Factors to Determine Business Intelligence Implementation in Organizations

Michael S. Moreno Saavedra, and Christian Bach

***Abstract*— In this study, we deploy review centric research of User Satisfaction, Cost Reducing, and Time Optimization impacting decision making on whether to implement Business Intelligence in organizations. The purpose of this paper is to present a literature review to examine the association between Business Intelligence and these three different factors. The primary goal of this study was to investigate the user's satisfaction, cost reducing, and time optimization implications in order to choose Business Intelligence as a business tool. A comprehensive literature review of business intelligence created a theoretical foundation for this paper. Using the grounded theory, a model was developed and evaluated based on how User Satisfaction, Cost Reducing and Time Optimization impacts managerial decision-making using Business Intelligence. Using data from JSTOR and Academic Search Premier databases a new model is presented to encapsulate the highly dynamic interaction of user satisfaction, cost reducing, and time optimization with business intelligence to provide elements to consider the implementation of BI in a firm. This model highlights three key aspects that administrators consider in order to determine the possibility of taking Business Intelligence as an instrument in their daily duties. The theoretical model is limited to three factors only, which could be extended in future studies on this topic. Moreover, this model has been discussed using a theoretical perspective whereas practical contributions has been given less attention. This study provides an exciting opportunity to advance our knowledge of business intelligence to efficiently and flexibly help companies make the right decisions in real time, grasp business opportunities, and gain competitive advantage.**

***Index Terms*—Business Intelligence; Cost Reducing; Decision Making; Time Optimization; User Satisfaction.**

I. Introduction

There is growing literature on Business Intelligence [1]–[15]. Business intelligence is a new and upcoming area of investigation in information systems. The Business intelligence idea has become more and more applied during the last two decades, and nowadays, this congregation of terminology is adopted over different environments of interest from data technology to process modeling in business [16]. The business intelligence approach is related to develop and deployment of information based systems to facilitate decision-making processes. It is possibly the most prosperous field of modern information systems practice and the structure of a company can be drastically changed by the agreements made using these tools [1]. According to Negash [9], business intelligence converts data into useful information and through human analysis, into knowledge. Some of the activities performed by business intelligence are: creating forecasts based on historical data, past and current performance, and estimates of the direction in which the future will go; "what if" analysis of the impacts of changes and alternative scenarios; ad hoc access to the data to answer specific, non-routine questions; strategic insight [9].

The aim of this paper is to provide a conceptual theoretical framework based on articles and journals in business intelligence. For analytical purposes the business intelligence approach has been considered a central part of the study and divided at three levels of aggregation: user satisfaction, cost reducing, and time optimization [7], [10], [11], [17], [18], [19]. In this article, we suggest these three levels as main areas of interest that executives need to consider in order to adopt business intelligence solutions in their enterprises. Further, these considerations have been examined proving linkage between each other and business intelligence development.

This study intends to contribute to this growing area of research by exploring the decision-making process to determine the implementation of business intelligence. Despite business intelligence systems being extensively used in commercial enterprises and the market, there is a limited research pertaining this matter. There are still unanswered questions about this issue. As an example, we can learn what the benefits managers get if they use this technology, what key aspects administrators should consider to implement this solution in their businesses, among others. Thus, this study offers some important insights proposing a framework model which highlights the importance of user satisfaction, cost reducing, and time optimization as a need to develop, acquisition or integration of business intelligence tools.

The report has been organized in the following way: first, the project's research method and the dependent variable are outlined. This is followed by a discussion of the three independent variables and analysis of relations between them and the dependent variable in terms of the review centric research method used in this study [20]. Lastly, it will present the contribution of a new insight to the research and the conclusion gives a brief summary and critique of the findings identifying areas for further research.

Published on December 5, 2017.

