PROMOTION OF EDUCATIONAL RESEARCH FOR PRODUCTIVITY AND INNOVATION AMONG SELECTED PUBLIC AND PRIVATE UNIVERSITIES IN NAIROBI COUNTY, KENYA

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DECLARATION

This thesis is my original work achieved through scientific research, personal reading and input from the supervisors. The thesis has not been submitted to any other university or college for any academic Degree. All information obtained from the sources have been duly acknowledged.

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DEDICATION

I dedicate this thesis to my family and Kenyans who are driving their energies in promoting educational productivity and innovation in Kenya.

ABSTRACT

The study aimed at-exploring on promotion of educational research for productivity & innovation among selected public and private universities in Nairobi County, Kenya.The study was guided by the following research questions: How does access and utilization of research funds affect research output in the universities? To what extent are research outputs commercialized? How does the management structures of the university influence research output? How does industry –university collaboration influence research output in the universities. The study was anchored on the Triple Helix Theory.The study adopted cross-section descriptive research design. The target population was 306 university researchers comprising of lecturers, PhD Students and any other staff in the universities involved in research. A sample size representing 30% of the target population was used for this investigation. The study used questionnaires to collect data. Cronbach Alpha technique was used to determine reliability of likert scale items in the university researchers' questionnaire. Quantitative data was analyzed using Statistical Package for Social Science version 23 to generate frequencies and percentages that summarized data. The findings revealed that access and utilization of research funds influenced research output in the universities. It was also revealed that universities are making good efforts to commercialize the outputs of their research Management structures of the university influence research output and industry –university collaboration greatly influence research output in the universities. The study concluded that universities in Kenya have not taken commercialization of research results seriously. Additionally, there is low venture in profitable and marketable products such as trademarks, industrial design and utility models. The study recommended that: universities should balance teaching workload to ensure that university researchers have balanced hours for both teaching and research; universities should continuously sensitize university researchers on university-industrial sector linkages; Universities should continuously sensitize university researchers on commercialization of research results; Funding organizations of research projects should come up with simple and suitable research project financial reporting procedures; the government and other research funding organizations should increase funds for both research and commercialization; the government and funding organizations should avail adequate and timely communication on disbursement of funds.

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ABBREVIATIONS AND ACRONYMS

AAU	Association of African Universities
CLE	Council of Legal Education
EARF	Energy Access Relief Fund
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IGAD	Intergovernmental Authority on Development
IP	Intellectual Property
KEI	Knowledge Economy Index
KIPPRA	Kenya Institute for Public Policy Research and Analysis
NACOSTI	National Commission for Science, Technology & Innovation
NGO	Non-governmental organization
NIPMO	National Intellectual Property Management Office
NOTAP	National Office for Technology Acquisition and Promotion
R&D	Research & Development
SPSS	Statistical Package for Social Sciences
ST&I	Science Technology & Innovation
UNEP	United Nations Environment Programme
USA	United States of America
WFP	World Food Programme

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

In order to boost their country's competitiveness, raise money for further R & D and maximize the returns on public investments and research usage, several governments have pushed universities to produce outputs from their research endeavors (OECD 2008). Additionally, in the 2012 KEI Rankings which included 146 nations from around the world, China, Korea and Malaysia are at the top of the list of knowledge-based economies (World Bank, 2012). On the other side, a lot of African nations came in the bottom of the list (Kefela, 2010).

According to their rate of publication and performance in securing research grants, researchers in Australia are frequently awarded. The government of Australia has established programs to strengthen ties with universities, and a number of organizations have established commercialization entities to let their academics make money from their findings and hasten knowledge transfer to industries (Collier & Gray, 2010). The government of Australia is also aware of the important role that support systems and training in commercialization play in helping researchers successfully market their own findings. The innovation-progression gap, which used to be a significant shortcoming in Australia's innovation system, has also been significantly reduced thanks in large part to university commercialization offices (Organization for Economic Co-operation and Development 2008).

The United States has a sophisticated entrepreneurship finance system, with early-stage venture capitalists and business people who are more technologically oriented. The country actively supports and effectively funds the commercialization of academic research findings. One

of the most important pieces of legislation fostering the commercialization of scholarly research is the Bayh-Dole Act of 1980. Engagement between academia and industry was a significant force behind university entrepreneurship, helped in part by a network approach to such collaboration (Guenther & Wagner, 2008). University academics now have the right to patent any invention they create while working on government-funded research according to the Bayh-Dole Act. In order to encourage research students to be entrepreneurial and tenaciously pursue commercialization of their results, the nation awards incentives to them (Mowery & Sampat, 2007).

The National Intellectual Property Management Office (NIPMO) was formed by the UK government to encourage the growth of capabilities in technology transfer and IP commercialization. The UK gives financing to organizations for the statutory preservation and maintenance of intellectual property rights through an IP fund. Government funding makes up the vast majority of university research and development in Russia. The Russian government established incentives to encourage the commercialization of scientific discoveries through an innovation program. As part of this endeavor, the law governing intellectual property rights was changed, public money were made available for venture capital, and more people overall participated in R&D spending. Commercializing research from higher education institutions is a major emphasis of Russian innovation policy.

Government programs that promote partnerships between colleges and industry enable the majority of Japanese universities to interact with it. Through these connections, Japanese institutions can produce outputs from their research findings and engage in commercialization (Tantiyaswasdikul, 2013). Through technological licensing and formal R&D collaborations with

industry, the nation has made great strides toward commercializing intellectual property since the late 1980s. Because of the proliferation of spin-off businesses and the increasing accessibility of commercial venture capitalists, many universities have been able to commercialize the results of their research.

University commercialization initiatives in New Zealand are impacted by university laws and regulations. Researchers who are subject to IP protection have benefited greatly from education and increased awareness of intellectual property laws and procedures provided by technology transfer offices (Collier & Gray, 2010). The promotion of university research commercialization has been linked to various factors, including finding appropriate industry collaborators and partners, negotiating license agreements, establishing start-up companies, raising funds from investors, and partnering with industry.

In 2008, Africa accounted for 2% of global scientific publications, with South Africa alone contributing for 0.5 percent of global articles in referenced journals, Asia 30.7 percent, America 35.3 percent and Europe 42.5 percent were the other areas' results (UNESCO, 2010). Publishing is linked to commercialization and allows for the most rapid and open dissemination of research findings (Trencher, Yarime, McCormick, Doll, & Kraines, 2013).

To develop a knowledge-based economy, the government South Africa recognizes that IP exploitation must be carried out by publically funded research groups through commercialization. According to an AAU case study, South Africa boasts the continent's longest-standing university-industry links despite the fact that South African universities hold only a few patents. This is due to the fact that industry owns the majority of patents resulting from industry-commissioned

research, as well as the numerous barriers and dangers associated with patent acquisition (AAU, 2012).

The NOTAP, which oversees IPR and technology transfer in Nigeria has created Intellectual Property and Technology Transfer Offices has established offices for the transfer of intellectual property and technology in tertiary institutions throughout the nation to help inventors with IPR preparation and filing (Ogunwusi & Ibrahim, 2014). A legislative and administrative framework, along with incentives for university academics to share their ideas and breakthroughs through financial and non-financial channels, have been found to be beneficial in promoting the commercialization of research outputs. Less than 60% of academic staff members at Ilorin University in Nigeria share their research findings and commercialization takes a backseat with only about 28% of university lecturers creating research products that can be used for societal development and less than 10% of university lecturers commercializing their research outcomes (Oduwaye, Onasanya & Shehu, 2010). Despite the fact that many institutions are experiencing a research boom, the report demonstrates that the rate of commercialization of research discoveries is still quite low (OECD, 2014).

In Kenya, NACOSTI is in charge of providing guidance, organizing science and technology activities, promoting them, and enforcing rules (ST&I Act, 2013). On behalf of the Kenyan government, NACOSTI has been managing the Research Endowment Fund since it was founded by the Ministry of Higher Education, Science, and Technology. The Fund's mission is to assist Kenyans in funding research and innovation projects throughout the country. In order to attain an innovation-driven economy for Kenya's development, learning institutions are anticipated

to translate their research discoveries into products and services, generate new ideas, and embrace innovation by fostering research, science, and technology in higher education institutions (NACOSTI, 2014). The Science, Technology, and Innovation (ST&I) Act of 2013 fosters the commercialization of scientific discoveries through the Kenya National Innovation Agency, which the Act created but has not yet begun to run. In accordance with the University Act of 2012, Kenyan institutions must also advance knowledge through instruction, scholarly investigation, and scientific advancement in addition to making their findings available to the general public.

Governments and organizations that finance research around the world are increasingly interested in how successfully research advances societal progress because research money is typically provided by taxpayers. They have concentrated their efforts on conducting evaluations and assessing the outcomes because they finance research programs (Mutz, Bornmann & Daniel, 2013). Globally, public universities are critical centers for scientific research that results in better lives through technological progress. They have achieved enormous innovation through sustained scientific research to help address myriad challenges throughout history. It has been on a declining trajectory in the past. Kenya's public universities are not immune to research inefficiency. Hence it is necessary to investigate why scientific research is not prioritized in public universities and what can be required to enhance it. Besides teaching, research has become a core function of universities around the world. Yet, like in many African countries, Kenyan universities still lag behind in terms of research productivity, due to factors many researchers refer to as constraints (Oringo 2016).

1.2 Statement of the Problem

As per the UNDP study from 2012, academic research is still a significant source of knowledge and innovation on a global, regional, and national scale. However, over the past ten years, the majority of industrialized nations have been compelled to deal with the concomitant challenges of sustaining adequate investment in high-level research activities while simultaneously extending access to post-secondary education and training. This is proving to be a tricky balancing act that depends on cutting-edge regulations and a wider divide.

Most university research proposals are not moved forward to the next stage and are instead left to gather dust in shelves when they could have been used to improve several economies with significant government financing. Few universities are engaged in the commercial exploitation of discoveries developed as a result of their research activities, according to a report on the topic that was created in 2013 in Canada by the OECD Directorate for Science, Technology, and Industry. For instance, only approximately 10 percent of institutions in Europe, which has the highest proportion of universities worldwide, are responsible for 85 percent of the total revenue from inventions (OECD, 2013). Regardless of the fact that governments in developing countries spend the most on R&D, universities and other R&D institutions (approximately 90 percent) have not been able to produce products that meet the demands of business and society (Ukiwoma, Amade, & Moghalu, 2013).

Numerous factors such as a lack of funding, insufficient business knowledge, a lack of understanding on commercialization, a lack of human capital to create startup companies when necessary and a lack of mentoring and educational support for new entrepreneurs have been linked

to the low rates of commercialization of university research results (Holy, 2010). Only when research can be turned into products and services or is somehow commercialized can it be useful to society (Bornmann, 2013). Concerns about the necessity of using publicly sponsored research to advance Kenyan society have been voiced frequently since 1997. Insufficient funding mechanisms, a lack of suitable institutional arrangements, and the inability to transfer knowledge and technologies are some of the factors that prevent the commercialization of research results, according to a 1999 study carried out in Kenya to explore the factors affecting the diffusion and adoption of inventions from research institutes and universities (Bwisa & Gachui, 1999).

Studies on the research outputs in Kenyan universities have been done on a range of subjects, including strategies for increasing the commercialization of university research in Kenya (Ondimu, 2012); the factors that affect research productivity in Kenyan public universities, with a case study of Moi University (Kendagor, Kosgei, Tuitoek & Chelangat, 2012) and the reasons for the low rate of research publication in the nation (Migosi, 2012). On the other hand, the present study gathered viewpoints from academic researchers who were either publicly or privately supported in order to identify research outputs and to show their expertise in commercializing their research results. Additionally, it gathered their ideas on how to enhance the commercialization of academic research to benefit society. There have been concerns amongst stakeholders on the capacity of universities in Africa in general and Kenya in Africa to attract research funding and to translate research outputs into enterprises. A lot of studies have been carried out on this (Mowery and Sapat, 2007, Rotheeamel, Agung and Jiang, 2007, Migosi, 2012). However no study has been carried out targeting the four universities. This study is therefore meant to fill that gap.

1.3 Research Questions

The following questions guided this study:

a) How does access and utilization of research funds affect research output in the universities?

b) To what extent are research outputs commercialized?

c) How does the management structures of the university influence research output

d) How does industry –university collaboration influence research output in the universities?

1.4 Significance of the Study

The findings of this study may be useful in demonstrating the economic worth of academic research and the reasons why the government and other important stakeholders should continue to fund R&D expenditures in accordance with Vision 2030 (GoK, 2013). Estimates of the societal impact of funding from either NACOSTI's Research Endowment Fund or other organizations are anticipated to use the study's findings as a starting point. The results of the study are also hoped to inspire researchers in Kenyan universities, both public and private, to produce research outputs and apply them to benefit society. Graduates are expected to be inventors and toll takers. They develop things to help their families and the neighborhood as a whole. In partnership with the Kenya Medical Research Institute, the faculty of health in public institutions can create a vaccine for the covid-19 virus as an alternative to importing. It was hoped that the study's conclusions, which might be published in scholarly journals, would contribute to the body of knowledge on Kenya's university research commercialization.

1.5 The Scope and Delimitation

Catholic University of Eastern Africa, the University of Nairobi, Strathmore University and Kenyatta University were the primary focus of the study, which primarily examined research

initiatives in those universities and how those initiatives lead to outputs that are commercialized and used for the benefit of the university.

1.6 Theoretical Framework

The Triple Helix Theory underpins this research study. Etzkowitz and Leydesdorff (1995) proposed the Triple Helix model to explain the dynamic interactions between academia, industry, and government in fostering entrepreneurship, innovation, and economic growth in a knowledge-based economy (Etzkowitz and Leydesdorff 2000). The theory emphasizes the interdependence of universities, industries, and governments in the formation of knowledge citizens. The Triple Helix theory has also been regarded as both a model and a concept (Etzkowitz, 2003). According to the Triple Helix hypothesis (Rieu, 2011), there should be more interaction among the government, industry and universities. This interaction, in the case of universities and industries, changes university culture and values and encourages more entrepreneurial tendencies. The government is crucial in creating the right institutions and laws to achieve the commercial production of research discoveries as well as funding R&D in universities, according to the Triple Helix Theory. Additionally, it is the main source of funding for the commercialization of products produced from supported university research projects and technology transfer (Gorasson & Brundenius, 2011).

