Integrating Knowledge Management with Business Intelligence Processes for Enhanced Organizational Learning

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Abstract

Knowledge Management (KM), either in a tacit or explicit form, plays an important role in decision making. Business Intelligence (BI) has acquired significant importance in the business world due to the recent technological advancements and availability of state-of-the-art software tools. Presently, most of the organizations across the globe are adopting BI solutions to promote business, retain customers, earn maximum profits, reduce recurring expenditures, etc. KM, on the other hand, has not gained significant acknowledgement from an implementation perspective. Moreover, the effect of BI on KM and vice versa is rarely observed. In this paper, we propose a model where KM and BI can benefit from each other. Since both of the said fields have a wide range of features, the proposed model is based on specific features. For that purpose, we have identified a number of Critical Success Factors (CSFs) related to both BI and KM technologies reported in contemporary research. Afterwards, we have drawn a comparison pertinent to the effectiveness of these CSFs with the similar research studies. The comparison shows that our model that combines both BI and KM technologies is more useful as compared to their individual utilization.

Keywords: Business Intelligence, Knowledge Management, Tacit Knowledge, Decision Making, Decision Support Systems, Organizational Learning

1. Introduction

It has been observed that the society we live in is gradually turning into a knowledge-based society [1, 3, 17]. In the age of information revolution, knowledge management (KM) plays an important role in selecting the right information at the right time from several pertinent resources [8] while converting it to useful insightful acumen so that an organization can get maximum benefits from it. In addition, KM is a fast and efficient way to manage intellectual property [12].

Business Intelligence (BI) is defined as an organization’s ability to gather all its capabilities and skills; and transform them into knowledge. The acquired knowledge may pertain to large amounts of information which may lead in the opening of new windows of opportunities to the concerned organization. When a new opportunity is identified and a strategy is effectively implemented, it endows organization with a competitive advantage in the market as well as stability in the long run.

BI technologies provide historical, current and predictive views of business operations. Common functions of BI technologies are reporting, online analytical processing (OLAP), data mining, business performance management, benchmarking, predictive and prescriptive analytics. The basic components include data warehousing, data Mining, OLAP, reporting, spreadsheet, etc.
Researchers categorize knowledge in two different types: implicit knowledge and explicit knowledge [9]. Explicit or codified knowledge is communicable in an official or organized language. Whereas, tacit knowledge corresponds to the personal traits and qualities present within an individual; hence, it is quite hard to make it official and communicable. The relationship between tacit knowledge and explicit knowledge is further classified into four subcategories: Socialization, Externalization, Combination and Internalization.

There is a lot of business knowledge that needs to be extracted from unstructured information most of which is in the textual form [18]. Therefore, it poses serious challenges for managers to integrate tacit knowledge into business processes.

2. Literature Review

In this section, we present a review of the contemporary literature along with critical evaluation of the previously presented techniques encompassing the components of both BI and KM.

Sanchez [15] analyzes tacit and explicit KM techniques and concludes that both of them are important factors for dealing with management issues. However, both forms of knowledge should be used in the right fusion. The advantage of one approach can be helpful to compensate for the disadvantages of the other approach. Hence, a hybrid design should be created for organizations that synthesize the correct combination and balance between tacit and explicit KM approaches.

Herschel and Jones [14] state that BI and KM are influenced by the environment within an organization. Additionally, the attitude of opinion leaders and employees play an important role to actualize the success of KM systems. Hence, it is necessary to create an environment within the concerned organization that helps encourage employees and leaders to share their thoughts and knowledge.

Campbell [6] proposed a framework to transform KM into BI. In addition, Campbell [6] outlined ten principles that managers can use to create KM initiatives. These principles focus on the systems which an organization should adopt so that managers can share new knowledge during their communication within the usual workflows. But, in general, it is hard to make sure that new solutions and options can be added quickly once the decision has been taken to adopt them.

Meyer and Sugiyama [13] introduced a memory model for demonstrating individual knowledge and linked it to KM concepts. Memory models, in general, describe processes that are embedded and active in mind. However, such models suffer from the lack of practical applications.

