

Business Intelligence Systems Supporting Sustainability on Firm's Decision-Making Processes and Performance

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Abstract

In today's competitive business environment, there exist the need to investigate the adequacy of infrastructural flexibility for Business Intelligence Systems to support Sustainability on Firm's Decision-making processes and performance. The Business Intelligence Systems consist of unique functions that are intrinsic aimed at supporting better quality decision-making within the organization. It is critical to the smooth operations of every organization. The intention of this study is not to discuss the technical details of implementing Business Intelligence Systems but to explore how to gain maximum benefits from the applications and usage of Business Intelligence Systems. An intensive literature review that highlighted the impact of Business Intelligence on firm performance and decision-making processes were initiated. The focus was on how to apply the Business Intelligence Systems to gain competitive advantage and to create more value from information by aligning it with the needs of employees who are engaged in complex business decision-making in today's business environment. The study contributed in both academic and industrial operations by providing first time evidence of Business Intelligence solutions with particular reference to Nigerian firms located in Lagos State, Nigeria. The study employed the partial least square analysis with a sample size of 985 respondents randomly selected from five manufacturing companies. The findings suggested that the more effective use of Business Intelligence implementation, the more effective the decision-making processes and firm performance. The study offers a number of implications for theory and practice, noting that Business Intelligence System is in effect allowing firms to shift their structure to more carefully and thoughtfully align with the needs of customers and partners.

Background to the Study

Business Intelligence System and Sustainability are two issues that have been studied in a scientific literature. Business Intelligence (BI) is a concept that involves the delivery and integration of relevant and useful business information and most organizations use BI to detect significant events, identify and monitor business trends in order to adapt quickly to their changing environment. It is also used for improving the decision-making processes at all levels of management and to improve firm's tactical and strategic management processes. Many efforts have been made to develop BI systems, but they all resulted to many different solutions that help managers to work effectively. Decision-making in most organizations have constantly included use of various information resources and BI systems are alluded to as an integrated set of tools, technologies and programme items that are utilized to gather, co-ordinate, analyse and make information accessible to support stream-lining business procedures and assets, maximizing benefits and enhancing proactive decision-making (Reinschmidt et al, 2000). Business Intelligence Systems leveraged the large data infrastructure investments and have the potential to realize the substantial value locked-up in a firm's data resources.

Muntean et al (2013), noted that Business Intelligence System is an umbrella term for strategies, technologies and information systems used by the firms to extract from large and various data relevant knowledge to support a wide range of operational, tactical and strategic business decisions. On the other hand, sustainability is an integrated part of the corporate business implies the integration of the new approach at all levels including business model, performance management system and data model. Boyer et al (2010) and Farver (2013), noted that Business Intelligence processes are sustaining the decision-making processes in various business contexts, while Getz (2014), noted that sustainability is the ability to keep an organization running indefinitely without depleting natural resources or impacting the environment, maintaining economic viability and conducting fair business practices, pointed that sustainability is a business approach that creates long term shareholders value by embracing opportunities and managing risks deriving from economic, environmental and social developments.

This study highlights the importance of effectively managing the integration of sustainability and the challenges face by selected Nigerian firms in sustainability reporting. The study proposes that architectural diffusion of Business Intelligence Systems are solution to overcome the challenges and effectively managing sustainability in the decision-making processes. Sustainability in traditional organizations consist of three components, namely environmental, social and economic (Elkington, 2004). Hence, managing sustainability therefore consist of managing environmental information, social information and economic information. In essence, Milner et al (2008) opined that sustainability is the process of disclosing key sustainability information to both internal and external stakeholders in a standardized report. Holmberg et al (2006) noted that the growing awareness in the importance of sustainability led to the development of laws and regulations requiring organizations to disclose their sustainability efforts. Likewise, Dhaliwa et al (2011) pointed that organizations that openly disclose sustainability

information are more likely to be backed by investors which increases the chances of receiving external funding and sponsorship. In essence, the concept of sustainability has become an important issue globally with many organizations being affected by the heightened awareness in sustainability. The concept of sustainability has been among the most important themes to emerge and refers as a long-term perspective based on the requirements necessary to provide for the present without compromising the needs of future generations. Recent studies, have suggested that Business Intelligence System is an appropriate technology that can assist in managing sustainability information to provide better information to management to support effective decision-making (Bosire, 2014).

