INFORMATION TECHNOLOGY BENCHMARKING APPROACHES, PARAMETERS AND CHALLENGES IN UNIVERSITIES IN KENYA

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DECLARATION

This project is my original work and has not been presented for an award in any other University.

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This research project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This work is dedicated to my mother, Jane M. Mulandi, without whose caring supports it would not have been possible, and to the memory of my father, the Late Peter Mweu Mbui, who passed on a love of reading and respect for education.

ACKNOWLEDGEMENT

On the very outset of this report, I would like to extend my sincere and heartfelt obligation towards all the personages who have helped me in this endeavor. Without their active guidance, help, cooperation and encouragement, I would not have made headway in this project. I also give thanks to the Almighty God for the continued grace.

ABSTRACT

Information Technology is increasingly becoming a strategic and competitive tool in Kenyan higher education. With so much expectation resting on the IT function, the aspect of comparison or benchmarking with other institutions is critical for continuous improvement. This study focused on IT benchmarking in universities in Kenya. The objectives were to establish how IT benchmarking is understood and practiced, approaches and methodologies adopted, parameters considered important, and challenges encountered in implementation. Six public and private universities were considered. Questionnaires were used as data collection tools. Respondents were drawn from divisions of the IT function of these universities. Data was analyzed using frequency distribution, mean, standard deviation, factor analysis, and results presented in tabular formats. Results indicate that Kenyan Universities interpret IT benchmarking in purely qualitative terms, which is the use of quantifiable parameters as reference points for comparisons. Research findings also reveal that Kenyan Universities mostly adopt external benchmarking but experiment with other approaches on a need basis. User satisfaction and operational parameters are considered most important, whereas financial parameters are least used. Best-practice parameters are used in isolated cases or on a needs basis. Availability of benchmarking peers, data availability, resource constraints, and lack of management support emerged as the leading challenges in the implementation of IT benchmarking. Research findings might have been affected by the limited scope of universities sampled, or limited historical data for reference. More research work is needed to give more insight on the subject of IT benchmarking in Kenyan Universities.

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LIST OF ABBREVIATIONS

BPR-Business Process Reengineering

CPU-Central Processing Power

E Learning-Electronic Learning

ERP-Enterprise Resource Planning

ICT-Information and Communication Technology

ISBSG-International Software Benchmarking Standards Group

IS-Information Systems

ISP-Internet Service Provider

IT-Information Technology

SLA-Service Level Agreement

MIS-Management Information Systems

TQM-Total Quality Management

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CHAPTER ONE: INTRODUCTION

1.1 Background

IT solutions are being used to improve content delivery and enhance student and teacher collaborations. E learning has eliminated the need for classrooms and accelerated market growth for universities to tap (Mugwe, 2010). Integrated information systems enhance efficiency in administrative and faculty processes. Library management systems provide global access to university material. ERP applications allow students and staff to access personal profiles on financials, academics, housing, medical etc. Timely and accurate reports are generated regarding different aspects of the University for Decision-making using IT solutions and made available via portals (University of Nairobi, 2014). Competitive advantage in the sector hinges on technology (Obura, 2012).

With so much expectation resting on the Information Systems function, the question of monitoring, control, measurement, and evaluation emerges. For instance, most Universities require justification in IT investments. IT managers have therefore been forced to compare the spending of their departments with other similar Universities. Measurable and realistic targets for the IT department can be established objectively through comparison with others. Evaluations of performance rely on comparison, whether internal or external (Gordon, 1994). The issue of benchmarking therefore arises. The word benchmark can be interpreted differently but the standard meaning according to the Merriam-Webster online dictionary is, a point of reference from which measurements are made; something that serves as a standard by which others may be measured or judged (Webster Dictionary, 2014).

Information Technology benchmarking compares the performance of one IT service provider with the IT services of other companies. Performance means both efficiency- and effectiveness criteria. The comparison can be carried out within one branch, but also on a cross-industry basis. The objective of IT benchmarking is to identify optimization potentials and extrapolate recommendations how performance could be improved. The benchmark is the so-called “best practice”; this means that the company or its processes provided by the IT service in question which largely meets the defined efficiency- and effectiveness criteria, is the best (Gordon, 1994).

1.1.1 IT Benchmarking

According to research, what is understood by IT benchmarking varies considerably between both different approaches and different practitioners. In his CIMS Working Paper Series 94-08, Gordon (1994) indicates that Information Systems (IS) professionals interpret benchmarking quantitatively. Massaro (1997) studies benchmarking in Australian higher education and notes, "the term is used fairly loosely to cover qualitative comparisons, statistical comparisons with some qualitative assessment of what the statistics mean, and the simple generation of statistical data from a variety of sources which are then published as tables with no attempt at interpretation."

In a paper written for the Association of Commonwealth Universities, Fielden (1997) notes that like most management buzzwords the word benchmarking is widely misunderstood and misused. He attributes the confusion to emergence of the term at the same time with business process re-engineering (BPR) and total quality management (TQM), all of which are geared towards organizational improvement. He attributes further confusion in the USA and Canada to the burgeoning industry of quality awards.

Barton (2006) writes a paper on benchmarking, outsourcing, and evaluation in the IT industry and indicates that benchmarking compares the performance of different organizations. According to him, "It differs from pure Performance Measurement and Evaluation by introducing external comparisons – setting targets based on what has been achieved by other organizations."
Finally, different research indicates that benchmarking is seen to display similarities and differences with other business practices such as total quality management, reengineering, and performance evaluation (CUTS, 2002). This further indicates the disparity that exists regarding how IT benchmarking is understood hence the need for more research and study.

1.1.2 Methodologies Adopted in IT Benchmarking

IT benchmarking is not an exact science and different organizations are seen to use different frameworks to conduct the exercise as indicated by research. However, as much as the approaches and methodologies differ they share a common denominator of comparison with an

established standard. These methodologies focus on whom the comparison is being made against and what activity, process, or event is being compared (Klaus, 2000).

According to the International Software Benchmarking Standards Group (ISBSG) benchmark standard v1.0 draft (2014), benchmarking of software and related activities can take one of the following forms. External benchmarking entails continuously is and comparing the performance of an organization with business leaders anywhere in the world with a view to improve performance; Peer group benchmarking is practiced internally within an organization and is done to compare divisions; Periodic benchmarking involves determining a metric baseline for an organization for purposes of comparison.

On the other hand, Alstete (1996) identifies four categories of benchmarking based on voluntary and proactive participation of universities, and a fifth category (implicit benchmarking) based on pressures within the market because of privately produced competitive data. Internal benchmarking entails performance comparisons being made across departments within the same organization in order to identify best practices without having an external standard. External competitive benchmarking involves comparisons in performance against organizations, which are seen as competitors. External collaborative benchmarking entails comparison with a large number of Universities who are not immediate competitors. External trans-industry (best-in-class) benchmarking seeks comparisons across multiple industries in order to identify new and innovative practices. Implicit benchmarking is an emerging trend initiated by control bodies of institutions such as the governments and funding agencies.

Alstete (1996) further identifies five methodological approaches to benchmarking in his study of benchmarking Universities in the United Kingdom, Europe, Australia, and North America. Ideal type standards (or ‘gold’ standards) involve creating a model to represent ideal best standards and evaluating the extent to which institutions fit into it. Activity based benchmarking entails selection of a set of activities (typical to organizational context) in one institution and comparing the same with another. Vertical benchmarking as a methodology focuses on performance comparison within a defined functional area, for instance the work of customer care. Horizontal benchmarking analyses the performance of single processes that cut across more than one

functional area. This methodology reviews performance of entire processes and practices across functions.

However, the British Quality Foundation fronts six other different types of benchmarking (Types of benchmarking | The British quality foundation, 2014). Strategic benchmarking involves assessing long-term strategies for dealing with change and improving overall business performance. Performance or competitive benchmarking entails analyzing performance aspects in the same sector. Functional benchmarking involves finding innovative ways to improve work processes by comparing with others. Internal benchmarking entails comparisons within the same organization for instance business units in different countries. External benchmarking is about comparisons with other organizations at the leading edge whereas International benchmarking is similar to external benchmarking but analyses global best practitioners. Processes benchmarking focuses on improvement of critical processes by comparing with best practice institutions.

1.1.3 Parameters Considered in IT Benchmarking

Parameters considered in IT benchmarking vary considerably from one organisation to another according to studies made. This is because every organisation is unique and seeks answers to specific challenges. For instance, one organisation might benchmark with an intention of improving investment in IT whereas another might benchmark with an intention of cutting budgetary allocation to the IT function. These two will focus on different parameters for comparison (Klaus, 2002).

According to Gordon (1998), benchmark parameters differ between companies performing metric benchmarking and those interested in best practice benchmarking. Companies doing metric benchmarking are interested in processes that can be measured easily and for which comparison with representative companies are easily available and relevant. Gordon shows examples of common metric benchmarks. Benchmarking for best practice looks for parameters or processes that are semi-stable and repeatable, for instance IT budgeting. Gordon argues that the most important thing is for organizations to identify the most critical success factors and use

them as the basis of identifying processes to benchmark. Xerox Corporation uses ten questions to identify possible areas for best practice benchmarking.

On the other hand, Smallen and Leach (2002) identifies seven IT benchmark parameters in their study of the use of benchmarking in campuses to evaluate efforts in provision of IT services. The first three benchmarks help understand the IT budget and include budget profile, budget support level and budget impact. The next three look into issues of staffing levels that is people supported per IT staff member, computers supported per IT staff member and staffing profile by service area .The last benchmark addresses pervasiveness of IT infrastructure.

In contrast, the Delta Computer Group (n.d.) specifically looks at benchmarking of Service Level Agreements (SLAs) of IT service providers as a critical performance enhancement exercise. Metrics used are primarily financial based. Other metrics used include response time, number of problems resolved, reduction of complaints, and how well the service provider's performance reflected the customer's broader business objectives.