Particularly in the emergence of knowledge-based civilizations, the Triple Helix theory's emphasis on the university's role in innovation is enhanced. This role includes both research and teaching for inclusive growth. Three interconnected dynamics: evolutionary mechanisms, institutional changes and the university's new position control the interaction between the three spheres (Etzkowitz & Leydesdorff, 2000). The concept proposes that universities should take a

more active part in innovation and economic development as well as the collaborative efforts they must make with business and government in order to support the generation, transmission, and application of knowledge for socioeconomic development.

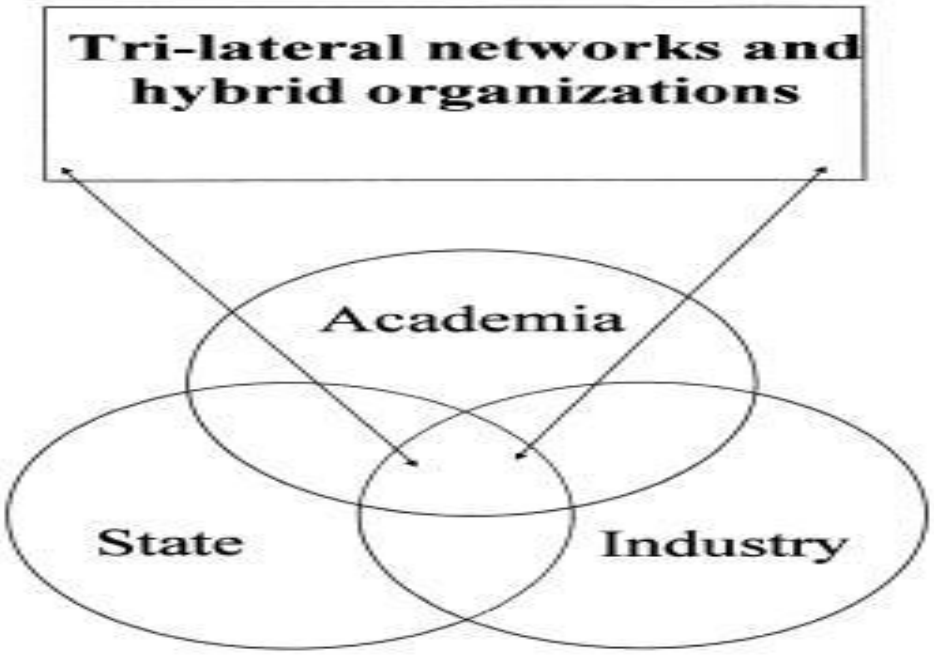

Figure 1: Triple Helix model, adopted from (Etzkowitz & Leydesdorff, 2000)

According to the Triple Helix concept, an entrepreneurial university is one that is adamantly committed to creating and applying knowledge (Etzkowitz, 2003).

1.6.1 The Strengths of the Theory

It has been examined that local triple helix initiatives in key cities/regions contribute to bridging the gap between science and industry, foster an increased number of proposed and implemented Research, Development and Innovation projects and enable a stronger ecosystem for innovative start-ups. That also contributes to the effectiveness of the national system of innovation,

as well to the implementation of the innovation policy. However, the strength of these effects is likely to vary and depend upon specific conditions in a given environment.

Triple Helix theory inserts the dualities of government-industry, university-industry, industry-government relationships within triadic university-industry-government interactions, opening relationships to innovation and new levels of cooperation and competition. Thus, new innovation platforms are expeditiously created to promote knowledge-based development. It is believed that strengthening universities and other knowledge producing and disseminating organizations should help in realizing the objective of a knowledge based development. Instead of playing peripheral roles in development, they should be regarded as the core actors of development.

The triple Helix development strategy differs from traditional development models in propounding the university as a leading development actor, removing the blockages to circulation and enhancing interaction and cooperation among development actors and agencies. As equal interacting spheres develop, the pace of innovation is quickened. The classic functional differentiation of institutions is superseded by hybridization of functions moving toward a common global triple helix innovation and development environment in which both developed and developing countries have much to learn from each other as knowledge opportunities multiply.

1.6.2 Weaknesses of the Theory

To be successful, Research, Development and Innovation initiatives need a critical mass of resources and existing linkages. However, there are also risks and limitations involved. Too strong

reliance on external financing may lead to sub optimal choice of projects, and synergies with market-driven innovation are sometimes difficult to achieve and sustain over time.

Furthermore, the development of the start-up population is not necessarily linked to Research, Development and Innovation, as their development patterns tend to differ and have shorter time horizons. Finally, the success of local triple helix partnerships can also lead to disproportionate utilization of structural investment funds by metropolitan regions and thereby can increase regional disparities within a country.

1.6.3 Application of the Theory to the Study

The Triple Helix is effective in understanding the dynamics of innovation at the international, regional and national levels because it provides a well-elaborated framework for understanding central inquiries in innovation processes, namely the key actors; the mechanisms of interactions between the actors; and the enabling conditions of the interactions.

Regarding the key actors, the Triple Helix model focuses on university, industry, and government. Nevertheless, it does not exclude other actors, such as intermediaries, legal firms and non-governmental agencies, but consider them secondary players (Cai & Etzkowitz, 2020). Indeed in each of the spheres of university, industry and government, there are ‘a wide array of actors among whom a distinction is made between: individual and institutional innovators; R&D and non-R&D innovators and single-sphere and multi-sphere (hybrid) institutions (Ranga & Etzkowitz, 2013, p. 238).The mechanism of Triple Helix interaction is taking the role of the other (Etzkowitz, 2008), performing new while maintaining their traditional function.

This study incorporates aspects of university, government and industry without excluding other actors on focusing on promotion of education research and productivity and innovation in Nairobi County. Therefore Triple Helix theory is applicable in this study

1.7 Conceptual Framework

The objectives are aligned with the conceptual framework, which also aids in understanding how interconnected concepts and variables relate to one another (Kombo & Tromp, 2009)

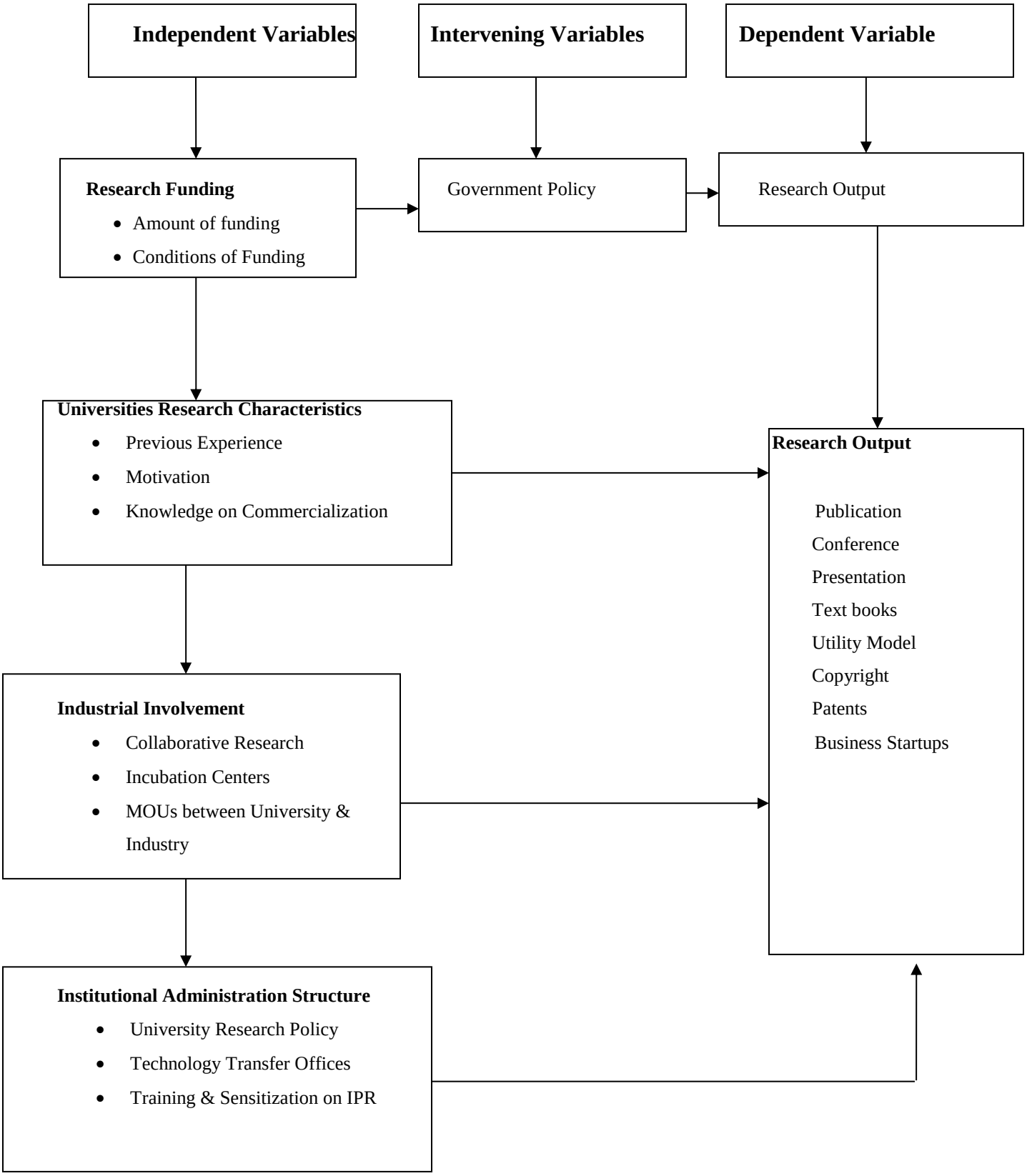

Figure 2: Conceptual Framework

The output of research is heavily reliant on government funding. This is dependent on the policy implemented by any government to promote research in higher education institutions. Some financial support may come from both donors and development partners. If financial support is sufficient, the likelihood of a positive outcome is high. It also depends on past experience, such as the university's previous success in the field of research. The output will also be affected by the motivational factors introduced by institution in order to boost the morale of those involved in the research activities. They must be adequately compensated and the security of their work must be ensured. There is a requirement for them to collaborate with other institutions doing similar work. The resources needed for the research must be made available to the researchers at the appropriate time.

1.8 Operational Definitions of Key Terms

Research Output: refers to scholarly study that has been published or is capable of being published, whether it takes the form of an academic journal article, a book or book chapter, a conference proceeding, a paper or poster, or any other type of private or public research.

Research Funding: A grant obtained for conducting scientific research, usually through a competitive process.

Researchers Characteristics: Personal effort of a university researcher toward commercialization

Industrial Involvement: refers to connections between industry and university researchers.

Institutional Administrative Structures: Universities have built institutional cultures and environments that support researchers in commercializing their work such as training and sensitization programs, technology transfer groups and university policy.

Disbursement Process: Granting university researchers access to research money.

Collaborative Research: Research done jointly by a university and an industry players.

Commercialization: the process by which academic scholars turn their insights into goods that may be supported for both the researcher and the university to make money. Among the products are patents, trademarks, utility models, and new businesses.

Publicly funded research: Academic research that is funded by the government or development partners.

Entrepreneurial University: a university that has made commercialization of its research a part of its strategy for financial gain.

Research and Development: Economic activities that involve using the results of scientific study to develop new products and enhance existing ones.

Technology Transfer: Adoption of innovations created by academic researchers by industry for economic advancement.

Educational Research: The structured collection of information and data in the field of education.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter is comprised of four sections. It focuses on the review of related theories and review of empirical studies. The themes were derived based on theoretical and empirical writings pertinent to the factors under consideration i.e. access and utilization of research funds; commercialization of research outputs by universities; research outputs and industrial involvement; and research outputs and management structures of the university.

2.2 Review of Related Theories

2.2.1 Lotka's law

It describes the frequency of publication by authors in any given field. It states that the number of authors making ***x*** contributions in a given period is a fraction of the number making a single contribution, following the formula $1/x^a$ where **a** nearly always equals two, i.e. an approximate inverse-square law, where the number of authors publishing a certain number of articles is a fixed ratio to the number of authors publishing a single article. As the number of articles published increases, authors producing that many publications become less frequent. There are 1/4 as many authors publishing two articles within a specified time period as there are single-publication authors, 1/9 as many publishing three articles, 1/16 as many publishing four articles, etc. Though the law itself covers many disciplines, the actual ratios involved (as a function of ***a***) are discipline-specific. The general formula says:

$$X^nY=C$$

Where ***X*** is the number of publications, ***Y*** the relative frequency of authors with ***X*** publications, and ***n*** and **C** are constants depending on the specific field (n⊐2).

2.2.2 University Research Outputs

Education at the university level is essential for progress. This is partly because of the research done in these institutions, which has the potential to lead to inventions and technological advancements that will advance the economy (Bloom, Canning & Chan, 2006). A critical step in the research process is dissemination. Research findings can only be applied if they are widely disseminated. A researcher's duties also include making the public aware of the information they have discovered via their research (Crosswaite & Curtise, 1994).

A chasm exists between research and practice due to a lack of dissemination (Wilson, Petticrew, Calnan, & Nazareth, 2010). A university has a responsibility to distribute every information that is beneficial to the society including discoveries from their research (Awuor, 2013). By enhancing academics to develop research outputs, effective dissemination of research findings allows them to contribute to political choices that may have an impact on the target population's behavior.

University research is meant to add to the current body of knowledge by publishing new findings. Papers published in peer-reviewed journals or academic textbooks are examples of publications. Books or book chapters, peer-reviewed journals, monographs and preprints are examples of formal publications. Academic repositories, blogs, and webpages are examples of digital publications.

Authors have the sole right to reproduce copyrighted content, whether it is published or not, thanks to copyrights. Contrarily, a trademark can be anything that differentiates a good or service, including a logo, a word, a slogan, or a design. Patents can help innovators keep a competitive edge by granting them for a specific amount of time, forbidding others from making, using, or selling their innovations. New enterprises formed to exploit intellectual property from universities are known as spin-offs or business start-ups (Adams, Graham, Gray, Purcell, & De Fazekas, 2005) and assist in open dissemination of research findings.

2.2.3 Previous Research Output

The first studies that examined research output (Cole & Cole, 1967; Lotka, 1926) discovered differences in professors' intellectual production. Later studies examined the factors that contributed to such disparities and discovered that one of the causes is professors' accumulative advantage or experience (Allinson & Stewart, 1974). According to the accumulative advantage, productive scientists are likely to be even more productive in the future, while low-performing scientists' productivity will decrease (Kwiek, 2016).

