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Role of Business Intelligence and Information Technology in Developing Countries

by

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in partial fulfillment of the requirements for the degree of

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And

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Program of Study Committee:
Anthony M Townsend, Major Professor
Russell N Laczniak

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this creative component. The Graduate College will ensure this creative component is globally accessible and will not permit alterations after a degree is conferred.

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Ames, Iowa

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ABSTRACT

Information technology is expected to play a key role in developing countries. Although information technology covers a wide range of technologies in general, this paper will use the term ‘information technology’ to refer to all computing and communication technologies.

Developed countries are constantly evolving their information systems by mining the uses of information technology and incorporating data analysis for decision making and forecasting. Likewise, developing countries are also moving forward in incorporating information technology standards and business intelligence techniques in evaluating their data to help them make informed decisions, to some extent. However, a lot of work needs to be done by developing economies to grasp the full potential of business intelligence and information technology. Although its rapid, the diffusion of information technology in developing countries has not been accompanied by substantial developmental benefits. This study therefore seeks to identify factors that influence the adoption of information technology and business intelligence in developing countries and will suggest ways in which the use of such technologies can be done to escalate the overall socio-economic standard in developing countries. The study will seek to ascertain how well information technology and business intelligence has been adopted, how useful it has been to date, what challenges developing countries could face while adopting business intelligence and other information technologies and what improvements can be made in this sector.

CHAPTER 1. INTRODUCTION

In this era of globalization and ever sharply changing competitive market trends, there is a need for timely and integrated engagement of information systems for effective decision making. With the introduction of information technology, a lot of businesses, industries and even government agencies which deal with large volumes of data are forced to gather electronic data from different sources, understand, and harness the data to make meaningful decisions. This has encouraged a number of them to adapt to computer-based intelligence in their operations to enhance efficiency and promote quick decision making. Developed countries are constantly evolving their information systems by mining the uses of information technology and incorporating data analysis for decision making and forecasting. Likewise, developing countries are also moving forward in incorporating information technology standards and business intelligence techniques in evaluating their data to help them make informed decisions, to some extent. However, a lot of work needs to be done by developing economies to grasp the full potential of business intelligence and information technology.

Availability of resources for processing data has evolved over the years due to changes in computing technology such as from mainframes to client-server to cloud computing (Rajan & Jairath, 2011). In the past, with every major shift in technology infrastructure, larger datasets are processed in much shorter timeframes. Yet, within organizations in developing countries, observing smooth, linear and longitudinal technology shifts are rare when compared to organizations in developed countries. Many researchers refer to this as digital divide (Barzilai-Nahon, 2006; Cullen, 2001; Novak & Hoffamn, 1998). Digital divide in such cases should not be understood from the simplistic notion of limited access to technology, but rather as a multilayered concept (Wei, Teo, Chan, & Tan, 2011) - of inequality of access to information and communication

technologies (ICT) (first-level), of inequality of the capability to exploit ICT (second-level) and of inequality of outcomes (e.g., learning and productivity) after exploiting ICT (third-level). Since the spread of internet and easy access to internet-based software services, organizational users in developing countries have started to expect that their work applications will provide the same characteristics, as services offered using cloud computing - like on-demand self-service, multi-device access, resource pooling, rapid elasticity and measured service (Mell & Grance, 2011). Recent research points to the use of business intelligence for managing the daily business operations (White, 2005). This has been referred to as Operational BI, as it is used to manage and optimize operational activities (Marjanovic, 2007). Although most literature characterizes Operational BI as real-time and low-latency availability of data, there is also acknowledgment that “Operational BI puts reporting and analytics application into the hands of users who can leverage information for their own operational activities” (Keny & Chemburkar, 2006).