Finally, in his benchmarking study, Barton (2006) further looks at the process of the exercise and mentions common key performance indicators. These include, Software and hardware counts, IT costs (capital expenditure, leases, software licensing, IT contracts, outsourcing and other miscellaneous items such as consumables), SLAs, user satisfaction, utilization levels of IT assets for instance servers and measurement of problem levels. He further avails a map of possible IT areas that can be considered in benchmarking and groups these areas into four categories.
ne category identifies functions whereby benchmarking is well established and includes operation of applications, storage farms, mainframes, Local Area Networks, servers, desktop infrastructure, voice, networks, service desks, office applications, mail and collaboration.

The second category identifies areas where benchmarking is often attempted but with lukewarm results particularly because the units of measure are not clear. Functions in this category include purchasing and finance applications, Customer Relationship Management (CRM), data centre, Wide Areas Network, Windows servers, UNIX servers, supercomputers and network perimeter management.

The third category includes functions where little success has been realized despite attempts being made at benchmarking. Items in this category include IT support in research and development, manufacturing, logistics, sale force automation, IT strategy and management, professional force automation and IT projects. Barton notes that surprisingly functions in this category have the most strategic and competitive impact.

1.1.4 Challenges Faced in IT Benchmarking

Studies conducted indicate that IT benchmarking is an intricate exercise that is dogged by numerous challenges. According to Muschter (1997), the main limitation with benchmarking is the focus on data rather than processes that result in the data. He notes that benchmarking should be used as a guide for improvement and not for statistical precision. Hacket (1997) supports him by claiming that many financial executives are being 'sucked into the number' instead of focusing on the processes that produce the data and looking for ways to adopt those processes in the organization.

Omachonu and Ross (1994) point out that that lack of proper implementation is a major challenge in benchmarking. One example of a potential pitfall of benchmarking is the lack of actively involving employees during the process. These employees will be the ones ultimately using the information and improving the process. They further claim that some organizations experience challenges by treating benchmarking as a one-time project as opposed to a continuous process. A snapshot perspective of issues is misleading.

Another inherent challenge in benchmarking is the inability to confirm where data originated (Benchmarking Challenges, 1997) which can cause errors in comparisons. "For example, an organization may want to compare their headcount in the treasury management process against the benchmarked organization. The benchmarked organization may consider cash management, foreign exchange, and real estate as a part of the treasury."

LNS research identifies top three challenges in benchmarking research (Top 3 Challenges in benchmarking research for industrial operations, 2012). The granularity of benchmarking poses a challenge because issues under consideration are either too specific or too general, for instance

benchmarking very specialized machinery in a specialized industry might pose a challenge and so is benchmarking operational excellence that is understood differently across organizations. Data availability, relevance, and quality are another challenge mentioned by LNS research. The third challenge entails deriving value from the results of benchmarking, which is not as straight forward as recommendations presume.

According to Business performance improvement resource (Benchmarking, what is benchmarking, 2014), a number of issues inhibit organizations from actively getting involved in benchmarking. These include difficulties in finding the right benchmark peers, challenges in data comparison, staff resistance, and inappropriateness of the exercise and resource constraints.

1.1.5 Public and Private Universities in Kenya

Public and private universities in Kenya are increasingly relying on technology to enhance internal processes such as administration, content generation and dissemination, collaborations and data management. Nganga (2012) notes that Kenyan Universities edged out others in the East African Region in the adoption of ICT according to a survey conducted by the research firm CPS international, and sponsored by the Pan African Education Trust. The report showed that ICT has opened up universities in sharing and access of academic materials, research materials, and corporate social responsibilities information.

ICT has become a critical tool, forming the backbone of strategic plans of most universities in Kenya. 'You must have a strategic plan and very specific outcomes. If you look at our strategic plan, there is a whole chapter on ICT. So we know exactly where we need to be every year for the next ten years.' (Olive Mugenda, KU Vice Chancellor). In its strategic plan, JKUAT indicates that it has realized tremendous growth in adoption and utilization of advanced technology. 'The university will embrace and seek modern pedagogical such as e-learning and video conferencing towards achieving its goals under this plan" (JKUAT, 2009).

The higher education sector is increasingly becoming competitive and IT is being used to differentiate among other things. ICT adoption ranking is being used in marketing literature to attract students. CPS International Social and Market Research Regional Director Dann Mwangi

notes that universities that have exhibited higher use of ICT in teaching and general administration tended to attract more international students, local and foreign grants and collaborations with private ICT service providers (Obura, 2012). Webometrics rank universities based on global web presence and its use to enhance knowledge generation and dissemination (Webometrics, 2014).

ICT is being used to solve existing challenges. For instance, with e-learning Kenyan universities are able to solve space challenges and admit more students thereby creating opportunity for growth (Mugwe, 2010). Nairobi University is using integrated systems to streamline data availability, accuracy and timeliness concerning both faculty and students (University of Nairobi, 2014).

With so much expectation resting on ICT and the Information Systems function, the question of governance, control, monitoring, measurement, and evaluation emerges. For example, most Universities require justification in IT investments. IT managers have therefore been forced to compare the spending of their departments with other similar Universities. Measurable and realistic targets for the IT department can be established objectively through comparison with others. Evaluations of performance rely on comparison, whether internal or external (Gordon, 1994). A good understanding of issues pertaining IT benchmarking as a continuous improvement tool is therefore critical for the development of Kenyan universities through the IS department. Research indicates that benchmarking is the most effective continuous improvement program in most organizations (Dew & Nearing, 2004).

1.2 Statement of the Problem

IT benchmarking is a new and emerging concept under the umbrella of organizational improvement. Research conducted indicates lack of a clear understanding of the subject and inconsistencies or gaps in existing knowledge. For instance, studies conducted by different researchers indicate disparity regarding how IT benchmarking is understood. Gordon (1994) indicates that IS professionals interpret IT benchmarking quantitatively but the term is taking new meaning to include qualitative comparison of best practices. Fielden (1997) suggests there is

confusion of the term with other organizational improvement programs such as TQM and BPR in universities. This research was conducted in Europe, America and Australia and Canada. No equivalent study has been done in Kenya Universities to establish how IT benchmarking is understood presenting an opportunity for research.

Researchers in the West have also suggested different approaches and methodologies for executing IT benchmarking. One study categorizes this according to the benchmark peer (Alstete, 1996) whereas another categorizes according to IT processes and activities (The British Quality Foundation, 2014). It is unclear what approaches are used in Kenyan Universities hence the need for research.

Studies indicate different institutions attach varied importance to various IT benchmarking parameters. Smallen and Leach (2006) attach importance to financial parameters whereas Gordon (1994) argues that parameters will depend on management dilemma. Xerox Corporation lists questions that organizations can use to settle on best practice IT benchmark parameters. Studies need to be conducted to establish parameters considered useful in Kenyan Universities.
Research and practicability dictates that different institutions will face varied challenges when executing IT benchmarking. Some studies show that data collection poses the greatest challenge (Muschter, 1997), whereas others indicate organizational challenges such as resistance to change and lack of commitment from management ("Top 3 Challenges in benchmarking research for industrial operations," 2012). No evidence was found to exit to show research on the challenges faced when benchmarking the IT function of Kenyan Universities.

This study set to address the following question about IT benchmarking in the context of Kenya universities: How is IT benchmarking understood in practice? What methodologies and approaches are used to conduct IT benchmarking? Which parameters are considered important? What are the challenges that are experienced in implementation?

1.3 Research Objectives

The objectives of this study are:

a) To establish how IT benchmarking is understood in practice

b) To establish the methodologies that are used when performing IT benchmarking

c) To establish the parameters that are considered when performing IT benchmarking

d) To establish the challenges that are faced when performing IT benchmarking

1.4 Value of the Study

The study findings of this work will be beneficial to researchers and academicians. Little evidence exists to show research pertaining IT benchmarking in Kenyan Universities. This research will therefore bridge the gap and set the basis for further work in this subject. More light will be shed on the issue and insight derived as regards how IT benchmarking is understood, methodologies used, and challenges experienced.

Practitioners in the emerging field of benchmarking can use this study to enhance their practicing knowledge in the specific area of IT benchmarking. Insight on parameters, challenges, and interpretation of IT benchmarking can be used to plan and prepare for effective implementations for clients in Kenyan higher education.

Universities are increasingly relying on technology to enhance effective and efficiency. Knowledge generated in this study can be used to guide benchmarking efforts that result in continuous improvement of IT department and the overall institution. IT consultants can use this study to add to their knowledge base on benchmarking in Kenyan universities and be in a better position to advice on planning for implementation. IT benchmarking is an emerging field with good prospects but still remains a relatively unknown territory. This study will make apparent the effective methodologies used, parameter considered most useful and anticipated challenges and associated workarounds.

The Kenyan government is also a stakeholder due to the push for digital migration in all sectors of the economy. IT benchmarking is seen to be an effective continuous improvement tool. A better understanding of this subject in Kenyan universities can help the government to formulate ICT policies for higher education.

