UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

A FRAMEWORK FOR ASSESSING READINESS OF ADOPTING BUSINESSINTELLIGENCE IN SMALL AND MEDIUM SIZED ENTERPRISES.

By

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Submitted in Partial Fulfilment of the Requirements of a Master of Science in Information Systems.

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DECLARATION

This research project being presented is my original work and has not been published for the award of any university degree.

Signature…….. Date…….

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This research project has been submitted for examination towards fulfilment for the award of a degree for a Master of Science in Information Systems with my approval as the University of Nairobi supervisor

Signature…….. Date…….

Dr. Evans A. Miriti.

DEDICATION

This research is dedicated to my entire family especially my parents Mr. & Mrs. Laleyo whose support, encouragement and presence have been a big contributor to my achievement this far. This also goes to my siblings for their support both psychologically and financially during the entire study period.

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ABSTRACT

There has been a rise in complexity of making effective and timely business decisions in the current highly competitive markets. For this reason, Data-driven decision-making using Business Intelligence (BI) applications have attracted many organizations worldwide. However, despite these applications being suited for use in most organizations regardless of size, only the larger enterprises have reached a stage of maturity in BI use while small and medium-size enterprises (SMEs) still lag behind. Whilst many academic researchers have conducted BI research focused on large organizations, literature relating to BI adoption within SMEs has remained limited.

This research presents a study which was aimed at proposing a model, presenting salient factors for identifying the current state of readiness for the adoption BI by SMEs in Kenya and the enabling factors that impact BI adoption. The research also aimed at providing a better and clearer understanding of BI adoption within SMEs by reviewing and analyzing current BI literature.

To undertake this research, we sampled 280 respondents from three strata (SMEs) i.e. Hotels, microfinance and hospitals and pharmaceuticals which had an overall population size of 950. With a response rate of 73%, a justified analysis of the 205 responses received was done to test the hypotheses under Information Evolution theory. Data was collected using structured questionnaire that has 35 questions which were completed by different decision makers from different areas of operations in respective selected SMEs. Data which responded to the Likert scale questions was then uploaded to STATA for further analysis using the Structural Equation Model (SEM) and variance analysis to test the stated hypothesis

The results of this study revealed that a majority of SMEs (47%) in Kenya are willing to invest in personnel and technology in order to provide a better data processing options to clients irrespective of the SME annual revenue, number of employees, and nature of business and years of operation. On the other hand, 15% have already adopted BI while 38% are not ready to adopt BI. Further Structured Equation Model (SEM) analysis showed a significant and positive relationship between all indicators adopted for data collection and the three factors, Technology, Organization and Environment that affect adoption of business Intelligence by SMEs.

This research will help managers in SMEs to assess their data processing needs and capabilities and make decision on whether to adopt BI systems and consequently assess their readiness for adoption if such a decision is made. We recommend further studies on this subject to focus on mixed of Technology Diffusion and TOE to find out how constructs derived from the two models would generate the concept of Business Intelligence adoption.

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1. BI – Business intelligence
2. EQS - Structural Equation Modelling Software.
3. EIM - Expected Information Matrix.
4. GT - Grounded Theory.
5. LISREAL - Linear Structural Relations
6. ML - Maximum likelihood.
7. STATA – Statistical Software.
8. SEM – Structural Equation Modelling.
9. OIM - Observed Information Matrix

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

With the advances of information technology (IT) in Kenya, increased competition, greater flexibility of products and more demands from customers, firms are now required to operate their businesses in highly complex and dynamic environments. Organizations that survive and succeed in these market conditions need to make decisions in a timely, effective and appropriate manner. However, many organizations are faced with the challenges of data overload where small subset of large amounts of data is vital to the overall evaluation of information. For example, the International Data Corporation (2012) reported that digital data growth was up by 48 percent with 90 percent of information being unstructured.

As a result of this type of data complexity, many businesses are now challenged to understand and analyze the wide range of information involved (Gens, 2011). However, as many business users lack access to the information they need, many tend to make decisions based on instinctive knowledge that can result in loss of productivity, reduced agility in the marketplace, and flawed decision-making. In this situation, it is important to seek ways to provide useful information that supports decision makers and adds value to business organizations.

In order to increase efficiency, many organizations have implemented IT systems in their business operations to collect, combine, access, and analyze massive amounts of data. One such analytical tool is BI technology that turns data into information and then into knowledge. BI technology supports firms not only in driving performance improvement throughout their enterprises but also assists in forecasting by analyzing historical data. For example, in conducting a survey among 2,053 Chief Information Officers (CIO) covering 36 industries in 41 countries, Gartner Research (2013) found that BI technology is often a first priority in technology investments. This finding agrees with O'Brien and Kok (2006) and Kimball et al. (2008) who found that BI technology had reached a stage of maturity that is widely used at all levels of the business world.

1.1.1 Business Intelligence

According to Eells and Nehemkis (1984), intelligence is the product of collection, evaluation, analysis, integration, and interpretation of all available information that may affect the survival and success of the company. Well-interpreted information, provided by a properly designed intelligence function, can be immediately significant in the planning of corporate policy in all of its fields of operations. Stated in both operational and organizational terms, the main purpose of intelligence is to help the chief executive officer fulfil his wide ranging responsibilities.

Business Intelligence (BI) therefore refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information. The purpose of Business Intelligence is to support better business decision making. Essentially, Business Intelligence systems are data-driven Decision Support Systems (DSS) that enables organizational management to come up with intelligent information from a given set of data for decision making processes.

Tan and Ahmed (1999) adopt more of a strategic intelligence perspective and state that intelligence is a continuing and interacting structure of people, equipment, and procedures to gather, sort, analyze and distribute pertinent, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation. Although BI is not a new area of information systems (Vitt et al., 2002), academic research in this field is at an early stage (Arnott and Pervan, 2005, Gibson et al., 2004, Negash, 2004) – with the term being defined in various ways according to context (Niu et al., 2009). The bulk of BI literature originates from the business world and IT industry (Gibson et al., 2004, Jagielska et al., 2003), with the various consulting companies and software vendors judging BI as compatible with their products, and promoting their particular connotations (Arnott and Pervan, 2005).

For this reason, there is currently no commonly agreed definition of BI. For example, Negash (2004) defined BI as a system that combines "data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers". Turban et al. (2007) defined BI as "an umbrella term that encompasses tools, architectures, databases, data warehouses, performance management, methodologies, and so forth, all of which are integrated into a unified software suite". Elbashir et al. (2008) defined BI as "a specialized tool for data analysis, query and reporting that supports an organizational decision-making that potentially enhances the performance of a range of business processes". Watson (2009) defined BI as "a broad category of applications, technologies, and processes for gathering, storing, accessing, and analyzing data to help business users make better decisions".

Although there is no commonly agreed upon definition of BI, existing definitions share two common characteristics. The first is the fundamental aspect of BI which includes collecting, storing, analyzing and delivering information that is available both internally and externally, and the second is the aim of BI which is to support the strategic decision-making process of the firm. However, a problem arises when considering the existing definition of BI because it only discusses the process, software and technology components. Therefore, the human factor is also important because BI cannot be evaluated independent of interpreting its meaning but considered according to information gained from the practical knowledge of the users.

Furthermore, an earlier study of BI in Finnish companies by Hannula and Pirttimaki (2003) found that more than 75 percent of responding business managers believed that human ability to use BI

represented a major aspect of its usage. For this reason, the definition of BI in SMEs perspective adjusts Watson's definition (2009) by including the aspect of human ability to use BI. Accordingly, BI is defined as: *the capability of an enterprise to use its human resources together with a broad category of processes, applications and technologies for accessing, collecting, accumulating and analyzing data in order to generate actionable and competitive information that can support its users to make better decisions.*

1.1.2 Need for Business Intelligence by SMEs

For years, organizations of all sizes have been accumulating data, big data, as some call it. Merely accumulating this data provides no strategic or tactical benefits whatsoever to the organization. Rather, to convert this data into an asset that adds real value to the organization, we must first dig in to the data, analyze it, and discover facts, trends, and observations that were previously unknown. With this newly-discovered information in hand, we can then make decisions that take full advantage of this information to advance the goals of the organization and this is where BI comes in. The advantages of implementing BI to support business operations are clear, and by utilizing BI technology appropriately, a number of benefits can be anticipated (Ko and Abdullaev, 2007, Watson and Wixom, 2007, Ranjan, 2005).

BI provides the tools necessary to convert mountains of data into intelligible information on which we can base decisions. Oftentimes, interactive dashboards provide the results of BI efforts. This is an important aspect of BI, as the interactivity provided by the dashboard allows each decision-maker to filter, query, and further explore the data for more relevant facts that were previously unknown. Ultimately, decision makers use the information provided through BI to make decisions about the future direction of the organization. For example, managers can use BI to help design an effective marketing program, create targeted sales programs for specific customers, plan production in a manner that minimizes inefficiencies, and manage cash flows to reduce financing costs. In sum, BI can assist organizations by facilitating better decisions in virtually all facets of operations. Some of the main benefits realized when an organization should adopt business intelligence include;

i) Reduced Labour Costs

The most tangible benefit of BI is the time and effort saved with manually producing the standard reports for the organization. It is rarely the largest benefit though. However, because it is so tangible it is often part of the equation when a decision must be made about implementing BI, and if it turns out that these savings alone can justify the BI system, then it is the easiest way to justify it. BI systems reduce labour costs for generating reports by; automating data collection and aggregation, automating report generation, providing report design tools that make programming of new reports much simpler and reducing training needed for developing and maintaining reports.

ii) Reduce Information Bottlenecks

The BI system allows end-users to extract reports when they need them rather than depending on people in the IT or financial department to prepare them. The BI system will even allow authorized users to design new reports to match their requirements. BI systems reduce information bottlenecks by; providing individualized, role-based dashboards that collect the most important data for daily operations, letting the user open and run reports autonomously, providing documentation of KPIs and other information, allowing users to analyze and validate the data without involving IT specialists and allowing users to create new views of data as needed.

iii) Make Data Actionable

What happens when employees in an organization get too much data, too little data, too old data, too detailed data or just irrelevant data? Most organizations use extensive amounts of resources putting together piles of standard reports that are delegated throughout the company. To make sure everyone has all information they need, all kinds of reports are sent to employees - usually on a very detailed level. As a result employees feel overwhelmed by the amounts of information that don't give a clear picture of the overall situation. And moreover, since so much effort is required to assemble the reports they usually arrive at the employees' desktop days or weeks after they were most relevant.

According to technology adoption research in SMEs, a number of researchers have found that the structural characteristics of SMEs are different from those in large enterprises, which explicitly affects their IT usage behaviours (Gutierrez et al., 2009, Struker and Gille, 2008, Buonanno et al., 2005). Man et al. (2002) point out that a small enterprise is not a small version of a large enterprise, but has dissimilarities in terms of structure, policy making procedures, and utilization of resources.

Another study on SMEs by Deros et al. (2006) classifies these dissimilarities in terms of structures, systems and procedures, cultures and behaviors, human resources, and markets and customers. In accordance with these understandings, this does not directly apply the concepts used to conduct research into large organizations to the study of SMEs.

Lack of resources is one of the key characteristics many researchers address when studying SMEs (Bhaird and Lucey, 2010; Deros et al., 2006; Knight et al., 2004; Levy and Powell, 2003). These limited resources include finance, technology, knowledge and human resources. In particular, Bhaird and Lucey (2010) found that financial resources are personally funded by the owner in most SMEs. Moreover, the unskilled workforce with lack of technical specialization results in SME managers being conservative when adopting IT innovations (Karkoviata, 2001). This may be the reason why many SMEs are reluctant to invest in new technologies and overly careful in assessing any investment strategies involving IT (Nguyen, 2009). For instance, Fuller-Love (2006) found that

owner-managers in SMEs deal with IT adoption only when they perceive the promise of success, because they do not want to take risks. This is especially the case for BI, since BI maintenance and implementation costs are very high as is the failure rate of implementation when compared to other technologies (Lawton, 2006). Moreover, due to their limitations in both human and financial resources and scale and complexity of operations, SMEs require different BI approaches from those adopted by large firms (Barnard, 2010).

1.2 Problem Statement

Business Intelligence is an important field of study in a number of areas, which include small and medium-sized enterprises (SMEs). Due to the numerous advantages of BI, SMEs are trying to adopt applications to support their business operations. BI adoption by SMEs differs from larger organizations because of their specific characteristics, such as electronic infrastructure, resources constraints, skills etc. A number of prior studies have attempted to gain a clear understanding of numerous pitfalls and challenges associated with BI adoption awaiting SMEs i.e. technological infrastructure, skills, capital and other external forces etc, as well as evaluate those factors affecting the successful deployment.