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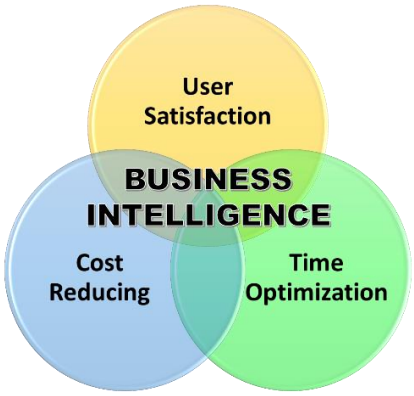

Fig. 1. Factors to determine Business Intelligence implementation in organizations.

II. Research Method

The research method used in this study follows the review centric research principles outlined by LePine and Wilcox-King [20]. More than sixty articles have been reviewed in relevant journals such as JSTOR, ProQuest, and Academic Search Premier, which created a theoretical foundation for this paper. Various approaches have been reviewed to extract information regarding the three main factors presented: user satisfaction, cost reducing and time optimization as essential for business intelligence [19], [21] –[29].

This exhaustive literature examination on business intelligence created a theoretical foundation for this article. Using the novel theoretical insight, considerable different approaches in collecting peer reviewed journal articles and books to reinforce the objective. Motivated by the lack of information and knowledge about this topic, a new model was developed and evaluated to advance our understanding of business intelligence consistent to decision-making processes in organizations.

This is a timely topic as the recent expanding requirement for analytics professionals, BI professional developers and engineers, and BI tools appears to be extremely attractive for companies. A new model is presented to summarize highly dynamic interactions of the considered variables and business intelligence to contribute outcomes that have a significant impact on the fast-moving behavior of those firms. The contribution of the study is intended to review and summarize the theoretical and empirical knowledge that should further our theoretical understanding about business intelligence implementation. In addition, this theoretical integration should mirror a complex network among special concepts in both conception and substantial grounds [20].

III. Discussion

A. Business Intelligence

This research that has been developed in regards of business intelligence in order to uncover the most valuable and detailed information about it. There are significant coincidences about business intelligence process and results, so that, most of the authors mentioned in this paper agree with each other that implementing Business Intelligence (BI) technologies applied in companies is a meaningful process to make companies worth more. BI refers to a data, model oriented decision support system which is designed to provide complete reports to managers about a company's situation so that they can take action about it [1]. As can be seen in Fig. 2, the definition of business intelligence involves Data, Model Oriented, Support Systems, and Reporting.

Additionally, organization's future directions and trends in the markets can be suggested by using BI technologies. Further, we can find out if the company is capable to compete and the actions it should take going forward [9]. In the same way, business intelligence represents an extensive area of utilization and technology for collecting, storing, analyzing and providing access to information for enhancing the quality of businesses process modeling [16].

Having data stored in warehouses with a positive treatment would give corporations a better position in today's marketplace. Plus, it would also improve decision-making processes to managers [4]. In order to acquire the most from the powerful of using business intelligence, it is needed to collect relevant information for the firm. Therefore, it will upgrade business strategy and lower crucial time [5].

Furthermore, BI systems are composed by both technological and managerial elements which present historical information and data to simplify in order to make an effective decision-making process by examining them and presenting a more powerful performance of organizations [6]. At all levels of an organization, business intelligence is applied to simplify information discovery and analysis making the process possible for executives. Additionally, accomplishing easier access, understanding, analyzing, collaborating, and acting on information at any moment and in any place [15].

B. User Satisfaction

The first factor discussed in the introduction of this paper is User Satisfaction which has been examined as a crucial determinant to be considered by companies' managerial stuff in their decision process. User satisfaction is referred to a clear perception whether users are pleasant or not resulting from all advantages these users receive from interacting with the evaluated information system [18]. In the same way, user satisfaction is defined as all data achieved and accessible on information systems that meets user's requirements [17].

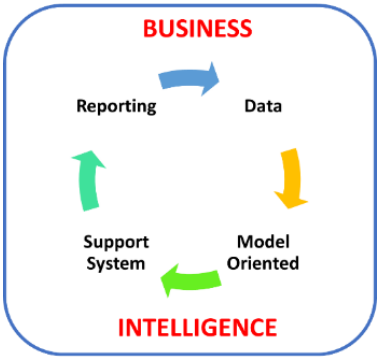

Fig. 2. Business intelligence definition model according to Arnott and Pervan [1].