CHAPTER TWO: LITERATURE REVIEW

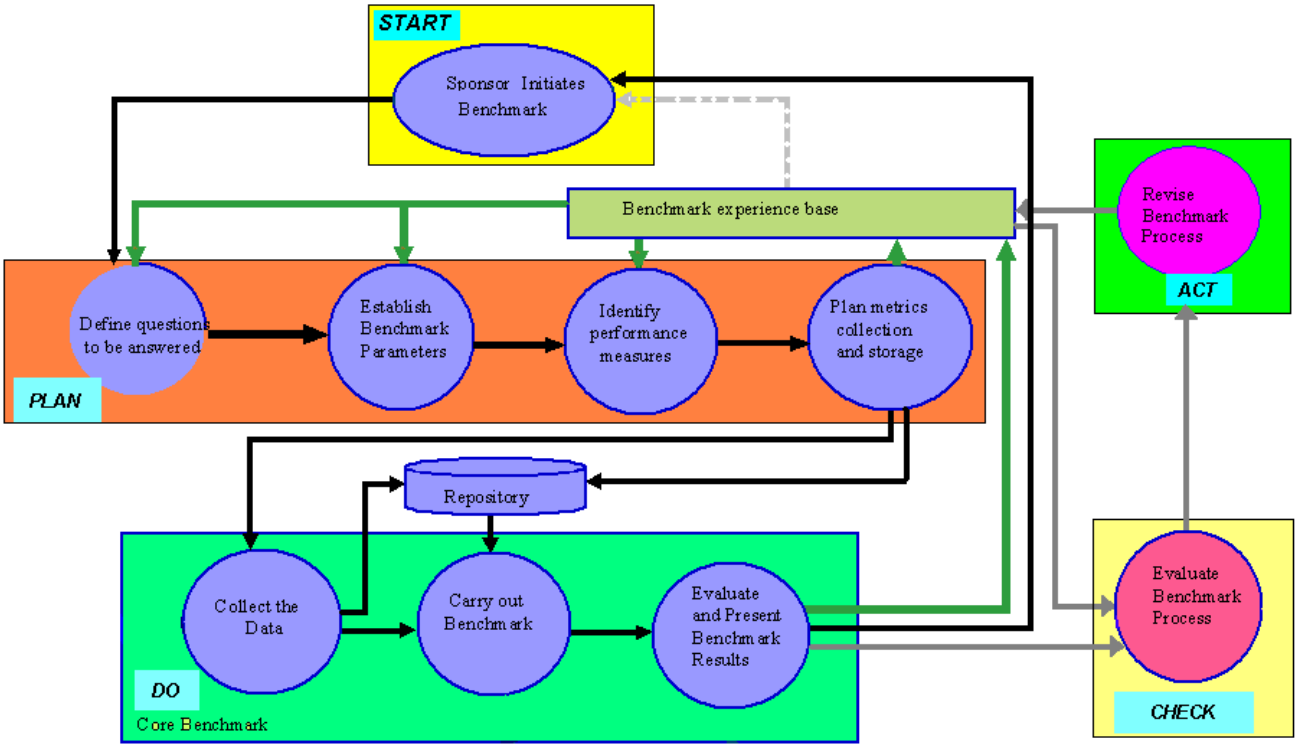
2.1 Introduction

This chapter seeks to examine in detail the available literature and studies that have already been conducted, and which are directly related to the topic under study.

2.2 IT Benchmarking

The International Software Benchmarking Standards Group (ISBSG) Standard V1.0 draft (2014) identifies a process model to illustrate the activities of a benchmark process. This model is based on the Measurement process in ISO/IEC 15939-1:2001. The three activities that are core to the benchmark process are planning the benchmark process, performing the benchmark process and evaluate and presenting the benchmarking results. The other activities sustain iterative the benchmarking process cycle by offering valuable feedback to evaluate results and improve.

Figure 2.1: Benchmark process cycle

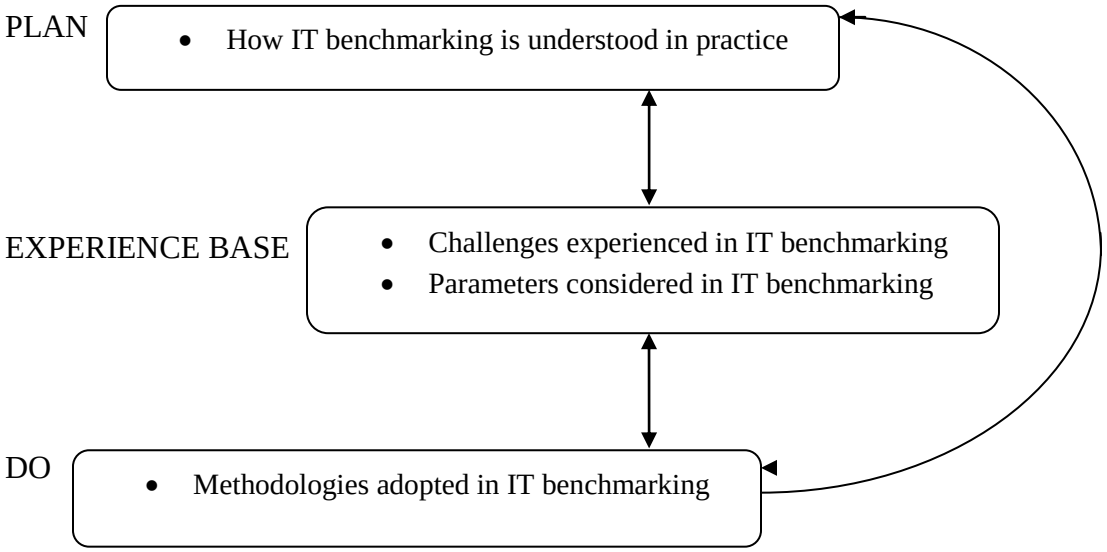


Adopted from ISBSG Standard draft V1.0 (2014)

At the center of the process is the "benchmark experience base" that captures information needs from previous iterative implementations, feedback, and evaluations. These include IT parameters that were found effective for the organization and performance measures. Information products maintained in the experience base are expected to be reused in future iterations (ISBSG, 2014). The process also includes a benchmark repository, which may be incorporated in the experience base or maintained externally by another organization.

Challenges experienced in the IT benchmarking process and parameters found relevant will add to the "experience base" and can be reused in future iterations if found to be factors in this research. Methodologies adopted will add to the "DO" section of the process if found to be a factor and facilitate the core process of IT benchmarking. An understanding of how IT benchmarking is understood as opposed to performance evaluation and measurement will facilitate the planning phase of the benchmarking process if found to be a factor in Kenyan Universities (ISBSG, 2014).

Figure 2.2: Research objectives as factors on the ISBSG benchmark



2.3 Interpretation of IT Benchmarking in Practice

According to research, what is understood by IT benchmarking varies considerably between both different approaches and different practitioners. In a paper written for the Association of Commonwealth Universities, Fielden (1997) notes that like most management buzzwords the word benchmarking is widely misunderstood and misused. He attributes the confusion to emergence of the term at the same time with business process re-engineering and total quality management all of which are geared towards organizational improvement. He attributes further confusion in the USA and Canada to the burgeoning industry of quality awards.

2.3.1 IT Benchmarking and TQM

TQM consists of three broad ideas. First is continuous liaison with input suppliers to ensure quality standard is maintained. The second area entails an ongoing analysis of work processes to improve functionality and reduce process variations. The third idea involves maintaining an efficient feedback mechanism with customers to ensure their quality expectation is met (CUTS, 2002).

Either TQM can be project-oriented or consultant oriented. The former involves staff in the process and factors their needs whereas the latter entails establishing a separate body to oversee quality control and improvement. In general, TQM occurs from within the organization and utilizes internal methods and ideas of staff. In contrast, benchmarking entails comparing one's company with another (CUTS, 2002).

2.3.2 IT Benchmarking and Reengineering

According to Hammer and Champy (1993), reengineering is "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in contemporary measures of performance, such as cost, quality, service, and speed" while reengineering is drastic and encourages employees to shake off traditional ways of doing things, it is still and internal process. It does not entail comparison of one's organization with another. Benchmarking usually improves on existing processes in as much as it may yield completely new ideas like reengineering. Organizations usually follow up reengineering with TQM.

2.3.3 IT Benchmarking and Performance Measurement

Barton (2006) writes a paper on benchmarking, outsourcing, and evaluation in the IT industry and indicates that benchmarking compares the performance of different organizations. According to him, this can be done for the benefit of line management for instance, performance appraisal or to justify investments in IT. "It differs from pure Performance Measurement and Evaluation by introducing external comparisons – setting targets based on what has been achieved by other organizations."

Performance measurement is used to monitor and provide quantitative and qualitative feedback on such parameters like quality, timeliness, effectiveness, throughput, and efficiency. Benchmarking uses data output from performance measurement as the basis of comparison of one's company against the other with a view to improving processes. Performance measurement is a prerequisite to benchmarking but the two are not the same (CUTS, 2002).

2.3.4 IT Benchmarking and Statistical Data Collection

In a recent short article for the HEFCE, Fielden (1997) notes that in higher education many people confuse benchmarking "with collecting statistics or performance indicators and complain about the poor cost-benefit of data collection exercises". Benchmarking demands that data must be capable of meaningful comparison; the mere collection of statistics is not enough.

On the other hand, Massaro (1997) studies benchmarking in Australian higher education and notes "the term is used fairly loosely to cover qualitative comparisons, statistical comparisons with some qualitative assessment of what the statistics mean, and the simple generation of statistical data from a variety of sources which are then published as tables with no attempt at interpretation."

Unlike statistical data collection, benchmarking will not be effective if it simply takes a snapshot of a comparative situation. It needs to be an on-going, systematic process for measuring and comparing the work processes of one organization with those of another by bringing an external focus on internal activities (Commonwealth Higher Education Management Service, 1998).

2.3.5 Metric and Best-practice IT Benchmarking

"Benchmarking is the process of continuously comparing and measuring an organization with business leaders anywhere in the world to gain information, which will help the organization take action to improve its performance" (American Productivity and Quality Center, 1993).
Metric benchmarking does this by comparing aspects of IT that can easily be measured in quantitative terms such as utilization ratios of IT resources whereas best practice benchmarking is aimed at identifying best methods of performing common IT tasks such as IT security policy. Metric approach compares closely to statistical data collection but introduces the aspect of comparison with a standard or peer.

Gordon (1994) indicates that Information Systems professionals interpret benchmarking quantitatively. He states that as the term "benchmarking" gained popularity among the general business community, many IS professionals began to wonder if non-IS professionals defined the term the same way, and if not, whether and how IS professional should react to the new meaning. Most of this confusion was caused by the fact that in the popular press "benchmarking" retained two meanings. One, commonly called metric benchmarking, is indeed what IS professionals have been used to. Metric benchmarking is the use of quantitative measures as reference points for comparison against prior experience, industry norms, or best-in-class organizations. The other meaning, commonly called best practice benchmarking, is the identification, and potentially the adoption, of best practices or techniques for performing common tasks.

2.4 Approaches Used in IT Benchmarking

IT benchmarking is not an exact science and different organizations are seen to use different frameworks to conduct the exercise (Kozak, 2004). However, as much as the approaches and methodologies differ they share a common denominator of comparison. Research shows they focus on whom the comparison is being made against and what activity, process, or event is being compared. InfoNet (2012) identifies two major approaches; metric (sometimes referred to as 'performance') and process. According to Tuominen (1997), different types of benchmarking can be identified based on what is being compared. Four types can be identified among the commonly used benchmarking applications. These are strategic, performance, process, and competence benchmarking.

