Business Intelligence
Definitions, Managerial Effects and Aspects: A Systematic Literature Review

Dalia Al-Eisawi and Mark Lycett

School of Information Systems, Computing and Mathematics, Brunel University, Kingston Lane, Uxbridge, U.K.

Keywords: Business Intelligence, Systematic Literature Review, Decision Making, Business Performance Management, Data Management.

Abstract: This paper presents findings from the Systematic Literature Review (SLR) on Business Intelligence (BI), to clarify key definition alongside managerial effects resulting from its implementation in organizations. In doing this, the paper aims to assist organizations, decision makers, managers and information system researchers to validate the existing state of research in BI motivation. The review highlights gaps in the presented body of existing literature, contradictory answers in relation to BI definition and aspects, in addition, uncovers themes significant to BI implementation that are not well addressed in the literature. The need for empirical research is also highlighted, as the majority of the articles analyzed are at the conceptual and/or theoretical level. In addition, the research recognized a connection between a set of different managerial aspects affected by BI.

1 INTRODUCTION

Given the emerging importance of BI in organizations, this paper presents a Systematic Literature Review (SLR) on the core aspects of BI, and their effect(s) on certain managerial and organizational aspects. The SLR followed a course of action derived from Brereton (2011) based on accumulating a representative pool of articles, classifying them according to research questions, evaluating and synthesizing that literature in relation to the research questions and, finally, documenting the review and its outcomes. The review addressed two key research questions:

RQ1: from a definitional perspective, what are the core aspects of BI?

RQ2: From a managerial perspective, how are these aspects affected by BI?

The review, once rationalized, examined 65 studies spanning from January 2001 to December 2012. And also proposed a novel and comprehensive definition of BI that includes a coherent relation between BI and a set of key managerial elements that should be mentioned

When defining BI. The coherent relation indicated that "Decision making", "Business Performance Management", and "Data Management" are interrelated and cohesive managerial and key organizational aspects that can be affected positively when applying and implementing BI within organizations.

In presenting the review, the paper is organized as follows. Section 2 provides an explanation of the method used for the Systematic Literature Review (essentially following rules in a protocol that is autonomously validated). Section 3 presents results of the synthesis of the literature, consisting of chronological and sequential aspects, alongside publication details. Section 4 reports the results and background of the analysis process in relation to the research questions. Last, Section 4 presents the conclusions of the exercise.

2 METHODS

In accordance with systematic review guidelines (Brereton, 2011), the following steps were undertaken:(1) Recognizing the need for a systematic literature review; (2) formulating a set of research questions; (3) accumulating a representative pool of articles; (4) evaluating and synthesizing the gathered articles; (5) dividing the papers according to research questions; and (6), documenting the review and outcomes.

The remainder of this section will present detail in relation to these steps.

2.1 List of Searched Resources

A primary set of key words were used for the literature search, these being 'Business Intelligence', 'Decision Making' and 'Business Performance Management' ,as these specific words were drawn up for each research question. Initially, the following databases were searched: Scopus; Science Direct; ABI Inform; Academic Search Complete (ASC); and the IEEE/IET electronic library. These sources were supplemented with selected conference proceedings and specific journals including The International Journal of Business Intelligence Research (IJBIR), Institute of Electrical and Electronic Engineers proceedings (IEEE) and the European Conference on Information Systems proceedings (ECIS). Overall, we established an ultimate list of 65 papers that matches our search requirements.