In addition, we can express that information system success or efficiency can be measured by user satisfaction,

which has become a very convincing estimate recently [30]. Correspondingly, user satisfaction shows a superior comprehension of the relational process between IT stuff and users as a mutual service due to the knowledge-intensive and collaborative nature of IT services in a contemporary business environment [31].

Hence, user satisfaction impacts computer system's effectiveness and is influenced by the information, and system quality. User satisfaction has become an important means of measuring users' opinions about Information System success; in this case used to compare business intelligence tools with another traditional reporting software such as Microsoft Excel [32]. On the contrary, user satisfaction is also viewed as an uncertain prognosticator of system usage. This is because of system and information's design attributes, such as information accuracy and system reliability which are potentially useful diagnostic measures for system design [33]. The key aspects of user satisfaction contemplated in this article can be listed as follows: User Skills, Perceived Usefulness, and Technology Acceptance.

First, regarding User Skills as an important element of User Satisfaction we have found in recent studies such as the one completed by Torkzadeh and Lee [34] that they attached the term end-user computer (EUC) skill indicating that final users, employees, customers using software are who will be measured in terms of their computer capabilities. EUC can be defined in terms of user's knowledge and ability to utilize computer hardware, software, and procedures to design, develop, and maintain specific applications for task-related activities [34]. Also known as basic computer skill. Goldhammer, Naumann [35] pointed out that it is a fundamental ability and speed of performing elemental activities in a computer graphic user interface to access, collect, and provide information. It also refers to elemental capability comparable to core technical skills enabling a person to perform simple actions which are common to many software applications [35]. Some literature refers to the EUC community including "early adopters", users who quickly accept new end-user tools and easily develop considerable abilities in the use of these tools. In contrast, there remains a far larger potential population of "reluctant users", individuals who lack inclination for involvement and have considerable difficulty learning to use a computer system [36]. Further, there is a high probability that EUC satisfaction varies with computer skill, computer attitudes, computer anxiety, and computer use, among others factors that should be considered to better understand user satisfaction [37].

Second, it has been confirmed by numerous studies that Perceived usefulness (PU) is a reliable indicator to users' involving the intention to adopt different technologies in different settings [29]. Previous literature defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance." It comes from the definition of the word useful: "capable of being used advantageously." Thus, in an organizational context people are generally encouraged to have good performance by raises, promotions, bonuses, and other rewards [38]. Usefulness perceptions is a result from subjective norms and image (i.e., using a technology enhances one's social status) through processes of internalization and identification. On the other hand, usefulness perceptions have their origin in cognitive beliefs of job relevance (i.e. technology is related to the task), output quality (i.e., technology performs the specific task well), and result demonstrability (i.e., results of using a system are observable) [27]. Previous studies recommended that users' continuance motivation is decided by their comfort with information system use and perceived usefulness of maintained system. Consecutively, user satisfaction is impacted by their ratification of likelihood from earlier information system use and perceived usefulness [39].

Third, we need to understand how users accept new and incoming technology, systems, and applications in view of User Satisfaction. Technology systems' acceptability can be defined as a function of three dimensions: (1) utility (the system works as needed); (2) usability (users work with the system successfully); (3) likeability (whether the system is suitable) [40]. Thus, technology acceptance model (TAM) describes two approaches that have influence on acceptance of informatics innovations: perceived usefulness and perceived ease of use [41]. Especially, the TAM presumes that a users' judgment about their ability to use a technology item and their personal assessment of the usefulness of that technology are the indispensable motivations of behavioral intentions [42]. Moreover, it was also shown that individuals with a more advanced grade of computer expertness were more expected to accept using the newest technology and would not be nearly as difficult for them in contrast to individuals with inferior grade of proficiency. Correspondingly, previous studies also suggested the connection between technology acceptance desires, conducts, and background knowledge is connected to a users' perceptions of the computer systems [43].

