Information Technology Governance Impact

On Banks E-Services Quality

By

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CERTIFICATION

I, Mohamed Mahgoub Shamseldin Mustafa (Student ID: 52117618) hereby declare that the information presented in this thesis project is original and it has not been submitted to any other institution and that all the sources used or quoted in this document have been indicated and acknowledged by complete references.

Mohamed ShamsEldin Mustafa

2019/05/30

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ABSTRACT

Information technology governance ITG is a subset of corporate governance focus on IT benefit realization, IT performance, and risk management. Due to the recent development in banking systems, ITG has become an essential process for banks to achieve high investment return and best IT performance. This research investigates the recent deterioration of banks e-services in Sudan and examines the relationship between ITG and e-services quality in the Sudanese banking sector.

To evaluate the ITG situation in the banks, we conducted a series of interviews with 18 Sudanese banks IT managers. COBIT 5 IT governance framework was used as a benchmark for evaluating banks ITG. In a later stage, we published an online questionnaire targeting 200 bank customers to get their opinions about their bank's e-services quality. Correlation and independent t-test were used to analyze the two data sets. The result of the analysis indicated that IT governance implementation was critical for consistently enhancing banks e-services quality.

Keywords:

Information technology IT, Information technology governance ITG, COBIT 5, banking e-services.

CHAPTER 1: INTRODUCTION

1.1 Study background

For decades, retail banks have been providing financial services using traditional manual methods where clients spend a considerable amount of time to complete transactions. However, the rapid development in the information and communications technology (ICT) over the last three decades has led to a radical change in the retail banks' ways of providing services. Communication with clients has become more convenient and banks are now able to offer a variety of services through new and innovative channels.

This development has a tremendous impact on banks' operational costs and services delivery time. It provides flexibility and ease of access for clients' transactions and increases business hours to 24 hours a day with less labor force. Furthermore, it also facilitated the business for enterprises. Owning a bank account became possible for all social elements; for instance, students, labors, employees, and enterprises can easily open bank accounts. Based on a report released by the World Bank in 2017, the global number of bank clients increased significantly between 2011 and 2014. Over 700 million people became account holders, while the "No bank account" population decreased globally by 20% to 2.5 billion.

In Africa, the development of ICT also affected people's lives and changed the course for banking sector services (Asongua, 2018). However, the utilization of ICT for business is notably slower in developing countries, which is possibly linked to several factors such as weakness of infrastructure related to telecommunications and information technology, political instability, and lack of investment capital. These factors together affected developed countries retail banks efforts for adopting ICT in business.

Some African countries were prosperous in developing their telecommunications sector and utilizing this development to the benefit of business sectors, especially the banking sector. Therefore, they managed to link their banking systems with global financial networks and significantly developed their retail banks' e-services. Based on the report published by International Telecommunication Union (ITU) in 2017, the internet service population in Africa has increased by 35% and 450 million Africans are using the Internet with an annual growth of 9% between 2001 and 2017 (ITU, 2017).

1.2 Information and communication technology in Sudan

In 1994, the Sudanese government announced a comprehensive national plan for developing the telecommunication sector (Central bank of Sudan C. , 2017). The project aims to connect all regions in Sudan with modern telecommunications networks and expand mobile network coverage to remote areas (MTIT, 2016). Even though Sudan is more than 1 million square miles, Sudan managed to set up an optical fiber network, and four mobile operators granted permission to operate in Sudan. In 2018, 4th generation mobile technology was introduced, and the number of mobile phone users exceeded 12 million subscribers.

Sudan connects to the outside world by submarine cable with Saudi Arabia and through Chad with West African countries. Some Sudanese enterprises establish several investments in the telecommunications field in West African countries such as Mauretania and Guinea. Despite the US embargo imposed on Sudan, the telecommunications sector was continually flourishing and has benefited from its excellent relationship with China in developing this sector. Chinese giant telecommunication companies Huawei and Zhongxing Telecommunication Equipment (ZTE) carried out many telecom infrastructures projects in Sudan. The development of the telecommunication sector in Sudan has helped to create a

new culture and awareness of information technology applications among Sudanese citizens. In Sudan, mobile services used for communication, entertainment, social networking, and recently as modes of payment means that social media applications are widely used, especially among youth. In 2018, the Sudanese National Telecommunication Corporation announced that the number of internet users in Sudan had reached 12 million users, and mobile subscribers jumped to 28 million across all operating mobile companies (NIC, 2018). Which indicate the vast spread of ICT among all Sundaneses society components.

1.3 Electronic banking in Sudan

Ongoing development of ICT in Sudan encouraged enterprises to adopt technology in their daily business operations. Sudanese banks were among the first economic entities in the country to apply telecommunication and information technology products in their business model. A variety of new services have been introduced, and new ICT assets had been installed all over the country (Intsar,hayder,Alrayah, 2006). While clients were able to learn to use new services quickly, this almost changed all aspects of the banking business in Sudan. It has also significantly reduced operating costs and developed the banking sector.

In 1998, the Central Bank of Sudan (CBOS) developed a comprehensive banking policy program aiming to develop banking sector in Sudan (Centeral Bank of Sudan, 2002). The implementation of this program started in 1999 and it mainly focused on the developing of banking sector, organizing of foreign currencies market and adoption of technology in banking operations. According to this program, technology will be use by CBOS as an essential tool for control and monitoring. In 1999, the central bank created a national committee to revise the current banking process and to set future automation and

modernization plans. One of the primary outcomes of this committee was to encourage banks to have a dedicated telecommunication channel connection with its branches. In addition, it recommended the introduction of Automated Teller Machines (ATM) systems (Union of arab banks, 2014). The committee also supported the implementation of an automated cheque clearing system, connecting retail banks with the central bank to exchange information and to connect banks to the international SWIFT network.

1.4 Problem description

Retail banks in Sudan obtained various benefits and successes by adopting IT in their business lifecycle. They managed to launch a wide range of new services such as internet banking, mobile payment, and 24 hours operating cash machines. However, the recent noticeable deterioration in e-services made transaction more difficult for bank clients. It was indicated in the Central Bank of Sudan annual report that commercial banks are facing the following challenges in managing their IT environment and e-services (Central bank of Sudan C. , 2017).

- System integration problems
- Ineffective ways of handling reported technical incidents.
- Banks are not using a standard management process for managing IT

1.5 The model

The research will use the five processes of COBIT 5 framework for information governance best practices developed by Information Systems Audit and Control Association (ISACA) organization as reference for testing the level of adherence to information technology governance (ITG) principles by Sudanese banks. In the Appendix, the figure demonstrates

these five processes, which are (Acquisition, Organization, Planning and Support & Delivery, Monitoring and Evaluate Direct) (ISACA, 2012). ISACA had formulated a set of questions to test each process, which had been used by the researcher during the data collection stage of this research.

1.6 Research objectives

This research aims to investigate the relationship between ITG in retail banks and e-services quality, taking the Republic of Sudan as the research case. The research objectives are as follows:

- Investigate the impact of ITG implementation on e-services quality in Sudanese banks and the current status of Sudanese banks in terms of ITG.
- Provide a framework for the successful implementation of ITG.
- Increase awareness in the Sudanese banking sector about the importance of ITG implementation and its relation to the quality of services.
- Contribute to the literature about IT and banking systems in Sudan.

1.7 Research scope

This study will investigate the banking sector's ITG situation in the Republic of Sudan. We will be targeting 18 Sudanese commercial banks focusing on the processes they use to manage their information technology environment, evaluating their methods, and handling of e-services. This study tests the relationship between ITG and e-services quality by interviewing a bank's IT managers and by asking bank customers about their e-services perception.