2.2 The Process for Including Study Papers, Data extraction and Synthesis

The process for including and excluding gathered studies is a crucial step in the methods, as it provides and assures a strong backbone to generating a quality based literature review. All published studies that answer the author's research questions and are published within the years 2001 –2012 was integrated in the inclusion list. Moreover, the included research study must be published in conference proceedings or journal paper, In order to insure that all references included will be recorded in a fully organized structure Refworks system (www. refworks.com) was used to document reference information and details for each study. We synthesized data through classifying themes derived from the findings and results documented in each accepted paper. The categorized themes consequently revealed the creation of the categories and segments for the results section. We also conducted a type of analysis called sensitivity analysis; it is a technique for assessing the riskiness of a certain investment. For the given research purposes the sensitivity analysis was used to test how certain factors affected the field of BI Research. Key factors analyzed were based on year of publication, type of study, and finally based on which Journal or conferences preceding these papers were published. The sensitivity analyses gave us a

clear idea and explicit information on where to find prejudiced and biased data. The sensitivity analysis is also reported in the results section.

3 RESULTS – BACKGROUND OF THE ANALYSIS PROCESS

3.1 Types of Study Papers

From the 65 studies, 47% were found to be theoretical or conceptual, and 37% empirical in nature. A small number of studies (16%) presented literature reviews. Empirical and literature review related to BI were less found within the pool of BI research, most of the studies were either conceptual or theoretical.

As for the data collection methods used in the case studies and empirical studies, they were primarily questionnaires/surveys, interviews by telephone or face-to-face interviews and, lastly, field studies. 46 % of the empirical research papers used questioners and surveys.

3.2 Sequential View of Publications

A statistical analysis for studies engaged in the review based on almost ten year period from 2001 until 2012 was performed, it showed that within the last 6 years there is an observed raise in published papers related to BI implementation in organizations, and its effects on decision making, We also noticed that before the year 2000 studies on BI were almost not present. The observed increase in BI research is in-line with emergent and increasing organizational awareness of the significance role of BI (and spends on technology). Alternatively, this increase might perhaps just counterpart a common rise in recent published papers in Information Systems and Decision Support Systems (Fitriana et al., 2011).

4 RESULTS – ANSWERING RESEARCH QUESTIONS

This part of the research illustrates how the literature provides answers to the research questions. The current research questions act jointly to provide an absolute explanation of the research focus. Information relating BI definitions was collected for (RQ1) to expand the understanding of traditional definitions, and extract key managerial aspects

embedded within those definitions. Papers were then analyzed to provide a more detailed understanding of BI in relation to those (addressing RQ2).

4.1 The Core Aspects of BI

Definitions within the analyzed papers were recognized as answering RQ1, these papers emphasized, or had a direct relation to a certain attributes which relates to 'Definitions' of BI such as Decision Making ,BPM, Data Management ,Knowledge Management, and finally better organizational relations. A closer assessment noticed from analyzing a set of definitions resulted in proposing that when defining BI it is always linked with any of the linked aspects as follows:

▪ BI Definition can contain a direct link with BI role in DM, decision making is defined as process that assist managers to make a choice about a course of action, decisions can be categorized as structured or unstructured; they also can be classified according to managerial levels such as strategic decisions, and tactical.

▪ BI Definition can contain a direct link with BI role in BPM. "(BPM) is a key business initiative that enables companies to align strategic and operational objectives with business activities in order to fully manage performance through better informed decision making and action"(Shi and Lu, 2010).

▪ BI Definition can contain a direct link with BI role in Data Management and control, data management and control refers here to how BI can assist organization in controlling the large amount of data generated daily, monthly, or annually.

▪ BI Definition can contain a direct link with one or more of the above given attributes.

▪ BI Definition did have a weaker direct relation contained by its definitions with aspects such as business knowledge, and effective organizational relationships. However, these two aspects might be required as very important facets, which are indirectly affected by BI, and the benefit of BI on them is required to be as an intangible benefit sometimes impossible to enumerate. They are however significant, and often unseen sources of business value.