1.3 Research Questions

After the end of this study, the following research questions were answered;

1. What effect do technological, organizational and environmental factors have on the decision to adopt or not to adopt business intelligence in SMEs?
2. What are the possible factors that decision makers in firms use to determine their readiness for adopting business intelligence?
3. Are there existing adoption models used for assessing readiness to adopt business intelligence?

1.4 Research Objective

The general objective of this study is to carry out an investigation by assessing the level of preparedness by small and middle sized enterprises in terms of organizational, technological, environmental and other factors that directly or indirectly affect the deployment of technologies, for the adoption of business intelligence.

The study will have three main objectives;

1. To investigate the importance of employing business intelligence and the impacts of BI on SME environment.
2. To investigate the factors that affect the adoption of business intelligence hence assess the level of preparedness by SMEs in adopting BI using these factors.

3. To select a suitable framework, customize and use as an adoption model for this research.

1.5 Significance

This research provides a framework that provides an understanding of the current state of preparedness for the adoption of BI in Kenyan SMEs and the enabling factors that may influence SMEs' adoption of BI.

The findings of this study will therefore enable the managements of SMEs and not limited to cases of this study, to understand the need of BI in business operations and if they consider employing BI in their businesses, to know what must be put in place for the successful adoption. This study will also present the levels of adoption of BI and critical success factor for each level. This will provide a guide to a systematic roll out of a BI project if one considers doing so.

Based on the framework of this study, SMEs should be classified into different levels of BI adoption before examining the factors that impact their decision on BI adoption. Rather than considering the BI adoption as a binary function, to adopt or not to adopt, the classification of organizations allows us to explore the enabling factors that impact each of the BI adoption levels and to gain an understanding of whether SMEs in the upper BI level have different impact factors from those in the lower levels. For this reason, different BI level groups of organizations will require different types of attention to help them prolong their use of BI technologies. All enabling factors in the frameworks will provide testable hypotheses for future researchers to examine technologies in Kenya.

CHAPTER 2: LITERATURE REVIEW

2.1 Concept of BI Adoption

Data-driven decision-making using Business Intelligence (BI) applications have attracted many organizations worldwide. This owes to the fact that there is a rise in complexities of making effective and timely business decisions in highly competitive markets, however, despite these applications being suited for use in most organizations regardless of size, only the larger enterprises have reached a stage of maturity in BI use while small and medium-size enterprises (SMEs) still lag behind. Whilst many academic researchers have conducted BI research focused on large organizations, literature relating to BI adoption within SMEs has remained limited. To fill this research gap and support the adoption rate of BI in SMEs, researches are coming up to identify the current state of preparedness for BI adoption by SMEs and the enabling factors that impact BI adoption and implementation.

As the utilization and commercialization of IT becomes more widespread throughout the world, the adoption of novel IT can generate new business opportunities and various benefits. Nowadays, both large organizations and small and medium-sized enterprises (SMEs) are seeking ways to reinforce their competitive position and improve their productivity. Accordingly, there is an increasing consciousness of the necessity to derive profit through investment in BI within SMEs. IT tools can significantly assist SMEs by supplying the required infrastructure, which is necessary for providing appropriate types of information at the right time. BI can also provide SMEs with competitiveness through integration between supply chain partners and inter-organizational functions, as well as by providing critical information.

However, prior BI literature has shown that only a small number of studies focused on the adoption and use of BI in SMEs. Moreover, it has been found that in spite of the exponential growth of IT within SMEs, the rate of BI adoption by these businesses has remained relatively low, and large organizations have noticeably profited more than SMEs in both BI-enabled improved sale and costs savings. In looking for reasons for such differences in BI adoption in SMEs, unique characteristics of these businesses can be highlighted. SMEs generally have limited access to market information and suffer from globalization constraint. In addition, management techniques such as financial analysis, forecasting and project management are rarely used by SMEs.

2.2 BI Technology Adoption

As the term BI can refer to both simple and complex technologies, the need for classifying BI levels is important. Organizations that adopt high levels of BI tend to have characteristics that are distinct from those with lower levels, and as a result have different enabling factors underpinning BI adoption (Olszak, 2013, Ong and Siew, 2013). However, as the number of studies on levels of BI

adoption is limited (Sacu and Spruit, 2010), this section reviews the few existing studies that have categorized the levels of BI adoption. For example, when categorizing BI levels in terms of technologies, (Gibson and Arnott (2003)) proposed five levels; Personal decision support, Executive information systems, Data warehousing, Intelligence systems, and Knowledge management.

However, McDonald (2004) preferred to define BI levels from the solutions perspective, stating that data structure positively impacts the efficiency of BI solutions. His framework comprised four levels; BI infrastructure which refers to the process of collecting, integrating and transforming data in order to generate the report for supporting decision-making, Business Performance Management (BPM) which refers to the use of data from level 1) above to provide feedback based on Key Performance Indicators (KPI) to management, Decision enablement that emphasizes the use of data from a knowledge repository to generate automatic decisions and Business Activity Monitoring (BAM) which refers to the process of monitoring changes or trends to assist users in taking the right action.

2.3 Technology Adoption Frameworks.

2.3.1 Technology Acceptance Model

The existing literature proposes that BI could enhance the performance of business operations through the organization of data and ensuring that information is available and reliable as much as possible. However, a new technology does not provide benefits, if it is not used by people. Thus, we need to understand and predict why people accept or reject a new technology (Davis, Bagozzi, & Warshaw, 1989). Since the last 50 years, user acceptance of new technology and its determinants have received significant attention from many researchers. Several frameworks were proposed to explain technology acceptance/adoption in terms of users' individual characteristics, organizational characteristics and/or characteristics of the new technology. Diffusion of Innovations Model (Rogers, 1962), Theory of Reasoned Action (Ajzen & Fishbein, 1980) and Technology Acceptance Model (Davis, 1989) can be given as examples of those widely recognized and studied technology acceptance frameworks.

Technology Acceptance Model (TAM), which was adapted from Theory of Reasoned Action (TRA) explains that people's beliefs influence attitude and with the combination of subjective/social norms, shape people's behavioral intention. Davis (1986; 1989) used and adapted the theory to TAM in his research in order to explain the determinants of technology acceptance. This is an information systems adoption framework that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably the Perceived Usefulness (PU simply the degree to which a person believes that using a particular system would enhance his or her job

performance and the Perceived ease-of-use (PEOU) which is the degree to which a person believes that using a particular system would be free from effort(Davis 1989).

However, the limitation of this model is model is that it is meant to be used only when the system is in place and under use.

2.3.2 Diffusion of Innovation

The diffusion of Innovation looks at the rate at which new innovation is spreading, how the new innovation is spreading and why it is spreading in order to investigate the factors affecting the adoption of new information technology innovation both at individual and SME levels, (Oliveira and Martins, 2011). The limitation of this model is that the key factors under consideration are attached to both firm and individual's role in adapting to a new technology hence users works on maximizing their social orientation other than maximizing on the utility of the technology.

2.3.3 Technology, Organization and Environment (TOE)

The theory of Technology, Organization and Environment (TOE) on the other hand looks at three major factors that are further broken down to smaller constructs when looking at how information technology is adopted at firm level , (Oliveira and Martins, 2011),these factors include technological context within the SME, organizational context within the SME, and environmental context. All these do not take in to account the firm level decision making process as opposed to Technology, Organization and Environment.

2.3.4 Information Evolution Theory

Other studies defined BI as not only a technology but also a process that transforms data into information and then knowledge, with the argument that BI involves other entities such as organizational function and human interaction, and applied the concept of a maturity model to explain the levels of BI adoption and (Lahrmann et al., 2010, Najmi et al., 2010, Eckerson, 2007, English, 2005). As Klimko (2001) explained, Maturity models are characterized by sequentially ordered levels with specific requirements at each level. In the BI context, the most commonly used maturity model is the Information Evolution Model (IEM) proposed by SAS, the leading company in business analytics software and services (Davis et al., 2006). The purpose of this model is to study the enablers of BI usage and explain firms' use of information to improve business, thus classifying BI adoption levels across four critical dimensions as follows; Infrastructure which involves the implementation of technologies including hardware, software and networking tools, to create, handle, store, distribute and apply information, Knowledge process that involves the role of information in corporate knowledge sharing, the role of information in decision-making, and the improvement of information accuracy and quality, Human capital which includes capabilities,

responsibilities, decision-making, training, enterprise goals and improvement of personnel skill-sets related to technological information and culture that includes the moral, social and behavioural norms of corporate culture in relation to the information flow within an organization.

However, as this IEM model (Davis et al., 2006) does not address the analytical application of BI but adds another dimension i.e. Application as derived from Sacu and Spruit (2010), that is; Application which includes analytic applications that organizations have implemented from basic software programs that generate reports to advanced programs that detect relationships in the data, provide predictive results, and generate an automated exception reporting when something unusual occurs.

2.4 Conceptual Framework

2.4.1 Overview

Recognition of the relationships between the five dimensions below makes the Information Evolution Model (IEM) model presented in this research unique and appropriate for adoption since it incorporates the three main factors under consideration and that is Technology, Environment and Organization. Furthermore, in accordance with Davis et al. (2006), each dimension is given five levels of maturity in the following order:

1. Operate: This basic level of BI adoption is found in organizations that focus only on general information from day-to-day operations, without long-range plans;
2. Consolidate: This next level refers to organizations that consolidate information by integrating and storing information at the department level for supporting decision-making;
3. Integrate: Organizations at this level collect data in a central data warehouse to gain new knowledge from performing enterprise-wide analysis and bridge the borders of separated departments;
4. Optimize: At this level organizations use new technologies for deeper analysis in order to better understand the marketplace and their customers in comparison to their competitors, to better serve their customers; and
5. Innovate: Organizations at this highest level seek ways to reinvent and transform their value position for sustainable growth.

As explained above, this IEM maturity model can assist organizations to assess their use of current information resources and rank themselves on one of the five levels in order to decide their business direction. Therefore, to address the research question regarding the current state of BI adoption by SMEs, the levels of BI are categorized primarily using the IEM model. Also, due to SMEs in different levels possibly having different enabling factors to BI adoption, all five levels of BI from this IEM model are included in the conceptual framework (see Figure 1 below).

The Proposed Framework

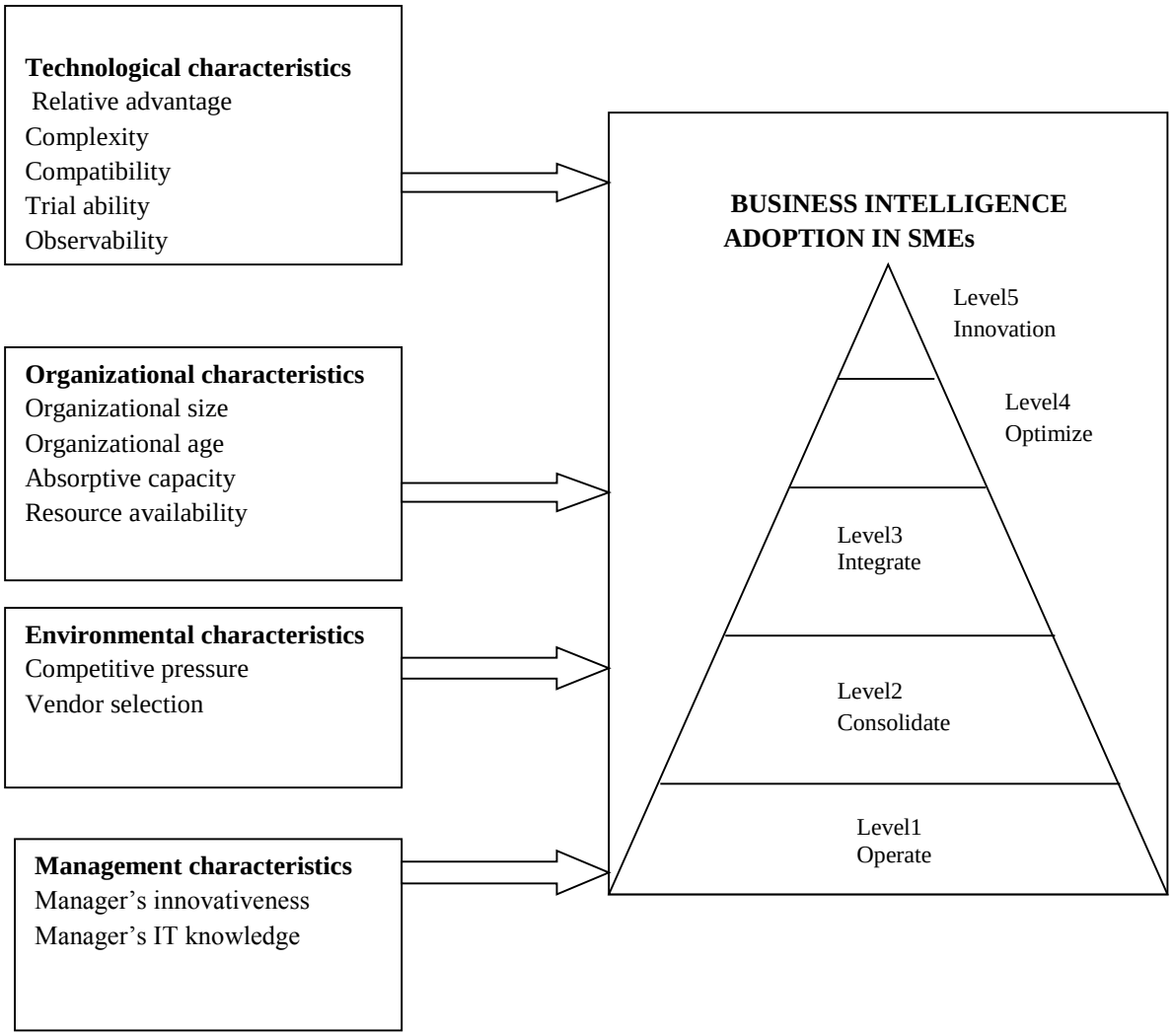

Figure 2.1: Information Evolution Model (IEM).