1.8 Research gap

A detailed survey of the related literature reveals that several researchers analyzed the relationship between ITG and business performance in different business sectors include banking such as financial reporting, profitability, performance, etc. However, from the literature reviewed, ITG has not been addressed in the context of e-services quality. This research is aimed at contributing to the literature and providing useful insight into the Sudanese banking sector in this matter.

1.9 Significance of the Study

1. Help retail banks in Sudan to plan and establish an information technology governance framework.
2. Use as a reference for future information technology governance framework studies in Africa in general and in Sudan in particular.
3. Help the Central Bank of Sudan in designing new regulations related to ITG in the banking sector.

1.10 Operational definitions

- **IT governance:** IT governance is a subset discipline of corporate governance, focused on information and technology (IT) and its performance and risk management (ISACA, 2012).
- **COBIT 5:** is the primary business and management framework for governance and management of enterprise IT. It is the only business framework for the governance and management of enterprise IT (ISACA, 2015). The framework has five main processes and seven supporting enablers.

- **Service quality:** “is a comparison of perceived expectations of service with the perceived performance” (Lewis and Booms, 1983)

CHAPTER 2: LITERATURE REVIEW

This chapter provides an introduction to information technology governance (ITG) and discusses in detail its related domains and principles. It also contains an evaluation for the COBIT 5 framework as the most popular ITG framework currently used by organizations worldwide. We will also explore the characteristic of banking e-services and its quality dimensions.

2.1 Overview of IT Governance

Rapid advancement occurred in information technology (IT) in the last decades shifted the use of this technology from primary productivity enabler to a strategic value creation tool. Enterprises realized the value of IT since its early appearance and the various benefits they can get by implementing IT applications in their business models. Numerous new services and products launched based on the introduction of IT in business. IT did not just have the potential for supporting existing business strategies, but it also shaped out new strategies, several modern and innovative business models developed and huge investments made by enterprises in information technology. New business emerges rapidly, and technology becomes essential for organizational success in terms of operational speed and business development. However, the results of using information technology applications in business or management might not be easy to observe. Generally, IT outcome will not be tangible or easy to measure because in most cases it used as management functions support.

In today's business environment stakeholders want to see the outcome of the massive investment they made in information technology. Thus, the concept of governance was introduced to give an overlook of management functions to optimize stakeholder interests

(Anand, 2012). Governance ensures stakeholder interest is met as well as enterprise objectives and setting the direction for organizations (ISACA, COBIT 5, 2012). By ensuring controls and compliance with the agreed-on technology direction.

2.2 IT governance definitions

Information technology governance (ITG) has emerged as an essential business development tool and a key to business value realization. ITG defines the elements of IT decision making and describes the rights and responsibilities of different stakeholders within the enterprise (Ryan Peterson, 2012). ITG allows enterprises to align business strategy and goals with IT services and infrastructure. The first appearance of ITG was in the 1990s, when (Brown, Sambamurthy, Zmud, 1993) introduced the concepts of ITG framework. Since then several ITG definition attempts have been made by researchers. Mainly, they consider ITG as a combination of information technology decision making, organization capabilities, structure, process (Simonsson,Johnson, 2008).

According to (Ron, 2012), Information technology governance (ITG) is collective tools and processes that work in harmony for assuring the efficient and effective use of IT for achieving organizational goals. The ITG processes include guidelines to aid the organization in planning, monitoring, and prioritization its information technology investment. Enabling stakeholders to measure IT business benefits and lead investment decision- making.

ITG is the duties of top management and director's board; that's why they expected to be aware of ITG importance. Directors' commitment is very crucial for the success of ITG. Moreover, ISACA organization consider ITG as the organizational exercise carried out by enterprise executives, director's board, and IT managers to ensure the development and

proper executions of information technology strategies (ISACA, 2012). The primary goal is to unite the business and IT towards the ultimate goal, which is the significant achievement of organization objectives (Van Germ & Beregn, 2002). Theoretically, ITG is the combination of several concepts such as leadership, organizational structure, and process all merged to make sure that enterprises bear and extend corporate strategy and objectives (ITGI, 2005). ITG described by (Peter Weill & Richard Woodham, 2002) as a framework of decision privileges and accountability that intend to inspire the organization towards the best IT performance. Many scholarly articles related to ITG agreed on the fact that the top management level should fully back ITG.

2.3 ITG domains

Information technology governance institute ITGI defined two main domains for ITG (ITGI , 2005). The first domain is the delivery of value to the business, and the second domain is risk mitigation. The first domain is focusing on the strategic alignment of IT and Business. The second domain is driven by setting accountability throughout the enterprise. These domains lead to 5 main critical areas in ITG, which is value delivery, strategic

alignment, resource management, risk management, and performance management.

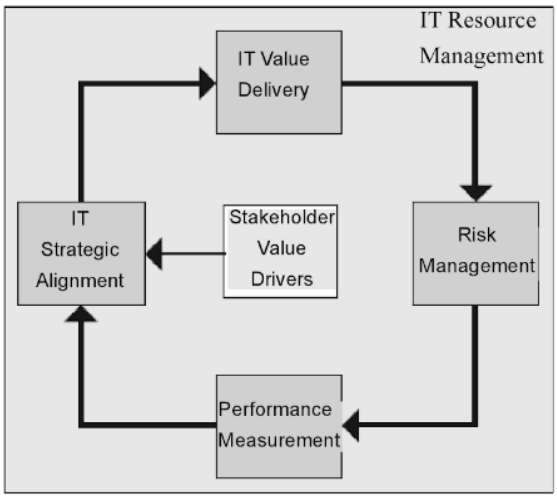


Figure 2.1 Source (ITGI, 2003)

2.4 ITG Frameworks

Over the last decade, the concept of IT governance continues to evolve several new regulations, standards, and frameworks globally introduced. For instance, the Sarbanes-Oxley Act (SOX) was introduced in the United States in 2002 and changed the norm of ITG practices and researches (Damianides, 2004). In 2005 Australian standard introduces a series of ISO standards for ITG The most important commonly use ITG framework developed so far is COBIT 5 framework. (ISACA, 2012). Various ITG frameworks introduced by several organizations and professional bodies to support enterprises to achieve the best implementation of ITG within the business environment below are some sample of this framework: COBIT

- ITIL v3
- AS8015-2005
- AS ISO/IEC 38500:2016

2.4.1 AS8015-2005 Framework

This framework published in 2005 by Australia standards committee (IT-030-governance and management) aiming to facilitate the corporate governance of ICT and to foster the effective application of IT in the business environment. AS8015 provides guidelines for managers, senior executives, board members, and partners of enterprises on how to ensure adequate utilization of Information and Communication Technology (ICT) in the organization. Different enterprises can use this standard guideline, including public, private organizations, and nonprofit organizations NGOs.

2.4.2 ASISO/IEC 38500:2016

In 2008 AS8015-2005 standards were superseded by AS8015-2010 which is also replaced by the current framework AS8015-2016. This development reflects the instant growth in corporate and information technology governance and a mounting need for better IT and business alignment in the organization. ASISO-IEC 38500:2016 this standard was prepared jointly by New Zealand and Australia standards Committee, ICT governance to succeed ISO 38500:2010 (Australia Standard, 2010). The main objectives of this standard are to provide top management with the principles and guidelines to foster the effective use of IT in the business. ISO38500 provides guidelines and regulations for enterprises to apply when evaluating, directing, and monitoring IT performance in their business organization.

