Application of Business Intelligence in Kenyan SMEs[1]

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Abstract:

Business Intelligence is still in its infancy stages in developing countries, particularly Kenya. Research has shown that different models are available to assess the usage and adoption of Business Intelligence (BI). In this case, the technological, organizational, and environmental (TOE) model was proposed as a suitable model for developing economies like Kenya. The study investigates how the TOE constructs affect BI adoption, the BI systems in Kenya, and whether managers influence BI adoption. The equivocal nature of the TOE framework allowed the creation of a structured interview questionnaire that was divided into two parts; the demographic profile and questions based on the TOE framework. The results demonstrated that the TOE factors led to more intensive BI adoption, but there might be a lack of awareness or technical skills to adopt advanced BI technologies. On this basis, it is recommended that managers within small- and medium-sized enterprises (SME) learn about better BI solutions and how they can leverage the advantage to enable them to stay profitable, competitive, and data driven. Further research is needed to better understand BI usage within SMEs preferably with larger and representative sample sizes and across different counties within Kenya.

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Introduction

A company's feasibility, competitiveness, and performance require perfect knowledge of the environment, adoption of strategic information to achieve the set objectives of a company, adapting its scope, operations, and resources to changes in the environment in the long term (Ouedraogo, Compaoré and Nassè, 2022). There is an increase in the disparity of information in the knowledge economy both externally and internally. Companies are faltering to control their production cycles, to get to know each other better, and mainly to know all their competitors and partners. In the 21st century, a manager should not be ill-equipped and anxious to manage their business when there is compressed decision-making time with the fast-paced and increased volumes of transactions (Séllei et al., 2024).

Presently, business requires a lot of data, which spectrum of data can be easily sourced, but for effective and efficient results, data must be transposed with software into functional information. Time constraint is a major influence to data availability and information. Many businesses require serious allocation of minimal time into decision making and information at their fingertips or they fail to survive. Companies all over the world are constrained by a proactive approach rather than a reactive one to help deal with future challenges.

Within the developed and developing nations, SMEs are undoubtedly the driving forces for the economies. According to the Central Bank of Kenya 90% of all businesses are SMEs in Kenya (KNBS, 2024), their importance is indisputable as they contribute to 38% of employment. However, it was evident that there is a massive untapped potentiality for an economic upturn within Kenya. SMEs faced innumerable hurdles including lack of knowledge, fast changes in technology and no market entry. In 2018, a survey by the Kenya National Bureau of Statistics highlighted that many of the Kenyan SMEs do not reach their second year anniversary (Wakiaga, 2019). This is a sign that a lack of vital strategic information is missing for most SMEs based in Kenya. However, SMEs also face stiff competition from multinationals, large companies, and new forms of commerce. For these reasons, SMEs must have contingencies to incorporate tools that will serve as a springboard to enable small companies to strategically leap from one stage of growth to another. This essential task of SMEs to hold, process, and analyze strategic information meets the opportunity of developing information and communication technologies (ICT) in business management.

Business Intelligence (BI) is a vital subject area for various enterprises including SMEs. The difference between large and small enterprises in the use of BI is due to aspects such as resource limitations, skills, and electronic infrastructure. Small enterprises are adapting to the fast-paced technological changes by embracing BI due to the plethora of advantages the tool offers to thrive their business operations.

The main objective of the present study is to examine the influence of TOE factors on the adoption of BI in SMEs in Kenya according to the TOE framework. The study

aims to identify and evaluate the factors that may directly and indirectly have an effect on the deployment of new technologies in their enterprises.

The present study aims to assess the usage of BI in Kenya. The research applies the TOE model and identify the factors leading to BI adoption by SMEs (Ain et al., 2019). Then, a better outlook on the commonly used Business Intelligence products among the SMEs in Kenya is presented. Lastly, since most Kenyan SMEs do not celebrate their second-year jubilee, a succinct picture of whether the age and size of enterprises affect the readiness to adopt BI is planned to be revealed. Therefore, the following research questions were formulated:

Q1. How do technology, organizational and environmental factors influence the adoption of BI in small and medium enterprises in Kenya according to the TOE framework?

Q2. What are the commonly used BI products among SMEs in Kenya?

Q3. Do the age and size of enterprises impact their willingness to adopt BI in Kenya? After the literature review and the presentation of the theoretical framework, the research methodology will be presented, then the research results and findings. The paper discusses the results and gives some recommendations in the Conclusion section.

Literature Review

This chapter discusses the concept of Business Intelligence, the models existing in assessing BI adoption in SMEs, the effects of the TOE factors on the adoption of BI in Kenyan SMEs, and the factors decision-makers consider in assessing the capability of adopting BI, Then the BI usage market in Kenya, the impacts of a particular BI system in a specific organization (Kowalczyk and Gerlach, 2015) will be discussed, and lastly the BI usage in Europe particularly Hungary in contrast to Kenya will be analysed. In conclusion, the literature review provides an all-encompassing summary of the key themes applicable to the research, although it may not be completely comprehensive.

Business Intelligence

Ever since Business Intelligence appeared (BI) in the mid-1950s, the system has developed into large data systems typically in a data warehouse that facilitates various functions such as data reporting, real-time analysis, dashboards, and ad hoc queries. Chen et al. (2012)(2012)(2012)(2012)(2012) posited that BI and analytics provide a modern digital foundation for collecting, analysing and integrating large and heterogeneous data groups. This amplifies the worth of information available for corporate strategy from the angle of information system. BI is regarded as an umbrella term that incorporates strategic aspects, data warehousing, analytics, and visualization methods with other information systems to support decision-making or managerial support. Beal (2021) regarded BI as tools, strategies, and systems that create analysis and

planning processes within a corporation. "BI can be interpreted in multiple ways subject to one's professional background and viewpoint. Some may view it as visualization, reporting, business performance management, data transformation, data extraction, data integration, statistical analysis or data mining." Also alluded as strategic BI, managers can consider BI as a tactical approach to making use of the accumulated information (Gangadharan and Swami, 2004).

Ain et al. (2019) conducted a systematic literature review that highlighted only ten studies published in Africa in their all-inclusive examination of BI incorporation, usage and triumph for over twenty years. In a Swahili article, Kiwia (2019) highlighted how BI was essential in ensuring SMEs in Tanzania cooperated with International Trade Center. This collaboration would ensure that SME staff are well equipped with BI expertise to ensure they can trade internationally and externally. A gap could be found in research in developing economies regarding the usage of BI to enhance competitiveness, optimize resources, save resources, and improve performance (Table 1).

Country	Article count
South Africa	7
Ghana	1
Morocco	1
Nigeria	1

Figure 1 BI research papers on the African continent. Source: Ain et al., 2019.