C. Cost Reducing

The second factor reviewed in the description of this paper is Cost Reducing which has been examined as an essential factor to be considered by organizations' administrators in their decision process considering business intelligence systems as an enhancement of the costs of a firm. The fundamental and most meaningful purpose of big data technology is to deliver dramatic cost reduction of projects and create financial benefits from it [19].

Information technology implementation is crucial because it allows a firm's competitive strategies by reducing production costs, while achieving operational adaptability, enhancing supplier or customer relations, and enhancing or creating new products and services [7]. As an example, patient information itself will not make better care or lower costs; medical computer programs will be required to adopt the use of BI technologies to have a positive effect on patient care by reducing the cost and improving the quality of that care [44].

In contrast, it is assumed that Customer Relationship Management's cost of implementation (including software, hardware, consulting, and reengineering process) increments when we have more targeting- and support-related CRM units to implement in big companies' systems [24]. Equally important, Thamir and Poulis [13] express the idea that due to the expensive cost of creating business intelligence, organizations need to examine if they need BI

implementation and a business justification for a comparison between cost and benefits that they would gain from BI. As well, BI implementation should be business driven instead of technology driven for BI decision-support justification. So that we can reduce business problems related to profitability or performance [13]. As an explanation, BI tools can assist executives and managers in the operating room and procedural areas track purchasing expenses more precisely and determine the origin that causes cost increases [2]. This topic can best be treated under three headings: Operational Capabilities, Acquisition Cost, and Information Technology Investment.

To begin with, operational capabilities are expressed as a specific set of skills, processes, and routines developed by a firm within the operations management system that are regularly used in resolving problems through configuring its operational resources [45]. In a like manner, information technology capability is an organizational potential that symbolizes the ability to mobilize and deploy IT-based resources in combination with other resources and capabilities in the firm [8]. A recent study refers to operational business intelligence systems as the on-demand capture and analysis of operational data at the right time intervals with the intention of taking immediate action to improve business processes [46]. Additionally, operational BI must process both analytical inquires and business transactions at the same time, on identical data, which results in mixed workloads. Operational BI and mixed workloads are a great challenge for current database management systems [12].

To better understand the mechanisms of Technology Investment and its effects, the literature expresses that this investment decision is a typical decision-making problem which is comprised of decision makers (receiving information from other stakeholders in the company), decision objectives (organization's mission) and decision alternatives (discrete investment options) [47]. In fact, in order to maximize IT investment value, a competent manager must make a judgment about the relevant risks and proactively build flexibility into an investment [48]. Equally important, IT investment projects are usually susceptible to life cycles implying that the mean of discounted cash in-flows will only increase up to a certain point in time and decrease after that time [25]. In the recent decades, to improve the quality of companies' products and services, firms have made investments in information technology a necessary process. Consistently, IT costs for the same performance level decreases as time passes [49]. In general, investment in technology can directly influence the performance of an organization when it is properly combined with other resources and capabilities of the company, hence it is considered a valuable resource in itself [50].

To undertake a technology project, each IT group has to incur in hardware and software acquisition costs that these systems require. Added to these costs, operating costs have to be incurred since these are directly associated with the continuous operation of an IT system. On the other hand, control costs are optional, and are used in order to reduce operating costs and / or improve service levels [51]. Indeed, there is a need to address the downstream cost impact produced by maintenance, utilization, and support of a system through its planned life cycle while making a decision on technology [21]. Subsequently technological growth and complexity, the shortening of product life cycles, and the escalation of technology development costs increasingly companies have to outsource technology to reduce time and the costs of development, sharing risks and accessing the experience not available at home. [52]. On the contrary, it should be taken into account, as a caution, that the use of external technology by companies can cause the erosion of their own competitive capacity. However, it is also important to know the fact that there are extensive strategic benefits of external acquisition, such as avoiding the high costs of internal development and saving time and effort [53].