In this research, we selected the COBIT 5 framework as a reference and primary instrument for assessing the level of information governance implementation in Sudanese banks. Although COBIT 5 and ISO-IEC 38500:2016 have some similar IT governance processes, ISO-IEC 38500:2016 is standard and has no official certification yet. ISO also need predefined requirements to be met by the organization before receiving full ISO accreditation.

On the other hand, the COBIT 5 framework required no predefine requirements, and organizations will not get COBIT 5 compliance certificate when they adopt the framework. A professional ITG consultant can assess the ITG situation in any organization using the guidelines of COBIT 5 framework. The organization chose to fulfill ISO prerequisites can get a certification and get full recognition as an ISO certified organization.

One of the main differences between COBIT 5 and other standards is that COBIT 5 five gives a complete road map for implementation of the information technology governance process. While different standards such as ISO-IEC 38500:2016 doesn't provide implementation hint and only gives the guidelines and compliance certification. Based on that researcher selected COBIT 5 framework to use as a benchmark for ITG in the banking sector in Sudan.

2.5 COBIT 5 framework:

Control objectives for information and related technology (COBIT) framework is a comprehensive IT governance framework developed by information systems audit and control association (ISACA) (Wim Van Grembergen, Steven De Haes, 2015). COBIT framework is a product of joint efforts of many IT, management, and audit experts who worked under ISACA supervision. The current version of the framework is the fifth edition, where the first version of COBIT released in 1996. This framework is using a holistic approach to cover all areas and functions of IT within the organization. These attributes allow the framework to be globally accepted and take the lead among other frameworks and implemented in 187 countries around the world.

COBIT 5 framework comprised of principles from different frameworks and standers such as Information Technology Infrastructure Library (ITIL) and various ISO standards related to ITG. The main objectives of the framework are the optimization of information technology

resources and the mitigation of IT-related risk. According to (ISACA, 2012), COBIT support organization to achieve a maximum outcome of IT by finding the even points between benefits realization and risk control and the optimal resource usage.

COBIT 5 uses a holistic approach for information and related technology governance, handling all IT functions in the organization. The framework process covers all ITG aspects and clearly defines responsibility and accountability (ISACA, 2015), addressing internal and external stakeholders' IT interest. COBIT 5 consist of five domains which are inclusive and applicable to organizations with different size and type. Public, private organizations, financial entities, and academics can use this framework for its ITG.

2.5.1 COBIT 5 processes

The idea behind COBIT 5 framework process is to categorize the IT management areas to simplify the implementation and monitoring of information technology governance within the enterprise. The main areas covered by the framework are strategic planning, service delivery, and monitor. The framework has five primary processes as follow

2.5.1.1 Align, plan and organization APO

APO process related to organization strategic alignment of IT with business goals and objectives (J. Luftman and R. Kempaiah, 2007). APO provides guidelines for the best use of information technology and explains how the organization can achieve idle alignment of its IT and business objectives.

2.5.1.2 Build, acquire and implement BAI

BAI process is related to IT requirement identification and acquisition of information technology assets. This process has many tasks included such as project, change,

configuration, and availability management (Edward W.N. Bernroider ∗, Milen Ivanov, 2011).

2.5.1.3 Deliver, Service and Support (DSS)

DSS focuses on services delivery-related tasks, and it concerns about achieving the value of IT services delivery to the organization and the best way to carry out IT services. It has sub-processes such as Manage Operations, service requests, Incidents, and Problems, Manage Continuity.

2.5.1.4 Monitor, Evaluate and Assess (MEA)

MEA is related to the assessment and evaluation of IT services performance and the ability to meet the business requirement, as well as compliance with internal and external regulatory requirements it includes performance metric and internal controls sub-processes.

2.5.1.5 Evaluate, Direct & Monitor EDM

EDM ensures the achievement of business objective its concern about the ultimate optimizations of IT related resource and risk mitigation. EDM includes several routines such as to assure benefit delivery and Stakeholder Transparency

2.5.2 COBIT in the literature

An experiment carried out by (Shi-Ming Huang Wei-Cheng Shen, David C. Yen, Ling-Yi Chou, 2011) in the United States added a new feature for implementing COBIT 5 frameworks in the banking sector. They approved that customers trusted internet banking increase when they informed that their bank is adopting COBIT 5 framework, and it was the cause of raising customer's confidence about bank e-services. This can be linked with the study of (Mark Wolden, Raul Valverde, Malleswara Talla, 2015) they linked the implementation of COBIT 5 framework with the decrease of internet cyber-attacks. The study survey number of

information systems managers working for organizations that use COBIT 5 framework, and the results indicated that COBIT 5 is information security enabler via its restrict policies and controls.

(David S. Kerr a,*, Uday S. Murthy, 2013) They conduct an international survey to investigate the relationship between COBIT 5 framework and the quality of financial reporting. They linked COBIT restrict internal control with the finical reporting quality. The same pattern study has been done by (Ziod, Hussain, Reem, 2014) in Syria, they investigated the relationship between COBIT 5 and the financial reporting quality of Syrian banks. The results show a significant relationship between the two variables.

Form the literature reviewed; several researchers argue that COBIT 5 is a quality determine for many business operations, and they approved that many organizations achieved better business performance after using this framework. However, the issue of e-services quality in the banking industry with COBIT 5 has not been covered yet by the scholars.

2.6 Information technology infrastructure library ITIL

- ITIL is a well-recognized IT services management framework introduced in 1980 by the UK central computer and telecommunications agency CTA (Arjen , Axel , Mike , Ruby , Annelies, 2008). The framework has a set of processes and functions that use for IT service planning, delivery, and maintenance mainly concerns about the alignment of IT services with organization needs.

- ITIL supported by the IT services forum (ITSMF), which is an international NGO organization devoted to promoting the IT service management development. Since

introduced ITIL has several released the current version of the framework is ITIL version3.

- ITIL considered a valuable addition to the IT services domain because it provides a clear vision about how organizations can manage their information system life cycle. The framework processes are applicable for managing the IT service lifecycle and the relationship between service management components. According (Arjen , Axel , Mike , Ruby , Annelies, 2008) IT services lifecycle consists of five phases listed below:

- . Service Strategy
- Service Design
- Service Transition
- Service Operation
- Continual Service Improvement

2.6.1 Service Strategy:

This phase is concern about the strategic planning related to IT services and the alignment of IT services strategy with organizations long term plans and objectives. It also contains processes of financial management and services portfolio management.

2.6.2 Service Design

This phase is related to the service design process, including the policy, objectives, and architecture process. When designing the services, ITIL always keeps organization, business requirements, and goals in the center of the designing process (Elena Orta,Mercedes Ruiz,

2018). Several key services functions created during this stage such as service catalog management, Service level management and IT service continuity management

2.6.3 Service Transition

- After identifying the requirements in the service design stage, the service transition phase uses this information to "build test and deploy" of new services. Service transition phase also coordinates the processes, functions, and system needed for building and testing and deploying new and updated services (Arjen , Axel , Mike , Ruby , Annelies, 2008). After identifying the services and customers' requirements in the services design stage. The success of the services transition phase depends on the effective delivery services that respond to the business needs and at a reasonable cost using the available resources. Below are some of the processes related to this phase:

- Change management
- Service asset and configuration management
- Release and deployment management
- Service validation and testing

2.6.4 Service Operation

The objectives of the service operation phase in ITIL framework is to ensure the efficient and effective delivery and support of services and to achieve a high availability level of services (Bon, 2008).