There is a real need for information and knowledge all over the world. Development of different information technology standards and trends of business intelligence have enabled developed countries to mine data and extract any kind of information they need. Landes (1998) points out that research and development efforts in information technologies have been concentrated in only a few developed countries. Even in these countries, only a handful of key IT companies control an overwhelming proportion of world’s IT resources. One does not need to emphasize the importance of information technology and information systems in today’s world. Yet, it is perceived that people in developing countries are slow to adapt to new technologies. As latecomers to the information technology scene, developing countries face enormous difficulties - perhaps the most important being that they are becoming users of information technology without building up the necessary infrastructure, planning and manpower to support it. The specific

conditions of business intelligence and information technologies in the developing countries are not subject to extensive research. Instead, there is a tendency to adopt models or results directly from developed countries. Efforts based on such assumption that similar models would work in every country may not be meaningful; especially if they do not take account of local technological and cultural constraints. Although its rapid, the diffusion of information technology in developing countries has not been accompanied by substantial developmental benefits.

The purpose of this study is to identify factors that influence the adoption of information technology and business intelligence in developing countries and suggest ways in which the use of such technologies can be done to escalate the overall socio-economic standard in developing countries. It will focus on the role of business intelligence and information technology in developing countries - “mainly targeted on the government use” and will show that those who adopted the current trends in information technology and incorporated the approaches in business intelligence have experienced effective competitive advantage and dominance in the global market. It also seeks to ascertain how well information technology and business intelligence has been adopted, how useful it has been to date, what challenges developing countries could face while adopting business intelligence and other information technologies and what improvements can be made in this sector. While the focus will be on developing countries as a whole, the paper bases the study taking the government sector of Nepal as a representative.

Information technology is expected to play a key role in developing countries. The paper will prove useful to anyone who is seeking to gain knowledge regarding the aspect of information technology and business intelligence usage in developing countries.

CHAPTER 2. LITERATURE REVIEW

The multi-layered view of digital divide suggests there is inequality of access to ICT, inequality of capability to exploit ICT and inequality of outcomes after exploiting ICT. This is evidently clear in different systems of developing countries (Purkayastha & Braa, 2013). A combination of constant technological innovation and increasing competitiveness makes the management of information a considerable challenge, not only for developing countries but also for developed countries, which requires decision-making processes that are built on reliable and timely information, gathered from internal and external sources. Although the volume of available information is increasing, this does not automatically mean that people are able to derive value from it. This context explains the emergence of the domain generally known as “business intelligence”, seen as an answer to the current needs in terms of information for decision making through intensive utilization of information technology (Petrini & Pozzebon, 2009).

Developing economies and developing countries, to some extent, incorporate business intelligence techniques in evaluating their data to make informed decisions. Kester and Preko (2015) considered the banking sector in developing economies with focus on Ghana as a case study in assessing the impact of the adoption of business intelligence tools with respect to its usefulness in the competitive emerging financial market. At the end of their study, they found that those who adapted the approaches in business intelligence have experienced effective competitive advantage and dominance in the market and have excelled in their product delivery to customer satisfaction.

With the digital disruption, governments all over the world have envisaged into business intelligence and information technology with the purpose of seeking values for the benefit of governmental activities. Governments have taken up these technologies as a game changer.

Following the global trend of digitalization and the ICT infrastructure development, Government of Nepal can initiate business intelligence and information technology to resolve many of the governmental services (P. Pradhan & Shakya, 2018). J. Pradhan (2002) believes that developing countries, in particular Nepal, need to urgently develop a culturally appropriate national strategy if they wish information technology to have a positive impact on their overall socio-economic development. While countries like Singapore claim to have very successful national strategies, the long-term impact on the country's social development may have been overlooked. Left unchecked the technological marketplace will impose a hard-to-reverse negative role on small countries like Nepal. This will make it increasingly difficult for Nepal to decide its own long-term preferences for social and economic development. Put bluntly, these countries need to decide what they want from the global technology marketplace and then work out how they are going to achieve it. It is believed that hard technological determinism can only be countered by very real and well thought out national strategies. The author argues that the national IT strategy will need to address the issues of resistance to change due to cultural, personal and infrastructural factors, be very culturally sensitive and, given the rate change of the technology, will need to be constructed as an evolving, and learning system. The first stage in the development of such a system is to design an appropriate forum for discussion, and a well-constituted and ongoing decision-making protocol. It seems appropriate that in countries with a less than thriving technology marketplace, it is incumbent on their Government to provide a lead in this complex undertaking.