2.4.1 Internal Benchmarking

Comparisons are made of the performance of different departments, campuses, or sites within a university in order to identify best practice in the institution, without necessarily having an external standard against which to compare the results. This type may be particularly appropriate to universities where a high degree of devolvement exists to the constituent parts of the institution, where a multi-campus environment exists, or where extensive franchise arrangements exist whereby a number of partner colleges in different locations teach standard programmes (Alstete, 1996).

2.4.2 External Competitive Benchmarking

Comparison of performance in key areas is based upon information from institutions, which are seen as competitors. Although initiatives of this kind may be potentially very valuable, and have a high level of 'face' validity amongst decision makers, the process may be fraught with difficulty and is usually mediated by neutral facilitators in order to ensure that confidentiality of data is maintained (Gordon, 1994).

2.4.3. External Collaborative Benchmarking

This involves comparisons with a larger group of institutions who are not immediate competitors. The methodology is usually relatively open and collaborative. Such schemes may be run by the institutions themselves on a collective basis, although in other cases a central agency or consultant may administer the scheme in order to ensure continuity and sufficient momentum (Kroos, 1996).

2.4.4. External Trans-industry Benchmarking

This seeks to look across multiple industries in search of new and innovative practices, no matter what their source. Amongst some practitioners, this is perceived to be the most desirable form of benchmarking because it can lead to major improvements in performance, and has been described by NACUBO (North American Colleges and Universities Business Officers) as "the ultimate goal of the benchmarking process". In practice, it may be extremely difficult to operationalize the results of such cross-industry comparisons, and may require a very high level

of institutional commitment to cope with the inevitable ambiguities that will result. Outside the USA little use of this approach is reported within higher education and it may be that some universities will wish to participate in inter-university benchmarking before considering this more ambitious approach (Kozak, 2004).

2.4.5 Implicit Benchmarking

This caters for situations where the initiative for some variant of benchmarking within higher education results from the market pressures of privately produced data, from central funding, or from co-coordinating agencies within individual systems. In such cases, a strong process focus may be difficult to achieve, and an analysis of relevant outputs may be all that can be achieved (Alstete, 1996).

2.5 Parameters Considered in IT Benchmarking

According to research, parameters considered in IT benchmarking vary considerably from one organisation to another. This is because every organisation is unique and seeks answers to specific challenges. For instance, one organisation might benchmark with an intention of improving investment in IT whereas another might benchmark with an intention of cutting budgetary allocation to the IT function. To one institution, a high IT budget might imply recognition of technology as a competitive tool whereas to another it might mean inefficiencies in the IT function.

2.5.1 Quantitative-based IT Benchmarking Parameters

According to Gordon (1998), benchmark parameters differ between companies performing metric benchmarking and those interested in best practice benchmarking. Companies doing metric benchmarking are interested in processes that can be measured easily and for which comparison with representative companies are easily available and relevant. Figure 2.1 shows common metric-based IT benchmarking parameters.

Figure 2.3 Examples of Common Metric Benchmarks

Process	**Benchmarks**
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Communications	Percentage of cost for telecommunication
	LAN contention in peak periods
	WAN cost per packet, per byte, and per message
Customer Satisfaction	Overall satisfaction of users/managers with info svcs
	User satisfaction with contacts with IS organization
	User satisfaction with response to problems
	Manager satisfaction with cost & speed of development
Financial	IT expense as a percent of revenue
	IT investment as a percent of assets
	Total system cost
	Average cost per job
	Average cost per input screen
	Average cost per report produced
Help Desk	Percentage of problems solved by 1st contact
	Average time to problem solution
	Number of problems handled per FTE
	Number of problems handled
Operations	Availability (% of time)
	Mean time between failure
	CPU Usage (% of capacity)
	Disk Usage (% of capacity)
	Average MIPS
	Number of jobs handled

Quality Assurance	Defects found per 1000 lines of code
	Percentage of erroneous keystrokes on data entry
Staffing	Percentage of professional staff with college degree
	Payroll as percent of IS budget
	Percentage of staff with advanced degrees
System Development	Projects completed in period
	Avg function points per employee per period
	Lines of code per employee per period
	Fraction of projects done on time & on budget
Technology	Percent of IS expense in R&D
	Percent of employees having a workstation
Training	Courses taken per IS employee per year
	Average courses taken per IS employee
	Average IS courses taken per non-IS employee

Adopted from "Benchmarking the Information Systems function" by Steven Gordon, 1994.

Smallen and Leach (2002) identifies seven IT benchmark parameters in their study of the use of benchmarking in campuses to evaluate efforts in provision of IT services. The first three benchmarks help understand the IT budget and include budget profile, budget support level and budget impact. Budget profile evaluates how financial resources are allocated across major IT budget classifications such as software, student wages, equipment, and so forth. Differences between institutions indicate different emphasis for different management of IT resources or IT deployment. Budget support level attempts to improve comparison by normalizing for institutional size. The number of people supported divides the total budget for IT. Budget impact is the ratio of total IT budget to total institutional budget. This benchmark parameter is a measure of the perceived impact of technology on the long-term development of an institution.

According to Smallen and Leach, the next three look into issues of staffing levels, which is people supported per IT staff member, computers supported per IT staff member, and staffing profile by service area. People supported per IT staff member provide a benchmark for the level of IT service delivery. Insight is derived pertaining how an institution is dependent on efficiencies of technology. Computer supported per IT staff member benchmark relates the total number of computers on campus to the total number of IT support staff. Support needs are seen to differ from one institution to another. Staffing profile per service areas indicates how staff members are distributed among core services. The decentralized nature of technology on campus environments has resulted in a variety of support models. Comparisons across institutions may help identify efficiency or creativity in delivering a particular service.

The last benchmark addresses pervasiveness of IT infrastructure. Computer availability parameter measures institutional investment in infrastructure particularly those of laptop and desktop computers. This is the ratio of campus computers to total institutional computers and gives insight into availability of computing resources.

2.5.2 Best Practice IT Benchmarking Parameters

Benchmarking for best practice looks for parameters or processes that are semi-stable and repeatable, for instance IT budgeting. Gordon (1994) argues that the most important thing is for organizations to identify the most critical success factors and use them as the basis of identifying processes to benchmark. Figure 2.4 indicates the ten questions used by Xerox Corporation to identify possible areas for best practice benchmarking.

Figure 2.4: **Xerox's Questions to Identify Processes for Best Practice Benchmarking**

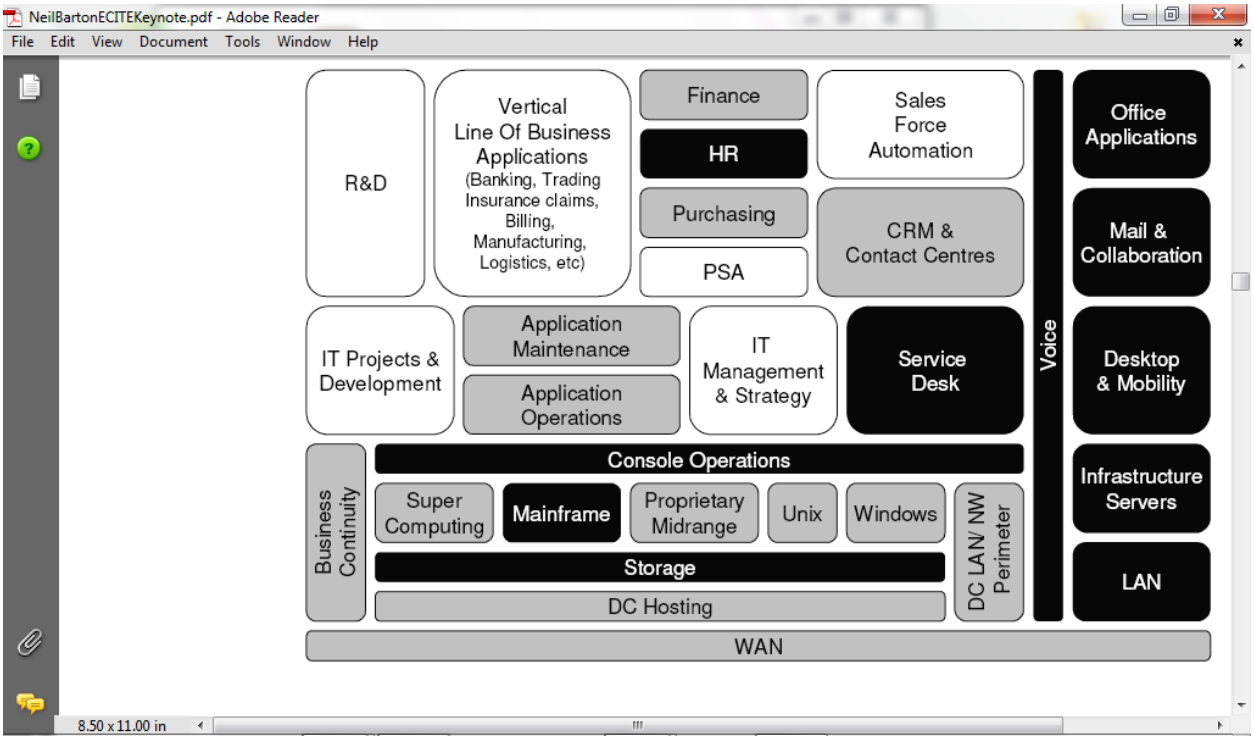
What is the most critical factor to the function /organization's success (e.g., customer satisfaction, expense to revenue ratio, and return on asset performance)?
What factors are causing the most trouble (e.g., not performing to expectations.)?
What products or services are provided to customers?
What factors account for customer satisfaction?

What specific problems (operational) have been identified in the organization?
Where are the competitive pressures being felt in the organization?
What are the major costs (or cost "drivers") in the organization?
Which functions represent the highest percentage of cost?
Which functions have the greatest room for improvement?
Which functions have the greatest effect (or potential) for differentiating the organization from competitors in the marketplace?

Source: Michael J. Spendolini, The Benchmarking Book (NY: American Management Association, 1992): 71.