The current section aimed at delivering an initial level of transparency by presenting and scrutinizing the results of analyzing a number of definitions available in the literature of the BI concept, as in the Table in the Appendix , covering the years 2001-2012 it was looked at a sample of 12 different definitions . The content of column (Direct relation

of BI) denotes the significant attributes that were proposed from the authors understanding of BI definitions and that can present a direct relation as a role or effect on specific managerial and organizational aspects. Moreover, revealing these relations will have an impact in assisting the author finding answers for RQ2. A number of these definitions were obviously stated in the article, whereas others were implicit in the text. Since the current review is concept-centric explicitly, the author performed a qualitative content analysis on the collected sample that answers RQ1; the content analysis is explained as in the following definition; "A research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Zhang and Wildemuth, 2009).The content analysis of the definitions revealed the following outcomes,

▪ It was not comprehensible withier BI is required to be a 'Process' or a "Product" ,the "process is composed of methods that organizations use to create useful information or intelligence that will support companies and organizations succeed and have a competitive advantage in the global economy" (Jordan, Rainer& Marshall, 2008).And a "product is information that will permit organizations to forecast and expect the performance and behaviours of their competitors, suppliers, customers, technologies, acquisitions, markets, products and services" (Jordan, Rainer& Marshall, 2008). As for other indicated that BI can be both a process and a product.

▪ Only two definitions out of the 12 given, pointed within their content to a direct relation between BI role with all the three roles defined previously by the author, within the definitions almost 90% of definitions mentioned a direct relation between BI and DM, and few had a relation with data management, BPM, both, or all three attributes.

▪ Since most of study papers collected for the purpose of this research found to be theoretical based, the author noticed that few of the given definitions were extracted form an empirical and observed practice. Therefore, this will lead to a delay in the understanding of what BI characterizes to business leaders and researchers.

▪ And finally, It was not clear weather BI is required be a technological or managerial concept, or it can be both.

As a result, applying a content analysis on the collected definitions realized a main and general concern as follows; "BI did not yet reach a standardized and unified definition".

4.2 How are these Aspects Affected by BI?

Another synthesis for the purpose of answering RQ2 was undertaken; the synthesis shows that 55% of papers illustrate a role of BI in (DM), 22 % Role on BI in Data Management and Control, and 23% are related to (BPM), and these statistics can be more explained as follows:

(BI effect on DM): most of the papers searched agreed that BI has a direct effect on DM; according to literature BI has turn out to be a vital aspect of decision-making, not only at the top, but at each particular hierarchical level. That is the reason behind the needs for it to be associated with the business and organizational strategy in order to be capable to support analytical decision-making. Nevertheless, this relation is turning to be as a known fact rather than just a proposition since it has been researched and proven in large number of study papers.

(BI effect on BPM): as defined earlier BPM" is a key business initiative that enables companies to align strategic and operational objectives with business activities in order to fully manage performance through better informed decision making and action"(Shi and Lu, 2010). According to the synthesized literature, BPM will start within the coming future to be required as being the last constituent of BI, and the following stage in the growth of BI, organization, and information systems. If BPM is a consequence of BI and better decision making, and contains many of its technologies, tools and techniques, then BI itself can play as a key role and deliver the insight needed to improve overall business performance .This was hypothesized by the authors from a theoretical viewpoint and sensible perspective.

(BI effect on Data Management): Data Management and control refers here to how BI can assist organization in controlling the large amount of data generated daily, monthly or annually. This effect was related in most papers to the use of Data Warehouse technology, that have the ability to assist the transformation of organizational operational data system into an analytical data system construction, and that can sustain business requirements and needs. Thus, this formation enables business executive to attain a chronological view of operational data, moreover, eliminating the load on organizational Information technology assets and enabling mangers to create positive decisions instead of unconsidered ones.

As a conclusion for answering RQ2: "Decision Making", "Business Performance Management", and "Data Management" are interrelated and cohesive managerial and key organizational aspects that can be affected positively when applying and implementing BI within organizations as the bellow figure.
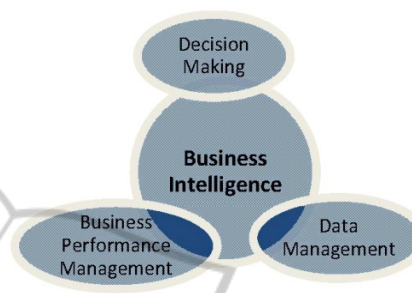

Figure 1: The cohesive effects of BI on managerial aspects.