According to Fox (1983), the accumulative advantage is frequently presented by different resources that researchers accumulate from their previous publications. Furthermore, while several studies have focused on previous scientific performance, there is no agreement on how human capital characteristics affect productivity (Ballesteros-Rodrguez et al., 2020). Some studies claim that previous research output has a positive effect on productivity levels. For example, Garca-Cepero (2009) discovered that the likelihood of a researcher conducting research is related to the difficulty of starting the production process, i.e., it is difficult to go from zero to one publication.

The desire to conduct more research and publish more is fueled by success in publishing (Gaus et al., 2020; Kwiev, 2016). Furthermore, Salinas-Ávila, Abreu-Ledón and Tamayo-Arias (2020) discovered that a professor's motivation to conduct research, stay current in their field of study, and develop research skills influences their research productivity.

2.3 Review of Empirical Studies

2.3.1 Access and Utilization of Research Funds

The amount of money spent on R&D is among the measures of economic health of a nation (OECD, 2014). Investing in R&D lays the groundwork for generating new knowledge leading to development of services and products due to applied research. It is notable that research is an expensive endeavor that necessitates ongoing funding channels, and commercialization provides an alternative source of cash that can be used to fund more research projects. According to the African Union, governments, donors, and public institutions account for over 60 percent of R&D spending in most African governments.

The rise of entrepreneurial universities in the developed world can be attributed to a variety of factors, including increased venture capital and advantageous legislation (such as the Bayh-Dole Act in the United States), which allows universities to patent their work with public funds, develop incubation centers, build science parks, and establish university spinoff companies (Rothaermel, Agung & Jiang, 2007).

University endeavors to commercialize research should be prioritized from the beginning since it is essential for proving and justifying public investment that universities commercialize publicly funded research (Narayan & Hooper, 2010). This is particularly true given that

governments in developing countries fund around 70% of research activities. However, little to no funding is allocated for the commercialization of research discoveries, despite the fact that many governments are the biggest benefactors of academic research. Few academic research projects advance beyond the research outputs, according to a study done at New Zealand universities to determine how governments support academic research development. This is because of a lack of finance and a lack of foresight towards commercialization (Narayan & Hooper, 2010). Many governments around the world have cited the need for efficiency, effectiveness, and accountability of public funds as well as the need for society to understand the role of research in economic development, a research that goes beyond the findings, as reasons for the need for basic research evaluation (Narayan & Hooper, 2010).

By developing job creators rather than job seekers, universities are increasingly contributing to wealth creation and enhancing employment chances in the twenty-first (21st) century (WIPO, 2007). In addition to teaching and research, the university's mission has been expanded to reflect its commitment to society through fostering economic development through the information it produces (AAU report 2012). Universities are currently in a situation where they must be more responsive to their surroundings as a result of the push for knowledge-based economies, which has strengthened the connection between economic requirements and academics (Martin, 2012).

The ability to produce, share, and use knowledge to advance society's welfare defines knowledge societies or economies. Universities have emerged as the cornerstones of systems for education, training, and innovation, serving as the basis for the knowledge economy. Academic

institutions, research centers, companies, think tanks, and other organizations make up an innovation system that can acquire information that is easily accessible, change it to match local needs and produce solutions for its population.

The third mission of a university, which is more significant than research and instruction, is regarded to be university entrepreneurship. The process of turning research findings into consumable goods, services, and treatments enables the general population to benefit from publicly funded research (WIPO, 2007). Research is essential for growth, knowledge transfer, and knowledge contribution. Universities must also maximize the value of their research in order to address socioeconomic challenges. Through their research and human resources, such as the students who graduate each year, universities continuously produce new knowledge. This is essential to advance manufacturing techniques and innovations, which will increase economic performance (Power & Malmberg, 2008).

To achieve long-term economic growth, strong knowledge bases can be used (Dosi & Nelson, 2013). Societal knowledge gaps and difficulties can be well addressed by universities which can provide mitigation to ever-increasing socioeconomic challenges. The benefits of research can be economic if they can develop goods that can be commercialized to better people's lives while also adding to existing knowledge. Many universities were unfamiliar with commercialization in the 1980s, but today, many countries have implemented rules that encourage universities to develop and market their research results (Students, 2007).

For university academics to have the resources they require to finish their research as well as to develop and market their discoveries, financial support is essential. Nevertheless, due to a shortage of money, many university research findings cannot be further exploited. The research funds provided are insufficient to support the research ideas' continued development (Khademi, Ismail, Lee, & Shafaghat, 2015). Many developing countries lack access to external finance, such as business persons or venture capital funds causing them to fall short of expectations.

2.3.2 Commercialization of Research Outputs by the Universities

It is crucial to consider researchers' goals, motivations, and perspectives regarding research findings as well as the financial benefits of commercialization. Individual abilities, age and career, industrial experience, social and personal benefits, networks, and interests are some internal elements that may influence researchers to commercialize their research discoveries (Ambos, Makela, Julian & D'Este, 2008). Each researcher's interpretation of these variables is different. Intrinsic factors are a researcher's own driving forces, which can vary from one researcher to the next and include things like a need for financial gain, academic entrepreneurship, or a specific interest or awareness. Inadequate time, business acumen, and awareness of university IP policies are all personal characteristics that affect a researcher's propensity towards commercialization. There are three ways to reward researchers: monetary compensation, resource or financial transfers, and incentives to boost productivity through patents and publications (Goktepe-Hultein, 2008).

In order for researchers to participate in exploitative behavior, they need to be motivated to create study results. Universities can set up a reward system for researchers who take part in commercialization, as well as training on the significance of information transfer, to increase their motivation. It has been concluded that the reputation and notoriety of researchers surpass any financial or economic gains from the process of commercialization. Lam (2010) classifies the factors that stimulate academics to market their research findings into three groups: "gold" (profitability/financial rewards), "ribbon" (reputational/career incentives), and "puzzle" (intrinsic fun). According to her, "ribbon" features excite conventional researchers who are unable to mix study and business, whereas "puzzle" and "gold" elements inspire researchers who are entrepreneurial by nature. New knowledge gets monetized, according to Acs, Audretsch, Braunerhjelm, and Carlsson (2008), when the researcher sees the benefits to themselves in doing so and are able to determine the commercial value of their research and also when another party sees the value of their research and decides to invest in it. The ability of a nation to create, adopt, modify, transmit, and market information has become increasingly crucial for economic competitiveness, long-term economic growth, and improved societal welfare, according to J. Otieno, M. Obamba, S. Chika, A. Goski, O. Ogachi, and M. Barifaij (2014).

Gender, age, academic qualification, academic rank, academic discipline, and work habits are the most important factors used to explain variations in research output. Several studies have found that male professors publish more than their female counterparts in various disciplines (Gul et al., 2016). Sá et al. (2020) investigated productivity among elite scientists and discovered that men outperform women in terms of number of publications and citations. Several studies have attempted to explain women's lower intellectual output throughout their careers as a result of

differences in family responsibilities, different patterns of time use, unequal resource allocation, different patterns of academic collaboration, and gender bias in peer-review (Sá et al., 2020). Some studies, however, contradict these research results, finding that gender has no significant effect on research productivity indicators and that women have production rates comparable to their male counterparts (Khalil & Khalil, 2019). Furthermore, previous research indicates that there may be gender differences in research productivity depending on academic fields. Webber (2011) discovered that faculty in physical and life sciences produce 25% fewer peer-reviewed articles than faculty in other fields or male faculty in the same discipline, and female faculty with one or more dependent children produce 8% fewer books and textbooks than female faculty without dependent children or male faculty.

In terms of age, some studies show that production increases with age, but then begins to decline. Abramo et al. (2016) described this effect in researcher productivity as an inverted U caused by two opposing effects: the abundance of innovative ideas during the professional development stage of the research and the increasing risk of becoming professionals with outdated skills and difficulties in finding new research themes during the decline stage. Similarly, Backes-Gellner and Schilnghoff (2004) discovered that after being promoted to full professor, professor productivity tends to decline. According to some studies, there is a significant relationship between research output and age (Khahil & Khahil, 2019). However, the findings are still contradictory because other studies (Bland et al., 2005) found no statistical evidence of an age difference in faculty research productivity.

Kozhakhmet et al. (2020) discovered that research-related formation and development are positively associated with research productivity. Several studies have found that academic rank is a significant predictor of research productivity because senior faculty members produce more research than junior faculty members (Hedjazi and Behravan, 2011; Khahil & Khahil, 2019). According to Bland et al. (2005), this occurs because one of the primary criteria for professor promotion is research output. Several authors (lvarez & Montesi, 2020; Gaus et al., 2020; Jung, 2012; Webber, 2011) concluded that there are significant inequalities in research output levels based on their academic disciplines. Previous research indicates that researchers in "hard" disciplines (e.g., natural sciences, engineering, and medical science) publish more than researchers in "soft" disciplines (e.g., humanities, social sciences, and business) (Heng et al., 2020), and that researchers in "soft" disciplines publish more books than academic articles (Jung, 2012). Finally, previous research suggests that the work habits that researchers develop early in their careers influence their future research productivity (Bland et al., 2005). Similarly, the abilities they develop to properly administer and manage their time are critical to achieving high levels of productivity (Wills et al., 2011)

2.3.3 Research Outputs and Industrial Involvement

The ability to capture information gained via research and apply it to drive economic development is made possible by collaboration between universities and industry. Benefits of this partnership include money for R&D, career prospects for university graduates, cooperative research, knowledge and resources for teaching and learning, and—most importantly—the ability to solve a range of societal concerns by utilizing research findings. A strategic partnership between academia and industry, when well-coordinated, can combine the innovation and discovery cultures

of the two sectors, fostering economic growth. It is more effective when the two parties share a common goal. Good leadership at the university has been identified as critical to the success of this relationship (Link & Siegel, 2007).

With regards to innovation and economic development, university-industry collaboration is a major concern but finding suitable motivation mechanisms, forming institutions and determining consequences for research policy remains a problem (D'Este & Patel, 2007). The cooperation between universities and industries allow the universities to realize their third objective, which is entrepreneurship (Leisyte, 2011). There are universities that respond to socioeconomic concerns and are crucial to regional economic development. They are referred to as entrepreneurial universities (Etzkowitz & Leydesdorff, 2000). Entrepreneurial universities have a history of pursuing and initiating industrial partnerships. Co-publication is a measure of university-industry partnership.

Commercialization is an expensive endeavor that necessitates large financial commitments that are not immediately available to researchers, necessitating the development of a plan for collaborating with industrial sector to assist translate research findings into outputs (Yaakub, et al., 2011). University-industry cooperation might enrich commercializing research outcomes from institutions of higher education (Ondimu, 2012; WIPO, 2007). Recently, it has been proposed that universities' collaborations with business, government and civil society provide them a more enduring mission that is essential for them to continue to exist in the modern period (Trencher, Yarime, McCormick, Doll, & Kraines, 2013).

For publicly financed research, approaches for producing research outputs and bringing them to market include corporate incentives and motivation through the creation of appropriate research environments. Encouraging research partnerships among the government, universities, and industry is essential for creating a knowledge-based economy and advancing a nation's global standing. This kind of cooperation is referred known as "triple-helix" (Narayan & Hooper, 2010). Recently, the venture capitalists and private sector have been added. Incentives that enable researchers in industrialized nations to profit from their innovations, such as the chance to keep up to 50% of the money made when their research findings are commercialized, are some of the ways that researchers have promoted university-industry links (World Intellectual Property Organization, 2007).

Universities form strategic partnerships with the industry sector based on an awareness of their respective strengths and areas of expertise in order for the connection to be mutually beneficial. Economic progress is associated with the practice of turning knowledge into profitable and job-producing businesses. In industrialized nations, numerous universities have established businesses that employ thousands of people and make money through their connections to industry. As indicated by certain Chinese businesses that devote up to 40 percent of their profits to academic research and development, the industrial sector in these nations is also highly active and the majority of corporations are eager to adopt and promote university research results (World Intellectual Property Organization, 2007). According to Ayisi (2016), commercialization is a more common method of knowledge transfer in Kenya. This can be accomplished in two ways: directly, by encouraging academic entrepreneurial spirit in incubators, or indirectly, by exchanging knowledge and skills through collaborations on research projects, consulting, patenting, contract

research, licensing intellectual property, or establishing start-up businesses. On the other hand, commercialization is a difficult process that must be overcome in Korea (Al Natsheh et al., 2015).

According to research, the knowledge base must be expanded by fresh academic knowledge to stimulate economic growth (Audretsch et al., 2006; ACS et al., 2010). Between the investment in new knowledge and its commercialization, there is a barrier or gap called the knowledge filter (Al Natsheh et al., 2015). It has been connected to excessive government regulation and bureaucratic red tape (Audretsch, 2014).

2.3.4 Research Outputs and Management Structures of the University

University-based research regulations must inspire and push researchers to create products based on their findings. Researchers must be permitted to use their discoveries in accordance with university policy to develop commodities and services that are beneficial to the society (Farsi, Modarresi, & Zarea, 2011). Universities should be aware of how their research policies and training affect researchers if they want to encourage faculty members to create research outputs. Supportive laws in the USA, including the Bahy-Dole Act of 1980, which encouraged institutions to patent their research findings and later transfer and commercialize them in business, have had a substantial impact on the commercialization of university research outcomes (Guenther & Wagner, 2008). In 1980, the Bahy-Dole Act was passed, allowing university research to be connected to business needs. Since then, various initiatives to commercialize concepts have been made in the US.

Universities engage in basic research, which is vital for generating the knowledge and discovery needed for innovation (Science Coalition, 2010). Governments have recently raised the bar for returns on their R&D expenditures as innovation becomes more and more important to economic growth (WIPO, 2007). Researchers are urged to submit their patent applications as soon as they develop original concepts or create new technologies (WIPO, 2007). Research-related intellectual property can aid in the transfer of technology from academic institutions to industry. University IP policy must include instructions and regulations about IP exploitation. Patenting innovations resulting from scholarly investigation can boost economic output (Svensson, 2008). University researchers can better grasp how to use their industry connections to market their research results with training and sensitization (Fletcher & Bourne, 2012).