Source: (Davis et al., 2006)

2.4.2 Explaining Constructs

Based on a multi-perspective framework, three supportive adoption models, namely the Diffusion of Innovation theory (Rogers, 1995), Technology-Organization-Environment model (Tornatzky and Fleischer, 1990), and Information Systems Adoption Model for Small Business (Thong, 1999), have been selected as the basic foundation for development of the theoretical constructs to best explain the proposed model. Using these three frameworks, possible enabling factors affecting preparedness for adoption are categorized into four characteristics including technological, organizational, environmental, and owner-managers. However, due to the limited number of studies related to BI in SMEs, the enabling factors in this paper have been developed based on prior research into technologies related to BI, in the context of both large enterprises and SMEs.

i. Technological Characteristics

In this study, the technological characteristics of BI are based on the **Diffusion of Innovation theory** as proposed by Rogers (1983). According to this theory, the attributes affecting technological innovation adoption are relative advantage, complexity, compatibility, trialability and observability. Chen (2003) also employed these attributes to examine electronic businesses and found that they influence technological innovation adoption. Since BI is an innovation technology (Ramamurthy et al., 2008), in this paper the possible factors affecting readiness of adoption BI will build on the studies of Rogers (1995) and Chen (2003).

Relative advantage of technologies refers to the degree an innovation is perceived as being betterthan existing ideas or systems (Rogers, 1995). Prior research studies indicated that BI technology can offer several advantages to firms. For example, retail companies used Data Analysis tools in BI technology to determine which of their products are most profitable, and where to place them in their stores. The banking industry used BI to create better processes for checking credentials and generating credit reports of customers (Williams and Williams, 2003).

Complexity is the degree to which an innovation is perceived to be difficult to understand or use(Rogers, 1995). Many researchers have found that complexity is a barrier to innovation adoption (Chang et al., 2010; Alam et al., 2008; Sahay and Ranjan, 2008; Bradford and Florin, 2003). Ramamurthy et al. (2008) found that lower complexities in a technology resulted in higher positive effects on the adoption of Data warehousing solutions. Therefore, due to the high complexity of BI technology, employees resist its adoption and continue to use traditional spreadsheet technologies (The Economist Intelligence Unit, 2007). Voicu et al. (2009) confirmed that BI models are highly complicated because they integrate mathematical functions to predict trends in a firm's performance to provide solutions in a variety of situations. Therefore, users with a weak IT and computing knowledge require a simple and stable solution that will meet their needs in the shortest time.

Compatibility is the degree to which an innovation is perceived to be consistent with existing values,past experiences, and needs of possible adopters (Rogers, 1995). Some researchers claim that BI systems are an expansion of Enterprise Resource Planning (ERP) systems, and provide higher performances in consolidating, transforming and analysing data (Hawking and Sellitto, 2010, Radding, 2000). Moreover, Voicu et al. (2009) regarded ERP systems as a minimal prerequisite for implementing BI tools. Any firms that have implemented an ERP system have to decide whether to employ their current ERP vendors, that can reduce compatibility related problems, or to use another BI vendor (Radding, 2000).

Trialability is the extent to which potential adopters have the opportunity to experiment with aninnovation (Rogers, 1995). The higher the trialability, the more comfortable the potential adopters

are with the technology and the more likely will be its adoption. Therefore, if BI providers give potential users opportunities to experience BI systems before adoption, doubts related to the unknown will be diminished.

Observability is the degree to which potential adopters of an innovation can perceive the results of using that innovation from users who have already adopted it (Rogers, 1995). Lundblad (2003) claimed that the visible results of an innovation affect the perceptions of its value by both individuals and communities. Moreover, the visibility of results stimulated them to communicate about the innovation, as peers were found to frequently request information related to the evaluation of an innovation

ii. **Organizational Characteristics**

Organizational characteristics are based on the **Technology-Organization-Environment (TOE)** model proposed by Tornatzky and Fleischer (1990). Although Roger's model of innovation contributed to explaining the foundations of technological innovations, some studies have suggested that technological innovation alone is not sufficient to guarantee success in diffusion of technology (Surry and Ely, 1999, Pool, 1997). The ability of organizations to adopt and implement technological innovation is also a considerable issue affecting the adoption decision. In the organizational dimension, there are four possible enabling factors that many researchers have used as a predictor of whether an organization should adopt innovation or not: organizational size, organizational age, absorptive capacity, and organizational resource availability.

iii. **Environmental Characteristics**

Environmental characteristics are based on the **Technology-Organization-Environment (TOE) model.** Environmental factors are commonly and frequently used as a key determinant of innovation adoption (Damanpour and Schneider, 2006). It is necessary to examine the influence of environmental factors before adopting a technology because competitive pressure and the selection of vendors influence the success of innovation adoption.

Competitive pressure tends to stimulate firms to look for new approaches to raise their efficiency and increase productivity that leads to firms achieving competitive advantage (Themistocleous et al., 2004). Waarts et al. (2002) found that competitors were the key drivers in innovation technology adoption. This is particularly so when competitive pressure significantly impacts on IT adoption (Premkumar et al., 1997, Iacovou et al., 1995, Premkumar and Ramamurthy, 1995, Mansfield et al., 1977). For example, in more recent research studies on SMEs, Alshawi et al. (2011) found that competitive pressure was an important influence on organisational adoption of CRM systems. Another study on data warehouse technology adoption by Hwang et al. (2004) found that

environmental attributes including the degree of competitive pressure and vendors selection, were key factors in data warehouse adoption.

Vendor selection is another environmental factor affecting the adoption of technology (Ghobakhlooet al., 2011, Lin and Hsu, 2007, Hwang et al., 2004, Chau and Hui, 2001). According to Seyal et al. (2004)'s study, the variable 'vendor selection' can be grouped and measured by quantifying the following items: the vendors' reputation and successful experience possessed; vendors' technical competence with the specific BI system proposed; and the professional competence of the consultant. In general, vendors are responsible for providing software, hardware, user training and technical support to customers in order to maintain their optimal performance (Moffett and McAdam, 2003). In the study by Hwang et al. (2004), the authors found a relationship between BI vendor selection and technology adoption. As BI is different from other enterprise information technologies, it requires a tailored solution to suit each particular firm and industry, and not just a total package (Hill and Scott, 2004)

iv. **Owner-Manager Characteristics**

Owner-manager characteristics are fundamental to the **Information Systems Adoption Model** for Small Business proposed by Thong and Yap (1996). Ghobakhloo et al. (2011) claim that SMEs generally have simple and highly centralized structures, with authority mainly being given to the Chief Executive Officer (CEO), and, oftentimes, the owner and CEO are the same person. Thus, the owner-manager is the sole decision-maker having a direct effect on the decision-making processes ranging from daily functions to future investments (Nguyen, 2009; Bruque and Moyano, 2007; Jarvenpaa and Ives, 1991). A study by Thong (1999) proposed that owner-managers who have innovativeness and IT background have increased potential for BI adoption success.

Table 2.1: Research Hypothesis Formulation.

CONSTRUCT	HYPOTHESIS
Technological factors	H1: Relative advantage of technology affects the readiness for adopting business intelligence
	H2: Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs
	H3: Need for data and information security encourages the adoption of business intelligence.
Organizational factors	H4: Greater management support affects the readiness of adopting business intelligence by SMEs
	H5: Larger organizational have higher capability to adopt business intelligence than smaller organizations.
	H6: Higher organizational readiness for new technologies leads to adoption of business intelligence.
	H7: SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with fewer points of operations (single entities).
Environmental factors	H8: SMEs facing greater competition from the market are more ready to adopt business intelligence than those without pressure.

H1: Relative advantage of technology encourages the readiness for adopting business intelligence.

Benefits of adopting business intelligence in Small and Medium Enterprises

Every firm will try and analyze the cost of adopting a technology in verses the benefits the technology will bring to the firm. In doing the cost benefit analysis, the firm may make a decision regarding the adoption of the technology, (Cris & Joe, 2004). SME also may be guided by the cost benefit analyses outcome in determining whether to adopt business intelligence or not. The eventual adoption may further determine the growth of the SME. This led us to the following hypothesis.

H2: Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs.

Complexity (Operational Friendliness)

The less complex the computer systems are, the more user friendly they are and this makes it more adoptable than complex ones. On the other hand, business intelligence might require complexity to some level hence necessary skill and knowledge is vital for adopting BI. This led us to the following hypothesis.

H3: Need for data and information security encourages the adoption of business intelligence.

Security concern on data and information

Data and information security setup is vital to any firm success. Many studies on technology adoption have used this construct to determine whether security is important to decision making process. Yoon (2009) for example applied the security concern in a study that was empirically investigating factors affecting organizational adoption. We also had it as part of our construct this formulated the following hypothesis.

H4: Greater management support enhances the readiness of adopting business intelligence by SMEs.

Management Support

Top management attitude has been found to be one of the determinant factors in a Firm's adoption of newer technology, (Sargent *et.al*, 2012). Therefore we can argue that in SME, the perception of the top management and there consequent support could have a positive effect on preparing organizations for the adoption of business intelligence. This leads to the following hypothesis:

H5: Larger organizational have higher capability to adopt business intelligence than smaller organizations.

Organization Size

The firm's capability with regards to financial as well as technical resources may be considered to positively or negatively influence how it makes decision on adoption of new technologies. Resource capability is affects the readiness of the technology acceptance, (Rosli *et.al*, 2012). This leads to the following hypothesis:

H6: Higher organizational readiness for new technologies leads to adoption of business intelligence.

Organizational Readiness

Yoon (2009) indicated how organization readiness could be split in to two main constructs of financial and technical readiness. The organizational readiness, the study indicated could be separated as formative, and sub constructs derived from them. Our research employed the same constructs and thus we generated the following hypothesis.

H7: SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with fewer points of operations (single entities).

Firm Scope

Firm scope was also felt to be very vital since it could have a key indicator within the firm's profile. Firm scope has also been used as a construct by other researches such as Yoon (2009). In our research, respondents were on the issues ranging from localized to global or distributed presence to define how the scope would affect their decision to adopt or not to adopt business intelligence. This led us to the following hypothesis

H8: SMEs facing greater competitive pressure from the market are more ready to adopt business intelligence than those without pressure.

Competitive Pressure

Ferguson *et.al* (2013), have since establish that there is a relationship between competitive pressures experienced by firms in an economic zone to the adoption of Information Technology. These relationships could either be financial or market pressure making them bow to pressure in either adopting or not adopting the information technology. This leads to the following hypothesis:

Table 2.2: Operationalization of Variables and Constructs.

Concept	**Variable**	**Variable Description**	**Variable type**
Technological context	Relative advantage	To establish what benefits do technology offers that encourages the readiness for adopting business intelligence in SMEs.	Ordinal
	Operational complexity	How does operational complexity affect readiness of adopting Business intelligence by SMEs?	Ordinal
	Need for data and information security	Does the need for data and information security encourage the adoption of business intelligence?	Ordinal
Organizational context	Management support	The influence that management support has that enhances the readiness of adopting business intelligence by SMEs	Ordinal
	Organizational size	Do Large organizational have higher capability to adopt business intelligence than smaller organizations?	Nominal
	Firm scope	Confirm whether SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with fewer points of operations (single entities).	Ordinal
	Organizational readiness	What determines organizational readiness for new computer technologies?	Ordinal
Environmental context.	Competition	Confirm whether SMEs facing greater competition from the market are more ready to adopt business intelligence than those without pressure.	Ordinal

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses data to be used in this study, how they would be collected and the analysis techniques and method that will be applied in analysing the data. It describes the characteristics of the population and other variables, and how data will be collected and measured. It also discusses data analysis procedures and the statistical methodology utilized in analysing the data upon collection and general data analysis methods and techniques.