Business Intelligence tools architecture

BI tools are a combination of systems that aid enterprises in their decision–making process. For a clearly defined, well–built and new strategic business opportunities, BI technologies incorporate a huge amount of structured and unstructured data (Friedman, 2011; Jonker, Tegelaar and Geurtsen, 2013; Mariani and Baggio, 2022). The International Data Corporation found that there was tremendous data produced among enterprises with 90% of the data being unstructured (Klein, Tran-Gia and Hartmann, 2013), which needs to be reconstructed by integrating BI tools. The reconstruction of data is vital for businesses since it ensures that value-added information support the decision-making within the enterprises. BI tools have an architectural layer which ensures transformation of both unstructured and structured data to a user-friendly report and helps meeting the business requirements. BI architecture consists of multiple layers with different structures and relationships. The Extract, Transform and Load (ETL) is fundamentally a segment of the BI architecture with additional layers constituting data sources, datawarehouse, end user and metadata (Marjamäki, 2017; Dhingra and Chaudhry, 2018; Drake and Walz, 2018).

The data warehouse (DW) layer is a principal determining factor within the BI architecture that gathers, stores data in a centralized system, constitutes analysis, and queries of the already loaded data. The data is then stored in different formats such as clustered data, historical data and summarized data. Data warehousing and BI have different objectives (Geetha, Dhanani and Doshi, 2020); data warehouses act as a

foundation for BI while BI systems utilize data warehouses. The DW layer might constitute multiple levels depending on the complexity of the ETL phase. The degree of database modelling that happens may directly influence how much effort is needed within a particular BI tool (Ain et al., 2019). The literature on ETL processes amongst companies is rather subjective depending on whether they already have an existing technological stack, cost efficiency and business requirements. There are popular ETL tools such as SQL Server integration (SSIS) and Pentaho. SSIS is a Microsoft tool used by companies relying on SQL server as their database whereas Pentaho is collaborative. According to Geetha et al. (2020), SMEs tend to use Pentaho ETL tool due to its debugging manager capabilities and also the logging ensures that errors can be identified in real time. The author's argument on usage of Pentaho due to its reduced throughput is weak since the speed of Pentaho is subjective depending on the hardware size, network and data size (Best Practices Team Pentaho, 2024). In addition, large companies tend to navigate towards SSIS due to the huge database handling capability provided by Microsoft (Geetha, Dhanani and Doshi, 2020).

All the BI architectural layers have a profound impact on the type of BI tool adopted within a company depending on its size and capability. Developing economies still generate unstructured data which is a huddle to integrate, they also use siloed data and several data providers which are sometimes not compatible with ETL providers like in the case of using Pentaho tool (Dobrev and Hart, 2015). Data regularly saved in silos within databases and systems prevent users from accessing the data for reporting and analytical purposes (Mullan, 2019).

According to an annual survey by KPMG East Africa (KPMG, 2024), SMEs in Kenya are regularly under pressure to operate in a competitive digital market leading to a need to effectively manage data as leverage in the business environment (KPMG, 2022). As SMEs worldwide, Kenyan SMEs also generate a significant amount of data which is an information overload for the individual businesses. To stay afloat and boost competitiveness, stakeholders within the enterprises need to understand the data generated. Failure in utilization of data, businesses end up using instincts to make decisions. A broad similar point is made by (Mesaros et al., 2016), who posits that SMEs are still grouped as being data deficient due to their inability to fully utilize data capabilities in semantic evolution and semantic acquisition.

Berbel et al. (2015) have found that there are limited studies conducted within third world nations to investigate important aspects of BI adoption. Data dependency is gaining traction because many applications, if not all, demand BI or data analytics to make critical decisions based on insights. SMEs must quickly adapt to the rapid changes to bridge the gap (Adeyelure, Kalema and Bwalya, 2018). Similarly, BI adoption is still at its formative stage within developing nations (Owusu, Ghanbari-Baghestan and Kalantari, 2017).

Small and medium-sized enterprises

SMEs are commonly referred to as firms with less than 250 employees (OECD, 2008, 2023). According to the European Commission, 99% of the total enterprises in the European Union are SMEs, which is also determined by the turnover or the balance sheet total and the number of employees (Enterprise Ireland, 2007)

A large and growing body of literature has shown that flexibility is the main element attributed to SMEs (Fiegenbaum and Karnani, 1991; Gupta and Cawthon, 1996; Storey, 2016), their viability is usually ascribed to their speed of response to customers' changing requirement, environmental change and adaptability (Levy and Powell, 1998). Llave (2017) argues that there might be owners having considerable knowledge of the enterprise's capability, and the managerial structure of SMEs usually lacks bureaucracy and is normally flat, therefore they are less limited by bureaucracy and by cumbersome organizational hierarchies (Lefebvre and Lefebvre, 1992). Gupta and Cawthon (1996) also points out that SMEs are intrinsically more innovative than large companies due to their small size and the day-to-day interaction of owner-managers, especially in the company lifecycle's early stages (Acs and Audretsch, 1987; Audretsch, 2002). SMEs are considered the cornerstone of the European economy (Executive Agency for Small and Medium sized Enterprises. et al., 2021), they generate the largest number of job opportunities with 66% in Europe. In emerging countries, SMEs have substantial influence on their economies (Cataldo, Pino and McQueen, 2020).

Expanding on the previous point of the importance of SMEs in underdeveloped countries, Ntwoku et al. (2017) asserted that SMEs serve as sparks and powerhouse for economic improvement. The goal of the SME Strategy Master Plan by the African Union (2016) is to aid the enforcement of the industrial development and economic reform under the agenda 2063.

Kenya has over 1.6 million registered SMEs and 5.8 million unregistered enterprises. According to the Kenya Economic Report (KNBS, 2024), the registered SMEs entail 98% of all the businesses in the country employing approximately 5 million people who constitute a percentage close to 75% of the labour force which consequently contributes 33% to Kenya's GDP. Small enterprises constitute a huge proportion of the registered businesses employing 5-50 citizens. In light of the fact that the Kenyan economy is prevailed by SMEs in industries such as manufacturing, construction, commerce, trading, services and agriculture, it is apparent that the role of these proprietor-run or family-operated enterprises can be tremendous.

To understand the adoption of BI, most studies have presented maturity levels, frameworks, adoption theories, and models. Boonsiritomachai et al. (2016) introduced a model to assess the level of BI incorporation among SMEs in Thailand. They also explored the aspects that facilitate the incorporation of BI in these enterprises through the Technological Acceptance Model (TAM), the Unified Theory of Technology Acceptance and Use of Technology, and the Theory of Planned Behaviour (Rogers, Singhal and Quinlan, 2019). In addition, the authors pinpointed two notable theories for the adoption of information systems at an organizational level, the Technology,

Organization, and Environment Framework (TOE) and the Diffusion of Innovation Theory (DIT) (Daft, Sormunen and Parks, 1988). Based on twelve determinants that influence the adoption of BI in SMEs by Puklavec et al. (2014), van der Krogt (2020) validated the model with several European countries.

In his impressive validation of the model, van der Krogt (2020) concluded that it is applicable in developing countries because the study is quite unbiased, uniform, and comparable and when applied to SMEs it would increase economic growth.