University technology transfer offices, which are entrusted with turning research findings into marketable goods, are seen as having a role in commercialization. By matching what academia has to offer with what businesses are looking for, technology transfer offices connect academics and industry (Gutierrez & Correa, 2012). Although academic researchers might be able to spot entrepreneurial potential, their interactions with business have a bigger impact on how these opportunities are used. Ambos, Makela, Julian, and D'Este (2008) claim that technology transfer offices serve as knowledge intermediaries between academia and industry, providing information about and managing the commercialization process, which includes technology transfer, patenting, licensing, and the creation of new businesses. Collaborations between academia and industry can lead to commercialization through a technology transfer method that is advantageous to both parties. On the one hand, industry gains access to academic research, while academia that develops

innovations and technologies obtains resources in the form of skills and knowledge to commercialize their work (Henderson & Smith, 2002).

2.4 The Summary of Literature Review and the Identification of the Research Gap

Research financing appears to have an effect on university research outputs, according to all of the writers in the literature that has been analyzed. Additionally, each author makes the point that incentives for university academics to commercialize are mostly driven by the rewards they stand to gain. Only Amanor-Boadu & Metla, (2008) investigate how well-versed researchers are on commercialization and intellectual property laws. According to all of the writers, industry-university cooperation is essential for producing research outputs and commercializing university research findings. All of the authors agree that university research policies and technology transfer offices have an impact on academics' capacity to create research outputs. The literature analysis excludes the research studies that NACOSTI and other organizations have funded at private and public universities in Nairobi County. Concerns have been expressed by stakeholders about the capacity of African universities in general, and Kenya in particular, to attract research funding and translate research outputs into businesses. Many studies have been conducted on this subject (Mowery and Sapat, 2007, Rotheeamel, Agung and Jiang, 2007, Migosi, 2012). However, no study focusing on the four universities has been conducted. As a result, the purpose of this research is to fill that gap.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

Research design, target population, sample size, sample selection method, data collection tools, research instrument reliability and validity, data collection and analysis methods are discussed in this chapter. Ethical concerns were also considered in doing the research project.

3.2 Locale of the Study

The study was carried out at four carefully chosen universities in Nairobi County, which included both public and private institutions. Nairobi County shares borders with Machakos to the East, Kajiado to the South, and Kiambu County to the North and West. The longest border between the three neighboring counties is that which Nairobi County and Kiambu County share. The County is situated between the longitudes of 36o 45' East and 1o 18' South and covers an area of 696.1 Km^2. It is located at 1,798 meters above sea level. Towards the city limits, deep valleys split the gently rolling topography on the County's eastern side. A variety of ecosystems and a varied web of biodiversity are supported by the County, which is primarily a terrestrial area. It is home to a variety of plant types, 527 bird species, and over 100 different species of animals. Despite having a few permanent rivers, the effects of pollution from many sources have severely damaged the aquatic ecosystems. The Nairobi River Basin is now being worked on to guarantee its sustainability and cleanliness.

There are 85 wards and 17 constituencies in the County. Three public universities—Kenyatta University, Technical University of Kenya and the University of Nairobi are located in Nairobi County. Additionally, there are 16 campuses run by both public and private colleges, including ten private universities. The Central Business District is where the majority of the campuses are situated (CBD). Additionally, there are 237 science and technology institutes in the County (Nairobi County CIDP 2013-2017).

3.3 Research Design

According to Kothari (2014), a research design is the organization of methods for collecting and analyzing data in a way that aims to combine relevance to study purpose. According to Njoroge et al. (2015), the cause-and-effect relationship between the endogenous and exogenous variables under inquiry can be determined through descriptive research design. When gathering data on people's attitudes, opinions, habits, or any number of educational or societal issues, descriptive surveys might be employed (Orodho and Kombo, 2002). In this study, the researcher used cross sectional survey design to collect data at one point in time (Creswell, 2014). This study's aim is to describe the current situation without trying to change it in any way. The cross-section descriptive research design was used for this investigation. Some of the key characteristics of a cross-sectional study include: the study takes place at a single point in time; it does not involve manipulating variables; it allows researchers to look at numerous characteristics at once (age, income, gender, etc.); it's often used to look at the prevailing characteristics in a given population; it can provide information about what is happening in a current population. A descriptive survey

is not just for gathering information; it may also frequently lead to the development of crucial knowledge concepts and answers to pressing issues.

Specific data collection techniques, including observation, case studies, and questionnaires, can be used to conduct descriptive surveys. Since quantitative data is gathered, it gives information and a comprehensive understanding of a research issue. In order to provide accurate and high-quality data, it delivers high-quality data that enables research to be conducted in the respondents' natural setting. The data collection process for a descriptive survey is rapid and inexpensive. Because the data gathered is reliable and simple to examine and serves as the foundation for decision-making.

3.4 Target population

All individuals and organizations that comprise study universes are referred to as the population (Kothari & Garg, 2014). The complete group of individuals, occasions, or problems that the researcher desires to examine is referred to as the "target population," and serves as a base from which the sample size or scope of the study will be determined (Mugenda and Mugenda, 2003). The target population for this study was university researchers who are lecturers, PhD Students and any other staff in the universities involved in research. A total of 306 university researchers from Kenyatta University, University of Nairobi, Strathmore University and Catholic University of Eastern Africa who are active researchers and have received funds from various organizations made up the target group for this study.

3.5 Sample and Sampling Procedures

An analytical subset of a broader population is called a sample. Any conclusions drawn from the sample should hold true for the entire population (Orodho, 2012). A specific method for choosing a sample from a given population is known as a sample design. An established strategy for drawing a sample from a certain population is known as a sample design. It speaks of the method or process the researcher would use while choosing the sample's components. Sampling was used to reduce costs, gather data more quickly, increase the reliability of the results, and make basic information about the population more available. The subject chosen for sampling must be illustrative of the total target population of the research. It is always possible to determine the extent of sampling errors and the degree of probability reliability of the results through sampling (Cooper & Schindler, 2012).The sample for this study was made up of university researchers. Cluster random sampling was used in this investigation. Cluster sampling subdivides a population into smaller groups known as clusters. Each university selected acted as a cluster. A sample was then drawn at random from these clusters. This is because the population under investigation was diverse. There are differences among university researchers in terms of gender, rank and academic specialties. Male and female university researchers were given questionnaires. University researchers were chosen using stratified sampling technique.

3.5.1 Sampling of Universities

Sampling is the process by which a researcher collects people, places, and things to study (Kombo & Tromp, 2013). Nairobi County is home to four public universities and ten private institutions. Universities were chosen for participation in the study using a stratified sampling

technique. Private and public universities formed the strata. The researcher used a stratified sampling technique to select 50% of public universities and 20% of public universities schools from each stratum, totaling four universities that participated in the study.

3.5.2 Sampling of University Researchers

The researcher got number of representation from each university by using the stratified sampling where each university was used as a stratum. From each stratum, the researcher picked between 10% to 30% of the university researchers which according to Mugenda and Mugenda (2013) were representative enough for each category to participate in the study. Strathmore University, Catholic University of Eastern Africa, Kenyatta University and the University of Nairobi were chosen from among the Nairobi County's universities. The universities were chosen at random based on their accessibility, location and availability of data on university researchers. The chosen universities are an ideal sample size for this study since they include a diverse range of faculties as well as a large student population. It actually comprises all researchable faculties and divisions. A sampling frame is a database of potential respondents from which people can be recruited to take part in a study. The sampling frame for this study is university lecturers from chosen universities. According to Mugenda & Mugenda (2013), for descriptive study instruments, a sample size of 10% to 50% is considered acceptable to assure consistency across all variables under consideration.

Table 1: Sample Matrix

University	Total	Percentage	Sample size
Kenyatta University	40	30%	12
UoN	63	30%	19
Strathmore	140	30%	42
CUEA	63	30%	19
Total	**306**		**92**

Source: NACOSTI, Strathmore University website and CUEA website

3.6 Description of Research Instruments

Data collection, according to Creswell (2014), is the process of obtaining information from the subjects of a research. Since this study relied on primary data, questionnaires were employed to gather information. Mugenda and Mugenda (2013) posits that questionnaire provide detailed answers to complex problems. Furthermore they are preferred method because of the ease and minimal cost in their construction and administration. There are two categories of questions that may be applied in a questionnaire i.e. closed-ended and open-ended questions (Fellows and Liu, 2015). The questionnaires for this study had both closed and open ended questions.

3.6.1 Questionnaires for University Researchers

Questionnaires were the primary data collection instrument in this project. The questionnaires were divided into five sections based on the variables provided in the research project. Open-ended and closed-ended questions were included. The first component of the questionnaire included closed-ended questions focusing on demographic information such as the

University researchers' gender, age, highest academic qualification, institutional affiliation, and role and research experience. The second section of the questionnaire asked about research funding and how it affects research outputs at various private and public universities in Nairobi County. The third section included questions on the commercialization of the research outputs in the four universities. The fourth section asked about industrial involvement and how it affects research outputs at Nairobi County's private and public universities. Finally, the fifth section included a series of questions about how research outputs are affected by institutional administrative structures in Nairobi County's selected private and public universities. This instrument is attached in this dissertation in appendix I.

3.7 Validity, Pilot Testing and Reliability of Research Instruments

Before going into the field to collect data, the research instrument's validity and reliability were determined. Instruments were also tested in advance for their use in the field study.

3.7.1 Validity of Research Instruments

The data's validity describes how well it covers the exact area of research (Ghauri and Gronhaug, 2005). The main measure of how well-founded and likely accurate a notion, conclusion, or measurement is called validity (Field, 2005). If a research tool measures what it is intended to measure and accurately captures the respondents' perspectives, it is regarded as valid. The validity of the content was a concern for the researcher. The research supervisors were consulted to ascertain the research instrument's content validity.

3.7.2 Pilot testing of the Research Instruments

A pilot study is an initial test done prior to the main study to verify that the questionnaires are functioning appropriately. Pilot testing of research instruments reveals flaws and makes recommendations for improvement. It ensures the content validity of a questionnaire by providing the opportunity to improve questions and the instrument's format (Creswell, 2014). The questionnaires were administered to 15 university researchers from universities that were not included in this study. Following the completion of the questionnaires, the researcher solicited feedback from researchers who had completed the questionnaires so as to evaluate the questionnaires in terms of clarity of question items, their appropriateness, and relevance, as recommended by Neuman (2014).

3.7.3 Reliability of Research Instrument

Reliability, which is characterized as the stability or consistency of scores across time, gauges how error-free and consistently accurate a measurement is (Mugenda and Mugenda, 2008).The Cronbach Alpha approach was employed, which only requires one test to assess instrument internal consistency. For survey research and other questionnaires containing more than two choices, such as the Likert scale, the Cronbach Alpha approach is the most appropriate internal reliability test (Kothari & Garg, 2014). The reliability coefficient of the questionnaire was 0.714 (refer to appendix II). According to McMillan and Schumacher (2001), a good rule of thumb for satisfactory reliability is at least 0.70, regardless of the sort of research done.

Table 2: A rule of thumb for interpreting alpha for dichotomous questions

Cronbach's alpha	**Internal Consistency**
$0.5 > \alpha$	Unacceptable
$0.6 > \alpha \geq 0.5$	Poor
$0.7 > \alpha \geq 0.6$	Questionable
$0.8 > \alpha \geq 0.7$	Acceptable
$0.9 > \alpha \geq 0.8$	Good
$\alpha \geq 0.9$	Excellent

The questionnaire for university researchers was subject to Cronbach's alpha test and 0.714 was arrived at. This is considered as acceptable according Table 2 contents.

3.8 Data Collection Procedures

According to Creswell (2014) data collection procedures refer to the protocol that must be followed to make sure that data collection tools are applied efficiently and correctly. The researcher obtained a clearance letter from the Department of Postgraduate Studies in Education at the Catholic University of Eastern Africa. Thereafter, the researcher applied and obtained a research license from NACOSTI for her to be able to conduct research. The researcher used questionnaires in this study to gather information from the respondents. The questionnaire was

printed and administered through give and pick method. Additionally, an online survey tool was developed where university researchers who were far filled the questionnaires.

3.9 Data Analysis Techniques

Data Analysis describes how the information gathered during the data collection method was interpreted to derive meaning. Both quantitative and qualitative data were collected for this project from the questionnaire's close-ended and open-ended questions, respectively.

Thematic analysis of qualitative data was used to identify and analyze the main themes that emerged from individual responses in order to assess the sufficiency, value, and consistency of the information provided. The quantitative information from the closed-ended questions was coded using SPSS software version 23 and descriptive statistics were utilized to examine it. The outcomes of the data analysis were presented using frequency tables and charts.

3.10 Ethical Considerations

NACOSTI granted a research permit after CUEA approved for the researcher to proceed for data collection. Prospective respondents were contacted to request their consent to take part in the research study and they were given the assurance that all information would be kept private and used solely for those objectives. The conclusions and suggestions of the study were not affected by any data manipulation. The research study included references and statements that were all correctly cited.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the research study's findings and discusses them. It contains the questionnaire response rate, demographic characteristics of the respondents, effects of amount of research funding, university researchers' characteristics, industrial involvement and institution administrative structures on research outputs.

4.2 Questionnaire Response Rate

The researcher sent questionnaires to the participants of the study in the selected universities. They were requested to fill the questionnaire online with the required information. Their response rate is presented in Table 3.

Table 3: Questionnaire Response Rate

Institution	**Sampled Size**	**Number Filled**	**Response rate**
University of Nairobi	19	19	100%
Strathmore	42	35	83%
Kenyatta University	12	12	100%
CUEA	19	17	89%
TOTAL	**92**	**83**	**90%**

Table 3 above shows that the average questionnaire response rate was 90%. This was above 70%, which Mugenda and Mugenda (2008) consider to be adequate for analysis.

4.3 Demographic Information of the Respondents

This concentrated on gender, age, highest academic qualification, university, role and area of research of the respondents as shown in table 4a.

Table 4a: Demographic Information of the Respondents

Statement	Frequency	Percentage
Gender of Respondents		
Male	29	34.9
Female	54	65.1
Total	**83**	**100**
Age		
20-24	4	4.8
25-29	1	1.2
30-34	6	7.2
35-39	13	15.7
40-44	19	22.9
45-49	15	18.1
50-54	17	20.5
55 and above	8	9.6
Total	**83**	**100.0**
Highest academic qualification level		
Degree	9	10.8
Diploma	1	1.2

Masters	42	50.6
PhD	31	37.3
Total	**83**	**100.0**
University a researcher belongs		
CUEA	17	20.5
KU	13	15.7
UoN	21	25.3
Strathmore	32	38.6
Total	**83**	**100**
Role played at the University		
Lecturer	24	28.9
Student	31	37.3
Both	23	27.7
Other	5	6.0
Total	**83**	**100.0**

From table 4a above, majority of the respondents were female (65.1 percent) and 34.5 percent were male. 22.9 percent of the respondents were in the age bracket 40-44 while 1.2 percent were in 25-29 age bracket. Majority of the respondents recorded that they had masters and PhD at 50.6 percent and 37.3 percent respectively. 38.6 percent of the respondents belong to Strathmore, 25.3 percent to University of Nairobi, 20.5 percent to CUEA and 15.7 percent to KU. With regards to their roles, 28.9 percent of the respondents were lecturers, 37.3 percent were students, 27.7 percent were both lecturers and students and 6 percent of the respondents had other roles such as administrative staff, quality assurance officer, community coordinator, innovation center office secretary and head of examinations.