Research Problem

Recent years have witnessed numerous discussions on the Business Intelligence issues, with little attention paid to the questions of creating and implementing BI systems in the Nigerian firms. The economic landscape in Nigeria firms have changed in recent years from a buoyant economic climate to a situation they have never expected. The firms face obstacles such as tighter budgets, reduce access to credit and technology landscape which has become more complex than ever. Systems that support decision-making have the potential to impact positively on firm's performance and competitiveness. Most managers in the Nigerian firms are not familiar with the BI processes, and the value of data has exponentially multiplied. In this sense Business Intelligence Systems when integrated into the Nigerian workflows would deliver inordinate levels of value that reverberate through the firms. Business Intelligence diffusion is useful because markets are changing and are becoming more complex day by day. New sets of consumers which were not present before are entering market continuously, so the taste, demand and expectations of the consumers are always evolving, hence, BI systems are always the solution in this case. In essence, the Nigeria's managers need the right information at the right time and at the right place to make effective decision for their firm's performance. Lack of adequate knowledge of Business Intelligence Systems might seem to be a huge barrier for the performance of the manufacturing sector in Nigeria.

Objectives of the Study

The main objective of this study is to explore the use of Business Intelligence Systems in selected Nigerian firms in order to provide insight into the situation and improvement in the firm's performance. The study intend to offer an insight into the measurement of BI systems and by so doing, to remedy the lack of timelines in the firm's decision-making processes. Other specific objectives include;

1. Gathering and analyzing large volumes of data and information extraction from both operational data-base and the data warehouse within the organization.
2. Obtain complex information from managers to support decision making within the firms.
3. Provide insight and guide the development of new strategies to remain competitive.

Research Questions

Based on the objectives of the study, the following research questions were proposed to guide the study:

1. Why is it necessary to implement Business Intelligence System within Nigeria's firm?
2. What are the key determinants of the success of Business Intelligence Systems?
3. What might be the impact of successful diffusion of Business Intelligence Systems in the Nigerian firms?

Research Hypothesis

Based on the research problem and the objectives of the study, the following research hypotheses were formulated to guide the study:

Ho:1 There exist a significant positive impact of Business Intelligence Systems on Nigeria's decision-making processes.

Ho:2 There exist a positive direct effect of Business Intelligence Systems on Nigeria's firm performance.

Significance of the Study

This study intends to make a significant impact to both research and practice. The study contributes to the growing information system literature which aims to examine the value of investing in information technology. They study therefore extends previous Business Intelligence value studies by examining the relative effect of BI within a framework of sustainability information management practices. Our systemic view builds on prior studies within the domain. In practical terms, the study identifies the role that Business Intelligence Systems play in supporting sustainability in firm's performance and decision-making processes. In addition, this study offers a number of important implications especially for BI stakeholders who are involved in planning, reviewing or implementing BI to support sustainability. Diffusion of Business Intelligence System has become widespread as firms continue to search for ways to support business performance management. The author emphasizes that Business Intelligence Systems should be an integral part of the management system.

Literature Review

The concept of sustainability stems from the idea of sustainable development which has become a usual terminology at the world's First Earth Summit in Rio 1992. The purpose for which it addressed this concept is continually the quality of life, improving present and future prosperity, an approach that takes into account the integration of economic development, environment and society. At the same time, the role of Business Intelligence System has shifted from being used in specific functional areas of an organization to being strategic in scope. The use of Business Intelligence System refers to certain skills, technologies, practices and processes that are employed as part of supporting decision-making in an organization. The diffusion of BI system is aimed at the support of better quality decision-making within an organization and is critical to the smooth and coordinated operation of every organization. Business Intelligence System is a set of methodologies, processes, architectures and technologies that assist in

transforming raw data into meaningful information to enable more effective strategic, tactical and operational decision-making (Sharman, 2010).

Sabherwal et al (2011) noted that Business Intelligence System be viewed as the product of the knowledge creation, defined BI in two distinct ways. First Business Intelligence refers to the process in which an organization collects, analyzes and distribute information and knowledge. Second, viewed BI as the product of the process of collection, analysis and distribution. The product of its process could be used in the decision-making process and other business activities. Davenport (2010) defined Business Intelligence as the skills, processes, technologies, applications and practices used to support decision-making. Business Intelligence has the potential to maximize the use of information by improving the company's capacity to structure large volumes of information and make accessible those data that can create competitive advantage through improvement of business management and decision-making (Watson, 2009). Stocker (2010) noted that Business Intelligence allows management to gain better insight into performance of enabling the integration of information within existing systems with the goal of presenting a single set of easy to understand graphical visualization.

A wide range of definitions exist for Business Intelligence System with different authors providing differing opinions on what exactly BI is. There is no one globally accepted definition for Business Intelligence System. Larissa (2003), presented Business Intelligence as an architecture and a collection of applications and operational integrated data-base which provide the business community easier access to business data, while Nedeleu (2013), defined Business Intelligence as a process that aims to serve and support business process management.