On the other hand, Barton (2006) compiles IT benchmarking parameters into a benchmark map that categorizes these according to ease of data collection, analysis and comparison.

Figure 2.5: Benchmark Map



Source: Barton, N. (2006). Benchmarking, Outsourcing, and Evaluation In The IT Industry.

The dark areas represent functions where benchmarking is well established due to industry consensus on validity of such comparisons. These include voice networks, operation of HR applications, storage farms, mainframes, desktop infrastructure, servers, office application, mail and collaboration, service desk and Local Area Network.

The grey functions represent areas where parameters allow for frequent benchmarking, but is not very fruitful. This is primarily due to lack of consensus on how to measure the parameter or that the cost driver of the function is not understood clearly. These include purchasing and finance applications, Customer Relationship Management (CRM), applications operation, Wide Area Network, network perimeter management, Unix servers, Windows servers, business continuity, application maintenance, contact center technology and data center.

The white functions represent areas where IT benchmarking has been achieved with minimal success rates if any. These include IT for Research and Development (R&D), professional service automation, sales force automation, IT management and Strategy, IT projects and development, and vertically oriented business applications found in manufacturing, trading, insurance, and banking. Barton notes that IT parameters that are most difficult to benchmark have the biggest strategic impact whereas those that are easiest to benchmark rarely offer any competitive differentiation.

2.6 Challenges Faced in IT Benchmarking

Studies conducted indicate that IT benchmarking is an intricate exercise that is dogged by numerous challenges, which range from conceptualization challenges, planning, execution, and implementation of recommendations derived from the process. George and Cassell (2001) states that most companies refrain from conduction benchmarking due to lack of time and resources. This is confirmed by Henczel (2002) who notes that ‘benchmarking requires a significant commitment of resources such as time, people, and money without any guarantee of a cost benefit.’ Other limitation also was the difficulty in finding partners (Holloway et al., 1999), the misunderstanding of the need to benchmark and the concept of benchmarking, failure to link benchmarking to competitive priorities and difficulty to benchmark untenable factor such as skills and services (Freytag and Hollensen, 2001).

LNS research identifies top three challenges in benchmarking research ("Top 3 Challenges in benchmarking research for industrial operations," 2012). The granularity of benchmarking poses a challenge because issues under consideration are either too specific or too general, for instance benchmarking very specialized machinery in a specialized industry might pose a challenge and so is benchmarking operational excellence that is understood differently across organizations. Data availability, relevance, and quality are another challenge mentioned by LNS research. The third challenge entails deriving value from the results of benchmarking, which is not as straight forward as recommendations presume.

According to Business performance improvement resource ("Benchmarking, what is benchmarking" 2014), a number of issues inhibit organizations from actively getting involved in benchmarking. These include difficulties in finding the right benchmark peers, challenges in data comparison, staff resistance, and inappropriateness of the exercise and resource constraints.
According to Muschter (1997), the main limitation with benchmarking is the focus on data rather than processes that result in the data. He notes that benchmarking should be used as a guide for improvement and not for statistical precision. Hacket (1997) supports him by claiming that many financial executives are being 'sucked into the number' instead of focusing on the processes that produce the data and looking for ways to adopt those processes in the organization.

Omachonu and Ross (1994) point out that that lack of proper implementation is a major challenge in benchmarking. One example of a potential pitfall of benchmarking is the lack of actively involving employees during the process. These employees will be the ones ultimately using the information and improving the process. They further claim that some organizations experience challenges by treating benchmarking as a one-time project as opposed to a continuous process. A snapshot perspective of issues is misleading.

Another inherent challenge in benchmarking is the inability to confirm where data originated ("Benchmarking Challenges," 1997) which can cause errors in comparisons. "For example, an organization may want to compare their headcount in the treasury management process against

the benchmarked organization. The benchmarked organization may consider cash management, foreign exchange, and real estate as a part of the treasury."

Keehley and Abercrombie (2008) identify six challenges that are likely to derail the process of benchmarking. They claim that benchmarking is a complex exercise that requires a lot of effort and commitment for success, and is time consuming and expensive. Competitive sensitivity prevents free flow of information, which hinders objective comparisons. Differences in organizational culture, strategy, size, and model also hinder benchmark comparisons. Downsides also occur in trying to implement best practices derived from the exercise.

Nayab (2010) also conducts research on benchmarking and identifies challenges inherent in the process. According to her, the major limitation of benchmarking is that there is no way of measuring the effectiveness of parameters used. Benchmarking discovers the standards attained by competitors but does not consider the circumstances under which the standards were arrived at. Another challenge is the danger of complacency and arrogance. Many organizations tends to reduce efforts after achieving standards met by the best-in-class. The realization of becoming the best tends to inhibit further developments and overall improvement efforts. Finally, Nayab indicates that another challenge involves undertaking benchmarking as a one-off initiative. True improvement is a continuous process, which should be accompanied by a plan to change.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the strategy, which was used to conduct the research. The chapter contains the research design, study population, sampling techniques, data collection methods, and methods of data analysis.

3.2 Research Design

This study applied descriptive survey. A descriptive survey was used to provide a picture of the situation in its natural setup. The practice of IT benchmarking takes place in the work environment. Therefore, objective conclusions could only be derived by collecting data from IT staff respondents in their places of work.

3.3 Population

The target population was Public and Private Universities in Kenya. The population size was 39 and was obtained from the Commissioner of University Education website (http://www.cue.or.ke/services/accreditation/status-of-universities). **Appendix I** lists Public and Private Chartered Universities in Kenya.

3.4 Sample and Sampling Technique

According to Cooper and Schindler (2006) sampling refers to the collection of respondents who represent the target population in a study. Gordon (1994) notes that organizations searching for benchmarking partners most commonly consider those that have received special awards, citations, or media attention; those referred to or cited by professional associations and independent reports; and those recommended by other professionals, associates and consultants. Even though recipients of these awards have not been judged exclusively on their information systems, there IS processes likely reflect the organizational focus on quality, increasing chances that they would be good partners for benchmarking.

In view of this, six public and private universities in Kenya were chosen. Cases chosen were comparable in many organizational aspects, which was key for successful IT benchmarking. For instance, they are ranked in Kenya by Webometrics (Webometrics, 2014.), they receive performance related media mentions and awards; they comply with leading quality standards for instance ISO and are comparable in size, student and faculty population. These institutions face similar information technology needs and provide more or less of the same IT services in addition to displaying a similar degree of organizational structure and management complexity.

3.5 Data Collection

Primary data was collected using questionnaires. The questionnaire had four sections. Section A captured demographic information of respondents. Section B covered how IT benchmarking is understood in practice. Section C enquired on the methodologies used to perform IT benchmarking. Section D looked at parameters considered in IT benchmarking whereas Section E concerned challenges faced in performing IT benchmarking.

The questionnaire that was used for this research is provided in **Appendix II**. The questionnaires were delivered to respondents using "drop and pick later". A minimum of eight respondents who are employees of each University were targeted. These were composed of personnel from the IT department's divisions such as Management Information Systems (MIS), Support and call center, IT management and leadership, Data center, network/infrastructure, security, quality assurance etc. depending on the functional structure.

3.6 Data Analysis

Completed questionnaires were checked for completeness and data cleaned before classification. Data collected with the questionnaire on demographics and how IT benchmarking is understood in practice was analyzed using frequency and standard deviation. Data collected regarding IT benchmarking parameters and approaches used was analyzed using mean and standard deviation whereas data collected concerning challenges faced during implementation of IT benchmarking was analyzed using factor analysis.

CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter deals with analysis of the data, interpretation, and discussion of the research findings. The chapter broadly covers general information about respondents, how IT benchmarking is understood in practice, methodologies used in performing IT benchmarking, and challenges faced in implementation of IT benchmarking. Twenty-eight out-of 30 respondents gave feedback on the questionnaires; therefore, the response rate was 93%.

4.2. General Information

General information section covered the demographics of respondents. Gender, age, job experience, and IT division of respondents were analyzed.

4.2.1 Gender

Responses were sought on gender. They were analyzed and the results were summarized in Table 4.1.

Table 4.1 Gender of Respondents

Gender	Frequency	Frequency (%)
Male	24	86
Female	4	14

Data in Table 4.1 show that 86% of respondents were male and 14% female. This indicates that though gender was represented in the respondents, there was a disparity

4.2.2 Age

Feedback was sought on age and the results of analysis are summarized in Table 4.2.

Table 4.2 Ages of Respondents

Age Bracket (yrs)	Frequency	Frequency (%)
18-25	4	14
26-30	10	36
31-35	7	25
36-40	3	11
46-50	1	3

Data in Table 4.2 shows that most of the respondent's age fell between 26 and 35 years. Low representation was noted for professionals between 18-25, and 46-50 years.

4.2.3 Experience

Response was collected on experience. They were analyzed and the results summarized in Table 4.3.

Table 4.3 Job Experience of Respondents

Experience (yrs)	Frequency	Frequency (%)
0 to 5	10	36
5 to 10	9	32
15 to 20	4	14
Above 20	5	18

Data in Table 4.3 shows that most respondents had a job experience lying between 1 to 10 years. Representation for youth is high compared to experienced respondents.

4.2.4 Divisions of Respondents

Response was sought on IT divisions. They were analyzed and the results were summarized in Table 4.4.

Table 4.4 IT Divisions of Respondents

IT Division	Frequency	Frequency (%)
MIS and Database	10	36
Network and Infrastructure	8	29
Management	5	18
Security	2	7
Others	3	10

Data in Table 4.4 shows that four IT divisions were represented in this study with MIS and Database divisions having the highest representation, and security the least. Three respondents belonged to an IT division other than the ones provided for in the questionnaire.

4.3 How IT Benchmarking is Understood in Practice

Response was sought on how IT benchmarking is understood in practice by Kenyan Universities. Responses were on a Likert scale where: **1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.** The means and standard deviations were computed and the results summarized in Table 4.5.