Table 4b: Area of Research

Area of Research	**No. of Lecturers**	**Percentage**
Business Administration	17	20
Law	10	12
Education	9	11
Information computer technology	9	11
Economics	8	10
Medicine	7	9
Actuarial Science	3	4
Human resource	2	2
Agriculture	2	2
Psychology	2	2
Research	2	2
Archeology	1	1
Arts and design	1	1
Chemical Sciences	1	1
Disaster management	1	1
Governance	1	1
HIV Management	1	1
Interior design	1	1
International Security	1	1
Petroleum Engineering	1	1
Public Relations	1	1
Engineering	1	1
Youth and drug abuse	1	1
Total	**83**	**100**

From table 4b above, the leading areas of research are business administration, law, education and Information, Communication and Technology at 20%, 12%, 11% and 11% respectively.

Table 4c: Length of Involvement in Research

Statement	**Frequency**	**Percentage**
1-5years	27	33
11-15 years	15	18
6-10 years	21	25
Less than 1 year	10	12
Over 15 years	10	12
Total	**83**	**100**

From table 4c above, majority of the respondents have been involved in research for a duration of 1-5 years (33 percent) followed by 6-10 years (25 percent). The least respondents involved in research are those with durations of less than 1 year and over 15 years at 12 percent each. The findings concur with Pablo, Beatrice and Danny (2021) findings that time invested on research have a direct impact on research output.

4.4. Findings according to the Research Questions.

This section presents results according to the research questions of the study which are:

a) How does access and utilization of research funds affect research output in the universities?

b) To what extent are research outputs commercialized?

c) How does the management structure of the university influence research output?

d) How does industry –university collaboration influence research output in the universities?

4.4.1 How access and utilization of research funds affect research output in the university

The first research question sought to determine how access and utilization of research funds affected research output in the four universities. To answer this question, university lecturers who participated in the study were asked if they were able to access research funds, the amount of research funds they received, the organizations where they got these funds and how efficiently the funds were disbursed. Tables 5 to 10 are addressing these matters.

Table 5. Receipt of research funding from any organization

Statement	Frequency	Percent
No	20	24.1
Yes	63	75.9
Total	**83**	**100.0**

From table 5 above, 75.9 percent of the respondents received funding whereas 24.1 percent did not. The respondents recorded that they received funding from the following organizations: Africa grant for young scientists, Afya bora fund, Asian and African students scholarship, Bill and Melinda gates foundation, Bamburi cement, Carissa (Canada), Church funding, Coca-Cola Africa, EARF, East African Science and Technology commission, French Institute for Research in Africa, Higher Education Loans Board, IGAD, Nuremberg Academy, GIZ, Johnson and Johnson scholars award, University of Nairobi, NGO, Kickstarter Program, Strathmore University, National Research fund, Rudisha Foundation, University of Pretoria, South Africa, UNEP, WFP, Women in Technology award, Young Scientists of Kenya and Xavier McKinney organization. However, some of the funding were bound by a Non-Disclosure Agreement.

Table 6: Efficiency of organization's disbursement process

Statement	**Frequency**	**Percent**
Yes	50	60.2
No	15	18.1
Not applicable	14	16.9
Total	**83**	**100.0**

From table 6 above, 60.2 percent of the respondents recorded that they believed organization's disbursement was efficient. However 18.1 percent of the respondents recorded that the disbursement process was not efficient. The reasons some respondents recorded that the disbursement process was not efficient were: inadequate budget, long bureaucracy, long waiting period to obtain funds and tedious application process. According to Velde, Robbin & Korlaar,

Leonique & Hertog, Pim & Steur, Jessica & Lilischkis, Stefan (2014), the performance of a research system is ultimately determined by the conduct of its researchers. Therefore essential factors (such as research funding) are important but only have an indirect effect on the performance of a research system.

Table 7: Amount received for research project in Kenya Shillings

Statement	**Amount of funding (KES)**
Highest	5,000,000
2nd Highest	4,050,000
3rd Highest	3,000,000
3rd Lowest	65,000
2nd Lowest	45,000
Lowest	30,000
Average	410,016

From table 7 above, the highest amount of funding was Kes 5 million followed by Kes 4.05million and 3 million respectively. The lowest amount of funding was Kes 30,000. On average a researcher received Kes 410, 016 for those who were able to receive funding. This figure is rather low because I was not able to talk to Directors of research and top managers of the university. This can be captured by another study.

Table 8: Adequacy of funding level

Statement	Frequency	Percent
Yes	47	60.3
No	19	24.4
Not applicable	12	15.4
Total	**78**	**100.0**

From table 8 above, 60. 3 percent of the respondents recorded that the funding level was adequate. 24.4 percent of the respondents recorded that the funding level was not adequate. They attributed this to other unbudgeted expenses that rose when doing project and low funding in comparison to their research work. This contradicted Philip Hunter's findings that university who found that research funding was not enough as many universities responded to the demand for more and better research by reducing funding for activities that do not seem to be related to research efforts (Hunter 2013).

Table 9: University Researchers' Responses on Research Funding

Statement	**1**		**2**		**3**		**4**		**5**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
The funds received were sufficient to cover all budget items	34	42.0	23	28.4	10	12.3	10	12.3	4	4.9
The funds received facilitated me to translate research findings	15	18.5	33	40.7	21	25.9	7	8.6	5	6.2
I used some of the research funds I received from organizations to translate my findings	22	27.2	34	42.0	13	16.0	4	4.9	8	9.9
The university provided me with some funding to help me translate my research findings	22	27.2	22	27.2	16	19.8	9	11.1	12	14.8

Key: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree

Table 9 above shows that 42 percent of the respondents strongly agreed that the funds they received were adequate to cover all their budget items while 4.9 percent of them strongly disagreed. 40.7 percent of the respondents agreed that the funds they received facilitated them in translating research findings while 6.2 percent strongly disagreed. 42 percent of the respondents agreed that they used some of the research funds from organizations to translate their findings while 9.9 percent strongly disagreed. There was strong agreement (27.2 percent) and agreement

(27.2 percent) by the respondents that universities provided them with some funding to help them translate their research findings. However, 11.1 percent disagreed and 14.8 percent were in strong disagreement.

On matters advice or recommendation on how to improve the disbursement process in the future, the respondents recorded that there should be: adequate and timely communication from the funding organization when the funds are disbursed; an automated communication to the applicants when funds are received; information on reasons for failure to get their requested amount in their applications; different forms of payouts to the applicants; frequent follow-ups between the organization and the researcher for role clarity and efficiency; a correct channel to disburse funds; clear guidelines; a system that contains all research funding programmes; less bureaucratic methods of financial reporting; more equitable research funding procedures; improvement of the funds to university for researchers and engagement of applicants to ensure that they reduction of dissonance levels which increase satisfaction and avoid embezzlement of funds.

Table 10: University Researchers' Responses on Research Funding

Statement	**1**		**2**		**3**		**4**		**5**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
The funds received were sufficient to cover all budget items	34	42.0	23	28.4	10	12.3	10	12.3	4	4.9
The funds received facilitated me to translate research findings	15	18.5	33	40.7	21	25.9	7	8.6	5	6.2
I used some of the research funds I received from organizations to translate my findings	22	27.2	34	42.0	13	16.0	4	4.9	8	9.9
The university provided me with some funding to help me translate my research findings	22	27.2	22	27.2	16	19.8	9	11.1	12	14.8

Key: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree

Table 16 above shows that 42 percent of the respondents strongly agreed that the funds they received were adequate to cover all their budget items while 4.9 percent of them strongly disagreed. 40.7 percent of the respondents agreed that the funds they received facilitated them in translating research findings while 6.2 percent strongly disagreed. 42 percent of the respondents agreed that they used some of the research funds from organizations to translate their findings while 9.9 percent strongly disagreed. There was strong agreement (27.2 percent) and agreement

(27.2 percent) by the respondents that universities provided them with some funding to help them translate their research findings. However, 11.1 percent disagreed and 14.8 percent were in strong disagreement. This contradicted Philip Hunter's findings that university who found that research funding was not enough as many universities responded to the demand for more and better research by reducing funding for activities that do not seem to be related to research efforts (Hunter 2013).

On matters advice or recommendation on how to improve the disbursement process in the future, the respondents recorded that there should be: adequate and timely communication from the funding organization when the funds are disbursed; an automated communication to the applicants when funds are received; information on reasons for failure to get their requested amount in their applications; different forms of payouts to the applicants; frequent follow-ups between the organization and the researcher for role clarity and efficiency; a correct channel to disburse funds; clear guidelines; a system that contains all research funding programmes; less bureaucratic methods of financial reporting; more equitable research funding procedures; improvement of the funds to university for researchers and engagement of applicants to ensure that they reduction of dissonance levels which increase satisfaction and avoid embezzlement of funds.

4.4.2 The extent to which research outputs are commercialized

Research question 2 sought to determine how research outputs were commercialized. To answer this research question, lecturers who participated in the study were asked to indicate the products that had been commercialized from research findings in the university. The responses are found in Tables 11 to 17.

Table 11: Research Products

Statement	Frequency	Percent
Publication Refereed Journal	14	16.9
Conference presentation	13	15.7
Other	12	14.5
Business startup	8	9.6
Policy Brief	8	9.6
Textbook	7	8.4
Copyright	5	6.0
Utility model	4	4.8
Industrial design	3	3.6
Trademark	2	2.4
Total	**83**	**100.0**

From table 15 above, the highest number of research products were publication refereed journal (16.9 percent) followed by conference presentation (15.7 percent) and policy briefs (9.6 percent). The lowest research products were trademark (2.4 percent), industrial design (3.6 percent) and utility models (4.8 percent). 14.5 percent of the respondents recorded that they had produced other research products not stated above. The findings match those of Lancho-Barrantes and Cantu-Ortiz (2020) who found that most research outputs were publications in journals.

Table 12: Commercialization of Research Results

Statement	Frequency	Percent
Yes	33	39.8
No	50	60.2
Total	**83**	**100.0**

From table 17 above, 60.2 percent of the respondents recorded that they had not commercialized their research results before. About 39.8 percent recorded that they had commercialized their research findings before. This findings match those of Knut, Jakob and Aikaterini (2018) who observed that there is a gradual change in transfer activities of researchers in the last decades which has expanded to include academic engagement and, more recently, commercialization.

Table 13: Experience influence on commercialization efforts

Statement	Frequency	Percent
Yes	59	78.7
No	8	10.7
Not applicable	8	10.7
Total	**75**	**100.0**

From table 18 above, 78.7 percent of the respondents believed that experience influences commercialization efforts now and in the future whereas 10.7 percent did not. The findings match those of Leitner, Bergner & Rybnicek, (2021), who proved in several studies that the scientific experiences and competences of academic leaders enhance the scientific performance of their teams and institutions in the future.

Table 14: Learning about commercialization

Statement	**Frequency**	**Percent**
Sensitization by University	34	41.5
Own Initiative	34	41.5
Other organizations	12	14.6
Sensitization by University, Other organizations	1	1.2
Sensitization by University, Own Initiative	1	1.2
Total	**82**	**100**

From table 19 above, majority of the respondents learnt about commercialization through sensitization by university (41.5 percent) and own initiative (41.5 percent). 14.6 percent learned through other organizations or sources which included: television network advertisement, Bill gates foundation, EARF, CLE, Intellectual Rights Board, KIPPRA, donors and social media. A smaller percentage of the respondents learned through both sensitization and other organizations (1.2 percent) and sensitization by university and own initiative (1.2 percent). The findings match

those of Caulfield and Ogbogu, (2015) who observed that the socio-economic benefits of increased and rapid research commercialization are often emphasized in policy statements and discussions, although there is less mention or discussion of potential risks. According to studies by Bacon et al. (1994) and Moenart et al. (1995), poor or insufficient understanding of the client is a result of poor communication between R&D and marketing.

Table 15: Factors influencing Research Outputs in Kenya

Statement	**1**		**2**		**3**		**4**		**5**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Research funding from the university	44	53.0	25	30.1	5	6.0	8	9.6	1	1.2
Reserve funds for commercialization	25	30.1	39	47.0	6	7.2	11	13.3	2	2.4
Entrepreneurial skills and commercialization knowledge	37	44.6	37	44.6	5	6.0	3	3.6	1	1.2
Policy requiring researchers to commercialize their findings	31	37.3	35	42.2	11	13.3	5	6.0	1	1.2
Interaction with the business / industrial sector	31	37.3	42	50.6	7	8.4	3	3.6	0	0
University Intellectual Property guidelines	37	44.6	38	45.8	5	6.0	2	2.4	1	1.2

Key: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree

There was strong agreement by the respondents that research funding from the university (53.0 percent) effect on research outputs whereas 1.2 percent of them were in strong disagreement. 47 percent of the respondents were in agreement that reserve funds for commercialization influences research outputs while 2.4 percent of them strongly disagreed. There was strong agreement (44.6 percent) and agreement (44.6 percent) that entrepreneurial skills and commercialization influenced research outputs while 1.2 percent were in strong disagreement. Additionally, majority of the researchers, agreed that presence of a policy requiring researchers to commercialize their findings influence research products while 1.2 percent strongly disagreed. Majority of the researchers agreed that interaction with business (50.6 percent) and UIP guidelines (45.6 percent) influenced research outputs. The findings matched those of Albert, Fretheim and Maïga (2015) who found that access to information, relevance of the research, use of research perceived as a time consuming process, trust in the research, authority of those who presented their view, competency in research methods, priority of research in the policy process and accountability were some of the factors that influenced research outputs.