The success of this study depends on how well it explains the role of business intelligence and information technology in socio-economic development of developing countries and how well it presents the factors that are responsible for hindering developing countries like Nepal to gain the full potential of what information technology and business analytical tools and technologies

has to offer. Finally, the study will seek to find ways by which developing countries can reap the full potential of business intelligence and information technology and provide recommendation points for improvement in this sector in developing countries.

CHAPTER 3. RESEARCH QUESTIONS

The specific research questions are as follows:

- RQ1: What is the relationship between the governmental use of business intelligence and information technology and socio-economic standard of developing countries?
- RQ2: In what ways can business intelligence and information technology be used to escalate the overall socio-economic standard in developing countries?
- RQ3: What are the factors that influence the adoption of information technology and business intelligence in developing countries?
- RQ4: What challenges developing countries could face while adopting business intelligence and other information technologies?

CHAPTER 4. RESEARCH METHODOLOGY

The present research has been conceived as a qualitative study. It aims at describing and understanding complex phenomena, whose contextual factors must be deeply analyzed.

To examine the research questions, data were collected from different sources. Multiple forms of data such as observations, documents, journals etc. were gathered rather than relying on a single data source. Since getting primary data did not seem to be feasible, secondary archival data related to developers, implementers and users, who work in information technology sector of a number of developing countries were also looked upon. Secondary sources of data such as earlier published work by the authors were also looked upon. The trends in the ICT Development Index (IDI) were also captured. The IDI published by the United Nations International Telecommunication Union is based on internationally agreed ICT indicators. This makes it a valuable tool for benchmarking the most important indicators for measuring the information society. The IDI is a standard tool that governments, operators, development agencies, researchers and others can use to measure the digital divide and compare ICT performance within and across countries. This helped to find the relationship between the use of business intelligence and information technology and socio-economic standard of developing countries. The different ways by which business intelligence and information technology can be used in different sectors were also researched.

The research investigated the implementation and use of business intelligence and information technology projects in Nepal, i.e., what approaches to business intelligence and information technology implementation are being applied by Nepalese companies and the Government of Nepal, what kind of information and sources are being used, what challenges have

they faced and what they perceived “value” or benefits of these projects are. For deep research on the condition of business intelligence and information technology in Nepal, articles, both academic documents and national-level magazines were searched. Research was done about the current condition in Government of Nepal’s bureaucracy, how knowledgeable are the bureaucrats about the importance of business intelligence and information technology, and national and local newspapers were a great help for this purpose. As I come from Nepal, a developing country, my life experiences were helpful throughout this study.

CHAPTER 5. FINDINGS

In developing countries, most of the citizens have become accustomed to use information technology in their daily life hence, making it less hesitant to use them. The concept of “Smart Cities” is rapidly encouraging the citizens to get “smarter in technology” in many ways. The increasing penetration of mobile phones with the usage of large number of smart phones shows how citizens are forced to get smarter with being mobile and socially connected. Mobile applications are finding a large innovative space to deliver newer exciting applications over the devices. Technology affordability has increased with the cost going down every year. The top 3 countries as ranked by IDI in the year of 2017 are Iceland (8.98), Korea (Rep.) (8.85) and Switzerland (8.74). The IDI 2017 rank for top 3 “developed countries” are Iceland (8.98), Switzerland (8.74) and Denmark (8.71). Similarly, the IDI 2017 rank for top 3 “developing countries” are Korea (Rep.) (8.85), Hong Kong, China (8.61) and Singapore (8.05). It is very interesting to see how Korea (Rep.) - a developing country is doing so well in ICT. Nepal ranks 140th in the overall ranking by IDI 2017 with a score of 2.88. Therefore, we can see that there is diversity between the developing countries as a group when the matter is about the current status and potential for ICT.