Most Nigerian firms are relying on outmoded data analytics that have over-time become their single version of the truth. Despite the rapid gains in Business Intelligence, the Nigeria's firms continue to be a reliance on legacy systems that are often not integrated to each other and do not integrate to each other and do not have predicted analytic capability. Given how critical time is today as a competitive aspect of any firm's performance, it seems astounding that more of the functionality of a given data analytics is not used in Nigerian firms. In recent time, the usage of Business Intelligence is allowing organizations to shift their organizational structures to more carefully and thoughtfully align with how their customers want to buy from them and how they want to stay connected with their customers over the long-term. In essence, when Business Intelligence Systems are sustainably integrated into the Nigerian firms the value of the data is multiplied.

As mentioned before, there are different interpretations of Business Intelligence System and many terms applied to it like competitive intelligence, strategic intelligence, market intelligence and customer intelligence. The use of these terms are haphazardous both in academic and business world (Getz, 2004). The term has been defined from several perspective and present complex corporate and competitive information to planners and decision-makers with the objective of improving the timeliness and quality of the input

to the decision process. Pirtimaki (2007) remarked that the definitions of Business Intelligence vary depending on the perspective from which it is defined, noted that Business Intelligence Systems combine data gathering, data storage and knowledge management with analytical tools to present complex internal and competitive information to planners and decision-makers with the aim of improving the timeliness and quality of inputs to the decision process, thus, facilitating managerial work. It is observed that the emergence of the data warehouse as a repository, the advance of data cleansing, the greater capability of hardware and software and the boom on internet technologies all combine to create richer Business Intelligence Systems.

Muller et al (2010), noted that Business Intelligence System is thought to contribute to the measurement and analysis practices by enhancing access to performance information, hence plays an active role in all of the management practices involved in sustainability issues relating to firm's performance. On the same note, Elbashir et al (2008), found this BI influenced internal process efficiency, understanding of customers and business supplier partnerships. Similarly, Wixom et al (2008) highlighted the impact of Business Intelligence tools on improving manager's understanding of organizational outcomes, while Chen and Siau (2012), noted that Business Intelligence technologies are specifically designed to systematically report on performance, that no one technology comprises of Business Intelligence System, rather most systems include a number of different technological components.

As stated in this study, the aim is to explore the role of Business Intelligence (BI) system in assisting to support the management of sustainability in contemporary Nigerian firms for effective decision-making. We realized that Business Intelligence Systems have an important but not yet well studied role to play in helping Nigerian firms implement and monitor sustainable and socially responsible business practices. Most Nigerian firms have reached a point where the use of tools to support the decision-making process at the strategic level should emerge as more important than ever. We found that BI is seen as a response to current needs in terms of access to relevant information for decision-making through intensive utilization of information technology.

Research Gap

The architectural diffusion of Business Intelligence Systems for sustainability firm performance and decision-making processes have not been investigated in Nigerian firms. To address this gap, the study conducted a medium scale survey collected data from five selected manufacturing firms located in Lagos State, Nigeria with a total number of nine hundred and eighty five (985) participants randomly selected from five firms. Partial least square method was employed to analyze the survey data. The study was intended to provide implications for theory and practice.

Methodology

In this study, descriptive research was adopted for collecting data to test hypotheses. Typical descriptive studies are concerned with the assessment of attitudes, opinions, demographic information, conditions and procedures. The research design chosen for the

study was survey research. Both secondary and primary data were used and the data collected for the model were through questionnaire. To test the questionnaire for clarity and to provide a coherent research questionnaire, a macro review that covered all the research constructs were thoroughly performed. Some items were added while others were dropped and others were reformulated to become more accurate to enhance the research instrument. The reliability analysis applied to the level of Cronbach's (α) alpha was the criteria of internal consistency. The results obtained were the accepted level as suggested by Sekaran (2003).

Data Collection

The study adopted survey method for data collection. Questionnaires were developed based on the literature review and the research hypotheses. The respondents were randomly selected from the five industries located in Lagos State, Nigeria and the questionnaires were distributed to 1,250 employees of the selected industries. A total of 985 fully completed responses were received (78.8%) and analyzed using the Partial Least Square (PLS) method.

Exploratory factor analysis (EFA) was employed to reduce the number of variables, followed by confirmatory factor analysis using smart PLS. As mentioned before, all composite reliability measures exceeded the recommended threshold of 0.70 and all Cronbach's (α) value were above 0.70, indicating strong reliability of the measurement model. Strong convergent validity was found by the average variances extracted (AVE) values which all exceeded the recommended threshold of 50% (Formela, 1981). For the discriminate validity, the cross loadings and the average variances extracted confirmed high measure model quality as suggested by Chin (1998).