Table 16: Reasons for generation of research outputs according to level of importance

Statement	**1**		**2**		**3**		**4**		**5**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
For recognition and reputation	43	51.8	26	31.3	8	9.6	1	1.2	5	6.0
For job satisfaction	32	38.6	44	53.0	6	7.2	1	1.2	0	0
For extra income	39	47.0	36	43.4	7	8.4	1	1.2	0	0
Requirement by University	23	27.7	42	50.6	16	19.3	2	2.4	0	0
Opportunity to do so	34	41.0	39	47.0	9	10.8	1	1.2	0	0
Career advancement	30	36.1	41	49.4	8	9.6	3	3.6	1	1.2

Key: 1=Very important, 2=Important, 3=Somewhat Important, 4=Uncertain, 5=Not Important

From table 21 above, there was strong agreement by researchers that recognition and reputation (51.5 percent) and extra income (47 percent) were some of the reasons for producing research outputs. There was also agreement by respondents that job satisfaction (53.0 percent), requirement by university (50.6 percent), existence of an opportunity (47 percent) and career advancement (49.4 percent) were reasons for producing research outputs. The findings matched those of Armijos, Pablo, Beatrice and Arévalo-Avecillas (2021) who found that previous research publications are the main factor that explains subsequent research production. They also found that age, academic rank, time invested on research, resource allocation, recognition, and research leaders have a direct effect on research output.

Table 17: Respondent's perception on research outputs and commercialization of research results

Statement	1		2		3		4		5	
	F	%	F	%	F	%	F	%	F	%
Train and sensitize on Commercialization and Intellectual property rights (IPR)	65	78.3	17	20.5	1	1.2	0	0	0	0
Allocate enough time to Concentrate on Research	40	48.2	36	43.4	4	4.8	3	3.6	0	0
Provide Financial Support for Commercialization	52	62.7	24	28.9	5	6.0	2	2.4	0	0
Develop policy on Commercialization	41	49.4	34	41.0	7	8.4	1	1.2	0	0
Establish well managed Technology Transfer Offices	53	63.9	30	36.1	0	0	0	0	0	0
Establish Incubation Hubs/Centres	49	59.0	30	36.1	3	3.6	1	1.2	0	0
Offer incentives to publish	45	54.2	28	33.7	9	10.8	1	1.2	0	0
Pay for patents developed by Researchers at University	46	55.4	31	37.3	5	6.0	1	1.2	0	0
Mainstream entrepreneurial skills in University Curriculum	46	55.4	33	39.8	3	3.6	1	1.2	0	0
Seek partnership with Industry to help in Commercialization efforts	52	62.7	28	33.7	3	3.6	0	0	0	0
Offer Incentives to those who have Commercialized their Research Results	50	60.2	26	31.3	5	6.0	2	2.4	0	0
Monitoring to ensure that researchers commercialize viable research results	45	54.2	35	42.2	2	2.4	1	1.2	0	0

From table 22 above, training and sensitization on commercialization and IPR (78.3 percent); allocation of enough time to concentrate on research (48.2 percent), provision of financial support for commercialization (62.7 percent); development of policy on commercialization (49.4 percent); establishment of well managed Technology Transfer Offices (63.9 percent); establishment of incubation hubs (59 percent); offering incentives to publish (54.2 percent); paying for patents developed by researchers at University (55.4 percent); mainstreaming entrepreneurial skills in University curriculum (55.4 percent); seeking partnership with industry to help in commercialization efforts (62.7 percent); offering incentives to those who have commercialized their research results (60.2 percent) and monitoring to ensure that researchers commercialize viable research results (54.2 percent) were recorded by respondents as ways that have increased research output and commercialization of research results.

4.4.3 How management structures of the university influenced research output

Research question 3 sought to determine how university management including policies influenced research output at the university. To answer this question the university lecturers who participated in the study were asked if there are guidelines governing the administration of research funds, whether there were offices that monitored completion of research projects and if the management had a committee overseeing research in the university. The answers to these questions are covered by Tables 23 to 25.

Table 18: Guidelines or regulations to ensure timely project implementation at University

Statement	Frequency	Percent
No	10	12.0
Yes	73	88.0
Total	**83**	**100.0**

From table 23 above, 88 percent of the respondents recorded that their universities have guidelines or regulations to ensure timely project implementation.

This is clearly supported by number of other international documents and codes of conduct have specified good or appropriate research practices (CCA, 2010; DCSD, 2009; ESF-ALLEA, 2011; ICB, 2010; IOM-NRC, 2002; MPG, 2009; NHMRC-ARC-Singapore Statement, 2010; TENK, 2002; UA, 2007; UKRIO, 2009). Furthermore, as illustrated by various educational guides, responsible research practices have served as the primary subject matter for the responsible conduct of research education activities (Gustafsson & Högström, Claes & Radnor, Zoe & Friman, Margareta & Heinonen, Kristina & Jaakkola, Elina & Mele, Cristina. (2016); IAP, 2016).

Table 19: Presence of policies at university that govern research outputs and commercialization of research results

Statement	Frequency	Percent
Yes	75	90.4
No	8	9.6
Total	**83**	**100.0**

From table 10 above, majority of the respondents (90.4 percent) recorded that their universities have policies which govern research outputs and the commercialization of research results while 9.6 percent did not. The findings were supported by Caulfield and Ogbogu (2015) who observed that socio-economic benefits of increased and rapid research commercialization are often emphasized in policy statements and discussions and called for a more balanced assessment of the commercialization ethos and trends.

Table 20: Presence of system in place at the university to monitor regulations

Statement	**Frequency**	**Percent**
Yes	64	77.1
No	19	22.9
Total	**83**	**100.0**

From table 11 above, majority of the respondents (77.1 percent) recorded that there was a system in place in universities to monitor that regulation are followed while 22.9 percent did not. The findings agrees with Ochieng, Ecuru, Nakwagala et al (2013) who found that compliance monitoring was feasible and affordable in resource limited setting and noted that there was need for a pro-active approach by all stakeholders so that there is achievement of ethical conduct of research.

Table 21: Teaching hours and research hours are allowed for University Researchers per week

Statement	Teaching Hours	Research Hours
Lowest	3	3
2nd Lowest	6	6
3rd Lowest	9	9
Average	24	20
Highest	55	56
2nd Highest	50	50
3rd Highest	47	47

According to the researchers, the lowest teaching hours as well as research hours were 3, 6 and 9. The highest teaching hours 47, 50 and 55. Additionally, the highest research hours were 47, 50 and 56 as shown in table 12 above. On average a researcher spend 24 hours teaching and 20 hours doing research.

Table 22: Sufficiency of the amount of time allocated for research

Statement	Frequency	Percent
Yes	53	64.6
No	29	35.4
Total	**82**	**100**

Majority of the respondents (64.6 percent) of the respondents recorded that they had sufficient time allocated for research in their universities while 35.4 percent did not as shown in table 13 above. The reasons for recording that they had sufficient time to conduct research were: being given adequate opportunity and resources to conduct research; mutual understanding; having more hours for research than work and balancing between working, research and personal life. The findings differ from those of Jung and Choi (2022) who found that there was deteriorated preference for allocation of research time especially after COVID-19.

The reasons for those who recorded they had no sufficient for research were: less hours allocated for research; more time being spend on teaching related activities; research being continuous and time consuming and too much work load for teaching. Jung and Choi (2022) suggested that there was need for universities to have systems and policies to facilitate academics' research time allocation for enhanced research productivity.

Table 23: Encouragement to publish or acquire IP for research findings

Statement	**Frequency**	**Percent**
Yes	70	84.3
No	13	15.7
Total	**83**	**100.0**

Majority of the respondents (84.3 percent) recorded that their universities encouraged them to publish or acquire IP for their research findings while 15.7 percent as shown in table 14 above.

Table 24: Completion of project in time

Statement	Frequency	Percent
Yes	72	86.7
No	11	13.3
Total	**83**	**100.0**

86.7 percent recorded that they completed their projects on time whereas 13.3 percent did not as shown in table 24 above. This was contrary to McManus and Wood-Harper (2008) findings that only one in eight information technology research projects can be considered truly successful (failure being described as those projects that do not meet the original time, cost and quality requirements criteria).

Some of the reasons recorded for not finishing projects on time were: lag in time in securing funding; balancing between being an employee and student; inadequate time to complete the project; inability to translate the results into an industrial design that was functional to be used on day to day transactions; lack of funds and inadequate project planning.

Table 25: Translation of research result into research products since completion of the research

Statement	Frequency	Percent
Yes	61	73.5
No	22	26.5
Total	**83**	**100.0**

73.5 percent of the respondents recorded that they were able to translate results to research products while 26.5 percent did not as shown in table 25 above. The findings agree with the arguments of Sandstrom and Van Den Besselaar (2016) who observed that there was constant or increasing marginal returns with higher numbers of publications in most research fields, including chemistry, life sciences and sociology.

4.4.4 Industrial Involvement in research output in the universities

The fourth Research question sought to determine the involvement of industry in the research output in universities. The lecturers who participated in the study were asked whether they collaborated with industry in their research activities or not. Tables 26 to 34 address these concerns.

Table 26: University and industrial sector linkage to support research outputs and commercialization

Statement	**Frequency**	**Percent**
Yes	63	75.9
No	7	8.4
I don't know	13	15.7
Total	**83**	**100.0**

From table 26 above, majority of the respondents (75.9 percent) recorded that there was a formal link between university and industrial sector to support research outputs and commercialization whereas while 7 percent did not. Surprisingly, 15.7 percent of the respondents

did not know whether such a linkage exists. The findings are supported by Assefa Abraham (2016) who recommended suggestions for development of a collaborative culture, improvement of the innovation system and facilitation of a greater university-industry collaboration.

Table 27: Institution involvement in joint/collaborative research with the industrial sector

Statement	**Frequency**	**Percent**
Yes	68	81.9
No	10	12.0
I don't know	5	6.0
Total	**83**	**100.0**

From table 27 above, majority of the respondents (81.9 percent) recorded that their institutions had a joint research with the industrial sector, 12 percent did not and 6 percent did know whether such collaboration exists. The findings are supported by Assefa Abraham (2016) who recommended suggestions for development of a collaborative culture, improvement of the innovation system and facilitation of a greater university-industry collaboration.

Table 28: Presence of a Technology Transfer Office at the university

Statement	**Frequency**	**Percent**
Yes	64	78.0
No	8	9.8
I don't know	10	12.2
Total	**82**	**100.0**

From table 28 above, majority of the respondents (78 percent) reported existence of a technology transfer office at their universities while 9.8 percent did not. Remarkably, 12.2 percent did not know whether such an office exists.

Table 29: Existence of a Technology Transfer Office and commercialization of research results

Statement	**Frequency**	**Percent**
Yes	70	86.4
No	11	13.6
Total	**81**	**100**

From table 29 above, most of the respondents (86.4 percent) recorded that presence of a transfer office boosts commercialization of research results while 13.6 percent did not. They recorded that a transfer office: acts as an open door to commercialize research; arranges the purchase and delivery of new computer hardware for research teams; enables people to get funds from different organizations; enhances efficiency in communication; provides linkages; acts as a platform for guiding researcher in commercialization of their research findings; enables researchers to have a smooth transition from the lab to the business world; maintains quality of research product; helps to achieve standardized process which facilitates cost effective production; promotes invention and innovation of new products; updates on trends of technological development and improvement; assist in the pairing up of researchers with appropriate partners for their project; emphasize the importance of intellectual property protection; facilitate research-based results through helping researchers in licensing, patenting or management of spin-off

creations; accelerates the commercialization process by providing services in several aspects that assist the researcher in the process and accelerates access to opportunities and resources.

The findings are similar to those of Dagmara (2014) who found two approaches to commercialization, namely transactions-focused practice and relations-focused practice which co-exist and co-evolve in some TTOs while in other TTOs they are predominantly transactions-focused.

Table 30: Collaboration with anyone from industry during research

Statement	**Frequency**	**Percent**
Yes	46	56.1
No	36	43.9
Total	**82**	**100.0**

From table 30 above, 56.1 percent of the respondents recorded that they collaborated with anyone from the industry while 43.9 percent did not. The collaboration help them in: accessing respondents and other data; combining expertise; finishing the research in time; having a more practical experience in analysis and interpretation; advancing research knowledge and creative skills; commercializing project and knowledge transfer and intellectual insight. The findings were supported by Guan, Jian & Yam, Richard & Mok and Chiu, (2005) who revealed that university research cannot produce innovation without practical knowledge which is provided by company during collaboration. Additionally, the company cannot produce scientifically based innovation without the interactive learning.

Table 31: Ability of the University to provide necessary equipment for research

Statement	Frequency	Percentage
Yes	61	73.5
No	22	26.5
Total	**83**	**100.0**

From table 31 above, a greater percentage of the respondents (73.5 percent) recorded that the universities were able to provide them with necessary equipment for research while 26.5 percent did not. Those who were not able to be facilitated obtained necessary equipment by: acquiring a loan from the bank and grants to purchase the needed equipment; seeking from family and friends; doing their own initiatives; hiring equipment for the period of research; collaborating with donors; sourcing through the internet; making purchases and collaborating with other institutions.

Table 32: Impact of university-industry collaboration on research outputs

Statement	Frequency	Percent
Yes	78	94.0
No	5	6.0
Total	**83**	**100.0**

From table 32 above, most of the respondents (94 percent) believed that collaboration between university and industry effects on research outputs while 6 percent did not. The respondents explained that collaboration effects on research outputs through: empowerment with

the necessary equipment and resources for the research; rise of new inventions; creation of synergy; faster market penetration; funding and linkages; giving insights into the area of study; interaction with experienced research persons; higher retention of research results; provision of mentorship program; commercialization of research results and application of real life scenario, There can be financial and interests differences between the collaborators, With the collaboration, university students are able to apply real life scenarios into research. The findings were supported by the ones of Banal-Estanol, Albert & Inés, Estañol & Pérez-Castrillo, David (2011) who found that the quality of the project (number and impact of the publications) increases with the quality of the researcher and firm, and with the affinity in the partners' preferences. Additionally, the collaboration with firms increases the quality of the project only when the firms' characteristics make them valuable partners.

Table 33: Impact of university-industry collaboration on the commercialization of university research results

Statement	**Frequency**	**Percent**
Yes	68	94.4
No	4	5.6
Total	**72**	**100**

From table 33 above, a large percentage of the respondents (94.4 percent) believed the partnership between university and industry effects on commercialization of university research results while 5.6 percent did not. They explained this was possible through: offering relevance and legitimacy that the research output has; filling research gaps; acceleration of vertical technology

transfer, knowledge, resources and guidance; enabling wide spread linkages; avoidance of duplication of research and operational delay on the research project; provision of better potential for societal impact; enhancement of innovation on project ideas which gain more profits and recognition; amplification of research visibility; funding; reduction of operational inefficiency; validation of research results and easier translation of research products. The findings agreed with Banal-Estanol, Albert and Jofre-Bonet, Mireia & Meissner, Cornelia (2008) who found that researchers with industrial links publish significantly more than their peers although academic productivity is higher for low levels of industry involvement as compared to high levels.