Alwis, et al., [16] analyzed that tacit knowledge plays an important role in all the phases of an innovation process and upcoming problems can be solved with the implementation of appropriate tacit KM. Although the transfer of tacit knowledge at the later stages of the innovation phase contributes a lot, the transfer in the early stages of the innovation phase is equally important.

Harlow [5] advocates that tacit knowledge has more influence on innovation as compared to financial measures. A survey was conducted in different organizations in different regions to analyze the effect of tacit knowledge. To get output of the survey, the tacit knowledge index (TKI) method was used. TKI provides managers a great instrument to analyze the strategy for innovation and to improve their businesses. Small affiliation of TKI to the financial outcome inhibits predicting the financial performance.
Holste and Fields [10] analyzed the effect of trust on tacit knowledge transfer. There are two types of trust; affect-based and cognition-based. Both effects have a positive effect on coworkers who want to share knowledge. Tacit knowledge can further be categorized as Share Tacit Knowledge and Use Tacit Knowledge. Affect-based trust motivates those who are willing to share tacit knowledge; cognition-based belief has a bigger control on those who are motivated to use tacit knowledge.

Campbell [4] examines the results of KM processes on the overall BI and organizational performance by looking at the dynamics of innovation and the interconnected processes of knowledge which are needed to influence one’s cerebral assets. It has been observed that many organizations are dependent on the individual knowledge and skill of individual members. Therefore, support of information systems to KM is considered to be the primary tool to achieve a competitive advantage.

You [7] discusses how KM and data mining can become more valuable for real time BI. Chennamaneni, et al., [2] analyzed that tacit knowledge is very important for an organizations. Many organizations despite their best efforts are hardly able to manage it. To overcome that problem, an integrated framework needs to be developed and tacit knowledge be categorized into different degrees. Such frameworks help organizations in creating mechanisms for transferring different degrees of tacit knowledge.

According to Weidong, et al., [19], BI and KM differ from each other but are interconnected in terms of synergy, common foundation and complementariness. Therefore, the relationship between KM and BI and the ways they differ from each other need to be explored. An insight into KM and BI integration reveals that BI transforms data into Knowledge and Information. KM helps share knowledge to create new knowledge and provides BI with an understanding of business perspectives as well as estimation and outcome analysis. Therefore, if KM and BI are aligned together, they can result in more effectual solutions.

Cheng and Peng [11] analyze BI and KM, and explain their pros and cons followed by proposing a framework named the KMBI Framework that integrates KM and BI. The KMBI is built on three layers: data integration, function integration and presentation integration. KM and BI have different features and the integration of both can maximize organizational efficiency and provide the best services to the customers.

Cody, et al., [18] introduced the eClassifier which categorizes large collections of text documents by applying different algorithms that can be either analytical or graphical. Such algorithms create reports that present the data to knowledge workers so that they can acquire deep understanding of the knowledge that exists in the data. Therefore, it can conveniently be assumed that BI and KM play an important role in improving the qualitative and quantitative value of information available for decision making.


3. The Proposed Model

In this study, we have used the KM Model proposed by Ikujiro Nonaka [9] as shown in Figure 1.

![Nonaka SECI KM Model](image1)

**Figure 1. Nonaka SECI KM Model [9]**

We have integrated this KM model with our BI Model so that we can check how interaction of BI with a KM model can support organizations to better manage their resources. The adopted model also examines how organizations can improve efficiency through enhanced organizational learning. Our proposed model consists of three layers: the Operational Layer, the BI and KM Layer, and the Output Layer (see Figure 2). The detailed description of these layers is provided in the subsequent paragraphs below.

![Proposed BI and KM Model](image2)

**Figure 2. The Proposed BI and KM Model**
3.1. The Operational Layer

Operational systems can be a mixture of manual and automated systems such as Production, Inventory Control, CRM, Sales, Marketing, etc. 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. The data available in this layer is fed to the BI and KM Layer for further processing.

3.2. The BI and KM Layer

This layer is an important layer as sorting, filtering, advanced search and query generation are all done within it. Data is passed to this layer through the Operational Layer; in this layer, information is extracted and processed according to the user requirements while passing through different phases. The end result of this layer is provided as an output to the user in the form of summary reports and analytical graphs.