3.2 Research Design

The study used descriptive research design which was concerned with analysis of existing data or facts and makes a critical review of the same with a view of understanding the situation. The study used both qualitative and quantitative data and that is explanatory in nature. Descriptive research design is a description of the state of affairs, as it exists at the present. The research design largely utilized qualitative and quantitative research methods. Research design is important in that it gives a strategy that one will use in data collection that will help in giving answer to the research questions (Yoon, 2009). It had been suggested that research on Information System use could be considered as a Social Science domain, (Cecez-Kecmanovic 2007; Urquhart, Lehmann, & Myer 2009; &Lisle 2011). Therefore, it would be argued that the best approach would be a descriptive research design. Behaviours or actions, the best appropriate research design was considered to be that of Explanatory.

A population can be defined as the entire group of individuals, events or objects having a common observable characteristic Mugenda and Mugenda (2003). Researchers usually cannot make direct observations of every individual in the population they are studying. The criterion for selection were based on the characteristics of organization under study, Business intelligence influence on performance and the enabling factors for adopting business intelligence. The research was conducted using structured questionnaire that has 35 questions covered under three sections. See Appendix 2.The questionnaire were completed by different decision makers from different areas of operations in respective selected SMEs. Questionnaires have been successfully applied in qualitative research. Kinnuthia (2014) observed that questionnaire was a more objective option and relatively a quicker way to collect information. They also observed that questionnaire was an affordable way of collecting information emanating from a large group. Due to limited resources and time, we employed the questionnaire as a means of data collection.

The questionnaire was basically a closed ended one that were geared towards answering questions emanating from H1 to H8 as well as open ended questions that were to assist in drawing any pattern in order that we may see if there may be any improved or newer theory of acceptance at Firm level. This model of questionnaire has previously been numerously adopted by many

qualitative researchers.

Kaplan et al, (2005) gave two distinctive features of open-ended question. In their study, they underpinned the goal of eliciting the respondent's views and experience in their own objective terms rather than a preconceived response. In addition, open-ended questions they argued, would give the respondent a chance to give deeper answers and expound on the subject thereby giving the researcher an opportunity to get a more concrete response that the closed-end question would not have given.

3.3 Target Population and Sampling

In order to arrive at the Population of the target group, various searches were conducted through physical visits, consultation and online searches that form professional or economic groupings of the said stratified groups such as Hotel and hospitality companies, microfinance, health and pharmaceuticals. The unit of analysis as the Small and Medium Enterprises (SME) in Kenya, whereby a stratified random sampling technique was used in selected amongst a group of participating SME that fell in three major strata that have generally been perceived to be having a greater number of clients;

1. Microfinance organizations.
2. Healthcare and pharmaceutical organizations.
3. Hotels and hospitality organizations.

The choices of the databases was strategic in that they gave a view of countrywide, regional and in some cases global reach of the selected population target such that the study would eventually be considered representative.

For the Hotels and hospitality companies, the population was derived to be 200 registered, whereas the microfinance database indicated an estimated membership of 400 registered. Health and pharmaceuticals database indicated an estimated total of 350 registered. This gave a total population of the target group as 950.This study took 20% of the target population to conduct the study on 280 SMEs in Kenya.

The study adopted stratified random sampling. According to Mugenda and Mugenda (2003) the goal of stratified random sampling was to achieve desired representation from various subgroups in the population. The population can be divided into known groups, and each group sampled using a systematic approach. The number sampled in each group was proportion to its known size in the parent population. According to Mugenda and Mugenda (1999) a 10% sample size is representative.

Table 4.1: Population Samples

Type of SME	Total Population	Target Sample
Microfinance	346	102
Healthcare and pharmaceuticals	407	120
Hotels and hospitality	197	58
Total	950	280

For purposes of this study and in an attempt to improve on accuracy in the data collection and analysis exercise, the target population was divided into three strata: (i) Hotels and hospitality companies; (ii) microfinance; and (iii) Health and pharmaceuticals. Stratification aims to reduce standard error by providing some control over variance.

Mugenda and Mugenda (2003) indicated a sample size of 10% or 20% will be sufficient for a study. This study took 29% of the population to select a sample size of 280 of the study population. From each stratum the study proportionally used simple random sampling to select 280 respondents.

The sampled size was proportionally specified using the formula below for each stratum sample size.

$$\frac{N_s}{N} \times n_p = n_s$$

Where: N_s is the stratum population size, in this study 197, 346, and 407. N is the overall population size, in this study 950. n_p is the overall sample size, in this study 280. n_s is the stratum sample size being calculated.

Source: Sampling Essentials,*Daniel (2012).*

Hotels and Hospitality

$$\frac{197}{950} \times 280 = 58$$

Microfinance

$$\frac{346}{950} \times 280 = 102$$

Health and Pharmaceuticals

$$\frac{407}{950} \times 280 = 120$$

SMEs were then randomly selected from the three strata with respect to the target size shown above to attain the target overall sample size of 280.

3.5 Data Analysis Techniques

In this research, our focus was on the study of constructs and variables and their inter-relationship patterns. Structured Equation Model (SEM) was the most appropriate data analysis model as attempt to offer verification of the model compatibility to be used, the approach taken by Ahmad *et al* (2012) on qualitative research nature presented a much stronger case for using Grounded Theory (GT) method even though SEM could have been argued to be the most appropriate model, (Tobbin & Kuwornu, 2011) and also despite Oliveira *et. al*. (2011), indicating that a majority of studies that focus on adoption studies at firm level tended to use SEM. Despite the strong case for GT as stated above, our decision to apply SEM eventually were more convincing when considering SEM had successfully been used by most Firm Level adoption research studies with Technological, Organizational, and Environmental variables.

Equally, Structured Equation Model (SEM) has been applied in many scholarly works to analyze data using the Technology, Organization, and Environment (TOE) platform to study factors affecting adoption of information technology by firms. The use of SEM emphasizes the usefulness of the TOE research model and theoretical framework for studying e-business (Zhu et.al, 2004).

The SPSS software was used to analyze the data. Descriptive techniques such as frequencies, tables and graphs were also used in the analysis. Other than that the Pearson's Coefficient's test, c hi square distribution tests was used to test the frequencies of several constructs and their correlation with intention to use, t test was used to test correlation of demographic factors and the various constructs.

Completed questionnaires were first edited for consistency and completeness before commencing the data analysis process. The data collected from the respondents was then coded for easier analysis and responded grouped in themes for specificity in classification and clarity in reporting. This data was then entered in a tabulated Excel spread sheet clearly showing the coded information shared by respondents for further analysis. From this spread sheet, data was described by use of measures like the mode, median, frequency and mean to analyses the nature and the profile of SMEs which formed the study.

Data which responded to the Likert scale questions was then uploaded to STATA for further analysis using the Structural Equation Model (SEM) and variance analysis to test the stated hypothesis identified under the literature review on a research framework for accessing readiness for adopting business intelligence in small and middle sized enterprises in Kenya. After the analysis and the interpretation exercise, an interpretation and presentation of the results was done as shown in the next chapter.

CHAPTER 4: RESULTS AND DISCUSION

4.1 Introduction

This chapter presents an analysis and findings of the study as set out in the previous chapter, the research methodology. It focuses on providing solutions and research objectives. The main research tool used in the findings was close-ended questionnaires. The study set to analyze the various frameworks for assessing readiness of adoption of BI as used in other parts of the world and the assessment on the major constructs required for developing such frameworks. Data was gathered exclusively from the questionnaire, as the research instrument, which brought out information on the profiles of the SMEs and as shared by the respondents who formed this study. The chapter included hypotheses testing to assess the strength of relationships between observed and unobserved variables. Frequencies, means, standard deviations, and the Structural Equation Model (SEM) analysis are presented, interpreted and findings discussed.

4.2 Data Analysis

Both descriptive and inferential statistics were used to analyze data. Descriptive statistics included means, frequencies and percentages. Inferential statistics included correlation and regression tests such as STATA distribution test, which were used at several points as they were efficient.

To achieve the first objective, which was (To investigate the importance of employing business intelligence and the impacts of BI on an SME environment), the Information Evolution Model was analyzed with the main factors i.e. Technology, Environment and Organization under test.

To achieve the second objective which was (To investigate the factors that affect the adoption of business intelligence hence assess the level of preparedness by SMEs in adopting BI using these factors), the various constructs obtain from the literature review were analyzed using correlation to indicate their relation and evaluate the indicator of assessing readiness for adopting BI.

To achieve the third objective, which was (To select a suitable framework and customize if necessary, to be used as an adoption model for this research), regression, and correlation analysis was used to identify the relationship between the moderating factors (technology, environment, and organization) and the various constructs and their effect readiness of adopting BI.

4.3 Reliability

Reliability is that quality of measurement that suggests that the same data will be collected each time in repeated observation of the same phenomenon (Chandron, 2004). To test the degree to which questions within the data collection instrument agree with each other, we used Cronbach's alpha on STATA to test the reliability of the questionnaires used for the pilot study. Cronbach's alpha has been used in much statistical research to test the internal reliability of questions within a questionnaire.

Boermans and Kattenberg (2011) for example indicated that one of the best ways of determining reliability of a set of question was to use Cronbach's alpha test. With a value of beyond 70%, the result would mean that the questions within a questionnaire are reliable for administration.

From the result below on tests done under technological, organizational and environmental factors, with 70.42%, 76.24% and 87.22% coefficient indicate that the items have relatively high internal consistency as they were all above 70%.

Technological variable coding

Alpha t1 t2 t3 t4 t5 t6 t7 t8 t9

n=20

Test scale = mean (unstandardized items)

Average interitem covariance: .1734401

Number of items in the scale: 9

Scale reliability coefficient: 0.7042

Organizational factor coding

Alpha o1 o2 o3 o4 o5 o6 o7

n=20

Test scale = mean (unstandardized items)

Average interitem covariance: .1632401

Number of items in the scale: 7

Scale reliability coefficient: 0.7624

Environmental factor coding

Alpha e1 e2 e3 e4 e5 e6 e7

n=20

Test scale = mean (unstandardized items)

Average interitem covariance: .5221432

Number of items in the scale: 18

Scale reliability coefficient: 0.8722

Table 4.2: Summary of Reliability

Section	Questions No. of	Alpha Cronbach's	Cut off	Comment
Technological factors	9	0.7042	0.7	Reliable
Environmental factors	7	0.8722	0.7	Reliable
Organizational factors	7	0.7624	0.7	Reliable

4.4 Descriptive Statistics

From the 280 sampled respondents 205 respondents representing the three categories of SMEs under this study filled and returned the questionnaires thus attaining a response rate of 73%. The researcher achieved this through the use of an introduction letter which comprehensively explained the purpose of the survey, and constant reminders to the respondents via e-mail, phone calls and physical visits. Table 4.2 shows a summary of the response rates per SME industry.

Table 4.3: Response Rate

Type of SME	Total Population	Target Sample	Response	Response rate (%)
Microfinance	346	102	71	71
Healthcare and pharmaceuticals	407	120	76	76
Hotels and Hospitality	197	58	58	72.5
Total	950	280	205	73

Figure 4.3 shows the distribution of SMEs as indicated by nature of business in the three industries under this study. A majority of the respondents were from Healthcare and pharmaceuticals at 37%, micro-finances at 35%, and the least from Hospitality and Hotel services with 28%. This shows that all respondents were from the three SME industries under this study and therefore information received is sufficient for further analysis.