Technology, Organization, and Environmental (TOE) model

The TOE model analyses the technological adoption within companies (Tornatzky and Fleischer, 1990). To examine user's views on specific systems, the model suggests general factors (technological, organizational and environmental) that influence the adoption of technological systems (Awa, Ukoha and Emecheta, 2016). Awa et al. (2016) also identified that the integration of the TOE model with other aspects such as the functionality context and individuality would add on the prediction and explanation of technological adoption within enterprises. This study uses the TOE framework with the 12 determinants as proposed by van der Krogt et al. (2020) (Figure 2).
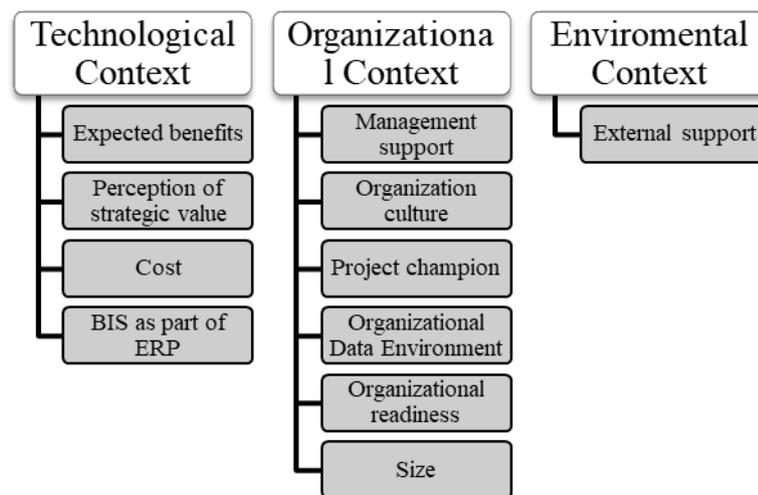

Figure 2 TOE Framework Source: based on (van der Krogt, Coronel and Núñez-Castillo, 2020), Source: author's edition.

There is a growing body of literature that recognizes the importance of the TOE model. Ramdani et al. (2022) conducted a systematic review of digital innovation among SMEs and highlighted how the model has gained prominence due to the wide range of determinants that would lead to the adoption, implementation, and wide use of digital technologies. The Technological context encompasses the technological attributes such as compatibility with existing technologies, perceived advantages, learning requirements and visibility. It takes into account the variety of technologies within the enterprise and outside. In a business setting, these factors play a fundamental role in determining whether technology adoption is feasible. The Environmental context describes the scope

of where the business operates. It includes external pressures which can be summed into normative and mimetic. The normative pressures stem from expectations within the legal frameworks, government, demands of customers and trade partners and professional organizations. As for the mimetic pressures, they stem from imitation of competitors, and intentional observation of competitors. An increased competition amongst rivals as a result of the mimetic pressure steers the enterprise towards technological adoption.

On the other hand, Organizational context is highly influential towards technological adoption. The ability to adopt technology within an organization can be as a result of either internal or external factors. Internal factors constitute the organization's structure, human resources and culture whereas the external factors are competitive pressure and strict government regulations. Change is inevitable within organizations and the model also takes into account the probability of adopting new technologies or changes on business models and organizational structure. The TOE model confirms that adoption of technology is not only influenced by technical aspects; organizational factors are also instrumental (Tornatzky and Fleischer, 1990; Awa, Ukoha and Emecheta, 2016).

Talaoui et al. (2021) discovered that the nature of the linkage between the environmental influences on BI is still equivocal. Some studies (Daft, Sormunen and Parks, 1988; Boyd and Fulk, 1996; Ebrahimi, 2000) endorse a "one rule fits all" approach to various environmental layers (e.g., customer, political remote, and direct) much less country–level contexts (e.g., developing vs developed countries). By doing so, they miss peculiarities of developing economies where other non–standard singularities and pressure (cultural, cognitive, and institutional) moderate the interrelation between the environment and BI. Wamai et al. (2022) confirmed that BI influences performance and managers play a pivotal role in spearheading the adoption and deployment of BI infrastructure as they are major drivers of performance.

Impacts of a particular BI system on an organization

With reference to the use of a particular BI system on an organization, Gartner's research reveals that BI has risen to the forefront as the top technology for improving competitiveness in recent years (Manis, 2024). Chaudhuri et el. (2011, p. 91) remarked that "today, it is difficult to find a successful enterprise that has not leveraged BI technology for their business."

In the 2022 report, Gartner Research identified twelve vital proficiencies for a current Business Intelligence technology. These include "governance, security, cloud-based analytics, data preparation, connectivity to data sources, automated insights, catalogs, data storytelling, data visualizations, natural language generation and query and reporting" (Manis, 2022, p. para 6). According to Gartner's Magic Quadrant Report, Microsoft (Power BI), Salesforce (Tableau), and Qlik were identified as leaders in the business information technology industry. What is striking in Figure 2 is how Microsoft has outpaced the rest of the leaders in the quadrant.

Figure 2: Magic quadrant for Analytics and Business Intelligence Platforms; Gartner, Inc. Source: Manis, 2024; Schegel et al., 2024.

Microsoft offers a plethora of services in the BI ecosystem such as data preparation, interactive dashboards, augmented analytics, and visual-based data discovery. Power BI is available as an on-premises option on Power BI Report Server or a SaaS alternative running in the Azure cloud (Wade, 2010, para. 14).

To determine the BI impacts, Llave et al. (2018) conjectured that when BI is an executive precedence, it would result in organizational performance. The study offers a detailed examination of the BI impacts such as competitive advantage, customer insights, and business insight and cost reduction. Business insight was acknowledged as the most impactful since it allows organizations to understand their strengths and weaknesses, performance, competition and market share. Customers are also crucial towards the success of businesses and BI technology also helps give customer insights which translates to increased sales and customer retention by implementing targeted retention strategies and identifying valuable customers. Cost control can be gained by automating reports and decision-making and implantation of better resource utilization (Llave, Hustad and Olsen, 2018).

BI usage market in Kenya

Business Intelligence is considered a crucial investment for organizations as demonstrated by a survey of over 4000 ICT experts from 93 countries (IBM, 2011). Certainly, global investment in BI was estimated to reach $18.3 billion in 2017 and was expected to increase to $22.8 billion by the end of 2020 (Moore, 2017). In Kenya, there has been an 11% increase in spending on information technology, including BI, from $2.28 billion in 2016 to $3.45 billion in 2017 (KNBS, 2020). BI is broadly acknowledged as an essential factor for organizational success in the global market. Some authors (Sasvari, 2015; Nagy et al., 2018; Saáry, Kárpáti-Daróczi and Tick, 2022; Tick, Saáry and Kárpáti-Daróczi, 2022; Tick, 2023a, 2023b) for example suggest that Hungary is still

lagging, mainly due to a lack of support from leadership and of clear strategy. Sasvári (2015) and Venczel et al. (2024) posit that companies are reluctant to spend on expensive BI systems. Respondents from the studies criticized the protection level of BI systems insisting that the data protection layers should be repaired to ensure data privacy and safety. The authors assert that within different geographical contexts, there is still much to learn about innovation and SMEs.