In our model, we have used the data warehousing, data mining, reports and graph components of the BI model. These components interact with each other to furnish users with comprehensive output. Input is generated by the Operational Layer and that input is passed to a 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. That data is passed to the KM component of the model in the shape of reports and graphs to get the user feedback. The output received from KM systems acts as a new dimension for BI and that input is stored into a database for future references.

3.3. The Output Layer

In this way, after passing through the entire aforesaid mechanism, a user can obtain outputs in the form of either reports or graphs. This layer further filters the reports as per the user requirement, policy support and organizational templates.

4. Validation and Discussion

The core objective of the validation phase is to understand how the incorporation of KM technology adds valuable components to the BI technology being used by financial, telecom and other leading corporate sectors. Such an evaluation helps determine the degree of efficiency enhancement in the decision making process. For this purpose, we have identified a number of critical success factors (CSFs) pertinent to successful BI system implementation studied by Yeah, et al., [20], Olszak and Ziemba [25]. The CSFs are identified from both BI and KM perspectives and are primarily based on contemporary empirical research studies. The identified CSFs for BI and KM are described under the following divisions:

4.1 Critical Success Factor of Business Intelligence

a. Committed management support and sponsorship: Consistent support, monitoring, leadership and sponsorship from business executives ensure the availability of the necessary operating resources such as funding, human skills, logistics, administrative
support, etc. throughout the implementation process [20, 25].

b. **Business user-oriented change management:** Active user participation in the change effort leads to the successful implementation of BI system’s [20, 25].

c. **Clear business vision and well-established case:** A long-term vision is needed to enable the establishment of a BI business case. The business case must be aligned to the corporate vision because it will eventually impact the adoption and outcome of the BI system [20, 25].

d. **Business-driven methodology and project management:** Adequate project planning and scoping allow the BI team to focus on the best and finest opportunity for enhancement. Scoping helps to set clear parameters and develops a common understanding as to what is included within the scope and what has to be excluded to make the system more efficient [20, 25].

e. **Business-centric championship and balanced project team composition:** For the success of implementation, selection of the right champion from the business side of the organization is imperative. A champion who has excellent business insight is always important because he/she would be the one to predict the organizational challenges and could change the business strategy and approach accordingly [20].

f. **Strategic and extensible technical framework:** According to the majority of experts, stable back-end systems are essential in implementing BI systems [20]. A reliable back-end system ensures that the updating of data work well for the ETL (extraction, transformation and loading) processes in the staging area. In addition, that data can be transformed so that it provides a consistent view into quality information for improved decision support [20, 25].

g. **Sustainable data quality and governance framework:** For a successful implementation of a BI system, the quality of data is crucial and plays an important role; particularly, at source systems. To improve the decision-making process, a BI system should integrate silos of data sources within the organization [20].

### 4.2. Critical Success Factors of Knowledge Management

The key success factors of implementing KM in organizations that have been reported in Mathi [21]; Wong [22]; Hasanali [23]; Mercadoa [24] are:

a. **Culture:** Employees innately do not want to share information, so the culture of knowledge sharing needs to be enabled. Successful organizations empower employees to share intellectual information, by rewarding them for such actions [21, 23, 24].

b. **KM Organization/Leadership:** The main important variable for any organization is leadership with a vision, tactic and ability to promote change. The adoption of a convincing knowledge management system clearly shows how KM contributes to achieving organizational objectives [21-23].

c. **Strategy:** Systems and Infrastructure: Strategy, systems and infrastructure establish a clear description of all the required KM elements as well as the system approach and integration [22-24].

d. **Effective Systematic Processes/IT Infrastructure:** Effective systematic processes or IT
infrastructure is essential to create a “knowledge environment” with processes so to capture the knowledge assets of the organization. To make this process more successful, electronic commerce technologies should be implemented [22-24].

e. Measures: The success of KM can be measured against practical milestones such as the creation of products, development of new clients and an increase in sales/revenue [21-23].

Based on the CSFs of both BI and KM, a comparative table (Table I) is created showing how the factors affecting BI and KM can be mapped with each other. This mapping is further discussed with reference to the proposed model. We have drawn a comparison of these CSFs with the existing research reported in [20-25].