The ultimate goal of services operations is to organize the processes and tasks needed to provide the agreed-on level of services to business users and customers. In addition, the services operations are expected to effectively manage the technology required to deliver and support IT services. The sampling process comprised in this phase is below.

- Incident management
- Problem management
- Access management
- IT operations
- Service desk

2.6.5 Continual Service Improvement CSI

CSI process is the responsibility of the IT department to foster continuous improvement of services to meet business requirements. The CSI process is impeded throw-out the services lifecycle. CSI required ongoing monitoring and measuring of services performed to determine the need for improvement. Based on CSI phase, the IT department should frequently update with the new business requirements. During this phase, the IT department regularly revisits the services level agreement (SLA) and to compare the current services performance with the expected and agreed on services level. ITIL framework defined the following primary objectives for Continual Service Improvement phase:

- CIS can recommend further enhancement of services To Innovate and introduce activities that can improve quality of services, customers satisfaction and promote the effective and efficient IT services management
- To strike a balance between the quality of the services, budget and customer satisfaction
- Apply appropriate quality management routine for improvement of the services.

2.7 COBIT VS ITIL

COBIT 5 is an IT governance framework, while ITIL is an information technology services management framework. Both frameworks have some processes in common such as risk management and change management. However, COBIT 5 is concern about enterprise overall IT governance aiming to create the ultimate value of its IT investments (skeptic, 2012). IT auditors can easily assess the IT governance status in an organization using COBIT 5. Furthermore, COBIT is relatively implemented at a low cost comparing to ITIL.

CHAPTER 3: THEORETICAL FRAMEWORK AND HYPOTHESES

3.1 Overview

The literature reviewed assisted in accruing the knowledge needed for developing the research framework and hypotheses. We appraised numerous researches and case studies that discussed the principles and implementation of information technology governance and its impact on the performance of businesses and organizations around the world. In this chapter, we will present the conceptual framework of the research and formulate research hypotheses. The recent noticeable deterioration of e-banking services in Sudan motivated the researcher to analyze why the grand investment made by Sudanese banks in banking information technology didn't lead to better services quality. We focused on the impact of IT governance on banks e-services quality, assuming that the implementation of ITG principles will provide practical solutions to current e-banking problems in Sudan.

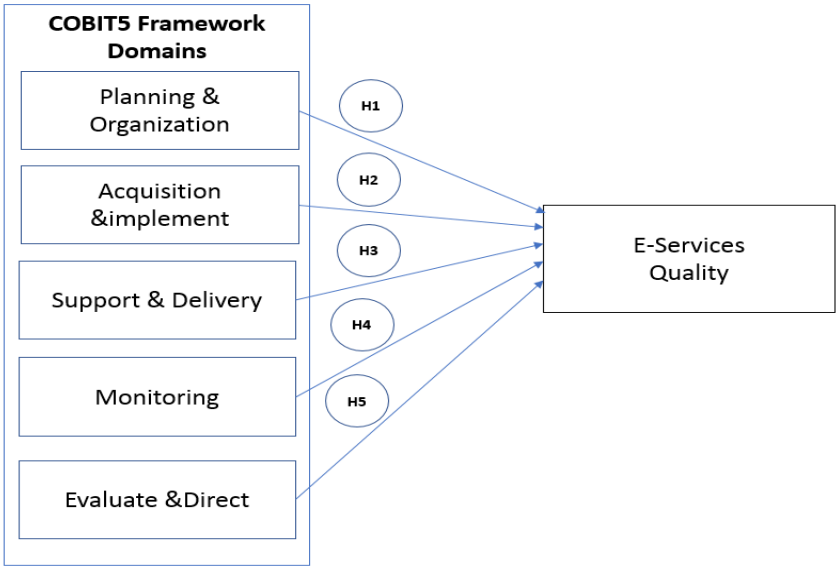
3.2 COBIT 5 framework

Based on the literature reviewed, different professional's organizations developed several ITG frameworks. For this research, we selected COBIT 5 principles to build the research framework. This decision supported by two reasons first, COBIT 5 is currently the only available comprehensive ITG framework covering all aspects of ITG. The second reason is, it's already well known among IT professionals working in Sudanese banks. COBIT 5 framework clearly distinguishes between management and governance processes. According to its principles, every organization should implement several governance and management processes to achieve full governance and management of enterprise IT

In theory, any organization can organize its governance process in any way as long as essential management and governance objectives are well covered because the small organizations will have fewer processes whereas bigger complex organizations may need many processes. COBIT 5 framework describes in detail each process activities and what is the functional purpose of each process, in another word, what process intends to deliver. This breakdown makes each process unique and different from other processes and provides different objectives. COBIT 5 also has guidance on how each process is to be executed, monitored, and improved. The framework guidance is identical for all processes.

3.3 Theoretical framework

Diagram 3.1 demonstrates the conceptual framework developed to test the impact of information technology governance on banks e-services quality.



The above diagram demonstrates the conceptual framework and the relationship between research variables. As shown above, there are five independents variables included in the framework. These were variables extracted from COBIT 5 framework representing

information technology governance dimensions. The framework also shows e-services quality as a single dependent variable.

The framework suggests that information governance processes as independents variables play a significant role in determining the e-services quality level for retail banks in Sudan. Each variable among the five independent variables represents a process that contains a set of controls and procedures for managing specific activities within the bank's IT environment.

3.4 Measurement and research variables

The framework includes a planning variable which is an ITG process concerned about how the banks plan and organize their IT services and how they define their future technological direction. The acquisition variable is related to IT assets procurement and management process. Support and delivery variables focus on operations and services continuity management. The monitoring variable is associated with system of internal control. The last independent variable is evaluating and direct which concern about governance framework as well as risk and resource optimization.

All Independent variables appear in the conceptual framework work together to form complete information technology governance.

3.5 Research hypotheses

After reviewing the literature about information technology governance and e-banking issue and constructed conceptual research model, we have been able to draw research hypothesis. The research has one central hypothesis that has a sub 5 hypothesis, which can be explained as follow.

H1: IT governance implementation has a direct impact on banks e-services quality.

H1.1: Align, plan and organize process has a direct impact on banks e-services quality.

H1.2 Build, acquire and implement BAI process has a direct impact on banks e-services quality.

H1.3. Deliver, service and support DSS process has a direct impact on Banks e-services quality.

H1.4 Monitor, evaluate and assess the MEA process has a direct impact on Banks e-services Quality.

H1.5 Evaluate direct & monitor the EDM process has a direct impact on banks e-services quality.

3.6 Research questions

Q1. To what extended adoption of the information technology governance framework will affect e-services quality?

Q2. Are banks in Sudan is adopting any IT governance framework?

Q3. What are the main factors affecting Information System governance framework adoption?

CHAPTER 4: RESEARCH METHODOLOGY

This chapter will discuss the research methodology emphasizing on how research technical part designed, describing data collection methods, target population and sample size determination process. Explaining in detail the statistical tools used during the data analysis stage.

4.1 Research design

This research relying on different data sources to identify the current situation of information technology governance practices in the Sudanese banking sector, for this purpose secondary data collected by government agencies and the central bank of Sudan as well as previous researches were utilized. When collecting primary data, this research adopted tow data collection methods. First and to have a deep understanding of the current situation in Sudanese banks researcher conducted a series of interviews targeting banks information technology department's managers and information system auditors. In later stage banks, customers' opinion has been explored via an online questionnaire. Statistical techniques like correlation testing and factor analysis were used to evaluate the relationship between main research variables (information technology governance and customer's satisfaction). Figure 4-1 demonstrates the method used and the expected outcome.