However, Kinuthia (2018) posited that despite the growth in investment, the performance of many corporate institutions especially those that are publicly listed has been reducing. This is concerning as the publicly listed SMEs play a key responsibility in the economic development and their reliable and prolonged performance is crucial. Understanding the manner in which SMEs rank and evaluate emerging digital technological investments, particularly in BI adoption, is vital (Li et al., 2016).

Theoretical Framework and Research Questions

The study will entail a couple of objectives. First, it investigates the BI systems used in Kenyan SMEs. Second, it investigates the factors decision–makers consider when adopting a BI system, hence assessing the managerial aspect in correlation to adoption factors. Third, it uses the TOE framework as an adoption model, which answers the goal of identifying the driving forces of BI applicability in SMEs. Finally, the research aims to explore the specific types of BI systems adopted by SMEs in Kenya and using the TOE framework aims to identify the advantages and provide recommendations for successful adoption. The findings of this study will enable the management of SMEs in Kenya to understand the need for BI in business operations and they opt to employ BI in their businesses, to know the prerequisites that must be put in place for successful implementation.

Many existing studies in broader literature have examined the advantages of adopting BI in companies. Based on the literature review and the research gap identified, this research hypothesizes that Kenyan SMEs would adopt Business Intelligence in their businesses if there were advantages, support, and easy-to-use systems. The following hypothesis is formulated:

H1: Relative benefits of technology affect the adoption of Business Intelligence.
Advantages of adopting Business Intelligence in small and medium enterprises: Most firms analyse the cost of adopting technology versus the advantages the technology brings to the enterprise. Cost-benefit analysis for the firm may help decide on the adoption of the technology (Tiernan and Peppard, 2004), may also be used among SMEs to assess whether there is a need to adopt BI. When BI is adopted, this may further determine the growth of the enterprise. This guided us to the following hypothesis.

H2: The complexity of technologies affects Business Intelligence adoption by SMEs.
User-friendliness: BI can help SMEs increase their cost-effectiveness (Lueg and Lu, 2013). For the reason that BI enhances user–friendliness and simplicity which are vital for

boosting economical use of resources and improving data validation. However, BI does involve some complexity, so having the necessary prerequisite skills and knowledge is advantageous for successful adoption. This led to the following hypothesis.

H3: Users are more likely to adapt to easy-to-use systems as opposed to complex systems.
Complex systems: For the success of enterprises, the need for data and information security is inherent. This will entail the use of complex technologies to safeguard the data and improve decision-making. BI models are complicated because they incorporate mathematical functions for the prediction of trends in a firm's performance to enhance solutions in certain situations (Voicu, Zirra and Ciocirlan, 2009). Thus, the following can be hypothesized:

H4: Larger enterprises have higher adoption capability than small enterprises.
Organization size: An enterprise's capability concerning technical as well as financial resources may be considered to negatively or positively influence how it makes choices on the adoption of modern technologies. Organizational size has been found to positively impact the adoption of technology innovations (Puklavec, Oliveira and Popovič, 2014; Rogers, Singhal and Quinlan, 2019). This extends to the following hypothesis:

H5: Managers' support affects the adoption of Business Intelligence by SMEs.
Management support: The perspective of management plays an essential role in ascertaining whether or not a company integrates new technology. BI requires that management professionals stay informed about the rapidly growing BI industry. This will ensure that the enterprise makes correct business decisions (Marjamäki, 2017). Endorsement from management can favorably impact a company's preparedness to adopt Business Intelligence. This leads to the following hypothesis:

H6: Organizational readiness for technologies leads to the adoption of Business Intelligence.

Organizational readiness: Papachristodoulou et al. (2017) indicated how researchers in the past have assessed organizational readiness for BI solutions. Hidayanto et al. (2012) created a scheme to support SMEs measure their preparedness for implementing BI tools. Scholz et al. (2010) identified that the primary drivers for using BI are enhancements in data support, external factors and improved decision-making capabilities. On the other had the main hinderances are the difficulties in managing the software failures and managing the system. This leads to the following hypothesis:

H7: SMEs facing stiff competition from the market readily adopt Business Intelligence more than those with no pressure.

Competitive pressure: Raj et al. (2019) conducted a case study among SMEs and found out that to be ahead of competitive pressure, enterprises should effectively use and monitor information resources, which will lead to positive business decisions being made while staying competitive in the market. Figure 3 summarizes the proposed research model of the TOE constructs and the related hypotheses.
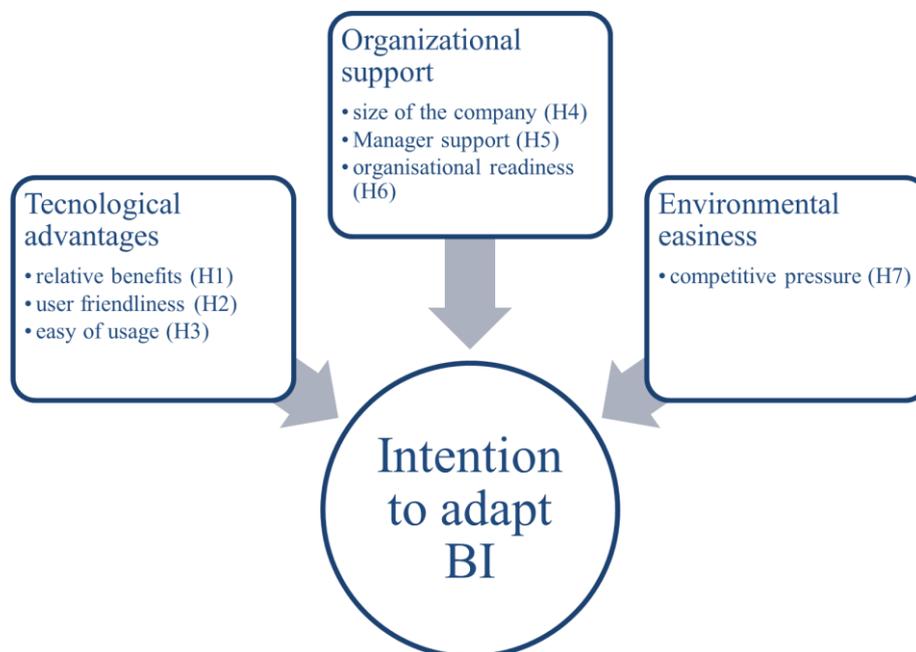

Figure 3: Proposed hypotheses based on the TOE model. Source; edited by authors.