Table 34: Encouragement of researchers to commercialize their research findings

Statement	**Frequency**	**Percent**
Yes	77	92.8
No	6	7.2
Total	**83**	**100.0**

Majority of the respondents (92.8 percent) thought that the move by universities to encourage them publish or acquire IP stimulated them to commercialize their research findings while 7.2 percent did not as shown in table 34 above. The results were supported by the recommendations of Ayisi (2016) that building capacity in entrepreneurship among staff and students and committing more resources to Research and Development (R&D) activities hold potential to increased commercialization of university research outputs in Kenya.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENTATIONS

5.1 Introduction

This chapter entails the summary of the research findings, conclusions of the study, recommendations and suggestions for further studies.

5.2 Summary of the Findings

The average questionnaire response rate was 90 percent. This was above 70%, which Mugenda and Mugenda (2008) consider to be adequate for analysis.

Majority of the respondents were female (65.1 percent) and 34.5 were male. 22.9 percent of the respondents were in the age bracket 40-44 while 1.2 percent were in 25-29 age bracket. Majority of the respondents recorded that they had masters and PhD at 50.6 percent and 37.3 percent respectively. 38.6 percent of the respondents belong to Strathmore, 25.3 percent to University of Nairobi, 20.5 percent to CUEA and 15.7 percent to KU. With regards to their roles, 28.9 percent of the respondents were lecturers, 37.3 percent were students, 27.7 percent were both lecturers and students and 6 percent of the respondents had other roles such as administrative staff, quality assurance officer, community coordinator, innovation center office Secretary and head of examinations.

The following research questions guided the study: How does access and utilization of research funds affect research output in the universities? To what extent are research outputs commercialized? How does the management structures of the university influence research output? How does industry –university collaboration influence research output in the universities?

The first research question investigated about how access and utilization of research funds affect research output in the universities. 75.9 percent of the respondents received funding whereas 24.1 percent did not. The respondents recorded that they received funding from the following organizations: Africa grant for young scientists, Afya bora fund, Asian and African students scholarship, Bill and Melinda gates foundation, Bamburi cement, Carissa (Canada), Church funding, Coca-Cola Africa, EARF, East African Science and Technology commission, French Institute for Research in Africa, Higher Education Loans Board, IGAD, Nuremberg Academy, GIZ, Johnson and Johnson scholars award, University of Nairobi, NGO, Kickstarter Program, Strathmore University, National Research fund, Rudisha Foundation, University of Pretoria, South Africa, UNEP, WFP, Women in Technology award, Young Scientists of Kenya and Xavier McKinney organization. However, some of the funding were bound by a Non-Disclosure Agreement.

60.2 percent of the respondents recorded that they believed organization's disbursement was efficient. However 18.1 percent of the respondents recorded that the disbursement process was not efficient. The reasons some respondents recorded that the disbursement process was not efficient were: inadequate budget, long bureaucracy, long waiting period to obtain funds and tedious application process.

The highest amount of funding was Kes 5 million followed by Kes 4.05million and 3 million respectively. The lowest amount of funding was Kes 30,000. On average a researcher received Kes 410, 016 for those who were able to receive funding. 60. 3 percent of the respondents recorded that the funding level was adequate. 24.4 percent of the respondents recorded that the funding level was not adequate. They attributed this to other unbudgeted expenses that rose when doing project and low funding in comparison to their research work.

42 percent of the respondents strongly agreed that the funds they received were adequate to cover all their budget items while 4.9 percent of them strongly disagreed. 40.7 percent of the respondents agreed that the funds they received facilitated them in translating research findings while 6.2 percent strongly disagreed. 42 percent of the respondents agreed that they used some of the research funds from organizations to translate their findings while 9.9 percent strongly disagreed. There was strong agreement (27.2 percent) and agreement (27.2 percent) by the respondents that universities provided them with some funding to help them translate their research findings. However, 11.1 percent disagreed and 14.8 percent were in strong disagreement.

On matters advice or recommendation on how to improve the disbursement process in the future, the respondents recorded that there should be: adequate and timely communication from the funding organization when the funds are disbursed; an automated communication to the applicants when funds are received; information on reasons for failure to get their requested amount in their applications; different forms of payouts to the applicants; frequent follow-ups

between the organization and the researcher for role clarity and efficiency; a correct channel to disburse funds; clear guidelines; a system that contains all research funding programmes; less bureaucratic methods of financial reporting; more equitable research funding procedures; improvement of the funds to university for researchers and engagement of applicants to ensure that they reduction of dissonance levels which increase satisfaction and avoid embezzlement of funds.

The second research question sought to determine how research outputs were commercialized. Majority of the respondents (90.4 percent) recorded that their universities have policies which govern research outputs and the commercialization of research results while 9.6 percent did not. Majority of the respondents (77.1 percent) recorded that there was a system in place in universities to monitor that regulation are followed while 22.9 percent did not. According to the researchers, the lowest teaching hours as well as research hours were 3, 6 and 9. The highest teaching hours 47, 50 and 55. Additionally, the highest research hours were 47, 50 and 56 as shown in table 12 above. On average a researcher spend 24 hours teaching and 20 hours doing research.

Majority of the respondents (64.6 percent) of the respondents recorded that they had sufficient time allocated for research in their universities while 35.4 percent did not as shown in table 13 above. The reasons for recording that they had sufficient time to conduct research were: being given adequate opportunity and resources to conduct research; mutual understanding; having more hours for research than work and balancing between working, research and personal life. The reasons for those who recorded they had no sufficient for research were: less hours allocated for research; more time being spend on teaching related activities; research being continuous and time

consuming and too much work load for teaching. Jung and Choi (2022) suggested that there was need for universities to have systems and policies to facilitate academics' research time allocation for enhanced research productivity.

Majority of the respondents (84.3 percent) recorded that their universities encouraged them to publish or acquire IP for their research findings while 15.7 percent. the highest number of research products were publication refereed journal (16.9 percent) followed by conference presentation (15.7 percent) and policy briefs (9.6 percent). The lowest research products were trademark (2.4 percent), industrial design (3.6 percent) and utility models (4.8 percent). 14.5 percent of the respondents recorded that they had produced other research products not stated above. 42 percent of the respondents strongly agreed that the funds they received were adequate to cover all their budget items while 4.9 percent of them strongly disagreed. 40.7 percent of the respondents agreed that the funds they received facilitated them in translating research findings while 6.2 percent strongly disagreed. 42 percent of the respondents agreed that they used some of the research funds from organizations to translate their findings while 9.9 percent strongly disagreed.

There was strong agreement (27.2 percent) and agreement (27.2 percent) by the respondents that universities provided them with some funding to help them translate their research findings. However, 11.1 percent disagreed and 14.8 percent were in strong disagreement. This contradicted Philip Hunter's findings that university who found that research funding was not

enough as many universities responded to the demand for more and better research by reducing funding for activities that do not seem to be related to research efforts (Hunter 2013).

On matters advice or recommendation on how to improve the disbursement process in the future, the respondents recorded that there should be: adequate and timely communication from the funding organization when the funds are disbursed; an automated communication to the applicants when funds are received; information on reasons for failure to get their requested amount in their applications; different forms of payouts to the applicants; frequent follow-ups between the organization and the researcher for role clarity and efficiency; a correct channel to disburse funds; clear guidelines; a system that contains all research funding programmes; less bureaucratic methods of financial reporting; more equitable research funding procedures; improvement of the funds to university for researchers and engagement of applicants to ensure that they reduction of dissonance levels which increase satisfaction and avoid embezzlement of funds.

60.2 percent of the respondents recorded that they had not commercialized their research results before. About 39.8 percent recorded that they had commercialized their research findings before. 78.7 percent of the respondents believed that experience influences commercialization efforts now and in the future whereas 10.7 percent did not. Majority of the respondents learnt about commercialization through sensitization by university (41.5 percent) and own initiative (41.5 percent). 14.6 percent learned through other organizations or sources which included: television network advertisement, Bill gates foundation, EARF, CLE, Intellectual Rights Board, KIPPRA, donors and social media. A smaller percentage of the respondents learned through both

sensitization and other organizations (1.2 percent) and sensitization by university and own initiative (1.2 percent).

There was strong agreement by the respondents that research funding from the university (53.0 percent) effect on research outputs whereas 1.2 percent of them were in strong disagreement. 47 percent of the respondents were in agreement that reserve funds for commercialization influences research outputs while 2.4 percent of them strongly disagreed. There was strong agreement (44.6 percent) and agreement (44.6 percent) that entrepreneurial skills and commercialization influenced research outputs while 1.2 percent were in strong disagreement. Additionally, majority of the researchers, agreed that presence of a policy requiring researchers to commercialize their findings influence research products while 1.2 percent strongly disagreed.

Majority of the researchers agreed that interaction with business (50.6 percent) and UIP guidelines (45.6 percent) influenced research outputs. There was strong agreement by researchers that recognition and reputation (51.5 percent) and extra income (47 percent) were some of the reasons for producing research outputs. There was also agreement by respondents that job satisfaction (53.0 percent), requirement by university (50.6 percent), existence of an opportunity (47 percent) and career advancement (49.4 percent) were reasons for producing research outputs. They also found that age, academic rank, time invested on research, resource allocation, recognition, and research leaders have a direct effect on research output. training and sensitization on commercialization and IPR (78.3 percent); allocation of enough time to concentrate on research (48.2 percent), provision of financial support for commercialization (62.7 percent); development

of policy on commercialization (49.4 percent); establishment of well managed Technology Transfer Offices (63.9 percent); establishment of incubation hubs (59 percent); offering incentives to publish (54.2 percent); paying for patents developed by researchers at University (55.4 percent); mainstreaming entrepreneurial skills in University curriculum (55.4 percent); seeking partnership with industry to help in commercialization efforts (62.7 percent); offering incentives to those who have commercialized their research results (60.2 percent) and monitoring to ensure that researchers commercialize viable research results (54.2 percent) were recorded by respondents as ways that have increased research output and commercialization of research results.

The third research question sought to determine how university management including policies influenced research output at the university. 88 percent of the respondents recorded that their universities have guidelines or regulations to ensure timely project implementation. 86.7 percent recorded that they completed their projects on time whereas 13.3 percent did not.

Some of the reasons recorded for not finishing projects on time were: lag in time in securing funding; balancing between being an employee and student; inadequate time to complete the project; inability to translate the results into an industrial design that was functional to be used on day to day transactions; lack of funds and inadequate project planning. 73.5 percent of the respondents recorded that they were able to translate results to research products while 26.5 percent did not.

The fourth research question sought to determine the involvement of industry in the research output in universities. Majority of the respondents (75.9 percent) recorded that there was a formal link between university and industrial sector to support research outputs and commercialization whereas while 7 percent did not. Surprisingly, 15.7 percent of the respondents did not know whether such a linkage exists. Majority of the respondents (81.9 percent) recorded that their institutions had a joint research with the industrial sector, 12 percent did not and 6 percent did know whether such collaboration exists.

Majority of the respondents (78 percent) reported existence of a technology transfer office at their universities while 9.8 percent did not. Remarkably, 12.2 percent did not know whether such an office exists. Most of the respondents (86.4 percent) recorded that presence of a transfer office boosts commercialization of research results while 13.6 percent did not. They recorded that a transfer office: acts as an open door to commercialize research; arranges the purchase and delivery of new computer hardware for research teams; enables people to get funds from different organizations; enhances efficiency in communication; provides linkages; acts as a platform for guiding researcher in commercialization of their research findings; enables researchers to have a smooth transition from the lab to the business world; maintains quality of research product; helps to achieve standardized process which facilitates cost effective production; promotes invention and innovation of new products; updates on trends of technological development and improvement; assist in the pairing up of researchers with appropriate partners for their project; emphasize the importance of intellectual property protection; facilitate research-based results through helping researchers in licensing, patenting or management of spin-off creations;

accelerates the commercialization process by providing services in several aspects that assist the researcher in the process and accelerates access to opportunities and resources.

56.1 percent of the respondents recorded that they collaborated with anyone from the industry while 43.9 percent did not. The collaboration help them in: accessing respondents and other data; combining expertise; finishing the research in time; having a more practical experience in analysis and interpretation; advancing research knowledge and creative skills; commercializing project and knowledge transfer and intellectual insight. A greater percentage of the respondents (73.5 percent) recorded that the universities were able to provide them with necessary equipment for research while 26.5 percent did not. Those who were not able to be facilitated obtained necessary equipment by: acquiring a loan from the bank and grants to purchase the needed equipment; seeking from family and friends; doing their own initiatives; hiring equipment for the period of research; collaborating with donors; sourcing through the internet; making purchases and collaborating with other institutions.

Most of the respondents (94 percent) believed that collaboration between university and industry effects on research outputs while 6 percent did not. The respondents explained that collaboration effects on research outputs through: empowerment with the necessary equipment and resources for the research; rise of new inventions; creation of synergy; faster market penetration; funding and linkages; giving insights into the area of study; interaction with experienced research persons; higher retention of research results; provision of mentorship program; commercialization of research results and application of real life scenario, There can be

financial and interests differences between the collaborators, With the collaboration, university students are able to apply real life scenarios into research.

A large percentage of the respondents (94.4 percent) believed the partnership between university and industry effects on commercialization of university research results while 5.6 percent did not. They explained this was possible through: offering relevance and legitimacy that the research output has; filling research gaps; acceleration of vertical technology transfer, knowledge, resources and guidance; enabling wide spread linkages; avoidance of duplication of research and operational delay on the research project; provision of better potential for societal impact; enhancement of innovation on project ideas which gain more profits and recognition; amplification of research visibility; funding; reduction of operational inefficiency; validation of research results and easier translation of research products. Majority of the respondents (92.8 percent) thought that the move by universities to encourage them publish or acquire IP stimulated them to commercialize their research findings while 7.2 percent did not.