Table 4.5 Qualitative and Quantitative Definition

Benchmark Parameters	1	2	3	4	5	Mean	SD
Quantitative interpretation (metric-based IT benchmarking)	0	2	3	20	3	3.86	0.69
Qualitative interpretation (best-practice based IT benchmarking)	2	2	15	5	4	3.25	1.02
Both quantitative and qualitative interpretation	4	9	8	3	4	2.79	1.24
Others (specify):							

Data in Table 4.5 indicates a mean of 3.86 on quantitative interpretation of IT benchmarking. This is nearer to 4 in the likert scale which indicates that respondents agree with this interpretation.

Response on IT benchmarking versus performance improvement was sought. Responses were on a Likert scale where: **1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.** The means and standard deviations were computed and the results summarized in Table 4.6.

Table 4.6 Performance Improvement Definition

Performance Improvement Programs	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Total Quality Management	5	6	8	6	3	2.86	1.25
Performance Evaluation	4	6	5	8	5	3.14	1.33
Business Process Reengineering	20	1	5	2	0	1.61	1.01
Statistical data collection	9	8	6	5	0	2.25	1.09

Data in Table 4.6 indicates TQM had a mean of 2.86. On the likert scale, this is nearer to 3 which indicates neutral response. The same case applies to Performance evaluation, which has a mean of 3. BPR has a mean of 1.61, which is nearer to 2 on the likert scale and indicates disagreement.

4.4 IT Benchmarking Approaches

Response was sought on the approaches and methodologies used to conduct IT benchmarking in Kenyan Universities. Responses were on a Likert scale where: **1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.** The means and standard deviations were computed and the results summarized in Table 4.7.

Table 4.7 Methodologies of Practice

IT Benchmarking Types	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Periodic IT benchmarking	15	5	4	4	0	1.89	1.11

Internal IT benchmarking	2	9	10	5	2	2.86	1.03
External IT benchmarking	1	1	3	20	3	3.82	0.8
Activity-based IT benchmarking	5	15	4	3	1	2.29	0.99
Strategic IT benchmarking	1	14	10	2	1	2.57	0.82
Performance IT benchmarking	13	10	2	2	1	1.86	1.06
Competence IT benchmarking	12	9	5	1	0	1.81	0.86
Competitive IT benchmarking	1	12	11	3	1	2.68	0.85
International IT benchmarking	4	7	6	3	8	3.14	1.43
Best-in-class IT benchmarking	5	9	8	4	2	2.61	1.14
Others, specify:							

Data in Table 4.7 indicates that the highest mean was 3.82 and the lowest mean was 1.8. External benchmarking had the highest mean, whereas competence benchmarking had the least.

4.5 IT Benchmarking Parameters

Response was sought on the parameters considered when performing IT benchmarking in Kenyan Universities. Responses were on a Likert scale where: **1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.** The means and standard deviations were computed and the results summarized in Table 4.8.

Table 4.8 Financial Parameters

FINANCIAL PARAMETERS							
IT Benchmark Parameter	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
IT budget profile	14	4	5	4	1	2.07	1.25
IT contracts and outsourcing	2	2	15	6	3	3.21	0.97

Software licensing costs	7	6	12	2	1	2.43	1.05
Infrastructure investment (network, data center, end user etc)	6	7	11	3	1	2.5	1.05
IT staff remuneration	1	4	5	14	4	3.57	1.02
Bandwidth costs	2	8	9	7	2	2.96	1.05
Training costs	15	10	3	10	0	2.21	1.22
IT consumables	10	15	2	1	0	1.79	0.72
IT financial policy	9	8	7	3	1	2.25	1.12
Financial innovations through IT	20	5	1	1	1	1.5	0.98
Telecommunication costs	8	7	10	2	1	2.32	1.07
Systems implementation costs	5	8	9	4	2	2.64	1.14

Data in Table 4.8 shows that the highest mean is 3.57 and the lowest is 1.5. IT staff remuneration has the highest mean and financial innovation through IT the lowest.

Table 4.9 Operational Parameters

OPERATIONAL PARAMETERS							
IT Benchmark Parameter (KPI)	**Extend of Parameter usage**						
Communications	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Percentage of cost for telecommunication	10	5	5	3	1	2.17	1.21
LAN contention in peak periods	11	6	4	4	3	2.36	1.39
WAN cost per packet, per byte, and per message	13	3	7	5	3	2.42	1.41
Customer Satisfaction							
Overall satisfaction of users/managers with information services	2	6	5	5	15	3.76	1.35

User satisfaction with contacts with IS department	1	2	14	4	7	3.5	1.05
User satisfaction with response to problems	1	2	5	12	8	3.86	1.03
Manager satisfaction with cost & speed of development	5	7	8	4	4	2.82	1.28
Help Desk							
Percentage of problems solved by 1st contact	1	1	14	10	2	3.4	0.82
Average time to problem solution	1	5	11	10	1	3.18	0.89
Number of problems handled per FTE	6	12	7	3	1	2.34	1.03
Number of problems handled	3	1	13	7	4	3.29	1.1
Operations							
Availability (% of time)	2	2	2	17	6	3.79	1.06
Mean time between failure	1	7	13	6	1	2.96	0.87
CPU Usage (% of capacity)	1	13	12	1	1	2.57	0.78
Disk Usage (% of capacity)	1	2	13	12	0	3.29	0.75
Average MIPS	1	11	14	1	1	2.64	0.77
Number of jobs handled	6	15	3	1	3	2.29	1.16
Quality Assurance							
Defects found per 1000 lines of code	0	1	14	12	1	3.46	0.63
Percentage of erroneous keystrokes on data entry	2	11	12	1	1	2.56	0.83
Staffing							
Percentage of professional staff with college degree	1	1	1	11	14	4.29	0.96
Payroll as percent of IS budget	1	1	2	4	20	4.46	1.02
Percentage of staff with advanced	1	1	5	10	11	4.04	1.02

degrees							
System Development							
Projects completed in period	1	1	3	8	15	4.25	1.02
Average function points per employee per period	2	14	11	1	1	2.48	0.81
Lines of code per employee per period	13	10	5	0	0	1.71	0.75
Fraction of projects done on time & on budget	1	2	16	5	4	3.32	0.93
Technology							
Percent of IS expense in R&D	5	9	11	1	2	2.82	1.2
Percent of employees having a workstation	1	1	12	11	3	3.5	0.87
Training							
Courses taken per IS employee per year	2	4	11	9	2	3.18	1
Average courses taken per IS employee	4	7	6	7	4	3	1.28
Average IS courses taken per non-IS employee	5	13	5	4	1	2.39	1.05

Data in Tables 4.9 indicates that the highest means is 4.46 and the lowest is 1.71. Operations parameters posted the highest means and lines of code per employee the lowest.

Table 4.10 Best Practice Parameters

BEST PRACTICE PARAMETERS							
IT Benchmark Parameter (KPI)	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
IT strategy, management and policy formulation	2	2	9	11	4	3.46	1.05
IT Customer service	2	2	12	6	6	3.43	1.12

IT governance	9	14	3	1	1	1.96	0.94
IT acquisition practices	2	13	9	2	2	2.61	0.98
IT contribution to competitive edge	4	8	8	7	1	2.75	1.09
IT security, audit and control	4	6	10	4	4	2.93	1.22
IT staffing practices	1	1	19	4	3	3.25	0.83
IT support in R&D	15	6	3	1	3	1.96	1.32
IT projects	2	6	8	9	3	3.18	1.1
Others (specify)							

Results in Table 4.10 shows that the highest means is 3.46 and the lowest is 1.96. IT strategy, management, and policy formulation parameter had the highest mean. The lowest mean was shared by IT governance and IT support in R&D.

4.6 IT Benchmarking Challenges

Response was sought on the challenges encountered when performing IT benchmarking in Kenyan Universities. Responses were on a Likert scale where: **1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.** The means and standard deviations were computed and the results summarized in Table 4.11.

Table 4.11 Benchmarking Setbacks

Challenges in IT Benchmarking	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Data availability, relevance and quality	0	2	2	20	4	3.93	0.7
Measurement and comparison challenges due to organizational differences	1	4	15	6	2	3.14	0.87
Measurement of benchmarking success rate	5	9	8	4	2	2.61	1.14
Staff resistance to benchmarking	1	2	14	8	3	3.36	0.89

Focusing on data rather than processes	11	9	5	2	1	2.04	1.09
Loss of focus on customers and employees	15	4	5	2	2	2	1.28
Lack of management support	2	6	13	5	2	2.96	0.98
Application of benchmarking recommendations	1	2	12	6	7	3.57	1.05
Resource constraints	1	2	5	11	9	3.89	1.05
Inappropriateness of benchmarking	1	10	8	7	2	2.96	1.02
Misconception of benchmarking	0	3	9	8	7	3.7	0.97
Challenges in selection of benchmark peer organization	0	0	7	10	11	4.14	0.79
Others (specify)							

Data in Table 4.11 shows that the highest mean is 4.14 and the lowest is 2. Selection of benchmark peer was the biggest challenge and loss of focus on customers and employees the lowest.

4.6.1 Factor Analysis (Communalities)

Responses collected were further subjected to factor analysis. Factor analysis reduces data into key information by seeking unobservable (latent) variables that are reflected in the observed variables (manifest variables). Communality is the proportion of variance that each item has in common with other items. The proportion of variance that is unique to each item is then the respective item's total variance minus the communality. The extraction method was the principle component analysis. Communalities are shown in the Table 4.12.

Table 4.12: Communalities

	Initial	Extraction
Data quality	1.000	.720

Data comparison	1.000	.986
Success measurement	1.000	.997
Staff resistance	1.000	.939
Data focus	1.000	.975
Customer focus	1.000	.846
Management support	1.000	.999
Recommendations actioning	1.000	.989
Resource constraints	1.000	.992
Benchmarking inappropriateness	1.000	.996
Benchmarking misconception	1.000	.995
Peer selection	1.000	.997

Extraction Method: Principal Component Analysis

4.6.2 Factor Extraction (Total Variance)

In the case of IT benchmarking challenges, principle analysis component was used to extract 12 factors. Eigen values indicate the relative importance of each factor accounting for a particular set and hence those with small Eigen values were omitted. As depicted on Table 4.13, only three factors were significant for the analysis.