Research Methodology

After the literature review and given the exploratory nature of the study, the research adopts a triangulation approach that involves qualitative (Kern and Willcocks, 2002; Golafshani, 2015) and quantitative methods (Golafshani, 2015), it incorporates a structured interview and a questionnaire. Half of the questionnaire is standardized and the other half is adopted from the determinants of the TOE framework as proposed by Ain et al. (2019). A structured interview was adopted because of reduced bias, cost–effectiveness, because it is simple and dependable and there is increased credibility and validity. The structured interview will have two parts, the first entails the collection of details such as organization size, title, type, and industry of the organization. The second part includes questions covering a variety of issues to garner an understanding of the usage of BI in Kenyan SMEs and explore the managerial aspects in decision–making for the proper BI system. The data collection will incorporate snowball sampling of the potential participants of the SMEs in the Nairobi Securities Exchange through LinkedIn and other social media channels. The sample did not reach the level of representativeness, however, gives a general view of BI adoption situation among SMEs in Kenya.

The questionnaire was close–ended with a 4–point Likert scale, and it was geared towards answering questions stemming from H1 to H7 as well as other questions that

were to assist in drawing any pattern to answer the research objectives and see if there may be any improvement at a firm level (Appendix 1). Previous studies have also adopted the use of the Likert scale when adopting the TOE framework (Boonsiritomachai, McGrath and Burgess, 2016; Popovič, Puklavec and Oliveira, 2019). MS Excel and SPSS v25 was used for analysis. Anonymity was assured and consent were given with filling in the questionnaire.

Descriptive and inferential statistics were used to explore the underlying relations between the items. Pearson correlation was used to determine the strength of the relationship between the ratio–scale constructs for the TOE framework. Reliability was calculated using Cronbach's alpha.

Results

Demographic profile

A total number of 42 SMEs filled in to the responses, 33.3% of them have been in operation for 1–5 years. Small enterprises accounted for 45.2% of the total sample size. The sample characteristics are presented in Figure 4.

		Count	Column N %
No of Employees	Small	19	45.2
	Medium	10	23.8
	Large	13	31
Total		*42*	*100*
Period of existence	less than 1 yrs.	4	9.5
	1-5 yrs.	14	33.3
	5-10 yrs.	5	11.9
	10-15 yrs.	6	14.3
	15-20 yrs.	3	7.1
	Above 20 yrs.	10	23.9
Total		*42*	*100*
Type of SME	Manufacturing industry	2	4.8
	Financial Institution	12	28.6
	Hospitality industry	2	4.8
	Health or medical organization	6	14.3
	Other	20	47.6
Total		*42*	*100*
Company Category	less than 1 yr.	4	9.5
	1-5 yrs.	14	33.3
	5-10 yrs.	5	11.9
	10-15 yrs.	6	14.3
	15-20 yrs.	3	7.1
	Above 20 yrs.	10	23.8
Total		*42*	*100.0*

Figure 4: Demographic profile. Source: edited by the authors.

As per the nature of businesses, most of the respondents were from the financial sector (28.6%), the Information technology sector (15.7%) and 14% were health or medical organizations. The information collected was from more than ten SME industries and therefore sufficient for further analysis. The first section of the questionnaire also covered how long the company has been in existence. One–third of the SMEs in the sample were between 1 and 5 years, 23.8% were above 20 years old and only 9.5 % were less than 1 year old.

Reliability

In empirical analysis, reliability is the measure of internal consistency of the constructs being measured. Cronbach's Alpha is used for reliability. The present TOE model proved to be reliable, as $\alpha_{Organizational\ construct}=0.857$, $\alpha_{Technological\ construct}=0.9$, and $\alpha_{environmental\ construct}=0.755$. According to Hair et al. (2013), a construct is reliable if its Cronbach's α is above 0.70.

BI adoption status and encouragement

The final question under this section expected respondents to indicate the status of Business Intelligence adoption. The respondents were to select (1) Our firm intends to adopt Business Intelligence, (2) Our firm has already adopted Business Intelligence, (3) I have no idea what Business Intelligence is, and (4) Our firm does not intend to adopt Business Intelligence. Table 3 highlights the distribution of the SMEs by their readiness to adopt Business Intelligence in Kenya.

BI use-case	Frequency	Percent%
Already adopted BI	5	12.2
Planning to adopt BI	3	7.3
No plans to adopt BI	16	39
No Idea what BI is	17	41.5
Total	41	100

Figure 5: Analysis of BI adoption. Source: edited by the authors.

The responses show that 41.5% of the participating SMEs were not aware of the concept of Business Intelligence, with 39% not ready to adopt it, meaning that most SMEs (80.5%) in the sample are either not familiar with BI or do not use it. The analysis also indicates that 12.2% of SMEs in the sample have already adopted BI while a mere 7.3% of them plan to do so. There was no answer from one SME. The results show a very low level of BI adoption, similarly, Owusu (2017) asserted that BI is still in its infancy stage among developing economies. The low awareness of BI poses a gap in most SMEs.

Figure 6 presents the descriptive measures all the factors that encouraged the adoption of BI in Kenyan SMEs. Improved performance and decision–making scored the highest with an equivalent standard deviation which corroborates the 2:1 rule of thumb (Yin et al., 2016). Participants were asked to indicate on a 4–point Likert scale whether they agreed that the above factors led to the adoption of BI in their companies.

It can be seen that respondents fully agreed with all the factors that encourage the adoption of BI, with improved performance and improved decision–making having the highest mean (3.31), implying that these two factors are the most advantageous for SMEs in Kenya.

Factors in the TOE framework	Mean	Median	Mode	SD
Operational performance	3.17	4.00	4	1.12
Operational efficiency	3.17	3.00	4	0.98
Reduced operational costs	3.12	3.50	4	1.06
Improved performance	3.31	4.00	4	1.00
Competitive advantage	3.19	4.00	4	1.13
Improved decision making	3.31	4.00	4	1.00

Figure 6: Factors encouraging the adoption of BI in SMEs in Kenya. Source: edited by the authors.

TOE Framework

Figure 7 presents the general statistical figures of the TOE constructs following the rule of thumb (2:1) (Yin et al., 2016).

Constructs	Valid	Mean	Median	Mode	STDEV	IQR
T	42	3.13	3.40	3.40	0.79	1.00
O	42	3.05	3.25	3.50	0.76	1.00
E	42	2.99	3.00	3.00	0.73	1.08

Figure 7: TOE Descriptive Statistics. Source: edited by the authors.

The technological construct reveals an overall mean score of 3.13 (SD=0.79) (Table 10), the highest compared to the rest of the constructs. This shows a positive perception of the technological aspect. Resistance to change was on the higher spectrum of the scale as a factor that can hinder the adoption of BI. The majority of the respondents strongly agreed with the organizational constructs with a mean of 3.05 (SD=0.76) amongst the participating SMEs, which shows a positive perception of the organizational constructs, indicating that SMEs regard the adoption of BI as highly dependent on the organizational readiness to adopt BI. The environmental construct under the TOE framework reveals an overall mean score of 2.99 (SD=0.73), therefore, SMEs somehow agree that environmental factors under the TOE framework influence the adoption of BI. Competitive pressure appears to be the largest factor influencing the adoption of BI among SMEs in Kenya.