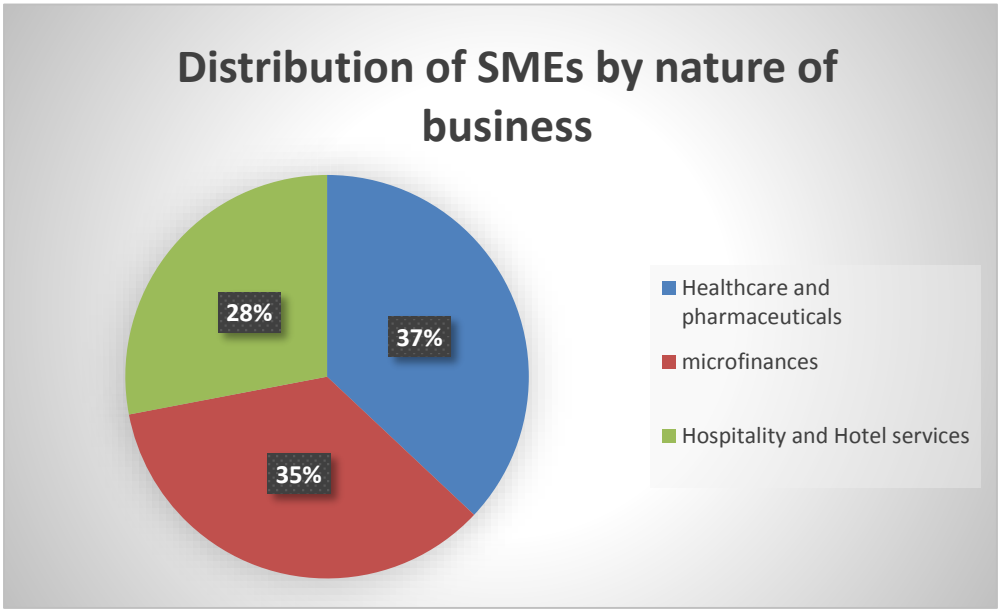

Figure 4.1: Distribution of SMEs by Nature of Business

4.5 Profiles of the SMEs under this Study.

Section A of the questionnaire covered aspects of the annual revenue of the firm, the number of years the firm has been in business, number of employees employed by the firm and the IT operating budget as a percentage of the total generated budget. Distribution of the SMEs by the estimated revenue generated annually is shown in Table 4.3. Respondents were asked to indicate the estimated annual revenue generated by their respective firms. From the table below majority of the respondents were from SMEs with estimated annual revenue of Sh. 5,000,001 to 10,000,000 with 40.5% and the least with 3.9% did not have this information.

Table 4.4: Distribution of SMEs by Estimated Annual Revenue

Annual Revenue scale	**Frequency**	**Percent (%)**
Below 500,000	8	3.9
500,001 – 1,000,000	15	7.3
1,000,001- 5,000,000	32	15.6
5,000,001- 10,000,000	78	38
Above 10,000,00	64	31.2
Information not available	8	3.9
Total	**205**	**100.0**

Regarding the SMEs annual operational budget as a per cent of the annual revenue, most firms' operational budget is more than 10% of the revenue with 50.9% as shown in the table below. Table 4.4 shows the distribution of SMEs by per cent of the operational budget on the annual revenue.

Table 4.5: Distribution of SMEs by Operational Budget as a Percentage of the Revenue

Operational budget scale	Frequency	Percent (%)
2% or less	2	0.9
2.1% - 3%	1	0.4
3.1% - 4%	2	0.9
4.1% - 5%	13	6.3
5.1% - 6%	24	12
6.1% - 7%	34	14.7
7.1% - 8%	29	16.5
Above 8%	91	44.3
Information not available	9	3.9
Total	**205**	**100.0**

Respondents were also asked to indicate the number of years their respective SMEs have been in business since establishment. Table 4.5 shows the distribution of SMEs by the respective number of years they have been in business.

Table 4.6: Distribution of SMEs by Duration of Operation

Years of operation	Frequency	Percent (%)
Less than 1 year	0	0
Above 1 year – 5 years	13	6.3
Above 5 years – 10 years	24	12
Above 10 years – 20 years	92	44.8
More than 20 years	75	36.5
Information not available	1	0.4
Total	**205**	**100.0**

Respondents also indicated the total number of employees working for their respective SMEs. Most SMEs, as shown in Table 4.6 below, employs 80 to 200 employees. The least of the respondents indicated working for SMEs that hire more than 400 employees.

Table 4.7: Distribution of SMEs by Number of Employees

Number of employees	Frequency	Percent (%)
Below 100	47	23%
101 – 200	62	30%
201 – 300	41	20%
301 – 400	28	14%
Above 400	14	6%
Information not available	9	4%
Total	**205**	**100.0**

The final question under this section required respondents to indicate the annual IT budget as a per cent of the firms‟ total annual budget.

4.6 Readiness for Adoption of Business Intelligence

The status of adoption of business intelligence by SMEs in the country was assessed from the data collected in section B of the questionnaire which required respondents to indicate their SMEs status of adoption. The respondents were to either select (i) our firm has already adopted business intelligence (ii) our firm intends to adopt business intelligence or (iii) our firm does not intend to adopt business intelligence. Figure 4.4 shows distribution of the sampled SMEs by readiness to adopt business intelligence in Kenya.

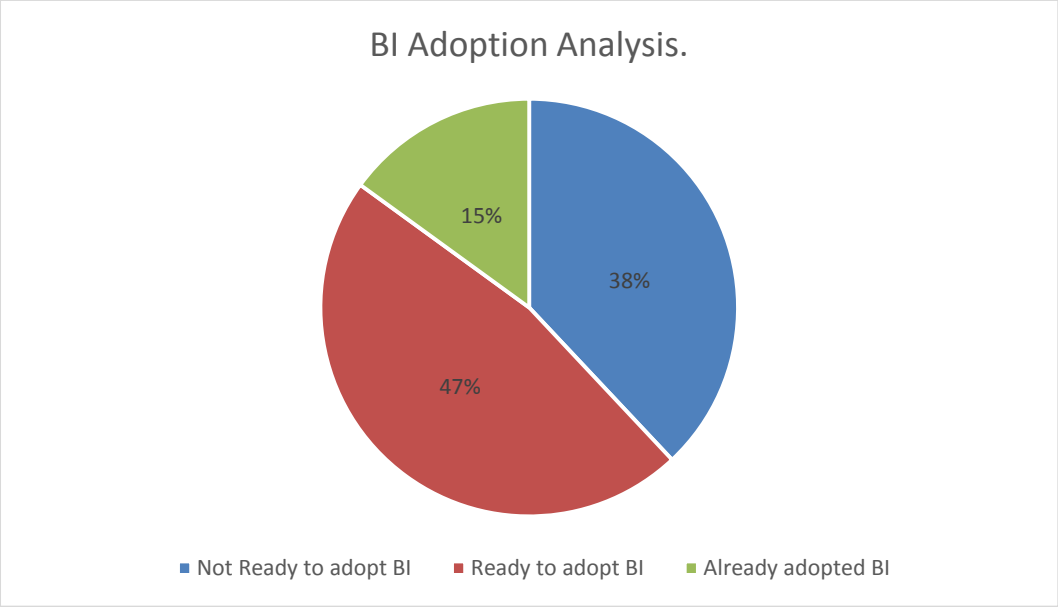

Figure 4.2: BI Adoption Analysis.

From the analysis in Figure 4.3, most SMEs in Kenya are ready to adopt business with 47%, 38% not ready to adopt and the analysis also shows that only 15% of SMEs in the three industries have already or partially adopted BI.

4.7 Structural Equation Model Analysis

Our choice of targeting decision making IT officers in the survey was strategic in assessing how

technology, organization and business environment affects adoption of business intelligence. These sections, A, B and C were used to collect information which has been used to describe our findings. Part C of the questionnaire was completed by 85% of the 205 respondents (those whose firms were ready to adopt or were ready to adopt) adopted a seven point Likert scale where and respondents were to indicate whether they: 1. Strongly disagree; 2. Quite disagree; 3. Slightly disagree; 4. Neither Agree nor Disagree; 5. Slightly Agree; 6. Quite Agree; and 7. Strongly Agree for each statement that appeared in the section. The three main factors assessed are discussed under 4.4.1, 4.4.2 and 4.43 below.

4.7.1 Technological Factors

Benefits of adopting business intelligence were assessed to determine if technological benefits affected the readiness for adoption of BI. This section had 9 questions which were coded q7, q8, q9, q10, q11, q12, q13, q14 and q15 for analysis. See Appendix 5. Data collected was analyzed using SEM model in STATA to illustrate regression and the correlation between the latent variables (benefits, complexity and security) and the observed variables ti where i=1 to 9 as listed above.

The observable variable under benefits are coded as T1, T2, T3 and T4.

e.t1 to e.t4 indicates variance

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -1340.2286

(1) [T1]Benefits = 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.8: STATA Results on Variable Tests under Benefits

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
T1 <-						
Benefits	1 (constrained)					
_cons	5.706897	.0778335	73.32	73.32	5.554346	5.859447
T2 <-						
Benefits	1.133734	.1346014	8.42	0.000	8699202	1.397548
_cons	5.663793	0775594	0775594	0.000	5.51178	1.397548
T3 <-						
Benefits	.8922676	.1152587	7.74	0.000	.6663647	1.118171
_cons	5.62069	.071948	78.12	0.000	5.479674	5.761705
T4<-						
Benefits	.6842614	.1098564	6.23	0.000	.4689468	.8995761
_cons	5.702586	.0744678	76.58	0.000	5.556632	5.84854

Variance

	Coef.	OIM Std. Err.	[95% conf.	Interval]
e.t2	.5486875	.5486875	.3899727	.771 9975
e.t3	.6763866	.082701	.5322547	.859 5486
e.t4	.9780466	.1006383	.7994168	1.19 6591
Benefits	.6588835	.128596	.4494459	.965 9171

LR test of model vs. saturated: chi2(2) = 1.87, Prob> chi2 = 0.3921

Table 4.8a and b: STATA Results for the SEM Model Tests on Benefits

As shown in the Tables above, all the indicators regress on Benefits of business intelligence and there exists a strong positive correlation between the latent variable and the observed variables. With a p value of significantly less than 0.05 we concluded that the latent variable (Benefits) is significant to explain all the four indicators. To test for fitness of the model, we used the chi square test and at 0.3921< 0.5 we thus adopted the model shown in Table 4.9 below. We could therefore not reject the stated hypothesis.

H1: Relative advantage of technology encourages the readiness for adopting business intelligence

The observable variables under complexity are coded as T5, T6 and T7.

e.t1 to e.t4 indicates variance

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -1274.0797

(1) [t5]complexity = 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.9: STATA Results on Variable Tests under Complexity

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
t5 <-						
Complexity	1(constrained)					
_cons	5.672414	.0722678	78.49	0.000	5.530771	5.814056
t6 <-						
Complexity	.8275	.3722291	2.22	0.026	.0979443	1.557056
_cons	5.655172	.0708804	79.78	0.000	5.516249	5.794096
t7 <-						
Complexity	.7722818	.383491	2.01	0.044	.0206533	1.52391
_cons	6.051724	.2281382	26.53	0.000	5.604582	6.498867

Variance

	Coef.	OIM Std. Err.	[95% conf.	Interval]
e.t5	.4418169	.3446964	.095753	2.038601
e.t6	.6384267	.2417359	.3039551	1.34095
e.t7	11.61577	1.097644	9.651897	13.97922
Complexity	.7698359	.3579191	.3094923	1.914902

LR test of model vs. saturated: chi2(0) = 0.00, Prob> chi2 =0.354

Table 4.9 a and b: STATA Results for the SEM Model Tests on Complexity

As shown in the tables above, all the indicators regress on operational complexity of technology and there exists a strong positive correlation between the latent variable (Complexity) and the observed variables. This means that lower operational complexity (user friendliness) would higher the rate of adoption of business intelligence. With a p vale of less than 0.05 the researcher concluded that the operational friendliness is significant to explain all the three indicators t5, t6 and t7. To test for fitness of the model, the researcher used the chi square test which was nil and thus fit. The researcher could therefore not reject the stated hypothesis.

H2: Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs.

The observable variable under security are coded as T8 and T9.

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -698.27405

(1) [t8]Security = 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.10 STATA Results on Variable Tests under Security

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
t8 <-						
Security	1 (constrained)					
_cons	5.702586	.0744731	76.57	0.000	5.556622	5.848551
t9 <-						
Security	.2995076	3.51313	0.09	0.932	-6.586102	7.185117
_cons	5.672414	.0722678	.0722678	0.000	5.530771	5.814056

variance

e.t8	0001819	15.09089		
e.t9	1.096244	1.357546	.0967859	12.41658
Security	1.286545	15.09091	1.33e-10	1.24e+10

LR test of model vs. saturated: chi2(-1) = 0.00, Prob > chi2 = 0.33

Table 4.10a and b: STATA Results for the SEM Model Tests on Security

As shown in the Tables above, both indicators regress on latent variable and there exists a strong positive correlation between the latent variable (Security) and the observed variables. A security concern on data encourages the adoption of business intelligence. With a p vale of less than 0.05 security is significant unobserved variable to explain the two indicators t8 and t9. To test for fitness of the model, we used the chi square test which was nil and we therefore adopted the model for further analysis of the hypothesis. We therefore could not reject the stated hypothesis.

H3: Need for data and information security encourages the adoption of business intelligence.

4.7.2 Organizational Factors

Top managerial support, organizational size IT skills and readiness (coded as Mgtsupport, size and readiness) were assessed to test H4, H5 and H6. This section had 11 questions in sections C. The codes adopted for the 11 questions were o1, o2, os3, os4, o1, o2, o3, o4, o5, o6 and o7.