5 CONCLUSIONS

The paper presented a global view of BI definition, and a global understanding of its effects and roles derived from a state of the art (SLR) process. Thus, the research presented clear face validity for researchers, managers, and decision makers to help them understand the managerial facets of BI. Within the (SLR) the author researched a total of 65 published papers. The results from analyzing papers showed that the predominance of the papers were published by Journals that are only dedicated for BI research, such as the International Journal of Business Intelligence (IJBIR) ,Other papers may be related to special interest group on computer personnel research and conference preceding. Also, it was observed that there is a noticed increase in BI published research, and this increase might be an indication of the emergent organizational awareness of the significance role of BI. The review process investigated that the empirical and case studies related to BI were scarcely obtainable within the pool of BI research; most of the studies were either conceptual or theoretical.

The research results from answering the first research question revealed that the existing definition of BI extracted from the literature, and extracted from applying a content analysis on the set of definitions did not yet reach a standardized and unified definition. Therefore, the author proposed a coherent relation between BI and a set of key managerial elements which are; 1. (DM) 2. (BPM) and 3. Data Management, that should be all

mentioned when defining BI as follows:

"Business intelligence is a combination of processes, products, and technologies that have the ability in supporting organization, and can have a direct key role in Data management by storing, and analyzing the data collected from internal and external sources ,and on Decision Making by creating knowledge ,and finally on Business Performance management "

The systematic review process also collected papers that investigated the effect of BI on those managerial aspects. 55% of papers illustrated a direct effect of BI on decision making, 22 % of the papers illustrated the effect of BI on Data Management and 23% showed an effect on BPM. Consequently, and as a results the author concluded a general understanding from the second research question as follows:

Decision Making, Business Performance Management, and Data Management are interrelated and cohesive managerial and key organizational aspects that can be positively affected when applying and implementing BI within organizations.

As future lines of work, we will expand the analysis of organizational features recognized by BI and its implementations this is, defining more substantial and insubstantial effects of its presence in organizations and where exactly inside an organization they are playing their significant roles, yet how can they be evaluated and quantified.

REFERENCES

Ariyachandra, T. and Frolick, M. H., R.T., (2011). "10 Principles to Ensure Your Data Warehouse Implementation is a Failure", pp. 37-47.

Böhringer, Martin; Gluchowski, Peter; Kurze, Christian; and Schieder, Christian,(2010) "A Business Intelligence Perspective on the Future Internet" *AMCIS2010 Proceedings.* Paper267. htt://aisel.aisnet. org/amcis2010/267.

Brereton, P (2011), "A Study of Computing Undergraduates Undertaking a Systematic Literature Review", *IEEE Transactions on Education*, 54, 4, pp. 558-563, Academic Search Complete, EBSCOhost, viewed 6 December 2011.

Fitriana1,R., Eriyatno, and Djatna,t(2011)," Progress in Business Intelligence System research : A literature Review", *International Journal of Basic & Applied Sciences IJBAS-IJENS* Vol: 11 No: 03.

Habul, A. & Pilav-Velic, A. (2010) "Business intelligence and customer relationship management", *Information Technology Interfaces (ITI), 2010 32nd International Conference on*, pp. 169.

Lida Xu, Li Zeng, Zhongzhi Shi, Qing He & Maoguang Wang (2007) "Research on Business Intelligence in enterprise computing environment", *Systems, Man and Cybernetics, 2007. ISIC. IEEE International Conference on*, pp. 3270.

Pirnau, M. & Botezatu, C.P. (2010) "General information on business Intelligence and OLAP systems architecture", *Computer and Automation Engineering (ICCAE), 2010 The 2nd International Conference on*, pp. 294.