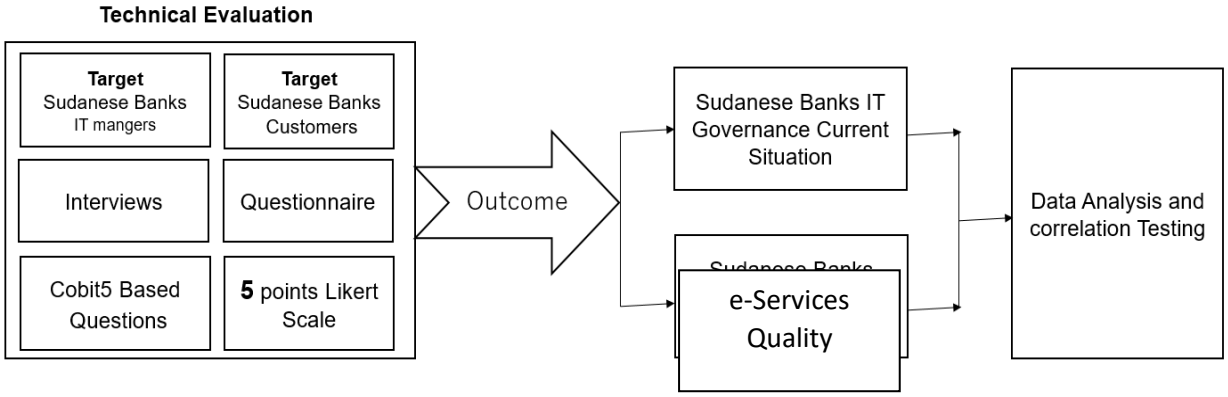


Figure 4-1: Research Methodology

4.2 Research population

The target populations of this research comprise of Sudanese retail bank customers and their banks' information technology department's managers. The study mainly targeting Sudanese citizens who are using retailer bank services those customers might be students', employees, businesses or any individual having different types of bank accounts using a range of banking services to make various transactions.

4.2.1 Sample size

Out of 34 retail banks operating in Sudan 18 banks, information technology department managers were interviewed as well as some information system auditors. They answered interview questions giving a precise description of their bank information technology management practices representing a response rate of 68 %. Banks were selected based on the scale of investment in technology, operating capital, and customer's number of respectfully using the central bank of Sudan data. In later stage questionnaires were designed and published on the internet and shared via social network websites to make it available for the public, targeting customers of banks already included in the interviews. ((200)) Customers fill up the questionnaire.

4.2.2 Sample selection

The research is using a probability sampling technique, where any member in the population has equal opportunity to be selected as a representative, which means customers of retailer banks are representing the target population. However, the Researcher limits the responses from customers of banks understudy (18 banks). This method allows researchers to have customer's responses analyzed in line with their related bank services quality.

4.3 Questionnaire measurement

Two different technics were adopted for data collection, banks information technology department managers received 24 interview questions. This questions are grouped into 5 main paragraphs each of them representing a domain in COBIT 5 framework, this questions test organization level of compliance to information technology best practices covering (Planning, implementing, services delivery & support and monitoring) domains, research is aiming to test the level at which banks adhering to ITG best practices. Usually, the questions used in the interviews are used by information systems auditors when assessing organizations IT related internal controls and compliance level to COBIT 5 framework guidelines.

To examine the Sudanese Banks services quality level and their customers view the researcher design a questionnaire to measure the services quality level based on services quality five dimensions (Tangibles, Reliability, Responsiveness, Assurance, and Empathy) each question in examining one of this aspects. The questionnaire questions are driven from different sources such as previous studies about information technology governing and customer's satisfaction and trust. While Likert 5-point scale was used to test research variables.

4.4 Ethical consideration

Interviewees consent obtained by informing them that data collected during the interviews will only be used for academic purposes. This issue clearly explained ahead of each meeting with IT managers. The researcher also treats the personal information of bank customers who responded to the online questionnaire as confidential and well protected.

4.5 Data analysis methods and techniques

After selecting suitable data collection methods, in the second part of this chapter, we will explain about the data analysis methods and tools used to translate the collected data to meaningful information.

4.6 Descriptive statistics analysis

Using descriptive analysis methods will enable the researcher to describe collected data features and summarized them in a meaningful manner. Descriptive statistics used to measures of variability of data using mean, median and mode.

4.7 Correlation

Correlation analysis is a statistical tool used to measure the fluctuation degree between two or more variables. Positive correlation refers to a parallel increase or decreases among variables. When one variable increase as the other decrease, this is described as a negative correlation. We utilize this analysis to test the relationship between research variables.

4.8 Independent sample t-test analysis

The Independent Samples t-test is a parametric test use to compare the mean of 2 independent groups to see if there is statistical evidence that the associated population means are significantly different. In this study, a t-test was conducted to compare e-services quality for banks applying or not applying IT governance processes.

4.9 Research Validity

Validity determines whether the research truly measures what it was intended to measure or how accurate the research results are. In other words, does the research instrument led to the achievement of the research objectives. For this research, we used a set of questions taken from COBIT 5 framework assessment program, which are developed by groups of IT and

auditing experts and published by ISACA organization and it can be described as a valid and reliable tool to assess ITG implementation.

CHAPTER 5: FINDINGS AND ANALYSES

This chapter discusses the statistical tests' results obtained using the collected data. Descriptive analysis, correlation analysis, and independent sample t-test were used to validate the research hypothesis and to examine the relationship between the variables. Results are achieved using the statistical package for social science IBM SPSS software version 25.

5.1 Demographic profiles of the respondents

This research follows a quantitative approach to test IT governance practices in Sudanese retail banks using COBIT 5 framework as a benchmark, investigating the impact of these practices on the quality of their e-services. For this purpose, a series of interviews were conducted on 18 Sudanese retail bank personnel who agreed to participate in the research. Interviewees were IT managers, information system auditors, information technology department staff, and senior managers. Questions used during interviews were taken from the COBIT 5 framework assessment program, covering all aspects of IT governance in the bank.

Furthermore, a questionnaire was developed and published on the internet targeting selected banks' customers to obtain their views about banks' e-services quality, and to identify the relationship between banks' IT governance practices and the quality of their e-services. 210 responses were collected via this questionnaire, however after further analysis, 10 incomplete responses were dropped, leaving a total of 200 valid responses remaining.

Table 5.1 shows the summary of bank staff demographic data, while Table 5.2 demonstrates bank customer's demographic data.

5.1.1 Profile of respondents

Table 5.1 Banks' staff demographic profile

Variables	Category	Frequency	Percentage
Gender	Male	17	94
	Female	1	6
Total		**18**	**100**
Years of experience	1 – 3	2	11
	4-6	1	6
	More than 6 years	15	83
Total		**18**	**100**
Academic Background	Computer science	10	55
	Computer engineer	1	6
	Information technology	6	33
	Accounting	1	6
Total		**18**	**100**

Table 5.1 shows information that includes the age, academic background, and years of experience of the bank IT department's staff. Out of 18 banks' IT officers, there is only one female that currently manages the IT department while the majority of IT managers are males (17), representing a dominant percentage of 94%.

The second demographic variable is years of experience, and it is observed that 15 of the IT managers or 83% of them have been working for more than 6 years in their current positions while those who have been working for 1 to 3 years represent 11% of the population which is 5% more than managers who worked between 4 to 6 years (6%).