Participants were asked whether they agreed with the TOE individual constructs contributing to Business Intelligence adoption. The correlation between the relative benefits and organizations' readiness to adopt Business Intelligence was also analysed. Relative advantages of BI were found to be moderately positive and statistically significant (r=0.529, p<0.01), hence H1 was supported. This showed that an increase in the relative advantages of technology would lead to an increased need for organizations to adopt BI. To investigate the correlation between the complexity of technology and an organization's readiness to adopt BI, the analysis shows a moderately strong positive, and significant relationship (r=0.499, p<0.01), hence H2 was

supported. This shows that the complexity of technology would lead to an increased need to adopt BI. The next section was concerned if users are more likely compared to adapt to easy-to-use systems as opposed to complex systems. This relationship was found to be highly positive and statistically significant (r=0.748, p<0.01) hence H3 was also supported. If we now turn to the fourth hypothesis, whether organizational size was correlated with the organization's readiness to adopt BI, it can be said, that based on the participants responses the relationship is moderately positive and statistically significant (r=0.587, p<0.01), therefore H4 is also supported, meaning that larger enterprises have higher adoption capability than small enterprises. Moving on to the next hypothesis, the agenda was to check the correlation between the top manager's innovation capacity and the organization's readiness to adopt BI. The correlation was found highly positive and statistically significant (r=0.731, p<0.01) hence H5 was supported stating that managers' support affects the adoption of Business Intelligence by SMEs. The next hypothesis asks whether an organization's readiness for technologies is influenced by the available technical and operational skills. Even in this case the correlation was found moderately positive and statistically significant (r=0.547, p<0.01), so H6 can be supported. This proves that the availability of technical and operational skills would ensure that organizations are ready to adopt BI. Lastly, the hypothesis H7 of whether stiff competition would influence SMEs to adopt BI was also supported as the correlation was found moderately positive and statistically significant (r=0.581, p<0.01). This showed an increase in competitive pressure would lead to an increased need for the organization to adopt Business Intelligence.

Figure 8 summarizes the results. It is apparent that manager support and ease of usage scored significantly higher (r2=0.56, r2=0.53, respectively) than the rest of the hypotheses when correlated to the intention to adopt BI.
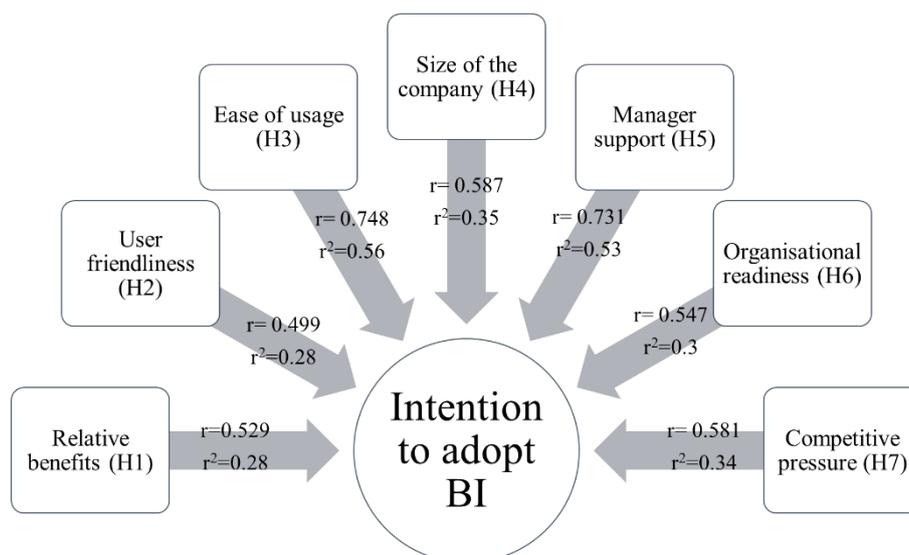

Figure 8: TOE constructs correlation. Source: edited by the authors.

BI systems used in Kenya

The last part of the questionnaire required individuals to indicate the BI system with which they are familiar. Figure 9 presents an overview of the BI systems used in Kenya. The majority of the respondents (21) regarded MS Excel as a BI tool, nine respondents consider Microsoft Power BI as a BI system, which was followed by IBM Planning Analytics with three users.
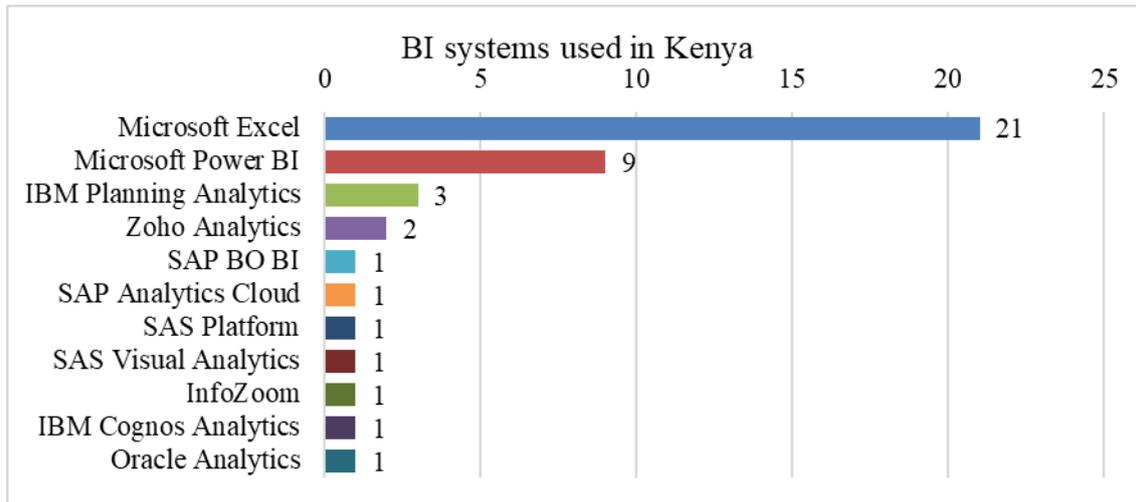

Figure 9: Business Intelligence Systems used in Kenya. Source: edited by the author.

Discussion

To answer the research aims on the TOE framework, seven hypotheses were formulated, which were set to give a picture of the current BI adoption based on the sample while analysing the individual constructs of the TOE framework. The study supplied an overview of the BI adoption of SMEs in Kenya. Initially, the literature review highlighted some gaps. However, with a small sample size of forty–two, caution must be applied as these findings might not apply to the whole country.