Yan Shi and Xiangjun Lu (2010) "The Role of Business Intelligence in Business Performance Management", Information Management, *Innovation Management and Industrial Engineering (ICIII), 2010 International Conference on*, pp. 18.

Zack Jourdan, R. Kelly Rainer Jr., Thomas E. Marshall, (2008). "Business Intelligence: An Analysis of the Literature." *IS Management* 25(2): 121-131.

Zhang, Y., and Wildemuth, B. M., (2009). "Qualitative analysis of content. In B. Wildemuth (Ed.), *Applications of Social Research Methods to Questions in Information and Library Science* "(pp.308-319). Westport, CT: Libraries Unlimited.

APPENDIX

A Review of BI Traditional Definitions							
Author	**Year**	**BI Explanation**	Is there a Direct relation with the following within the definition?				
			DM	**BPM**	**Data control**	**Better relations management**	**Knowledge Management**
Ortiz, 2003	2003	*"(BI) is a set of products, which are sets of tools and technologies designed to efficiently extract useful information from oceans of data"*	No	No	Yes	No	Yes
Dharan & Swami, 2004	2004	*"BI is a term that encompasses a broad range of analytical software and solutions for gathering, consolidating, analysing and providing access to information in a way that is supposed to let an enterprise's users make better business decisions"*	Yes	No	Yes	No	No
Xu, Zhang & Jiang, 2005	2005	*"The concept of Business Intelligence (BI) is brought up by Gartner Group since 1996. It is defined as the application of a set of methodologies and technologies, that improve enterprise operation effectiveness, support management/decision to achieve competitive advantages."*	Yes	Yes	No	No	No
Xie & Zhou, 2008	2008	*"Business intelligence systems are interactive computer-based structures and subsystems intended to help decision makers use communication technologies, data, documents, knowledge, and analytical models to identify and solve problems. The new generation of BIS offers the potential for significantly improving operational and strategic performance for organizations of various sizes and types".*	Yes	Yes	No	No	Yes
Viaene, 2008	2008	*"BI refers to a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data that helps Decision making process"*	Yes	No	Yes	No	No
Yoav & Kolodner, 2009	2009	*"BI is a system that supports activities such as data analysis, managerial decision making, and business-performance measurement".*	Yes	Yes	Yes	No	No
Wixom & Watson, 2007	2010	*"Business intelligence (BI) is an umbrella term that is commonly used to describe the technologies, applications, and processes for gathering, storing, accessing, and analysing data to help users make better decisions."*	Yes	No	Yes	No	No
Foley & Guillemette, 2010	2012	*"A combination of processes, politics, culture, and technologies for gathering, manipulating, storing, and analysing the data collected from internal and external sources in order to communicate information, create knowledge and inform decision making. BI helps report business performance, uncover new business opportunities and make better business decisions "*	Yes	Yes	Yes	No	Yes
Patrick; Christian; Christian; Peter & Martin, 2010	2010	*"Business Intelligence (BI) a concept provides a means to obtain crucial information to improve the decision making process"*	Yes	No	No	NO	NO
Hill, Ariyachandra & Frolick, 2011 10 prince	2011	*"(BI) is seen as the ultimate solution that will help organizations leverage information to make informed, intelligent business decisions"*	Yes	No	Yes	No	No
Glancy & Yadav, 2011	2011	*"Business intelligence (BI) a system that provide relevant competitive intelligence, combine it with a business 'internal information, provide expert information, incorporate advanced analytical decision techniques, and are able to inform the executive of the relevance of the knowledge created from the system."*	Yes	Yes	Yes	No	Yes
Gluchowski & Gluchowski, 2011	2011	*"BI is a data driven decision support system (DSS) that combines data gathering, data storage, and knowledge management with analysis in the interests of better managerial decision making"*	Yes	No	Yes	No	Yes