Table 4.13: Factor Extraction

Total Variance Explained

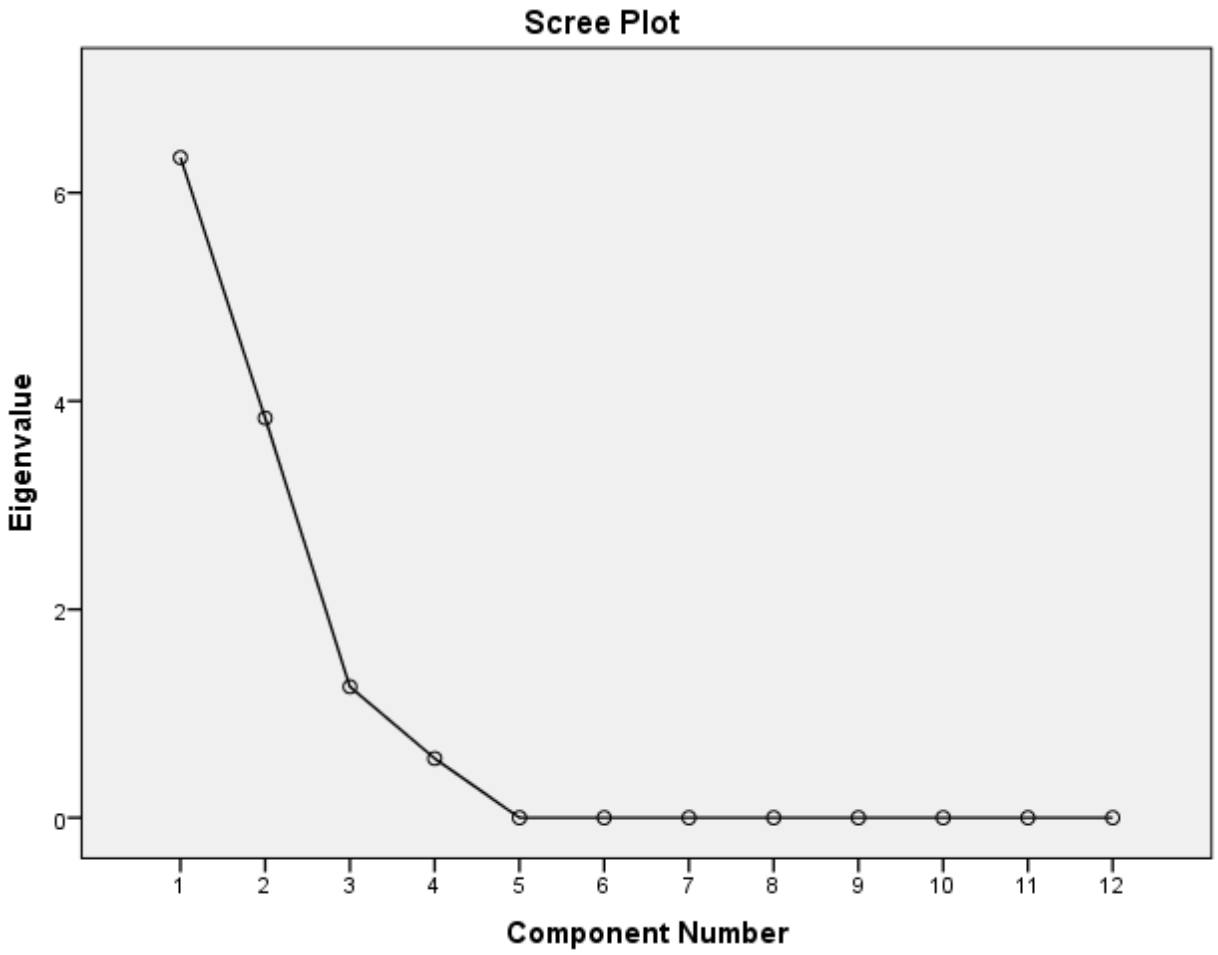
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.338	52.815	52.815	6.338	52.815	52.815	4.855	40.455	40.455
2	3.837	31.971	84.787	3.837	31.971	84.787	4.283	35.688	76.143
3	1.257	10.474	95.260	1.257	10.474	95.260	2.294	19.117	95.260
4	.569	4.740	100.000						
5	3.547E-016	2.956E-015	100.000						
6	1.892E-016	1.577E-015	100.000						
7	1.365E-016	1.138E-015	100.000						
8	6.458E-017	5.381E-016	100.000						
9	-7.233E-017	-6.028E-016	100.000						
10	-8.148E-017	-6.790E-016	100.000						
11	-1.728E-016	-1.440E-015	100.000						
12	-3.054E-016	-2.545E-015	100.000						

Extraction Method: Principal Component Analysis

4.6.3 Scree Plot

The Scree plot is a plot of the factor Eigen value against the component numbers. According to the Scree plot on Table 4.14, the curve tends to flatten from the fourth component onwards, due to relatively low Eigen values.

Table 4.14: Scree Plot



4.6.4 Component Matrix

Component matrix contains the relative Eigen values in respect of each factor. Each factor belongs to one of the set of factors extracted and is determined by the Eigen values of the factors relative to each set. Table 4.15 shows which set each factor falls into.

Table 4:15 Component Matrix

	Component		
	1	2	3
Data quality	.561	-.419	-.479
Data comparison	.674	.701	.203
Success measurement	-.145	.945	-.287
Staff resistance	.805	.485	.236
Data focus	-.855	.493	-.010
Customer focus	-.785	.147	.457
Management support	.543	.833	.100
Recommendations actioning	.872	.255	.405
Resource constraints	.798	-.583	-.123
Benchmarking inappropriateness	.373	.658	-.651
Benchmarking misconception	.996	.014	.051
Peer selection	.853	-.494	.156

Extraction Method: Principal Component Analysis

(3 components extracted)

Table 4.15 presents the factor analysis on the fourth research objective of determining the challenges encountered when implementing IT benchmarking using the extraction method: principal component analysis with 12 components extracted. Each component represents the correlation between item and the un-rotated factor. These correlations help formulate an

interpretation of the factors of components. This is done by looking for a common thread among the variables that have large loadings for a particular factor or components. The table shows that majority of the factors had high loadings. From the results in Table 4.16, the variables that measured challenges in IT benchmarking are highly correlated with this factor.

Table 4.16: Rotated Component Matrix[a]

	Component		
	1	2	3
Data quality	.830	-.101	.145
Data comparison	.042	.937	.326
Success measurement	-.516	.282	.807
Staff resistance	.246	.921	.174
Data focus	-.904	-.299	.262
Customer focus	-.839	-.209	-.314
Management support	-.089	.872	.481
Recommendations actioning	.356	.923	-.097
Resource constraints	.961	.145	-.218
Benchmarking inappropriateness	.165	.284	.943
Benchmarking misconception	.716	.694	.034
Peer selection	.848	.371	-.376

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 6 iterations

4.7 Discussion of Findings

The data analysis section yielded results that confirm objectives of this study were met. IT benchmarking in Kenyan Universities is mostly interpreted quantitatively. There is no confusion

regarding IT benchmarking and other organizational improvement programs like TQM and BPR. This is because IT benchmarking is not conducted as part of these initiatives, therefore chances of confusion are minimal. It is conducted as a stand-alone exercise.

IT benchmarking in Kenyan Universities is mostly done with external peers, either in Kenya or globally as opposed to internal peers. This indicates the desire to learn from other top performers. The operating environment for universities is getting more competitive by the day hence the need to constantly learn and improve by referencing what others are doing. Other methodologies are also in use, but this seems to be on a needs basis, probably because IT benchmarking is a new concept not warranting further granularity. Activity-based IT benchmarking is the least adopted methodology.

There was no specific pattern on preference of IT benchmarking parameters, although some had a higher weighted mean like staffing, customer satisfaction, and operations. It is noticeable that these have the biggest strategic and competitive impact. The lack of a pattern could indicate that different universities attach varied importance to parameters depending on their objectives. A cost cutting strategy will focus on financial parameters as opposed to infrastructure expansion strategy, which will concentrate on operational parameters. The leading challenge experienced by Kenyan universities regarding implementation of a benchmarking effort is lack of collaborative peers, unavailability, and inaccessibility of data, resources constraints as well lack of management support.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, discussions and conclusions from the research findings as per the objective of the study.

5.2 Summary of Findings

The study found out that IT benchmarking is not a new idea and Kenyan Universities have been involved with the exercise. However, it is understood in two broad perspectives indicating non-maturity of the concept. The study revealed that a huge number of university staff interpret IT benchmarking as a purely quantitative exercise where metrics and their measure is of prime importance, or a purely qualitative undertaking where best practice adoption is key for continuous improvement. The study also revealed that as opposed to previous studies, IT benchmarking in Kenyan Universities is not confused with other performance improvement initiatives like TQM and BPR since it is conducted as an independent instance. However, IT benchmarking seems to contribute considerable in performance evaluation.

Findings indicate Kenyan Universities focus more on external IT benchmarking, either within the country or internationally. Other methodologies are in use but in isolated instances implying that the exercise is catching up and institutions are doing all sorts of comparisons to improve.
Regarding IT benchmarking parameters, institutions seem to give more importance to processes, staffing, customer focus, and operations. Other benchmarking parameters show no particular pattern on use but remain relevant. Finally, finding indicate that peer selection, data availability, resources constraints, and lack of management support rank highest in the list of challenges faced when implementing IT benchmarking.

5.3 Conclusion

The research objectives were met and answers to the management dilemma on IT benchmarking derived. IT is a strategic tool in Kenyan Universities; therefore, the aspect of comparison with

other organizations is vital to guarantee continuous improvement and stay ahead of competition. This study concludes that indeed IT benchmarking is happening in Kenyan Universities although it is being done on a needs basis. The improvement program has good prospects and is expected to gain popularity, and get incorporated in departmental policies, procedures, and standards.

5.4 Recommendations

The following recommendations were suggested; Kenyan Universities need to bring in the aspect of collaboration for effective IT benchmarking. The leading challenges of data availability and peer selection will be addressed through the approach that has been effective in the West. Continuous growth of Kenyan higher education should supersede competition.