Information technology has been recognized as one of the most important factors separating the developing and developed countries. The inability to harness the large amounts of data and failing to use it for their advantage has been deemed responsible for the slow pace of development of developing countries. I have a strong belief that the role of business intelligence and information technology cannot be undermined, especially in developing countries like Nepal. Considering that business intelligence and information technology use takes place within a context

of “globalization” and being aware that companies that participate in such a globalized process do not compete under equal conditions, I expect that use of business intelligence and information technology would help companies in developing countries find competitive advantage.

Optimally used, the values of business intelligence and information technology can bring about transparency, organized or collaborative informative system, speed in corrective decision making and newer business opportunities. McKinsey estimated that developed economies of Europe's government administration saved more than \$149 billion in operational efficiency improvements alone by using business intelligence (Manyika et al., 2011). Using business intelligence and information technology can improve decision making and organizational efficiency.

All economic sectors including agriculture, mining, banking, commerce, health-care, education, publishing, environment-management, energy conservation and transportation are becoming fast, flexible and information intensive (Hanna, Guy, & Arnold, 1995). If properly used in developing countries, business intelligence and information technology can be the main factor in increasing productivity in public administration, communications infrastructure, industry and agriculture (Avgerou, 1995; Chou & Gill, 1977; Lind, 1996; Oyomno, 1996). Furthermore, many studies have already shown that information technology can be useful for educational purposes (Grobler, 1996; Makau, 1990), geographical applications (Madon & Sahay, 1996), financial applications (Bhatnagar, 2010; Corformat, 1985), health systems (Adam, 1996; Braa, 1995; Getao & Odhiambo, 1996; Madon, 2000), water resources management (Kelsey, 1988), tourism and other sectors of the economy.

Although most of the countries have seen the benefits of business intelligence and information technology, it does not seem as if the Government of Nepal has efficiently explored the adoption of this technology.

Business intelligence and information technology is still not well known among government bureaucrats. The attitude of the government administration must be forced to be changed by first training the bureaucrats and their concerned IT departments. Training must be added in local administration and technical institutes. Consultant hiring from reputed global organization can play a key role in turning the traditional working scenario.

Although it is slow, Nepal is transforming governmental systems into digital systems. The Government of Nepal has encouraged the growth of ICT index by incorporating some ICT infrastructure projects. Broadband backbone projects and reach of rural areas are being prioritized along with the hype of mobile penetration with speed focused data services. Nepal must benefit and seek the data values. Big data technologies can be adopted to solve many of the issues faced in different sectors.

Recently, the Government of Nepal has planned to issue digital national identity cards to its citizens and the distribution has also started since November 2018. The electronic card has biometric data of each eligible Nepalese citizen along with a unique identification number. It contains family name, given name, address, father's name, mother's name, photo and four fingerprints of both thumbs and two index fingers. It will replace the existing paper citizenship card. The national identity card is a multi-purpose machine-readable biometric smart card, laser engraved polycarbonate, with several world leading security features. The new identity card has been designed to improve identity management services and assist in delivering government services and social security benefits. The cards can be used as an electronic authorization for e-

services, cross-border security documentation and for the delivery of healthcare and welfare services. Same information such as photographs, citizenship number, address, and other personal profile could be shared from single source instead of entering the same information multiple times. However, the decision by the Government of Nepal to expand the distribution of biometric national identity cards throughout the country is drawing criticism from advocacy groups, privacy experts, and legislators. Despite constitutional protections, privacy is an alien concept in the country, and it is likely the state will handle sensitive data recklessly. The government reportedly did not conduct security tests or provide guidelines to citizens prior to the trial, and security researchers fear since the government has a history of inadequate information security. Regular reports of data breaches from India's Aadhaar system have only increased concerns. Moving to digital identity cards is inevitable, but what needs to be taken care of is where these biometric data are being stored, who has access to these private data and how long is the state going to retain them? Therefore, there needs to be more discussion on what measures should be followed, especially given the lack of expertise and experience in data security in Nepal.