The third variable is the academic background. Generally, the main academic background among banks' IT managers are computer sciences, computer engineering and information technology, represented by 55 %, 6%, and 33% respectively. Only one respondent came from an accounting background. In Sudan, information technology university degrees usually consist of management and computer science courses. The students study accounting, management, and operations management, plus database and programming languages to acquire both IT and management knowledge.

Table 5.2 Banks' customers demographic profile

Variables	Category	Frequency	Percentage
Location	Capital city	131	66
	Another region	69	34
Total		200	100
Banks type	Commercial	195	97
	Industrial	2	1
	Agricultural	3	1.5
	Saving	1	0.5
Total		200	100

Table 5.2 contains the banks' customer's demographic data collected via the online questionnaire. We used only two demographic items to shorten the questionnaire expecting that the majority of respondents will be using low-speed internet connection in Sudan.

The geographical distribution of respondents showed that 131 out of 200 respondents are located in the country's capital, representing 66% of the population, while 34% of them live in different Sudanese states. Data obtained showed that 97% of the respondents are commercial bank clients, and the remaining respondents hold accounts in other specialized

banks such as industrial, agricultural, savings banks, represented by 1%, 1.5%, 0.5%, respectively.

5.1.2 Respondent responses

Table 5.3 contains descriptive statistical information of banks' IT managers' responses to the interview questions. Interview questions covered the five processes of the COBIT 5 framework and 5-point Likert scale were used in the questionnaire

Table 5.3 Banks IT managers responses descriptive statistics

Process	N	Mean	Median	Mode	Minimum	Maximum
APO1	18	4.4	5	5	2	5
APO2		4.5	5	5	2	5
APO3		4.0	4	5	2	5
APO4		4.6	5	5	2	5
APO5		4.1	5	5	2	5
BAI1		4.3	4.5	5	2	5
BAI2		4.6	5	5	2	5
BAI3		4.4	5	5	2	5
BAI4		4.3	4.5	5	2	5
BAI5		4.1	4.5	5	2	5
DSS1		4.0	4.5	5	2	5
DSS2		4.0	4	5	2	5
DSS3		4.1	5	5	2	5
DSS4		3.9	4	4	2	5
DSS5		4.6	5	5	3	5
MEA1		4.1	4	5	2	5
ME2		4.0	4	5	2	5
MEA3		4.2	5	5	2	5
MEA4		4.3	5	5	2	5
MEA5		4.4	5	5	3	5
EDM1		4.7	5	5	4	5
EDM2		4.2	5	5	2	5
EDM3		4.2	5	5	1	5
EDM4		3.4	4	4	2	5

The first questionnaire was for testing the first variable (APO) where the “manage strategy” paragraph got the highest average with 4.5, its mode was 5 = strongly agree. The lowest coefficient was for “service agreements” question with an average of 4.0 and mode 5 = strongly agree. This result shows that banks have documented and approved a strategic plan related to IT. However, only 27% of the banks have service level agreements.

As to the second variable (BAI), 80% of the interviewees mentioned that they have proper requirements definition process. However, the lowest coefficient was for the technological

infrastructure plan with a 4.1 average. This finding indicates that banks have documented user's training plans, but only 20% of banks have documented technical infrastructure plan to identify future technological directions.

In the third variable (DSS), the operating policies standards got the highest average with 4.5. The lowest coefficient was for disaster recovery plans with a 3.9 average. This information implies that banks have documented operating policies standards identifying roles and responsibilities of IT staff members, but only 27% of banks have disaster recovery plans.

In the fourth variable (MEA), it seems that most of the banks (80%) have a monitoring and evaluation process for their IT Performance. However, they do not have or implement the System of Internal Control.

In the fifth variable (EDM), resource optimization got the highest average with 4.7. The lowest coefficient was for risk optimization and disaster recovery with 3.4 median, and mode 5 = strongly agree.

5.2 Correlation analysis

To test the relationship between the variables, this study used the correlation test. Analysis result indicate that variables are significantly correlated at Pearson value below 0.01. The following diagram demonstrates the degree of correlation and its related values.

Correlation for control and predictor variables

Correlations

		APO	BAI	DSS	MEA	EDM
APO	**Pearson Correlation**	**1**				
	Sig. (2-tailed)	**.**				
BAI	**Pearson Correlation**	**.771(**)**	**1**			
	Sig. (2-tailed)	**.001**	**.**			
DSS	**Pearson Correlation**	**.795(**)**	**.898(**)**	**1**		
	Sig. (2-tailed)	**.000**	**.001**	**.**		
MEA	**Pearson Correlation**	**.825(**)**	**.949(**)**	**.933(**)**	**1**	
	Sig. (2-tailed)	**.000**	**.003**	**.000**	**.**	
EDM	**Pearson Correlation**	**.911(**)**	**.890(**)**	**.943(**)**	**.947(**)**	**1**
	Sig. (2-tailed)	**.000**	**.000**	**.000**	**.000**	**.**

** Correlation is significant at the 0.01 level (2-tailed).

The table above shows the internal correlation result for information technology governance variables Align, Plan, and Organize (APO), Build, Acquire, and Implement (BAI), Deliver, Service, and Support (DSS), Monitor, Evaluate, and Assess (MEA), Evaluate, Direct, and Monitor (EDM) (ISACA, 2015).

Pearson correlation result shows that all r values are above 0.7, which indicates that there is a strong positive correlation between the variables.

5.3 Reliability analysis

Cronbach's Alpha reliability test was used to measure research instrument's internal consistency and the variables' reliability coefficients (testing questionnaire paragraph internal consistency). The research instrument's total reliability coefficient is 0.974. The standard value is from 0.7 to 0.9, which indicates that the research instrument was internally consistent.

Variables	Questions	Items Number	Cronbach Alpha
Overall items		24	.9741
Align, Plan and Organize	APO1 -APO5	5	.7204
Build, Acquire and Implement	BAI 1-BAI5	5	.8703
Deliver, Service and Support	DSS1-DSS5	5	.8519
Monitor, Evaluate and Assess	MEA1-MEA5	5	.9394
Evaluate direct & monitor	EDM1-EDM4	4	8242

5.4 Independent sample t-test analysis

		Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ITG SERVICEQ	Equal variances assumed	3.313	.071	2.148	132	.034	.35	.163	.028	.674
	Equal variances not assumed			3.185	13.063	.007	.35	.110	.113	.589
APO SERVICEQ	Equal variances assumed	.171	.680	1.287	132	.200	.27	.210	-.145	.685
	Equal variances			1.304	5.493	.244	.27	.207	-.248	.789

	not assumed									
BAI SERVICEQ	Equal variances assumed	2.264	.135	1.939	132	.055	.29	.151	-.006	.591
	Equal variances not assumed			2.446	15.102	.027	.29	.120	.038	.547
DSS SERVICEQ	Equal variances assumed	2.831	.095	1.918	132	.057	.33	.172	-.010	.671
	Equal variances not assumed			2.762	10.905	.019	.33	.120	.067	.593
MEA SERVICEQ	Equal variances assumed	3.020	.085	1.974	132	.050	.29	.145	-.001	.575
	Equal variances not assumed			2.567	17.407	.020	.29	.112	.052	.523
EDM SERVICEQ	Equal variances assumed	4.238	.041	1.791	132	.076	.19	.105	-.020	.395
	Equal variances not assumed			2.112	58.905	.039	.19	.089	.010	.365

High versus low e-services quality: IT governance (ITG).