This study set out with the aims to analyse the factors affecting the adoption of BI by incorporating the TOE framework, assessing the commonly used BI systems used in Kenya, and whether age or size affects the readiness to adopt BI. The study aimed to also assess the factors decision–makers consider when adopting BI including the managerial side, namely operational performance, operational efficiency, reduced operational costs, improved performance, competitive advantage, and improved decision-making. The data suggest that all these six factors are crucial for the adoption of BI in SMEs, while improved performance and improved decision-making standing out as the most important ones (H1 supported). These results support the previous research on Business Intelligence systems conducted by Gauzelin and Bentz (2017) who also stated that BI leads to increased performance and productivity for the employees which leads to overall improved performance in a company. Similarly, the authors concluded that BI is essential at the managerial level due to improved decision making which is a result of timely, quality, and accurate data. It is therefore necessary for SMEs

to compare their goals and outcomes to get a vivid picture of the performance of the BI system adopted. When determining BI performance, the authors also posited that it is necessary to consider the following dimensions: operational, financial, and overall effectiveness.

SMEs in Kenya referred to MS Excel as a BI tool when that is not the case. Most respondents have been fervent supporters of MS Excel which might be triggered due to the low cost, easy integration with other MS tools, and the global recognition the software has garnered. Papchristodoulou et al. (2017) support this finding, as they also observed that MS Excel had become more prevalent due to its affordability. Preceding research has proven that BI is now viewed as indispensable for businesses to remain competitive and feasible in today's data-centric environment, rather than just being an additional advantage (Liebowitz, 2017).

MS Power BI was the second tool adopted by the sample although based on the responses, it has not garnered traction in the SME market. It is worth noting that Power BI is the leading tool based on the Gartner survey due to the plethora of advantages the system offers. It is therefore critical for BI champions within SMEs to ensure the transition to a more adaptable tool, such as Power BI in this scenario, as it is also a less expensive solution when compared to MS Excel. Most Excel users would be able to work seamlessly with Power BI without much supervision.

A study conducted by Ray et al. (2016) on the use of BI in SMEs suggested that there are various phases involved when implementing a BI solution and SMEs should have a good understanding of their existing infrastructure before diving into new investments, for SMEs looking to adopt BI solutions, the Microsoft suite of BI tools may be the prime pick particularly if they are formerly conversant with Microsoft products, and a lot of SMEs are usually discouraged by the complex and expensive implementation process when there are simple and affordable BI solutions that can easily be embedded in their existing IT solutions. There is a need for industry–standard tools, and the study by Llave (2017) recommends that SMEs adopt MS Power BI since it allows for integration with other solutions while also offering prompt data and insights.

The proposed research model took into account the relevant factors that influence the incorporation of BI, managerial considerations using the TOE model as a base. In each case a positive, moderately strong correlation was detected, ranging from r=0.499 to 0.798. The results on relative benefits suggested that an increase in relative advantages of technology would lead to an increased need for BI adoption, which are consistent with previous studies by Tiernan and Peppard (2004) The data thus supports that analysing the costs of adopting technology is paramount to ensure that the benefits outweigh the costs. The results on user-friendliness revealed a moderately low positive correlation which refutes previous studies of Lueg and Lu (2013). Simplicity and user–friendliness would lead to the adoption of BI due to the strengthened data validation which might be complex to form (H2 and H3 are supported).

The success of an enterprise is inherent in the adoption of industry–standard tools. According to Raj et al. (2019) it is crucial for an IT solution to be intuitive in order to

expand integration by end-users. Drushku et al. (2019) applied a wide variety of resource to examine the significance of user-friendliness. They maintain to note that the interfaces may be tedious and unproductive since the BI systems do not detect user interest.

BI is not only for big companies, but this is also a strong opinion that has been disposed of and spread around the world. Although large companies have already adopted BI and reached maturity, large software providers like Microsoft, SAP, Oracle, and Micro strategy have adapted Business Intelligence to the needs of the SME. From the sample, organizational size is a factor in BI adoption and there is an interesting observation from the demographic profile. Most of the companies within the sample were small companies and had been in operation for 5 years. This data suggests that ideally, SMEs have not yet gathered enough information throughout the time they have been in operation as compared to large firms which have huge data centres that can be upgraded from software providers. In terms of infrastructure, existing systems over time become easier to upgrade since they just need to adapt, ensure compatibility, and are easy to learn for the users (H4 is supported).

For SMEs to be competitive, managers cannot depend on intuition-they need accurate information based on timely data. For this reason, the sample within this study should have a strong correlation that was highly positive (H5 is supported). Previous studies have shown that in the past SME managers did rely on intuitive decision-making (MacGregor and Vrazalic, 2005). These strategies are based on constrained essential skills that always do not meet their business objectives and goals resulting in reduced competitiveness. From the sample results, data suggests that managers play a crucial role since they will usually function as BI champions within their enterprises which will positively impact the SMEs.

H6 is also supported and the results align with the fact that availability of technical and operational skills within an enterprise would lead to the adoption of BI. Prior studies that have noted the importance of organizational readiness for BI adoption concluded that quick installations, ease of use, continuous data access, responsiveness, and reduced costs were major factors to ensure that SMEs adopt BI. The correlation was moderately positive and an explanation for this might be due to the huge upfront costs incurred during the adoption process of BI. Cloud software for instance has extra costs, non-establishment within the public, and reduced checking services.

The results showed that the more the SMEs in the sample perceive competitive pressure, the more it is likely that they will adopt BI (H7 is supported). Currently, there is increased competitive pressure due to the rapidly growing IT infrastructure and this can signal the need to adopt advanced technologies that improve enterprise performance (Beheshti et al., 2007).

Upon analysing the factors in the TOE framework, a significant correlation between all the constructs was detected. Many of the respondents agreed with all the factors affecting BI adoption. The TOE framework was found a reliable measurement tool for BI adoption model. Complexity, relative advantage, easy-to-use, managerial support,

and competition were significant in BI adoption which corroborates the ideas of Boonsiritomachai et al. (2016). Interestingly, the research shows that managerial support and easy-to-use systems are highly susceptible to BI adoption among SMEs in the sample. An exploratory study by Llave et al. (2018) examined the factors that affect how BI creates value. The study did highlight that BI can create value through data control, automation, improved decision-making, cost reduction, competitive advantage, customer and business insights. Furthermore, for a successful value-creation after implantation of BI, it is also dependent on other factors such as business' competitive position, nation-specific variables and industry dynamics (Llave, Hustad and Olsen, 2018).

The study has some limitations due to the limited number of potential people to be interviewed and that it could not cover the entire country. Therefore, the conclusions derived from this research may be refined with more data gathered in future studies. In addition, given the qualitative exploratory study, generalizations of outcomes should be done with vigilance.

To summarize, these findings suggest that most of the sample agrees with all the factors leading to the adoption of BI within SMEs in Kenya. A further study with more focus on the macro and micro-environment is suggested to give a clear picture, and that takes these factors into account might also need to assess the current information systems to suit the research process.

Conclusion

In conclusion, the research has demonstrated that BI and corresponding technologies are considered among the most worthwhile IT investments for SMEs, and the research interest is intensifying. The research aimed to appraise the use of BI in Kenyan SMEs using the TOE framework.