Data collected was analyzed using means, frequencies and SEM model in STATA to illustrate

regression and the correlation between the latent variables (organization size, top managerial support and readiness and the observed variables osi where i=1 to 4 and oi where i=1 to 7 as listed above, and to test the significance of organizational factors to explain the observed variables.

The observable variable under management support are coded as o1, o2 and o3.

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -1002.2836

(1) [o1]Mgtsupport = 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.11 STATA Results on Variable Tests under Management Support

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
o1 <-						
Mgtsupport	1 (constrained)					
_cons	5.702586	.0744678	76.58	0.000		
o2 <-						
Mgtsupport	1.694741	.3578153	4.74	0.000	.9934359	2.396046
_cons	5.672414	.0722678	78.49	0.000	5.530771	5.814056
o3 <-						
Mgtsupport	1.65323	.3478017	4.75	0.000	.9715516	2.334909
_cons	5.655172	.0708804	79.78	0.000	5.516249	5.794096

Variance

e.o1	1.059177	.1078654	.8675272	1.293165
e.o2	.5586183	.1374399	.3448969	.9047758
e.o3	.5441409	.1312338	.3391734	.8729733
Mgtsupport	.2273681	.0810034	.1131034	.4570705

LR test of model vs. saturated: chi2 (0) = 0.00, Prob > chi2 = 0.267

Table 4.11 a and b: STATA Results for the SEM Model Tests on Management Support

As shown in the Tables above, all the indicators regress on top managerial support for mobile payment and there exists a strong positive correlation between the latent variable and the observed variables. We tested fitness of the model using chi square which was nil as shown in the results above and thus adopted the model for further analysis. With a p vale of less than 0.05 the researcher concluded that top managerial support is significant to explain all the three indicators

o1, o2 and o3. The researcher could therefore not reject the stated hypothesis.

H4: Greater management support enhances the readiness of adopting business intelligence by SMEs.

From the filled questionnaires, 38% of SMEs which are not ready to adopt business intelligence: i) have an annual revenue of less than KSh.1,000,000; ii) have an operational budget of less than 8%; iii) have been operational for less than 10 years; and iv) hire less than 80 employees. With these observations on the profiles of the SMEs under this study as discussed in part 4.3 of this chapter, we could not reject the following hypothesis.

H5: Larger organizational have higher capability to adopt business intelligence than smaller organizations.

The observable variable under management support are coded as o1, o2 and o3.

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -579.21649

(1) [o4]Ready = 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.12: STATA Results on Variable Tests under Readiness

	Coef.		OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
o4 <-							
Ready	1 (constrained)						
_cons	4.534483		.0354718	127.83	0.000	4.464959	4.604006
o5 <-							
Ready	1.326372		.1362295	9.74	0.000	1.059367	1.593377
_cons	6.284483		.0296206	212.17	0.000	6.226427	6.342538
o6 <-							
Ready	.6047505		.1622284	3.73	0.000	.2867887	.9227123
_cons	5.75		.047119	122.03	0.000	5.657648	5.842352
o7 <-							
Ready	1.270865		.1331301	9.55	0.000	1.009935	1.531796
_cons	5.37931		.0324339	165.85	0.000	5.315741	5.44288

Variance

e.o4		.1871512	.0183106	.1544943	.2267111
e.o5		.0192465	.0119123	.0057215	.0647426
e.o6		.4767719	.0450127	.3962302	.5736853
e.o6		.0748519	.0129222	.0533647	.1049908
Ready		.1047632	.0215868	.0699545	.1568923

LR test of model vs. saturated: chi2(2) = 11.90, Prob> chi2 = 0.0026

Table 4.12 a and b: STATA Results for the SEM Model Tests on Readiness

From the Tables above, all the indicators regress on top managerial support for business intelligence and there exists a strong positive correlation between the latent variable and the observed variables. The researcher tested fitness of the model using chi square which was at 0.0026 as shown in the results above and thus adopted the model. With a p vale of less than 0.05 the researcher concluded that higher organizational readiness is significant to explain all the four indicators o4, o5, o6 and o7. The researcher could therefore not reject the stated hypothesis.

H6: Higher organizational readiness for new technologies leads to adoption of business intelligence.

From the filled questionnaires, 38% of SMEs which are not ready to adopt business intelligence only operate their business within Nairobi. With these observations on the profiles of the SMEs under this study as discussed in part 4.3 of this chapter, we could not reject the following hypothesis.

H7: Organizations with distributed operations (enterprises) are more ready to adopt business intelligence that those with less operation points (single entities).

4.7.3 Environmental Factors

Pressure from the competitors, clients and associations was assessed to test H8, H9, H10 and H11. This part of the questionnaire had 3 questions. The code adopted for the 1 questions were ei with i= 1 to 3. Data collected was analyzed using means, frequencies and SEM model in STATA to illustrate regression and the correlation between the latent variable (pressure from competitors) and the observed variable and to test for significance of the unobserved variable in explaining the observed variable. In the SEM models we labelled the latent variable as Competition as discussed below.

The observable variable under management support are coded as o1, o2 and o3.

Structural equation mode

Nunber of Obs = 97

Estimation method = ml

Log likelihood = -120.64974

(1) [e7]Competition= 1

OIM

Coef. Std. Err. z P>|z|[95% Conf. Interval]

Table 4.13: STATA Results on Variable Tests under Competition

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
e7 <-						
Competition	1 (constrained)					
_cons	5.689655	.2240236	25.40	0.000	5.250577	6.128733
e8 <-						
Competition	1.2	.4638941	2.59	0.010	.2907842	2.109216
_cons	5.862069	.1994293	29.39	0.000	5.471195	6.252943
e9 <-	_cons |					
Competition	.9109948	.3337269	2.73	0.006	.256902	1.565087
_cons	6	.1888698	31.77	0.000	5.629822	6.370178

Variance

e.c1	.8876338	.2961534	.4615681	1.706993
e.c2	.3357907	.2774363	.0664953	1.695691
e.c3	.5632786	.2118131	.2695508	1.17708
Competition	.5677765	.3537173	.1674519	1.925151

LR test of model vs. saturated: chi2(0) = 0.00, Prob > chi2 = 0.249

Table 4.13 a and b: STATA Results for the SEM Model Tests under Competition

The Tables above show that all the indicators regress on the latent variable and there exists a positive correlation between the unobserved variable and the observed variables. We tested fitness of the model using chi square which was at 0.2499 as shown in the results above and we thus adopted the model. With a p vale of less than 0.05 across all the results, as shown above, we concluded that our latent variable (competitors) significant to explain all the four indicators and we therefore could not reject the hypothesis.

H8: Organizations facing greater competitive pressure from the market are more ready to adopt business intelligence than those without pressure.

4.8 SMEs Ready to Adopt Business Intelligence.

The study further did an analysis of the estimated period for adoption of business intelligence by SMEs which were ready to adopt the technologies for business intelligence. As shown in the table below, 60% of SMEs would have adopted the technologies within the next 24 months although this projection is also reliant on the three factors analyzed under section 4.4 of this chapter.

Table 4.14: Target Time for Adoption of Business Intelligence by SMEs

Target Time	Frequency	Per cent (%)
Less than 6 months	12	5.9%
Above 6 months - 12 months	18	8.9%
Above 12 months - 18 months	26	12.7%
Above 18 months - 24 months	34	16.6%
Information not available	8	3.9%
Not Applicable	0	0%
TOTAL	98	100%

4.9 Additional Factors that Affect Readiness for Adopting Business Intelligence.

Respondents from SMEs which do not intend to adopt business intelligence outlined factors that hinder them from adopting the new technologies. The outlined factors were grouped into the following three major categories:

i. Small volumes of data insufficient to employ business intelligence as a contributor to 38% of SMEs not willing to adopt BI.
ii. Lack of required skills to operate in a business intelligent environment; and
iii. Fear for loss of jobs, especially frontline staff, if the technology is adopted.

Respondents were also required to outline any other factors that would promote adoption of business intelligence. The outlined factors were grouped into the following three major categories;

i. Training on current technologies and support services;
ii. Managers support and innovation capacity, and
iii. Need for security, reliability and accuracy of data and information.

Table 4.15: Summary of Findings to Validate the Hypothesis.

FINDINGS	Hypothesis	Key Indicators and Coding
Firms that have adopted and using BI realizes much profits and efficiency than those that have not yet adopted BI	H1:Relative advantage of technology affects the readiness for adopting business intelligence	Relative advantage or benefits of technology influences the adoption of Business Intelligence.(T1) as shown in Figure 4.3 a and b where there is a high positive correlation between the observed variables and the expected variance.
Users are much more willing to adopt simple technologies than complex ones.	H2: Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs	Complexity of technology (user friendliness) affects the adoption of Business intelligence.(T2) Available technical and operational skills affects the adoption of Business intelligence.(T3) User have adequate skills and knowledge to operate complex computer technologies.(T6) User are more likely to adopt easy to use systems as opposed to complex ones.(T7) as shown in figure 4.4 a and b.
BI enhances data and information security.	H3: Need for data and information security encourages the adoption of business intelligence.	Need for data and information security is a major reason for adoption of business intelligence.(T4) as shown in figure 4.5 a and b.
Readiness of adopting or adopting of BI is determined by managerial interest to adopt.	H4: Greater management support affects the readiness of adopting business intelligence by SMEs	Managerial support has effect on readiness for adopting of BI.(O1) Top manager's IT knowledge is sufficient for the adoption of BI.(O2) Top manager's innovation has an effect on the adoption of BI.(O3) as shown in figure 4.6 a and b.
Large organizations are more ready to adopt new technologies than small ones.	H5: Larger organizations have higher capability to adopt business intelligence than smaller organizations.	Organizational size has an effect on the adoption of BI.(O4) Enterprise organizations are more ready to adopt BI than those with single operating points.(O5) as shown in figure 4.7 a and b.
Adoption of BI is influenced by organizational readiness in terms of infrastructure, technical and operational factors	H6: Higher organizational readiness for new technologies leads to adoption of business intelligence.	Adoption of business intelligence highly depends on organization's readiness to adopt it.(O6) as shown in figure 4.8 a and b.
Number of operation points also determines the need for business intelligence.	H7: SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with fewer points of operations (single entities).	Enterprise organizations are more ready to adopt BI than those with single operating points.(O7)
Market competition for organization product and services can lead to adoption of new technologies.	H8: SMEs facing greater competitive pressure from the market are more ready to adopt business intelligence than those without pressure.	Competitive pressure on the market prepares the firm to adopt BI(E1)

A majority of SMEs in Kenya regardless of the nature of business or size in terms annual revenue and number of employees are planning to adopt business intelligent systems within the next 24 months. This shows that despite the experienced factors as highlighted by 38% of the sampled SMEs as reasons to why they do not consider adopting business intelligence, most SMEs, 15% and 47% of SMEs have adopted and are ready to adopt business intelligence. These 85% of the sampled SMEs have invested in IT personnel and systems in order to realize all the beneficial factors discussed in chapter four.

All the hypotheses discussed in chapter three and tested under (i) technology, (ii) organization and (iii) environment as factors influencing readiness of adopting BI could not be rejected since the latent variables generated from the above mentioned factors were strongly significant to explain all the observations indicated by the respondents. This implies that technology, organization and environment strongly affect readiness for adopting business intelligence.

4.10 Framework Validation

The findings after SEM chi square tests on constructs variables indicates probability level(p value) significantly less than0.05 as the conventional STATA value in all tests. It also indicates the variance level of less than 0.05 being the conventional value. This implies that there is a positive relationship between the indicators (variables) in the three main constructs i.e. technological, environmental and organizational factors and the stated hypothesis.

Based in the Information Evolution Model (IEM) by Davis et al. (2006), the forth minor construct i.e. management characteristics tends to be assimilated in the three main constructs since it's observable variables have similar characteristics with the variables of the other constructs as shown in the Figure below.