There is also need to assimilate the practice into institutional policies and standards. IT is a critical strategic tool and initiatives that improve the function need to be adopted as a matter of strategy. This will also speed up maturity of the process and accelerate gains made from the program. Finally, recommendations generated from IT benchmarking need to be adopted and structures set in place to evaluate and review progress. The exercise is time consuming and strains institutional resources, but findings indicate recommendations are not acted on or adopted.

5.5 Limitations of the Study

Finding respondents was not easy mostly due to their busy schedules and junior staffs were hesitant to divulge information citing sensitivity of organization's data. Rigid management structures prevented access to more data from more institutions within the period of this research. This affected scope of universities studied therefore reducing the confidence level of findings.

IT benchmarking is a new program within organizational improvement initiatives. This affected accuracy because of lack of insight and experience on the part of respondents. A section of respondents cited checking out the meaning of benchmarking terms before giving feedback. The

questionnaire was too long for the comfort of some users and this might have affected accuracy of response.

5.6 Suggestions for Further Study

This research recommends a similar study to be conducted on this subject. The practice of IT benchmarking is expected to change as the exercise gains popularity due to increasing competition in Kenyan higher education. Methodologies and approaches are expected to grow towards maturity, and the meaning of IT benchmarking is bound to evolve with time.

The scope of this research needs to be expanded to try to uncover patterns regarding benchmarking with a higher confidence level. This will give insight on what parameters are considered strategic for the IT functions of Kenyan Universities, and give a better understanding of the subject. Finally, IT benchmarking is a new area on performance improvement. More research will create a strong basis for further work, and help subsequent researchers on the same. More research data will be generated to aid in studies.

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APPENDIXES

APPENDIX I: PUBLIC AND PRIVATE UNIVERSITIES POPULATION IN KENYA

List of Public and Private Charted Universities in Kenya obtained from CUE website

Public Chartered Universities		
1.	University of Nairobi (UoN)	Established - 1970 Chartered - 2013
2.	Moi University (MU)	Established - 1984 Chartered - 2013
3.	Kenyatta University (KU)	Established - 1985 Chartered - 2013
4.	Egerton University (EU)	Established - 1987 Chartered - 2013
5.	Jomo Kenyatta University of Agriculture and Technology (JKUAT)	Established - 1994 Chartered - 2013
6.	Maseno University (Maseno)	Established - 2001 Chartered - 2013
7.	MasindeMuliro University of Science and Technology (MMUST)	Established - 2007 Chartered - 2013
8.	DedanKimathi University of Technology	2012
9.	Chuka University	2013
10.	Technical University of Kenya	2013
11.	Technical University of Mombasa	2013
12.	Pwani University	2013
13.	Kisii University	2013
14.	University of Eldoret	2013
15.	Maasai Mara University	2013
16.	JaramogiOgingaOdinga University of Science and Technology	2013
17.	Laikipia University	2013
18.	South Eastern Kenya University	2013
19.	Meru University of Science and Technology	2013
20.	Multimedia University of Kenya	2013
21.	University of Kabianga	2013
22.	Karatina University	2013

Private Chartered Universities		
1.	University of Eastern Africa, Baraton	1991
2.	Catholic University of Eastern Africa (CUEA)	1992
3.	Daystar University	1994
4.	Scott Christian University	1997
5.	United States International University	1999
6.	Africa Nazarene University	2002
7.	Kenya Methodist University	2006
8.	St. Paul's University	2007
9.	Pan Africa Christian University	2008
10.	Strathmore University	2008
11.	Kabarak University	2008
12.	Mount Kenya University	2011
13.	Africa International University	2011
14.	Kenya Highlands Evangelical University	2011
15.	Great Lakes University of Kisumu	2012
16.	KCA University	2013
17.	Adventist University of Africa	2013

APPENDIX II: QUESTIONAIRE

Dear Respondent,

Thank you for your willingness to contribute towards this study on IT benchmarking in Public and Private Universities in Kenya.

The main goal of the study is to understand how IT benchmarking is understood and practiced in the context of Kenyan Universities, parameters considered, and the challenges experienced during implementation.

You are assured that any information provided is solely meant for the research and nothing else. Your response to the questions will be kept confidential.

Thank You.

Regards,

Albanus Mulandi Peter

Researcher

SECTION A: GENERAL INFORMATION

Please complete this section by ticking the applicable box and filling in answers where appropriate

1. What is your Gender?
   Male ……..[ ]
   Female …….[ ]
2. What is your age bracket in years?

   18-25 ……[ ]
   26-30 ……[ ]
   31-35 ……[ ]
   36-40 ……[ ]
   41-45 ……[ ]
   46-50 ……[ ]
   Above 50 ……[ ]

3. Is your education IT related
   Yes……[ ]
   No ……[ ]

4. How many years have you worked for the University? …… years.

5. Which section or division of the IT department do you work in?

   Management Information Systems/Applications……[ ]
   Network and Infrastructure ……[ ]
   End user support/desktop services ……[ ]
   IT management……[ ]
   IT security and assurance ……[ ]
   Database administration ……..[ ]
   Others (specify) …….

SECTION B (I): How IT benchmarking is understood in practice

Indicate the extent to which IT benchmarking is interpreted quantitatively, qualitatively or both.
Use the following rating and Tick Appropriately

1 – No extent 2 – Small extent 3 – Moderate Extent
4 – Great extent 5 – Very Great extent

Benchmark parameters	**1**	**2**	**3**	**4**	**5**
Quantitative interpretation (metric-based IT benchmarking)					
Qualitative interpretation (best-practice based IT benchmarking)					
Both quantitative and qualitative interpretation					
Others (specify):					

B (II): Indicate the extent to which IT benchmarking is conducted as part of the following performance improvement initiatives or programs.
Use the following rating and Tick Appropriately

1 – No extent 2 – Small extent 3 – Moderate Extent
4 – Great extent 5 – Very Great extent

Performance improvement programs	**1**	**2**	**3**	**4**	**5**
Total Quality Management					
Performance Evaluation					
Business Process Reengineering					
Statistical data collection					

SECTION C: Methodologies and Approaches used when conducting IT benchmarking
Indicate the extent to which the following approaches are used to conduct IT benchmarking.
Use the following rating and Tick Appropriately

1 – No extent 2 – Small extent 3 – Moderate Extent
4 – Great extent 5 – Very Great extent

IT Benchmarking types	**1**	**2**	**3**	**4**	**5**
Periodic IT benchmarking					
Internal IT benchmarking					
External IT benchmarking					
Activity-based IT benchmarking					
Strategic IT benchmarking					
Performance IT benchmarking					
Competence IT benchmarking					
Competitive IT benchmarking					
International IT benchmarking					
Best-in-class IT benchmarking					
Others, specify:					

SECTION D: Parameters (KPIs) considered when performing IT benchmarking
Indicate the extent to which the following parameters are used to conduct IT benchmarking.
Use the following rating and Tick Appropriately

1 – No extent 2 – Small extent 3 – Moderate Extent
4 – Great extent 5 – Very Great extent

(I) FINANCIAL PARAMETERS

IT benchmark parameter	**1**	**2**	**3**	**4**	**5**
IT budget profile					
IT contracts and outsourcing					
Software licensing costs					
Infrastructure investment (network, data center, end user etc)					
IT staff remuneration					
Bandwidth costs					
Training costs					

IT consumables					
IT financial policy					
Financial innovations through IT					
Telecommunication costs					
Systems implementation costs					

(II) OPERATIONAL PARAMETERS

IT benchmark parameter (KPI)	**Extend of Parameter usage**				
Communications	**1**	**2**	**3**	**4**	**5**
Percentage of cost for telecommunication					
LAN contention in peak periods					
WAN cost per packet, per byte, and per message					
Customer Satisfaction	**1**	**2**	**3**	**4**	**5**
Overall satisfaction of users/managers with information services					
User satisfaction with contacts with IS department					
User satisfaction with response to problems					
Manager satisfaction with cost & speed of development					
Help Desk	**1**	**2**	**3**	**4**	**5**
Percentage of problems solved by 1st contact					
Average time to problem solution					

Number of problems handled per FTE					
Number of problems handled					
Operations	**1**	**2**	**3**	**4**	**5**
Availability (% of time)					
Mean time between failure					
CPU Usage (% of capacity)					
Disk Usage (% of capacity)					
Average MIPS					
Number of jobs handled					
Quality Assurance	**1**	**2**	**3**	**4**	**4**
Defects found per 1000 lines of code					
Percentage of erroneous keystrokes on data entry					
Staffing	**1**	**2**	**3**	**4**	**5**
Percentage of professional staff with college degree					
Payroll as percent of IS budget					
Percentage of staff with advanced degrees					
System Development	**1**	**2**	**3**	**4**	**5**
Projects completed in period					
Average function points per employee per period					
Lines of code per employee per period					
Fraction of projects done on time & on budget					

Technology	**1**	**2**	**3**	**4**	**5**
Percent of IS expense in R&D					
Percent of employees having a workstation					
Training	**1**	**2**	**3**	**4**	**5**
Courses taken per IS employee per year					
Average courses taken per IS employee					
Average IS courses taken per non-IS employee					

(III) BEST PRACTICE PARAMETERS

IT benchmark parameter (KPI)	**1**	**2**	**3**	**4**	**5**
IT strategy, management and policy formulation					
IT Customer service					
IT governance					
IT acquisition practices					
IT contribution to competitive edge					
IT security, audit and control					
IT staffing practices					
IT support in R&D					
IT projects					
Others (specify)					

SECTION E: Challenges faced when executing IT benchmarking

Indicate the extent to which the following challenges are faced when conducting IT benchmarking. Use the following rating and Tick Appropriately

1 – No extent 2 – Small extent 3 – Moderate Extent
4 – Great extent 5 – Very Great extent

Challenges in IT benchmarking	**1**	**2**	**3**	**4**	**5**
Data availability, relevance and quality					
Measurement and comparison challenges due to organizational differences					
Measurement of benchmarking success rate					
Staff resistance to benchmarking					
Focusing on data rather than processes					
Loss of focus on customers and employees					
Lack of management support					

Application of benchmarking recommendations					
Resource constraints					
Inappropriateness of benchmarking					
Misconception of benchmarking					
Challenges in selection of benchmark peer organization					
Others (specify)					

THANK YOU