D. Time Optimization

The third assessment from Business Intelligence is Time Optimization where organizations can gain and be more efficient in time. The primary goal of business intelligence is to make advances in the quality of decisions while decreasing the time it takes to make those decisions [11]. In the same way, implementing data views in warehouse environments bring several efficient superiorities such as improving response time and maintaining data integrity in their systems [54]. With this intention, the critical target for Real Time Business Intelligence is to reduce action time in order to increase business value and use that saved time in other activities like decision making [55]. For instance, soft computing techniques were applied to optimize and arrange a modular tool's functional tips, allowing surgeons to deliver improved quality treatment in less time, while decreasing overall cost of that procedure [56].

Due to a the rapidly growing society life has been changed, the workload has increased, the answers are expected quicker and more challenges have emerged between firms' personnel. We can also mention from previous experiences that time is a meaningful resource which has to be optimized through rationalized proportions and supervised within an organization [57]. Finally, according to Dr. Richard Hackathorn, creator of the Time-Value Curve, "the value of data is directly proportionate to how fast a business can react to it. In other words, a corporation loses money every time it delays getting information into the hands of decision-makers" [10].

In this article there have been chosen three factors that have a direct impact on Time Optimization in enterprise processes. These are: Labor Productivity, Processing Power and Response Time.

Knowing that if a firm increases employee productivity efficiently, the time spent in working through different tasks will decrease. Recent publications have found that a significant contributor to Labor Productivity in the recent decades has emerged: Information Technology capital. There have been many attempts to establish the driving force behind productivity resurgence in developed economies. Hence, tracking the size and growth of IT capital (computers, copying machines, communication equipment, computer software, and etc.) has become a standard practice in productivity investigation [28]. Some preliminary studies show that there is a positive relation between labor

productivity and the level of IT implementation and integration. Equally important, the labor productivity may be improved by the implementation of proper solutions [26]. Every business makes an effort to be more profitable trying to cut costs, and they are not willing to reduce their workload. Instead of thinking about cutting costs, it can thus be suggested to increase productivity [22]. Various approaches have proposed that information communication technology (ICT) has a positive and significant effect on labor productivity growth, although in terms of impact it is essential to include the human capital variable. On that account, a higher level of educated workforce is required to rise up a labor productivity growth through the ICT [58].

Many expert materials published on firms' financial services suggest that organizations are capable to provide a quick response while revenues increase and costs decrease provided that they use business intelligence as a primary source to identify revenue-generating and revenue-retaining opportunities with customers [59]. Lowering response time and offering the correct resources to the authorized users is the first concern of Business Intelligence coupled with recent technology like cloud computing [60]. Having the information in the same place can be accessed anytime and can be presented in an intuitive form, leading to the significant improvement of productivity. BI systems offer the opportunity to obtain the needed reports and analyses in the most abbreviated time by management and employees [57]. Recently, operational BI has been evolved to Real-Time BI. Sandu [61] has explained the term Real-Time BI stating that data being analyzed as soon as it enters the firm systems. In this context, delivering information in a range from milliseconds to a few seconds after the business event may be the closest definition of real-time BI [61]. Another difficulty businesses address is that as dormancy grows, the data starts having minor relevance and the capability to execute on it diminishes, most likely creating an enterprise to enhance operational performances or to invest additional capital. To ensure decision-makers have the data as present as possible, real-time data integration tools offer important solutions having the analytic information virtually synchronized with operational information [23].

It has been demonstrated that to process huge quantities of data stored in data warehouses it requires enormous processing power and space. Interestingly, these are fundamental resources for companies which manage their day-to-day operations based on information technology systems. As an explanation, if a corporation wants more from their servers, IT departments will not be able to supply additional processing potential to the data warehouse until after hours [14]. As a result, a typical relational or object-oriented database cannot manage a data set of the big data, even with normal computers, or traditional desktop application software. For this type of structures, is needed a huge parallel processing power of computer clusters [3]. A good example for this is the internet, there is almost limitless processing power available to quickly scale up and process analytical workloads. We can also find the simplicity of providing mobile apps that support on the go data (essential data on any mobile device) which is known as the era of the "New BI." [62]. Finally, the term 'big data' possess an amazing impact on the solution space for business analytics, data warehousing, and data integration. Due to the fact that big data is addressing new questions to improve BI performance, it has found better ways to process volumes and varieties of data at higher speeds and at a faster velocity [23].