Research Findings

Table 1: Demographic Variables

Variable	Categorization	Frequency	Percentage
Age	25 - 30 years	139	14.11
	31 - 39 years	251	25.48
	40 - 49 years	299	30.36
	50 - 59 years	174	17.67
	60 - above	122	12.39
		985	100
Gender	Male	694	70.46
	Female	291	29.54
Educational Qualification	WASC	81	8.22
	OND	112	11.37
	B.Sc/HND	365	37.06
	M.Sc/MBA	228	23.15
	Ph.D	94	9.54
	Professionals	105	10.66
		985	100
Experience	2 years or less	67	6.80
	3 - 6 years	98	9.95
	7 - 10 years	186	18.88
	11 - 14 years	198	20.10
	15 - 18 years	208	21.12
	19 - above	228	23.15
		985	100
Job Title	Top management	165	16.75
	Middle manager	267	27.17
	Supervisors	313	31.78
	Desk officers	198	20.10
	Others	42	4.26
		985	100

Source: Survey Data

Table 2: Partial Least Square Method

Contents	R	R ²	F-calculated	DF	Sig	β	T-calculated	Sign
Decision-making	0.753	0.567	68.573	—	0.00	0.742	6.35	0.00
Firm-Performance	0.846	0.716	72.64	—	0.00	0.831	7.48	0.00

Data Analysis

The findings of the study support the critical success factor (CSF) literature by providing evidence of the importance of Business Intelligence System management. We found that high quality Business Intelligence Systems translate into more comprehensive solution and stronger diffusion across business functions. The correlation coefficient employed to measure the strength of the linear between the variables as shown on table 2. The studies suggested that a strong relationship exist between Business Intelligence and decision-making processes and were significant at the 0.01 level.

In order to further reveal support for the hypothesis, the factors that influence Firm performance, the variables of Business Intelligence System was used. The regression procedure was employed because it provided the most accurate interpretation of the independent variables, which were expressed in terms of the Business Intelligence factors. The significant factors in the regression equation were shown in order of importance based on the Beta (β) coefficients. The F-ratio which explained whether the results occurred by chance had a value of 68.573 for decision-making and 72.64 for firm performance respectively. Which was considered significant. The Beta (β) coefficients explained the relative importance of the attributes (independent variables) in contributing to the variance in a performance (dependent variable).

The study finding suggested that Business Intelligence Systems deliver data which enables the management for effective decision-making, and provided historical data that directly inform the setting of objectives for subsequent decision-making processes. In essence BI Systems helps to deliver data quickly and accurately to decision-maker with greater insight.

Contribution to Knowledge

This study contributes to both academic and industry by providing evidence of factors influencing benefits of BI solutions by conceptualizing and systematically analyzing the mechanisms which translate the input of BI systems on the quality of management decision-making. This study fills the gap in the existing literature related to the value of BI systems in the Nigeria firms. Previous studies failed to examine the value of BI systems on a sustainability perspective. By examining the relationships between BI systems implementation and decision-making processes, this study provided a new perspective on firm's performance. In other words, this study has shown the degree to which Business Intelligence Systems directly influence(s) the effectiveness of planning, measurement and analytics and indirectly influence operational process effectiveness. Finally, this study has contributed to bridging the gap in the empirical literature. For future research, a longitudinal approach is suggested to better understand the specific mechanisms through which BI systems support sustainability decision-making process over-time.

Study Implications/Limitations

This study offers a number of implications for practice especially for BI stakeholders who are involved in planning, reviewing or implementing Business Intelligence System to support sustainable decision-making. The system has become widespread as firms continue to search for ways to support firm performance management. We therefore suggest that BI systems should be an integral part of a management system.

Like all studies on management sciences, this study has several noteworthy limitations. The partial least square method employed was quite tolerant towards small sample sizes. Furthermore, there were no established measures for the Business Intelligence constructs, which required us to develop our own measurement instrument. The measurement quality indicators provided strong support for high reliability and validity.

Conclusion

In today's competitive business environment, there is the need for firms to stay ahead of their competitive by actively measuring, monitoring and analyzing firm's performance and decision-making processes. One way which firms can do this is through the application of Business Intelligence Systems which is viewed as a combination of management practices and technologies that enable firm's performance. Furthermore, BI is seen as the application that extracts and transfer data from source systems, facilitates data visualization and allows users to select subsets of data along different dimensions. Therefore, in order to reap all the benefits of an effective Business System, the firm(s) should ensure of investing in the skilled business intelligence personnel and software designed for analytical efficiency and accessibility. One of the most important reasons why we should invest in an effective BI system is because such a system tend to improve efficiency within the firms and as a result increases productivity, we can also use BI to share information across different departments and this enables the firm (organization) to save time on reporting processes and analytics, and the ease in information sharing is likely to reduce duplication of roles/duties within the organization and improve the accuracy and usefulness of the data generated by different departments.

Furthermore, BI System can assist management understand the implications of various organizational processes better which enhances management ability to identify suitable opportunities, thus enabling management to plan for successful future. In concluding, the potential benefits of Business Intelligence Systems include accelerating and improving decision-making, optimizing efficiency, driving new revenues and gaining competitive advantages over business rivals. These benefits could assist companies identify market trends and spot business problems that need to be addressed.

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