Leveraging data and analytics for better tax and customs administration is another area developed countries are trying to excel in. Many countries have benefitted by using big data analytics and business intelligence in modern taxation. ICT tax management has been adopted by 159 countries of the UN member states. China is using big data for taxation in several ways including the utilization of data with multi and cross referencing to verify taxation and tax related business processes. Brazil is another country adopting the big data system for taxation. In the USA, many tax returns are filed electronically, which helps fraud-spotting systems to look for suspicious Internet protocol (IP) addresses. For example, when tax auditors notice that similar IP addresses are submitting a series of returns for refunds which cannot be matched to any employer data, they

are flagged for further scrutiny (Tomar, Guicheney, Kyarisiima, & Zimani, 2016). As USA ties the social security number with tax control, Nepal can also use the unique citizen identifier to control and track the taxation. By adopting business intelligence and information technology in the taxation sector of Nepal, the Tax evasion and fraud can be minimized.

Natural disasters are common in Nepal. The country suffers from floods, earthquakes and landslides occasionally. The aftermath situation of the April 2015 devastating earthquake in Nepal is still a topic of discussion. Nepal could benefit largely with business intelligence and information technology applications on how reliefs and benefits are distributed and to study the economic damages. Data science methods for extracting patterns from natural disaster data can provide insights for understanding the economic impact of natural calamities. Recent advances in cloud technologies and numerous open source tools enable this analysis with no initial infrastructure investment. Data scientists have recognized the value of employing data mining techniques for evaluating these events to assist in understanding trends, predicting future disasters, and assessing vulnerability of populations. Such analysis can prepare governments for emergency response and relief efforts as well as to formulate strategies for future disaster mitigation (Joseph & Kakade, 2014). The disaster relief activities can be faster with the use of social media. The social media can be integrated along with offline and online activities and included on the ground activities. Resource allocation and discussions should be part of the social media tool for such times. A cloud computing disaster management system could provide for a dedicated platform to enable users (workers, first-responders, local disaster-related non-profit organizations, volunteers and local residents to access information, communicate and collaborate in real time from all types of computing devices, including mobile handheld devices, such as smartphones, tablets, iPads, etc. Such a system could help for the establishment of a community-based, effective and self-scalable

cloud computing environment in which a diverse set of organizations and personnel can contribute their data, knowledge, experience, storage and computing resources to deal with natural disasters (Velev & Zlateva, 2016).

Another sector in Nepal where business intelligence and information technology can be used is the tourism sector. Tourism database management system can be used to understand the whole picture of tourism industry. Hotel information, destination preferred, their social networking study, weather reports, preferred routes for travel, trekking security and facility can be enhanced with the help of information technology tools.

Information technologies are the product of developed countries, and to make that technology suitable for developing countries, there should be an effort to build a capacity to recognize the importance of implementing information technology according to local development needs. Formulating an appropriate information strategy, which is favorable and supportive to development, a country can best use business intelligence and information technology for overall progress.

Furthermore, the problem is not about getting technology in the developing countries. The major problem arises when the time comes for managing the information technology in a particular environment. There is no single best procedure for managing information technology, since it depends on external social, economic, political and cultural factors that vary from one country to another, as well as on internal forces like organizational culture, and on skills that vary from one organization to another even within the same industry in the same country (Bjorn-Andersen, Belardo, & Mohan, 1990). Therefore, there is a great need of academic research in the field of business intelligence and information technology in developing countries and the role of government in developing national capabilities. Business intelligence and information technology

can be a powerful tool that helps countries promote their own development and emphasize the local context where the information technology-based solutions will be implemented. However, the nature of these “adaptations” and the factors that influence them are poorly understood.

Although Nepal at this stage cannot think of becoming self-reliant in this sector, there will need to be a clear vision of local need, and the country must not become a ‘dumping ground’ for other nations’ obsolete technologies. Therefore, the government will need to require that technologies be viewed with the Nepalese context clearly in mind. Nepal needs to base its national information technology strategy on a much greater consideration of local cultural and social issues. The government has a major role to play if the country wants to stand in the information arena.

Likewise, it is important for every developing country to have a national IT strategy as a foundation whereby the great potential of IT can be realized, development be promoted, technology be exploited, and communication problems be alleviated. The government must play an important role, not only as a major user, but also through its other role as regulator, promoter and diffuser.

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