IV. Results

The evidence from this study points towards the idea that to adopt the business intelligence approach in an enterprise it has to have a great significance on the business processes staring from improving personnel satisfaction in their work, cutting down the budget cost of the firm, and completing quicker responses to customers, executives, and suppliers.

These findings add substantially to our understanding of the factors impacting decision-making process. Managers should consider the implementation of business intelligence as part of the technology stuff in their companies. The results of the study are presented in Fig. 3, where the framework developed involves all variables discussed in this research.

V. Contribution and New Insight

After reviewing the literature, we agree that business intelligence has a positive impact on decision making through the whole business process. Starting from simple data, business intelligence merges primary and different sources of information to make clearer knowledge accessible to managers. As we discussed the three variables in this paper and analyzed them together we can suggest that there is a strong association between user acceptance, cost reducing, and time optimization with business intelligence results. Here the essential outcome is determining what our employees need, budget management, and time rationalization are fundamental to make a determination whether to implement business intelligence solutions as part of their technology platform.

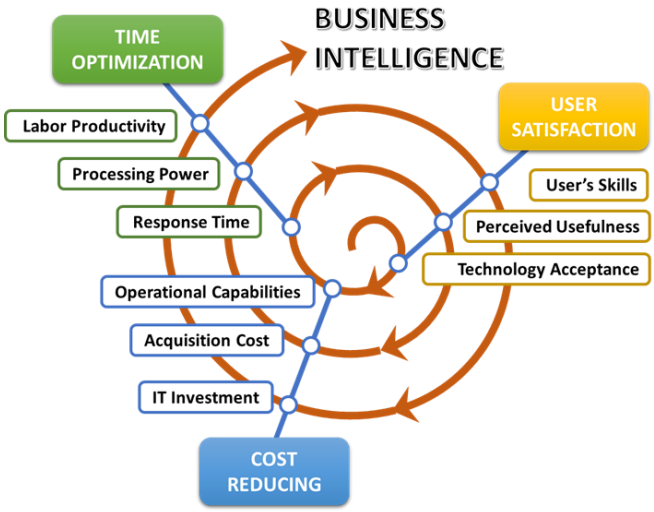

Fig. 3. Proposed framework model of relationship between key factors to determine business intelligence implementation.

Moreover, the most striking observation to emerge from the literature is business intelligence also has an impact on these three variables: enhancing user satisfaction among employees, reducing the cost of the decision process, and optimizing the information system response time saving

crucial time which can be used for other purposes.

However, more research on this topic needs to be undertaken before the association between business intelligence and these three variables is more clearly understood.

VI. Conclusion

This is a timely topic because researchers want to develop a better understanding of which primary factors managers should consider to make a decision about implementing business intelligence solutions in their firms. As recent technology is changing in such a short period of time, the demand to use business intelligence in organizations to improve their performances is indispensable. A new model based on over sixty articles is presented to provide results on how the variables such as user satisfaction, cost reducing, and time optimization shapes the decision-making process, and how business intelligence will impact changes in companies' competences that would not have otherwise taken place.

Although the research has accomplished its objectives, there were some unavoidable limitations. The empirical data is limited to sixty articles within the topic and its variables. The results of the study provide support for the use of a business intelligence tools/solutions through daily business operations to make reporting easier and more understandable to managers, proving that well developed BI applications can be used to reduce time processing, enhance user acceptance, and reduce the cost of operations.

Acknowledgment

The author would like to thank the Lord God, who gives wisdom and from Him comes knowledge and understanding. The author wants to express his gratitude to his parents, Francisco and Fiori, who have been supporting his education. The author would also express his appreciation to Christian Bach, Ph.D., professor at Technology Writing Communication & Research class, who provided insight, expertise, and encouragement that greatly assisted the research.

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