Table 1. Comparative Table

<table>
<thead>
<tr>
<th>S/N</th>
<th>Business Intelligence</th>
<th>Knowledge Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Committed management support and sponsorship</td>
<td>Culture, KM Management</td>
</tr>
<tr>
<td>2</td>
<td>Business user-oriented change management</td>
<td>KM Management, Measures</td>
</tr>
<tr>
<td>3</td>
<td>Clear business vision and well-established case</td>
<td>Measures</td>
</tr>
<tr>
<td>4</td>
<td>Business-driven methodology and project management</td>
<td>KM Organization/Leadership, Measures</td>
</tr>
<tr>
<td>5</td>
<td>Business-centric championship and balanced project team composition</td>
<td>Strategy, Systems and Infrastructure</td>
</tr>
<tr>
<td>6</td>
<td>Strategic and extensible technical framework</td>
<td>Effective and Systematic Processes</td>
</tr>
<tr>
<td>7</td>
<td>Sustainable data quality and governance framework</td>
<td>Strategy, System and Infrastructure</td>
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</table>

The comparative table shows that when a KM factor is combined with a BI factor, the BI’s outcome gets strengthened; this helps an organization in efficient decision making. The mapping of BI and KM factors helps the organizations in different perspectives. Some of the key perspectives are:

- a. Efficiency enhancement
- b. Increase in productivity
- c. Important monitoring capabilities
- d. Innovation
- e. Competition edge

The committed management support and sponsorship helps the concerned organization in concentrating on business development because top management is more concerned about the financial issue. In such an environment, the rest of employees concentrate on efficiency enhancement. Similarly, culture and KM management in the KM domain also helps in efficiency enhancement by providing an environment to the organization where the employees can share their knowledge. So, if culture and KM management is combined with committed management support and sponsorship, then the efficiency of the organization is expected to increase manifold. The proper implementation of these CSFs will help improve the effectiveness of implementation of BI systems. However, this also necessitates acquiring
better understanding of the likely antecedents that may lead to a successful deployment of BI systems [20, 21, 23, 24, 25].

Similarly, business user-oriented change management in BI helps an organization to create both a business oriented and user-friendly environment. Better communication of a user and his/her participation leads to successful implementation of BI systems. This can be possible when an organization provides a friendly environment where users are able to share their knowledge. So, the management has to ensure the provision of knowledge sharable environment in KM. When both KM and BI are combined, they help the organization in providing friendlier environment and hence this will result in increasing the productivity. Also, deliverables will be more efficient and will be in accordance with the user’s requirements. This combination will satisfy the user’s needs; this is a step forward in gaining a competitive edge [20, 21, 22, 23, 25].

Clear business vision and a well-established case help in efficient BI deployment. A clear business vision impacts the adoption and outcome of BI systems. A vague vision will result in less support of executives and management. Similarly, solid business cases derived from the analysis of business requirements will result in increased support from the top management. On the other hand, measurement is required in KM processes to get feedback when KM initiatives are implemented and to check whether the knowledge present within the organization is being effectively used. So, when clear business vision and KM measures are implemented simultaneously, they create a strong organizational vision resulting in more efficient business outcome and quality products [20, 21, 22, 23, 25].

In business-driven methodology and project management, a BI team concentrates on improvement when a project is better scoped and planned. Scoping helps in setting clear parameters for the project and helps in eliminating unnecessary requirements. Similarly, in KM, leadership and measures play an important role in project scoping. Measures help in determining the scope of the project while leadership helps in fulfilling the requirements and attaining the organizational goals. So, BI along with KM helps in better scoping of the project by adopting the latest business technologies while achieving the predefined organizational goals. Overall, they increase productivity and enhancement [20, 21, 22, 23, 25].

Business-centric championship and a balanced project team composition have a very important role in business success. Champions who have a better business insight are important because they will be able to better predict the organizational challenges and can act accordingly. Similarly, in the KM domain, the strategy plays a vital role to adopt the updated systems and infrastructure. Therefore, when both BI and KM works together, they help in producing efficient and successful businesses [20, 22, 23, 24, 25].

5. Conclusion

In the modern age, 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 study, a hybrid model is proposed that demonstrates how a BI system can benefit from a KM system and vice versa. A number of CSFs were identified for both BI and KM systems. Further, the study analyzed how the CSFs of BI and KM can work together while benefiting each other.
References

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