This study tested if the banks are applying or not applying IT governance processes that have the same or different e-services quality. There was a statistically significant difference in the quality of e-services between the banks surveyed. Banks applying ITG (M=3.30, SD=.508) and banks with no ITG (M=2.95, SD=.317) conditions; t =2.148, p = .034. These results show that IT governance implementation does affect banks' e-services quality.

High versus low e-services quality: align, plan, and organize (APO)

There was no statistically significant difference in e-services quality between banks that apply or do not apply the APO process. APO (M=3.29, SD=0.503) and no APO process

(M=3.02, SD=0.496) conditions; t =1.287, p = .200. These results show that APO process implementation does not show a tangible effect on banks' e-services quality.

High versus low e-services quality: build, acquire, and implement (BAI)

BAI process is concerned with managing programs and projects and requirements definitions, so this study tested whether banks applying or not applying this process have different e-service quality. Significant difference is shown in the result for banks that apply the BAI process (M=3.30, SD=0.508) and no BAI process (M=3.01, SD=0.382) conditions; t =1.939, p = .055. These results show that the BAI process does affect banks' e-services quality.

High versus low e-services quality: deliver, service, and support (DSS)~~, monitor~~

DSS focus on operations and service requests management. The implementation of this process exhibited a statistically significant difference of high and low e-services quality among banks that ~~result for~~ apply DSS process (M=3.30, SD=0.508) and those that do not apply DSS (M=2.97, SD=0.332) conditions; t = 1.918, p = .057.

High versus low e-services quality: monitor, evaluate and assess (MEA) process

There was a significant difference in the result in banks that apply MEA process (M=3.30, SD=0.509) and those that do not apply MEA (M=3.02, SD=0.367) conditions; t =1.974, p = .050. These results show that the MEA process does affect banks' e-services quality.

High versus low e-services quality: evaluate, direct, and monitor (EDM)

EDM process is related to risk and resource optimization. After testing whether high/low e-services quality banks have this process in place, results showed that there is a significant difference between applying the EDM process (M=3.32, SD=0.525), not applying the EDM (M=3.13, SD=0.391)

conditions; t=2.112, p = .039. These results show that the EDM process does have a significant effect on banks' e-services quality.

Group Statistics

	ITG		APO		BAI		DSS		MEA		EDM	
H/L	HESQ	LESQ	HESQ	LESQ	HESQ	LESQ	HESQ	LESQ	HESQ	LESQ	HESQ	LESQ
N	124	10	128	6	122	12	125	9	121	13	105	29
Mean	3.30	2.95	3.29	3.02	3.30	3.01	3.30	2.97	3.30	3.02	3.32	3.13
Std D	.508	.317	0.503	0.496	0.508	0.382	0.508	0.332	0.509	0.367	0.525	0.391

5.5 Hypothesis testing

The null hypothesis (H_0) = wanted to know whether high or low e-services quality banks applying the same IT governance processes. The alternative hypothesis (H_1) = wanted to know whether high or low e-services quality banks have unequal or different IT governance processes. This study tested IT governance implementation variables for high and low e-services banks. The result shows that t= 2.148, p= .034, which indicate a statically significant relationship between the two variables, so the null hypothesis is rejected and H_1 is accepted.

H_1: IT governance implementation has direct impact on banks e-services quality.

Then this study checked the sub-hypothesis which is related to IT governance internal processes and e-services quality. Starting with align, plan, and organize, the process was to see if its implementation affects banks' e-services quality or not. The result shows that t=

1.287, p= .200 which indicate that there is no statically significant relationship between the two variables, so the null hypothesis is accepted and $H_{1.1}$ is rejected.

$H_{1.1}$: Align, plan, and organize (APO) process has a direct impact on banks e-services quality.

For $H_{1.2}$, the researcher tested the impact of the adoption of the build, acquire, and implement (BAI) process on ~~the~~ banks' e-services quality. The result shows t= 1.93, p=.05 which indicate a robust statistical relationship between the two variables, so the null hypothesis is rejected and $H_{1.2}$ is accepted.

$H_{1.2}$: Build, acquire, and implement (BAI) process has a direct impact on banks e-services quality.

Also, the researcher tested whether the implementation of delivery, service, and support (DSS) process will have an impact on e-services quality. The results indicate that t= 1.918, p=.057 ~~this result~~ demonstrate a strong statistical relationship between the variables, so the null hypothesis is rejected and $H_{1.3}$ is accepted.

$H_{1.3}$: Deliver, service, and support (DSS) process has a direct impact on banks' e-services quality.

$H_{1.4}$ hypothesized that applying monitor, evaluate, and assess (MEA) will affect e-services quality for retail banks. The result was t= 1.974, p=.050 which show a strong, statically significant relationship, so the null hypothesis is rejected and $H_{1.4}$ is accepted.

$H_{1.4}$: Monitor, evaluate, and assess (MEA) process has a direct impact on Banks e-services quality.

For $H_{1.5}$ implementation of evaluating, direct, and monitor (EDM) process tested against e-services quality and the outcome was t= 2.112, p=.039 so the null hypothesis is rejected and $H_{1.5}$ is accepted.

$H_{1.5}$ Evaluate, direct, and monitor (EDM) process has a direct impact on banks' e-services quality.

Summary hypothesis testing table

hypothesis	Evidence	Conclusion
H1 ITG -> E-SQ	**t= 2.148, p= .034**	**Accepted**
H1.1 APO -> E-SQ	**t= 1.287, p= .200**	**rejected**
H1.2 BAI -> E-SQ	**t= 1.939, p=.055**	**Accepted**
H1.3 DSS -> E-SQ	**t= 1.918, p=.057**	**Accepted**
H1.4 MEA -> E-SQ	**t= 1.974, p=.050**	**Accepted**
H1.5 EDM -> E-SQ	**t= 2.112, p=.039**	**Accepted**

CHAPTER 6: DISCUSSION AND CONCLUSION

6.1 Results discussion

This research employed survey data and independent t-test to examine the relationship between information technology governance (ITG) and retail banks e-services quality in Sudan. The study use COBIT 5 framework processes, Align, Plan, and Organize (APO), Build, Acquire, and Implement (BAI), Deliver, Service, and Support (DSS), Monitor, Evaluate, and Assess (MEA), Evaluate, Direct, and Monitor (EDM) to test the ITG situation in Sudanese banks. The main research question was how the implementation or absence of these processes would affect the quality of banks' electronic services. This study tested the research hypotheses with IT professionals currently working in Sudanese banks, as well as banks' customers using the e-services. This chapter further discusses the findings and data analysis results included in the previous section.

The main finding of the research is that there is significant evidence that the implementation of information technology governance impacts banks' e-services quality. The research hypothesis states that applying the ITG process directly affects e-services. However, most of the Sudanese banks surveyed do not officially and fully use comprehensive ITG framework, but they do apply principles of the COBIT 5 framework for managing their information technology environment and still can have good results on the quality of their services. This result is supported by the finding of (Anand, 2012) in his study about ITG in Indian banks. He has linked the service quality with IT governance and controls. In addition, a study by (Shi-Ming Huang a, Wei-Cheng Shen a, David C. Yen b,∗, Ling-Yi Chou a, 2011) implies that applying information technology governance process will affect the quality and

customers' perception of internet banking. This finding confirms the assumption that there is a coexisting relationship between ITG and service quality.

Among the processes of COBIT 5 framework used to test research variables, results showed that surveyed banks that apply the Build, Acquire, and Implement (BAI) process principles in managing their IT environment. BAI process provides a set of procedures and controls for managing IT assets, configuration, and projects. As hypothesized, it was found that this process has a tangible impact on service quality. BAI is the most suitable process for project management and capacity management (ISACA COBIT 5, 2015). BAI also gives attention to the requirement definition and control, and it is an essential part of ITG.