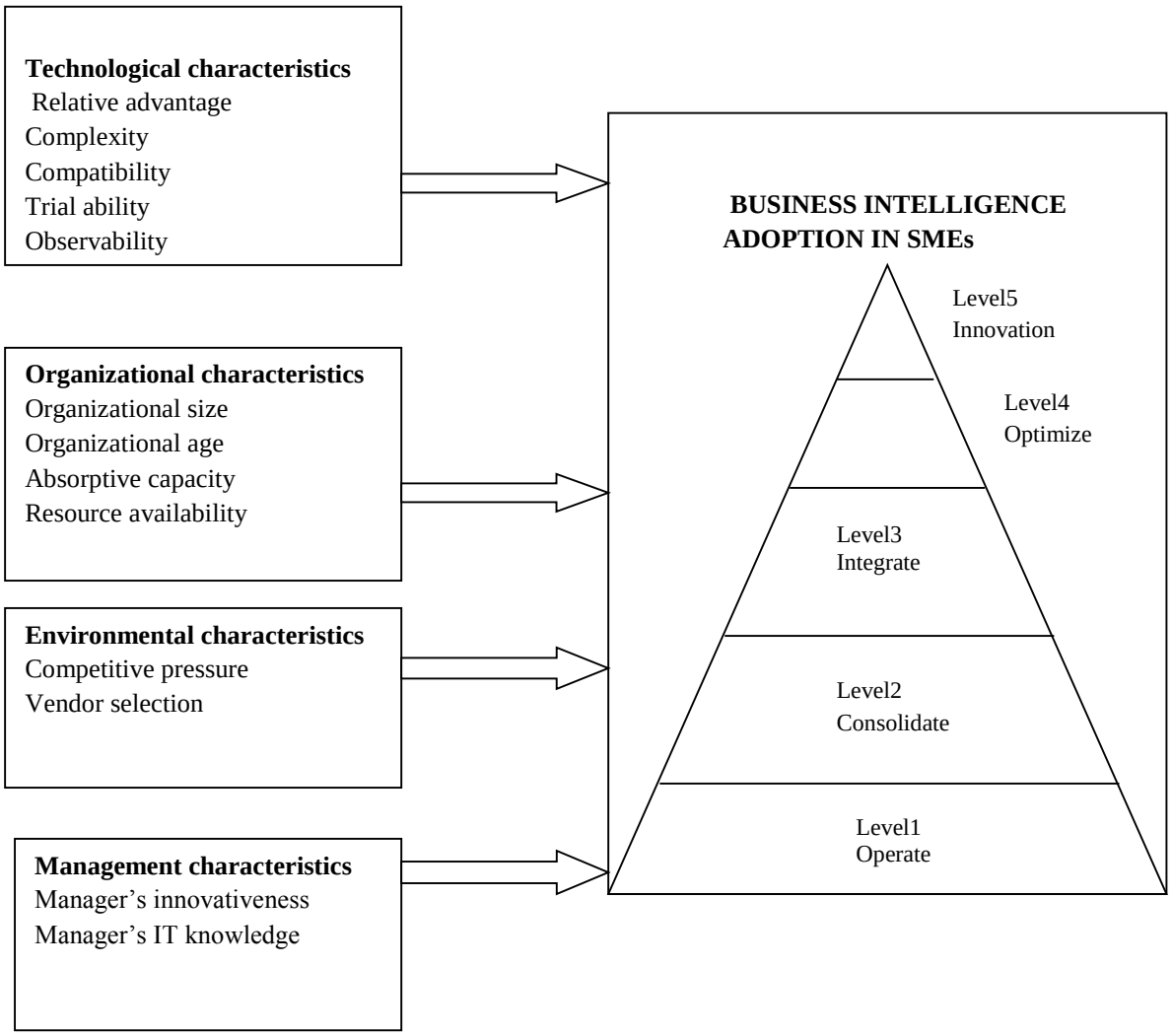

Figure 4.3: Information Evolution Model (Framework after validation)

Source: Davis et al. (2006)

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Chapter Overview

This chapter presents findings of the research objectives as well as makes necessary recommendations. Based upon the findings, this final chapter will first present findings on the research objectives, theoretical and practical implication of the research will be presented. Next, the academic contribution of the study will be presented followed up by the research limitations and recommendations for future research.

5.2 Research Objectives

The first objective investigate the importance of employing business intelligence and the impacts of BI on SME environment of which the Information Evolution Model was analyzed with the main factors i.e. Technology, Environment and Organization under test. The results shows a great correlations between the variables under investigation and the indicators for readiness of adopting BI in SMEs.

The second objective was to investigate the factors that affect the adoption of business intelligence hence assess the level of preparedness by SMEs in adopting BI using these factors. The various constructs obtain from the literature review were analyzed using correlation to indicate their relation and evaluate the indicator of assessing readiness for adopting BI. The results shows a great correlations between the variables under investigation and the indicators for readiness of adopting BI in SMEs.

The third objective was to select a suitable framework and customize if necessary, to be used as an adoption model for this research. Regression and correlation analysis were used to identify the relationship between the moderating factors (technology, environment, and organization) and the various constructs and their effect readiness of adopting BI. The results shows a great correlations between the variables under investigation and the indicators for readiness of adopting BI in SMEs.

5.3 Theoretical and Practical Implication

This study has significant implications on identifying major indicators for readiness for adopting business intelligence. The results suggests that factors identified are capable of providing adequate explanation of readiness of adoption of BI and decision making processes managers in SMEs on implementing BI technologies. The study validates the constructs of technology, environment and organization derived from various frameworks. That is Diffusion of Innovation theory (Rogers,

1995), Technology-Organization-Environment model (Tornatzky and Fleischer, 1990), and Information Systems Adoption Model for Small Business (Thong, 1999).

The study has shed light on some of the main factors which influence readiness of adopting business intelligence. Findings from this research can be considered by developers and even the managers who are directly responsible for developing and implementing BI technologies. Also large organizations can improve and use the framework to come up with systems that will be accepted at the firm level.

5.4 Limitations to the Research.

In the process of conducting this research study, a number of limitations were encountered. Insufficient funds hindered the research to the extent that information from remote locations, other than Nairobi were not collected creating an assumption that all SMEs have the same perception of BI systems regardless of where they are based. This may have caused some skewness as far as the representation of user's perception is concerned.

5.5 Conclusion

This case study of SMEs in Kenya on readiness of adopting business intelligence aimed at researching on the effects of (i) technology, (ii) organization and (iii) environment on the status of adoption and how ready firms are when it comes to adopting BI. On successfully concluding the study, we found out that indeed there is a greater correlation between the three construct and readiness of BI adoption. This is a clear indication that indeed the Information Evolution Model is the most applicable framework for this study since it best explains TOE(Technology, organizational and environment) in addition of other theories that forms the three major factors of the study. Our conclusion can therefore be summarized as follows;

1. For the research question of whether there is any technological, organizational and environmental effect on decision to adopt BI by a firm, the answer is yes. The correlations were so strong as per the results and discussion.
2. For the question as to whether there could be any factors that can make a firm reject the BI technologies, we can conclude that yes, some firm, due to size and the incapacity of investing in sophisticated technologies as well as the risk of losing job for those who are at a position to adopt business intelligence, would opt not to adopt and therefore not ready to adopt.
3. For the question as to whether there are other factors that would make a firm adopt a technology, we can conclude that yes there are, however the significance is statistically low for us to define a new theoretical construct or model. Therefore Since we had also an objective of identifying if there is any other pattern out of the constructs so far used in

Technology Adoption, we would like to indicate that there was no significant pattern to that effect thus we would not be in a position to propose any newer model.

5.6 Areas for Further Study

As with the norm with any research report, it would be great to highlights areas we felt needed further investment with regards to knowledge search. These areas include using the mixed model of Technology Diffusion, TOE and TAM. It would be interesting to find out how the constructs derived from the three models would generate the concept of business intelligence technology adoption and also readiness of adopting BI in SMEs.

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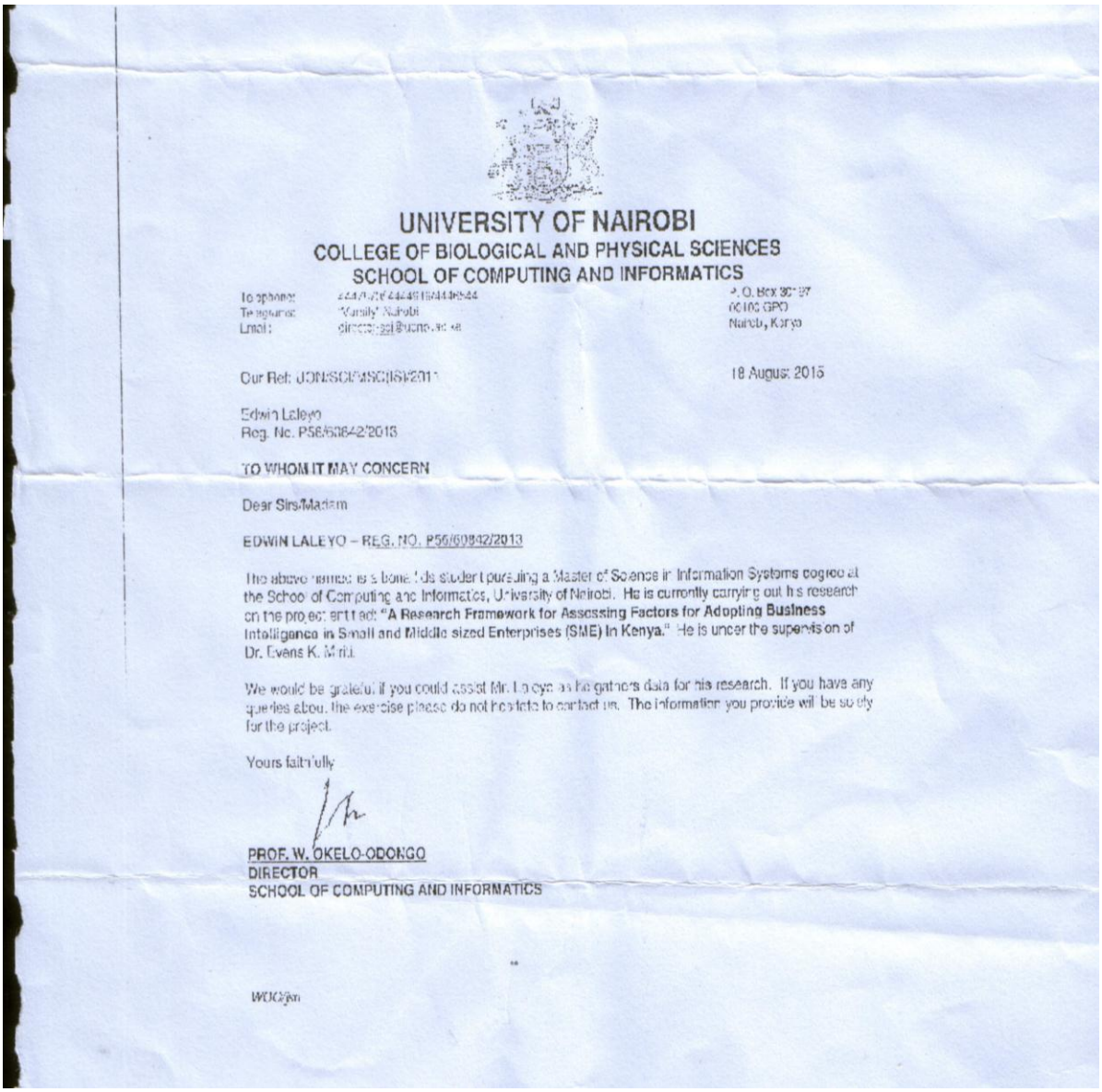
APPENDICES

Appendix 1: Introduction Letters



UNIVERSITY OF NAIROBI
COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES
SCHOOL OF COMPUTING AND INFORMATICS

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P. O. Box 30197
00100 GPO
Nairobi, Kenya

Our Ref: UON/SCI/ASC/161/2011

18 August 2015

Edwin Laleyo
Reg. No. P56/60842/2013

TO WHOM IT MAY CONCERN

Dear Sirs/Madam

EDWIN LALEYO – REG. NO. P56/60842/2013

The above named is a bona fide student pursuing a Master of Science in Information Systems degree at the School of Computing and Informatics, University of Nairobi. He is currently carrying out his research on the project titled: **"A Research Framework for Assessing Factors for Adopting Business Intelligence in Small and Middle sized Enterprises (SME) In Kenya."** He is under the supervision of Dr. Evans K. Mirit.

We would be grateful if you could assist Mr. Laleyo as he gathers data for his research. If you have any queries about the exercise please do not hesitate to contact us. The information you provide will be strictly for the project.

Yours faithfully

PROF. W. OKELO-ODONGO
DIRECTOR
SCHOOL OF COMPUTING AND INFORMATICS

WOO/jm

Appendix 2: Revised Questionnaire

Instructions:

Please take a look at the following questionnaire and try to answer correctly and accurately. All the information gathered here will be kept strictly confidential and will be used only for research and analysis purposes without mentioning the person or company names.

Business intelligence is simply a collection of technology-driven approaches for gathering, storing, analyzing, providing access to data and presenting actionable information to help corporate executives, business managers and other end users make more informed business decisions.

SECTION A: COMPANY'S CHARACTERISTICS

Q1. Which of the following is the specialty of your company?