This research has multiple findings. Firstly, through the review of existing literature it was determined that use of Business Intelligence is still gaining traction in the Kenyan market. The results indicate that financial sectors have a huge adoption rate, and this is also consistent with the available literature on BI adoption in Kenyan SMEs. This paper clearly illustrates that the responding SMEs considered MS Excel as a BI tool and provides insight into why the SMEs might still be fervent supporters of the spreadsheet tool other than advanced BI technologies. The cost of purchase is a hindrance to advancing to new BI technologies.

SMEs account for 75% of the labour force and the registered SMEs entail 98% of all the businesses in Kenya. This paper contributes to the existing knowledge of Business Intelligence in developing countries particularly Kenya by providing a snapshot of BI usage among SMEs. However, the small sample size should be treated with a grain of salt and not generalized to the whole country. More information on BI among the rest of the SMEs would help us to establish a greater degree of accuracy on this matter.

Third, to analyse the managerial side, the paper suggested that managerial support has a high influence on the adoption of BI. Since the managers are also the decision-

makers in the SMEs, they need to incorporate the use of Business Intelligence to stay competitive in the growing market economy. Fourth, the TOE framework that was used in the paper assists in our understanding of the factors influencing BI adoption in SMEs. All the correlations were strong as per the discussions and the results.

Further research should explore adopting longitudinal research while analyzing the BI tools' lifecycle with their value creation. Notwithstanding the limitations above, the study suggests that detailed data collection should be collected across the country. Although the study is also based on a small population, it suggests that BI champions play a critical role in ensuring that Kenyan SMEs adopt industry-standard BI tools that fit their modus operandi and delivers value.

Conflict of Interest

The article has not been submitted to any journal for publication.

Notes on Contributors

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Appendix 1

The questionnaire consists of 3 sections.

A (Company characteristics)

B (BI applicability)

C (BI adoption factors)

I truly appreciate your valuable time and effort in helping me with this research. 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 (BI) 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."

"A small and medium enterprise (SME) is an enterprise that has between 51 and 250 staff members and a turnover that doesn't exceed Sh100 million."

Use of Business Intelligence in SMEs	Measurement Items
SECTION A: COMPANY'S CHARACTERISTICS	
Which of the following is the specialty of your company?	Manufacturing industry
	Financial Institution
	Hospitality industry
	Health or medical organization
	Others (specify)
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
How long has the firm been in existence	Less than 1 yr.
	1-5yrs

	5-10yrs
	10-15yrs
	15-20yrs
	Above 20 yrs
Select which one 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 idea what Business Intelligence is

SECTION B: BUSINESS INTELLIGENCE APPLICABILITY IN SMEs
The question below is related to the **Business Intelligence applicability** in SMEs. Please rate the next items in the matrix using a scale ranging from "strongly disagree" value=1 to "totally agree" value=4

Investing in new computer technologies will improve operational performance	Strongly agree
	I agree
	Disagree
	Strongly disagree
The following **factors encourage the adoption of Business Intelligence** in your organization. Please rate the next items in the matrix using a scale ranging from "strongly disagree" value=1 to "totally agree" value=4	Operational efficiency
	Reduced operational costs
	Improved performance
	Competitive advantage
	Improved decision-making
SECTION C: BUSINESS INTELLIGENCE ADOPTION ENABLING FACTORS	You're doing great; we're about halfway through now.
	Let's find out what you think about **BUSINESS INTELLIGENCE ADOPTION ENABLING FACTORS FOR SMEs in Kenya**

The following **are organizational factors related to Business Intelligence adoption in SMEs**. Please rate the next items in the matrix using a scale ranging from "strongly disagree "value=1 to "totally agree "value=4

Organizational size affects the adoption of BI	Strongly agree
	I agree
	Disagree
	Strongly disagree
Organizational age influences the use of BI	Strongly agree
	I agree
	Disagree
	Strongly disagree
A top manager's innovation capacity affects the adoption of BI	Strongly agree
	I agree
	Disagree
	Strongly disagree

Adoption of Business Intelligence is highly dependent on an organization's readiness to adopt it	Strongly agree I agree Disagree Strongly disagree
Technological factors	
The complexity of technology (user-friendliness) affects the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Relative advantages or benefits of technology influence the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Available technical and operational skills are sufficient for the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Users are more likely to adopt easy-to-use as opposed to complex systems	Strongly agree I agree Disagree Strongly disagree
Resistance to change can hinder the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Environmental factors	
Competitive pressure on the market forces the firm to adopt BI	Strongly agree I agree Disagree Strongly disagree
Owner managers, IT knowledge is a prerequisite for the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Vendor selection of new technology is important for the adoption of BI	Strongly agree I agree Disagree Strongly disagree
Select the BI product you are familiar with	
Alteryx Antivia DecisionPoint Birst Bissantz DeltaMaster BOARD CALUMO Chartio Coheris Corporate Planner Corporater EPM Suite Cubeware C8 Solutions Platform (Cockpit) cubus outperform CXO-Cockpit Cyberscience Cyberquery Datapine DigDash Dimensional Insight Diver Platform Domo Dundas Entrinsik Informer Envision evidanza GoodData Halo BI IBM Cognos BI/IBM Cognos Analytics IBM Cognos TM1/IBM Planning Analytics iDashboards IDL.DESIGNER InetSoft Infor BI Information Builders WebFOCUS Izenda Jedox BI Suite	

(formerly Palo) Konvergence Shuttle Logi Analytics Logi Suite Longview Analytics (formerly arcplan Enterprise) Looker Microsoft Excel (Excel only and Power Pivot) Microsoft Power BI (released in 2015, not formerly Excel-based version) Microsoft SharePoint Server Excel Services (only BI usage, no portal) Microsoft SQL Server Reporting Services (SSRS) MicroStrategy Analytics Platform MIK (now prevero BI) OpenText Information Hub (formerly Actuate) Oracle BI (formerly OBIEE and OBIFS) Oracle Hyperion Planning Oracle Hyperion Smart View for Office Pentaho Business Analytics (HDS) Phocas prevero prevero Prognoz Platform Pyramid Analytics Qlik Qlik Sense Qlik QlikView Report One sales-i270 THE BI Survey 17 – Sample, Products and Methodology - 19 - Salient SAP BO Analysis (OLAP or Office) SAP BO Cloud (formerly Cloud for Analytics/for Planning) SAP BO Lumira (Designer, formerly Design Studio) SAP BO Lumira (Discovery, formerly Lumira) SAP BO Web Intelligence SAP Business Explorer (BEx) (including SAP Web Application Designer (WAD) and SAP BEx Analyzer) SAP BW Integrated Planning (IP) SAP Crystal Reports SAP Predictive Analytics SAS Base SAS Intelligence Platform SAS Visual Analytics and Visual Statistics Sisense SpagoBI Tableau TARGIT BI Suite TIBCO Jaspersoft TIBCO Spotfire Yellowfin Zoho reports Don't know Other, please specify