From the analysis, it was found that most of the banks surveyed are implementing the principles of Deliver, Service, and Support (DSS), Monitor, Evaluate, and Assess (MEA), Evaluate, Direct, and Monitor (EDM) (ISACA, 2015) processes. However, there is less compliance with Align, Plan, and Organize (APO) process. This indicates that targeted Sudanese banks are adopting 4 process principles out of 5 processes included in COBIT 5 framework.

APO process is linked to the strategic alignment and governance area (Atichat Preittigun&Wachara Chantatub, 2102). APO process also focuses on managing enterprise architecture and innovation. The t-test results indicate that there is no significant relationship between this process and the e-services quality of banks covered. From the interviewees' responses, it is noticed that most of the banks have a weak implementation of APO principles, precisely in architecture and innovation management. Furthermore, the translation of strategic plan goals into operational plans prove to be a challenge.

Therefore, it is concluded that surveyed banks are partially implementing IT governance processes for the governance part of their IT systems. However, none of these banks are fully adopting this framework or any other framework. Moreover, some of the banks' technical staff members already participated in training programs for COBIT 5 framework and other IT related management frameworks such as ITIL.

6.2 Conclusion

This research was conducted in response to the current notable decline of Sudanese banks' e-services quality, aiming to contribute to the future development of this sector. The study examined the relationship between information technology governance ITG implementation in Sudanese banks and e-services quality using COBIT 5 framework as a benchmark. It was found that application of the ITG process Build, Acquire, and Implement (BAI), Deliver, Service, and Support (DSS), Monitor, Evaluate, and Assess (MEA) and Evaluate, Direct, Monitor (EDM) lead to a perceived improvement in banks' e-services quality.

It was also found that Sudanese banks were partially applying ITG principles for managing their information technology environment. However, none of the 18 banks surveyed were implementing IT governance framework from end to end, except foreign banks operating in Sudan. This study draws attention to the importance of information technology governance in the banking sector as a determinant for e-services quality. Customers' responses to the survey showed that security, network speed, services continuity, and technical support are the main quality attributes that drive their satisfaction.

The results of this research can help retail banks in enhancing their ITG practices and considering full-implementation of the ITG framework. These results may also be useful for the Central Bank of Sudan to develop new policies and controls related to information

technology and e-banking services. The research findings might also be used as a model for other African countries for assessing their banking sector ITG.

6.3 Significance of the study

- The outcome of this research can help Central Bank of Sudan to design new policies and controls related to information technology.
- Research results will raise the awareness of Sudanese banks about the importance of information technology governance and its impact on e-services quality.
- Sudanese banks can follow the pattern of this research to do in-depth studies related to IT governance and how to improve current IT management practices.
- The research can be considered as an addition to academic literature associated with IT management in Sudan's banking sector.

6.4 Recommendations

The outcome of this research suggested that there is a positive relationship between IT governance and the quality of e-services provided by Sudanese banks. Based on that, this study recommends the following:

6.4.1 Adoption of IT governance in Sudanese retail banks

The Central Bank of Sudan (CBS), as governor of the banking sector in Sudan, has a direct responsibility to encourage the adoption of IT governance by issuing the required policies and regulations. This study recommends that CBS ~~to~~ choose one of the internationally recognized IT governance frameworks to be used by Sudanese banks. This study also recommends retail banks to consider the full implementation of an IT governance framework.

6.4.2 Quality Assurance

Sudanese retail banks are expected to deliver high-quality e-services to satisfy their customers' needs. This study recommends retail banks to increase their technical staff's awareness regarding concepts, assurance, and control of e-services quality. This study also suggests that banks have comprehensive information technology training and certifications plans, paying more attention to the IT management and e-services quality assurance training programs. It is also recommended to pay attention to the gender issue because females have low representation in Sudanese banks IT departments.

6.5 Limitation

- The study focuses on e-services' quality as derivatives of information technology governance implementation, though there are other external factors that might affect banks' e-services such as internet connection, infrastructure and power.
- The study receives responses from bank customers living in the capital and central state due to the time limit. Future research might include customers from different regions of the country.

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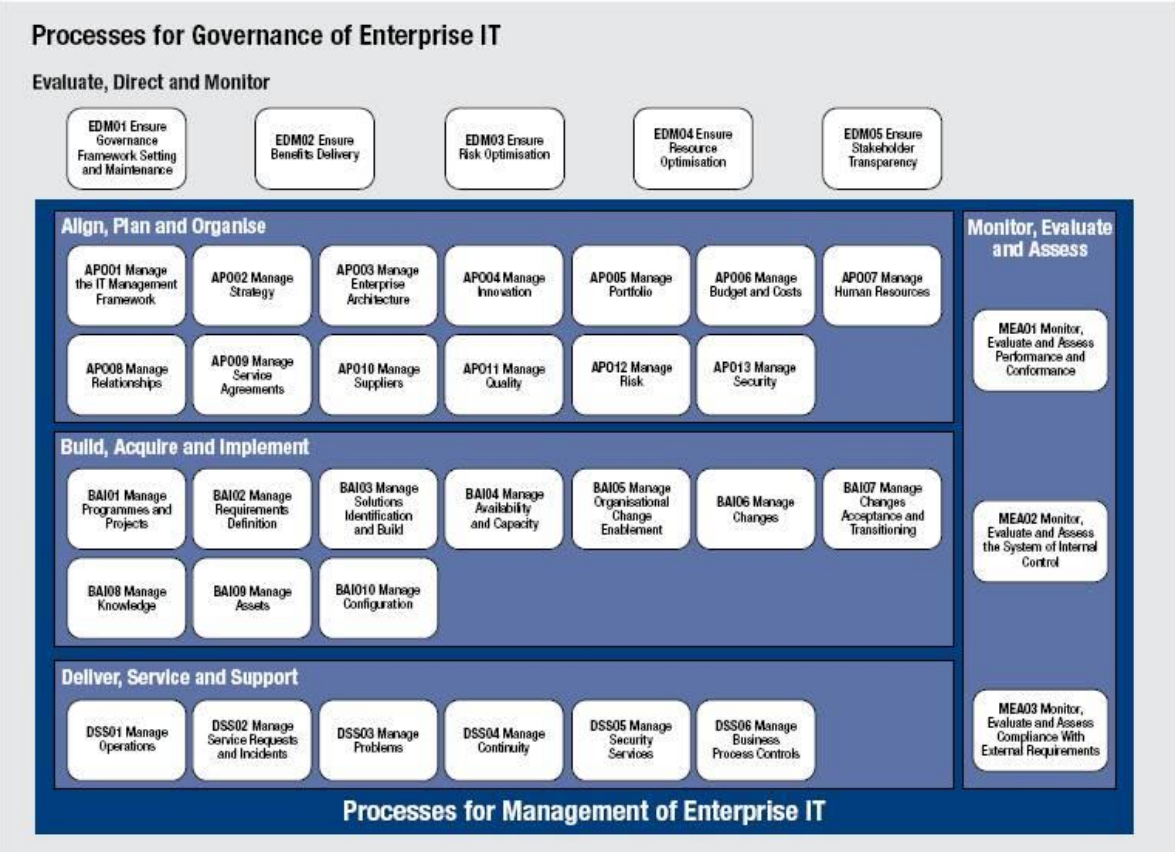
Appendix

I. COBIT 5 framework



(ISACA, 2012)