- ☐ Financial institution
- ☐ Manufacturing industry
- ☐ Hospitality industry
- ☐ Health or medical organization
- ☐ Others (Specify)…….

Q2. What is the number of employees in your company?

- ☐ Less than 20.
- ☐ Between 20 and 50.
- ☐ Between 51 and 100.
- ☐ Between 101 and 200
- ☐ More than 200.

Q3. What is your estimate company's net annual revenue turnover in Kenya shillings?

- ☐ Less than 5 million.
- ☐ Between 5 and 20 million
- ☐ Between 20 and 50 million
- ☐ Between 50 and 100 million.
- ☐ Between 100 and 200 million
- ☐ More than 200 millions

Q4. About how much is your firm's operating budget as a percentage of your revenue?

- □ Less than 2%
- □ 2-3%
- □ 3-4%
- □ 4-5%
- □ 5-6%

□ 6-7%
□ 7-8%
□ Above 8%

Q5 How long has your firm been in existence?

□ Less than 1 yr
□ 1-5yrs
□ 5-10yrs
□ 10-15yrs
□ 15-20yrs
□Above 20yrs

Q6. How many employees does your firm have?

□ Below 80
□80-200
□200-300
□300-400
□Above 400

Q7. What is the estimated firm's total annual operating IT costs as a percentage of the total revenue?

□ Less than 2%
□ 2-3%
□ 3-4%
□ 4-5%
□ 5-6%
□ 6-7%
□ 7-8%
□ Above 8%

Q8 Select which one below best represents your case.

□Our firm has already adopted business intelligence.
□Our firm is planning to adopt business intelligence.
□Our firm has no plans to adopt business intelligence
□I have no what business intelligence is.

Q9. Please rank the choices in order of importance (1, 2, 3…) where "1" is the most important.

	1	2	3	4	5
1. Organizational i.e. resour finances, size etc					
2. Technological i.e. efficie reliability, accuracy					
3. Environmental i.e. competit suppliers, market					
4. Management i.e. innovation, te employees welfare					

Q10. Investing in new computer technologies will improve your company's operational performance

☐ Strongly agree
☐ I agree
☐ Disagree
☐ Strongly disagree

Q11. The following factor encourages the adoption of advanced information system technologies in your organization.

	1(Strongly agree)	2(I agree)	3(Disagre	4(Strongly Disagree)
1. Operational efficiency				
2. Reduced operational costs				
3. Improved performance				
4. Competitive advantage				
5. Improved decision making				

Q12. The following will most likely hinder the adoption of new information technologies in your organization.

	1(Strongly agr	2(I agree	3(Disagree)	4(Strongly Disagree)
1. Change resistance				
2. Investment capital				
3. Technical requirements				
4. Operational requirements				
5. Systems compatibility				

Q13. The following functions ensure successful use of information in our company.

Systematic and regular collection of data

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Reporting on data to gain usable knowledge

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Analyze the data to identify areas for improvement.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

SECTION B: BUSINESS INTELLIGENCE ADOPTION ENABLING FACTORS

The following factors influence successful adoption of new information technologies if suggested in our company.

Technological factors

☐**Q1. Relative advantage or benefits of technology influences the adoption of BI.**

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q2. Complexity of technology (user friendliness) affects the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q3. Available technical and operational skills are sufficient for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q4. Need for data and information security is a major reason for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q5. Our current systems are sufficient to deploy BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q6. Users have adequate skills and knowledge to operate complex computer technologies.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q7. Users are more likely to adopt easy to use as opposed to complex systems.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q8. Regular changes of technology hinder the firm's ability of preparing to adopt BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q9. Resistance to change can hinder adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Organizational factors

Q1. Organizational size has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q2.The amount of resources allocated in Information systems is enough for the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q3. Current Organization financial capacity is sufficient to deploy of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q4. Organizational age has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q5. Top manager's IT knowledge is sufficient for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q6. Top manager's innovation capacity has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q7. Adoption of business intelligence highly depends on organization's readiness to adopt it.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q8. Enterprise organizations are more likely to adopt business intelligence than those with single operating point.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Environmental factors

Q22. Vendor selection of new technology is important for the adoption of BI?

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q23. Competitive pressure on the market forces the firm to adopt BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q24. Owner manager's IT knowledge sufficient for the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q25. Owner manager's innovation has an effect on the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree.

Appendix 3: Pilot Questionnaire

Instructions:

Please take a look at the following questionnaire and try to answer correctly and accurately. All the information gathered here will be kept strictly confidential and will be used only for research and analysis purposes without mentioning the person or company names.

Business intelligence is simply a collection of technology-driven approaches for gathering, storing, analyzing, providing access to data and presenting actionable information to help corporate executives, business managers and other end users make more informed business decisions.

SECTION A: COMPANY'S CHARACTERISTICS

Q1. Which of the following is the specialty of your company?

- ☐ Financial institution
- ☐ Manufacturing industry
- ☐ Hospitality industry
- ☐ Health or medical organization
- ☐ Others (Specify)…….

Q2. What is the number of employees in your company?

- ☐ Less than 20.
- ☐ Between 20 and 50.
- ☐ Between 51 and 100.
- ☐ Between 101 and 200
- ☐ More than 200.

Q3. What is your estimate company's net annual revenue turnover in Kenya shillings?

- ☐ Less than 5 million.
- ☐ Between 5 and 20 million
- ☐ Between 20 and 50 million
- ☐ Between 50 and 100 million.
- ☐ Between 100 and 200 million
- ☐ More than 200 million

Q4. About how much is your firm's operating budget as a percentage of your revenue?

□ Less than 2%
□ 2-3%
□ 3-4%
□ 4-5%
□ 5-6%
□ 6-7%

□ 7-8%
□ Above 8%

Q5 How long has your firm been in existence?

□ Less than 1 yr
□ 1-5yrs
□ 5-10yrs
□ 10-15yrs
□ 15-20yrs
□Above 20yrs

Q6. How many employees does your firm have?

□ Below 80
□80-200
□200-300
□300-400
□Above 400

Q7. What is the estimated firm's total annual operating IT costs as a percentage of the total revenue?

□ Less than 2%
□ 2-3%
□ 3-4%
□ 4-5%
□ 5-6%
□ 6-7%
□ 7-8%
□ Above 8%

Q8 Select which one below best represents your case.

□Our firm has already adopted business intelligence.
□Our firm is planning to adopt business intelligence.
□Our firm has no plans to adopt business intelligence
□I have no what business intelligence is

Q9. Please rank the choices in order of importance (1, 2, 3…) where "1" is the most important.

	1	2	3	4	5
5. Organizational i.e. resour finances, size etc					
6. Technological i.e. efficie reliability, accuracy					
7. Environmental i.e. competit suppliers, market					
8. Management i.e. innovation, te employees welfare					

SECTION B: BUSINESS INTELLIGENCE ON COMPANY'S PERFORMANCE.

Q1. Investing in new computer technologies will improve your company's operational performance

☐ Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q2. The following factor encourages the adoption of advanced information system technologies in your organization.

	1(Strongly agree)	2(I agree)	3(Disagre	4(Strongly Disagree)
6. Operational efficiency				
7. Reduced operational costs				
8. Improved performance				
9. Competitive advantage				
10. Improved decision making				

Q3. The following will most likely hinder the adoption of new information technologies in your organization.

	1(Strongly agr	2(I agree	3(Disagree)	4(Strongly Disagree)
6. Change resistance				
7. Investment capital				
8. Technical requirements				
9. Operational requirements				
10. Systems compatibility				

Q10. The following functions ensure successful use of information in our company.

Systematic and regular collection of data

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Reporting on data to gain usable knowledge

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Analyze the data to identify areas for improvement.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

SECTION C: BUSINESS INTELLIGENCE ADOPTION ENABLING FACTORS

The following factors influence successful adoption of new information technologies if suggested in our company.

Organizational factors

Q1. Organizational size has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q2.The amount of resources allocated in Information systems is enough for the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q3. Current Organization financial capacity is sufficient to deploy of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q4. Organizational age has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q5. Top manager's IT knowledge is sufficient for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q6. Top manager's innovation capacity has an effect on the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q7. Adoption of business intelligence highly depends on organization's readiness to adopt it.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q8. Enterprise organizations are more likely to adopt business intelligence than those with single operating point.

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☐ I agree

☐ Disagree

☐ Strongly disagree

Technological factors

☐**Q1. Relative advantage or benefits of technology influences the adoption of BI.**

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q2. Complexity of technology (user friendliness) affects the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q3. Available technical and operational skills are sufficient for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q4. Need for data and information security is a major reason for the adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q5. Our current systems are sufficient to deploy BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q6. Users have adequate skills and knowledge to operate complex computer technologies.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q7. Users are more likely to adopt easy to use as opposed to complex systems.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q8. Regular changes of technology hinder the firm's ability of preparing to adopt BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q9. Resistance to change can hinder adoption of BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Environmental factors

Q22. Vendor selection of new technology is important for the adoption of BI?

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q23. Competitive pressure on the market forces the firm to adopt BI.

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q24. Owner manager's IT knowledge sufficient for the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Q25. Owner manager's innovation has an effect on the adoption of BI

☐Strongly agree

☐ I agree

☐ Disagree

☐ Strongly disagree

Appendix4: Measurement of constructs

Constructs	Operationalization Type	Sub- construct	Operationalization Type	Hypothesis
Readiness for Adoption of BI				
Technological context				
Relative advantage	Reflective(+)			**H1:** Relative advantage of technology encourages the readiness for adopting business intelligence
Operational complexity	Reflective(-)			**H2:** Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs
Need for data and information security	Reflective(+)			**H3:** Need for data and information security encourages the adoption of business intelligence.
Organizational context				
Management support	Reflective(+)			**H4:** Greater management support enhances the readiness of adopting business intelligence by SMEs
Organizational size	Reflective(+)			**H5:** Larger organizational have higher capability to adopt business intelligence than smaller organizations.
Organizational readiness	Formative	IT sophistication	Reflective(-)	**H6:** Higher organizational readiness for new technologies leads to adoption of business intelligence.
		Financial resources		
Firm scope	Reflective(+)			**H7:** SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with less points of operations (single entities).
Competitive pressure	Formative	Market forces	Reflective(+)	**H8:** SMEs facing greater competitive pressure from the market are more ready to adopt business intelligence than those without pressure.
		Technological chances	Reflective(-)	

Adopted from Yoon (2009)

Appendix 5: Hypothesis and Key Indicators coding

Hypothesis	Key Indicators and Coding
H1: Relative advantage of technology encourages the readiness for adopting business intelligence	• Relative advantage or benefits of technology influences to adoption of Business Intelligence.(T1)
H2: Operational complexity of technologies affects the readiness of adopting Business intelligence by SMEs	• Complexity of technology (user friendliness) affects the adoption of Business intelligence.(T2) • Available technical and operational skills affects the adoption of Business intelligence.(T3) • User have adequate skills and knowledge to operate complex computer technologies.(T6) • User are more likely to adopt easy to use systems as opposed to complex ones.(T7)
H3: Need for data and information security encourages the adoption of business intelligence.	• Need for data and information security is a major reason for adoption of business intelligence.(T4)
H4: Greater management support enhances the readiness of adopting business intelligence by SMEs	• Managerial support has effect on readiness for adopting of BI.(O3) • Top manager's IT knowledge is sufficient for the adoption of BI.(O5) • Top manager's innovation has an effect on the adoption of BI.(O6)
H5: Larger organizational have higher capability to adopt business intelligence than smaller organizations.	• Organizational size has an effect on the adoption of BI.(O1) • Enterprise organizations are more ready to adopt BI than those with single operating points.(O8)
H6: Higher organizational readiness for new technologies leads to adoption of business intelligence.	• Adoption of business intelligence highly depends on organization's readiness to adopt it.(O7)
H7: SMEs with distributed operations (enterprises) are more ready to adopt business intelligence that those with less points of operations (single entities).	• Enterprise organizations are more ready to adopt BI than those with single operating points.(O8)
H8: SMEs facing greater competitive pressure from the market are more ready to adopt business intelligence than those without pressure.	• Competitive pressure on the market prepares the firm to adopt BI(O9)

Adopted from Yoon (2009)

Appendix 6: Project Time Schedule

Activity	Timeline	
	Start Date	**End Date**
Consultation & picking of project titles	01-06-2015	06-06-2015
Preparing the proposal	06-06-2015	29-06-2015
Presenting the final Proposal	30-07-2015	30-07-2015
Milestone one presentation	07-11-2015	07-11-2015
Conducting research, Literature review, working on corrections and analysis	08-12-2015	20-12-2015
Milestone two presentation	21-02-2016	20-02-2016
Working on finalization Literature review, working on corrections and analysis	21-03-2016	06-03-2016
Milestone three presentations	07-04-2016	07-04-2016