and speed of decision making and enhance competitive advantage.

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