5.3 Conclusions

The first research question investigated about how access and utilization of research funds affect research output in the universities. Majority of the percent of the respondents received funding from the following organizations: Africa grant for young scientists, Afya bora fund, Asian and African students scholarship, Bill and Melinda gates foundation, Bamburi cement, Carissa (Canada), Church funding, Coca-Cola Africa, EARF, East African Science and Technology commission, French Institute for Research in Africa, Higher Education Loans Board, IGAD,

Nuremberg Academy, GIZ, Johnson and Johnson scholars award, University of Nairobi, NGO, Kickstarter Program, Strathmore University, National Research fund, Rudisha Foundation, University of Pretoria, South Africa, UNEP, WFP, Women in Technology award, Young Scientists of Kenya and Xavier McKinney organization. However, some of the funding were bound by a Non-Disclosure Agreement. Majority of the respondents recorded that they believed organization's disbursement was efficient. The reasons some respondents recorded that the disbursement process was not efficient were: inadequate budget, long bureaucracy, long waiting period to obtain funds and tedious application process. On average a researcher received Kes 410, 016 for those who were able to receive funding. Majority of the respondents recorded that the funding level was adequate. They attributed this to other unbudgeted expenses that rose when doing project and low funding in comparison to their research work. A slight majority of the respondents strongly agreed that: the funds they received were adequate to cover all their budget items; the funds they received facilitated them in translating research findings and they used some of the research funds from organizations to translate their findings .There was also agreement by a majority the respondents that universities provided them with some funding to help them translate their research findings.

The second research question sought to determine how research outputs were commercialized. Majority of the respondents recorded that their universities have policies which govern research outputs and the commercialization of research results. Majority of the respondents recorded that there was a system in place in universities to monitor that regulation. According to the respondents, on average a researcher spend 24 hours teaching and 20 hours doing research.

Majority of the respondents recorded that they had sufficient time allocated for research in their universities. The reasons for recording that they had sufficient time to conduct research were: being given adequate opportunity and resources to conduct research; mutual understanding; having more hours for research than work and balancing between working, research and personal life. The reasons for those who recorded they had no sufficient for research were: less hours allocated for research; more time being spend on teaching related activities; research being continuous and time consuming and too much work load for teaching. Majority of the respondents recorded that their universities encouraged them to publish or acquire IP for their research. The highest number of research products were publication refereed journal followed by conference presentation and policy briefs. The lowest research products were trademark, industrial design and utility models. A majority of the respondents strongly agreed that the funds they received were adequate to cover all their budget items.

Majority of the respondents agreed that the funds they received facilitated them in translating research findings. Majority of the respondents agreed that they used some of the research funds from organizations to translate their findings. Majority of the respondents agreed that universities provided them with some funding to help them translate their research findings. On matters advice or recommendation on how to improve the disbursement process in the future, the respondents recorded that there should be: adequate and timely communication from the funding organization when the funds are disbursed; an automated communication to the applicants when funds are received; information on reasons for failure to get their requested amount in their applications; different forms of payouts to the applicants; frequent follow-ups between the

organization and the researcher for role clarity and efficiency; a correct channel to disburse funds; clear guidelines; a system that contains all research funding programmes; less bureaucratic methods of financial reporting; more equitable research funding procedures; improvement of the funds to university for researchers and engagement of applicants to ensure that they reduction of dissonance levels which increase satisfaction and avoid embezzlement of funds. Majority of the respondents recorded that they had not commercialized their research results before. Majority of the respondents believed that experience influences commercialization efforts now and in the future. Majority of the respondents learnt about commercialization through sensitization by university and own initiative while considerable percentage of the respondents learnt through other organizations or sources which included: television network advertisement, Bill gates foundation, EARF, CLE, Intellectual Rights Board, KIPPRA, donors and social media.

A smaller percentage of the respondents learned through both sensitization and other organizations and sensitization by university and own initiative. There was strong agreement by the respondents that research funding from the university effect on research. Majority of the respondents were in agreement that reserve funds for commercialization influences research. There was strong agreement that entrepreneurial skills and commercialization influenced research outputs. Additionally, majority of the researchers, agreed that presence of a policy requiring researchers to commercialize their findings influence research products. Majority of the researchers agreed that interaction with business and UIP guidelines influenced research outputs. There was strong agreement by researchers that recognition and reputation; job satisfaction; extra income; requirement by university and existence of an opportunity were some of the reasons for

producing research outputs. They also found that age, academic rank, time invested on research, resource allocation, recognition, and research leaders have a direct effect on research output. training and sensitization on commercialization and IPR; allocation of enough time to concentrate on research, provision of financial support for commercialization; development of policy on commercialization; establishment of well managed Technology Transfer Offices; establishment of incubation hubs; offering incentives to publish; paying for patents developed by researchers at University; mainstreaming entrepreneurial skills in University curriculum; seeking partnership with industry to help in commercialization efforts; offering incentives to those who have commercialized their research results and monitoring to ensure that researchers commercialize viable research results were recorded by respondents as ways that have increased research output and commercialization of research results.

The third research question sought to determine how university management including policies influenced research output at the university. Majority of the respondents recorded that their universities have guidelines or regulations to ensure timely project implementation and they completed their projects on time. Some of the reasons recorded for not finishing projects on time were: lag in time in securing funding; balancing between being an employee and student; inadequate time to complete the project; inability to translate the results into an industrial design that was functional to be used on day to day transactions; lack of funds and inadequate project planning. Majority of the respondents recorded that they were able to translate results to research products.

The fourth research question sought to determine the involvement of industry in the research output in universities. Majority of the respondents recorded that there was a formal link between university and industrial sector to support research outputs and commercialization. Surprisingly, a considerable percent of the respondents did not know whether such a linkage exists. Majority of the respondents recorded that their institutions had a joint research with the industrial sector and a small percent did know whether such collaboration exists. Majority of the respondents reported existence of a technology transfer office at their universities. Remarkably, a considerable percent did not know whether such an office exists. Most of the respondents recorded that presence of a transfer office boosts commercialization of research results.

The respondents recorded that a transfer office: acts as an open door to commercialize research; arranges the purchase and delivery of new computer hardware for research teams; enables people to get funds from different organizations; enhances efficiency in communication; provides linkages; acts as a platform for guiding researcher in commercialization of their research findings; enables researchers to have a smooth transition from the lab to the business world; maintains quality of research product; helps to achieve standardized process which facilitates cost effective production; promotes invention and innovation of new products; updates on trends of technological development and improvement; assist in the pairing up of researchers with appropriate partners for their project; emphasize the importance of intellectual property protection; facilitate research-based results through helping researchers in licensing, patenting or management of spin-off creations; accelerates the commercialization process by providing services in several aspects that assist the researcher in the process and accelerates access to opportunities and

resources. There was a close gap between respondents who recorded that they collaborated with anyone from the industry and those who did not. The collaboration helped them in: accessing respondents and other data; combining expertise; finishing the research in time; having a more practical experience in analysis and interpretation; advancing research knowledge and creative skills; commercializing project and knowledge transfer and intellectual insight. A greater percentage of the respondents recorded that the universities were able to provide them with necessary equipment for research. Those who were not able to be facilitated obtained necessary equipment by: acquiring a loan from the bank and grants to purchase the needed equipment; seeking from family and friends; doing their own initiatives; hiring equipment for the period of research; collaborating with donors; sourcing through the internet; making purchases and collaborating with other institutions. Most of the respondents believed that collaboration between university and industry effects on research outputs.

They explained that collaboration effects on research outputs through: empowerment with the necessary equipment and resources for the research; rise of new inventions; creation of synergy; faster market penetration; funding and linkages; giving insights into the area of study; interaction with experienced research persons; higher retention of research results; provision of mentorship program; commercialization of research results and application of real life scenario, There can be financial and interests differences between the collaborators. With the collaboration, university students are able to apply real life scenarios into research. A large percentage of the respondents believed that partnership between university and industry effects on commercialization of university research results. They explained this was possible through:

offering relevance and legitimacy that the research output has; filling research gaps; acceleration of vertical technology transfer, knowledge, resources and guidance; enabling wide spread linkages; avoidance of duplication of research and operational delay on the research project; provision of better potential for societal impact; enhancement of innovation on project ideas which gain more profits and recognition; amplification of research visibility; funding; reduction of operational inefficiency; validation of research results and easier translation of research products. Majority of the respondents thought that the move by universities to encourage them publish or acquire IP stimulated them to commercialize their research findings.

The researcher concluded that Universities in Kenya have not taken commercialization of research results seriously. Additionally, there is low venture in profitable and marketable products such as trademarks, industrial design and utility models. Therefore universities have a lot to do to ensure that they promote education research for productivity and innovation through continuous sensitization on commercialization of research outputs into marketable and profitable research products.

5.4 Recommendations

The researcher recommended that:

a) Universities should balance teaching workload to ensure that university researchers have balanced hours for both teaching and research.
a) Universities should continuously sensitize university researchers on university-industrial sector linkages

b) Universities should continuously sensitize university researchers on commercialization of research results
c) Funding organizations of research projects should come up with simple and suitable research project financial reporting procedures.
d) The government and other research funding organizations should increase funds for both research and commercialization.
e) The government and funding organizations should avail adequate and timely communication on disbursement of funds.

5.5 Recommendation for Further Studies

The study investigated promotion of educational research for productivity & innovation among selected public and private universities in Nairobi County, Kenya. There is need to investigate the impact of commercialization of research output on the Kenya's economy. This will give a full understanding of the participation and contribution of the university researchers in matters economic growth and development.

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APPENDICES

APPENDIX I

QUESTIONNAIRE FOR PUBLIC AND PRIVATE UNIVERSITIES' RESEARCHERS

INTRODUCTION

This questionnaire has been designed for the purpose of collecting data on promotion of educational research for productivity and innovation among selected public and private universities in Nairobi County, Kenya. The data collected will be treated with a very high degree of confidentiality and it is meant for academic purpose only.

Please respond to the questions by ticking where appropriate and also fill in the blank spaces for questions that need elaborate answers. You are requested to give honest information when filling in the questionnaire.

SECTION A: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Please tick where appropriate

1. Please indicate your gender:

   Female { } Male { }

2. What is your age bracket in years?

   20-24 { } 25-29 { } 30-34 { } 35-39 { } 40-44 { }

   45-49 { } 50-54 { } 55 and above { }

3. Indicate your highest academic qualification level

   PhD { } Masters { } Degree { } Diploma { } Certificate

4. Please indicate the university in which you belong:

   University of Nairobi { } Kenyatta University { }

   Strathmore University { } Catholic University of Eastern Africa { }

5. a) Which role do you play at the University?

Lecturer { } Student { } Both { } Other { }

b) If other please specify

……

6. Please indicate the area of research you have specialized in

.....

……

7. How long have you been involved in research?

Less than 1 year { } 1-5years { } 6-10 years { } 11-15 years { }

Over 15 years { }

SECTION B: AMOUNT OF RESEARCH FUNDING

8 a) Have you received research funding from any organization?

Yes { }

No { }

b) If yes, from which organization

……

……

c) Do you think the organization's disbursement process is efficient?

Yes { }

No { }

Not applicable { }

d) If No, please explain why?

……

……

e) How much did you receive for your research project in Kenya Shillings?

……

……

f) In your opinion was this funding level adequate?

Yes { }

No { }

Not applicable { }

g) If your answer is No, please explain

.....

.....

9. Does your University have guidelines or regulations to ensure timely project implementation?

Yes { }

No { }

10. a) Did you complete your project in time?

Yes { }

No { }

b) If your answer is No, please explain why

.....

.....

11. a) Have you been able to translate your research results since completion of the research project into any products?

Yes { }

No { }

b) If yes, please tick as appropriate

Copyright	
Industrial design	
Patent	
Utility model	
Policy Brief	
Textbook	
Conference presentation	
Publication Refereed Journal	
Trademark	
Business startup	
Other	

c) If any other, specify.....

12. Please tick as appropriate;

1. **Strongly Agree**
2. **Agree**
3. **Neutral**
4. **Disagree**
5. **Strongly Disagree**

	1	2	3	4	5
The funds received were sufficient to cover all budget items					
The funds received facilitated me to translate research findings					
I used some of the research funds I received from organizations to translate my findings					
The university provided me with some funding to help me translate my research findings					

13. What advice or recommendation do you have on how to improve the disbursement process in future?

…….....

.....

SECTIONC: UNIVERSITY RESEARCHER CHARACTERISTICS

14. Have you commercialized your research results before?

Yes { }

No { }

15. Do you think this experience would influence your commercialization efforts now or in the future?

Yes { }

No { }

Not applicable { }

16. a) How did you learn about commercialization? Please select from the options below:

Sensitization by University { }

Own Initiative { }

Other organizations { }

16. b) If from other organizations please name them.

……

17. On a scale of 1-5, kindly indicate the extent to which the following factors influence Research Outputs of Universities in Kenya;

1. **Very great Extent**
2. **Great extent**
3. **Moderate Extent**
4. **Little Extent**
5. **No extent**

	1	2	3	4	5
Research funding from the university					
Reserve funds for commercialization					
Entrepreneurial skills and commercialization knowledge					
Policy requiring researchers to commercialize their findings					
Interaction with the business / industrial sector					
University Intellectual Property guidelines					

18. Rate the following reasons why you would generate research outputs according to your level of importance:

1. **Very important**
2. **Important**
3. **Somewhat Important**
4. **Uncertain**
5. **Not Important**

	1	2	3	4	5
For recognition and reputation					
For job satisfaction					
For extra income					
Requirement by University					
Opportunity to do so					
Career advancement					

SECTION D: Industrial Involvement

19. Is there a formal link between your university and the industrial sector to support research outputs and commercialization?

    Yes { }

    No { }

    I don't know { }

20. Is your institution involved in joint/collaborative research with the industrial sector?

    Yes { }

    No { }

    I don't know { }

21. Is there a Technology Transfer Office at your university?

    Yes { }

    No { }

    I don't know { }

22. a) Do you think the existence of a Technology Transfer Office encourages the commercialization of research results at your university?

Yes { }

No { }

b) Explain your answer

……

……

23. a) During your research, did you work with anyone from Industry?

Yes { }

No { }

b) If yes explain what it helped

……

……

24. a)Was the University able to provide you with all of the necessary equipment for your research?

Yes { }

No { }

b) If not, could you please explain how you got them?

……

……

25. a) As a researcher, do you believe that university-industry collaboration has an impact on research outputs?

Yes { }

No { }

b) How, please explain

……

……

26. a) As a researcher, do you believe that university-industry collaboration has an impact on the commercialization of university research results?

Yes { }

No { }

b) How? Please explain.

……

……..……..

……

SECTION E: Institutional Administrative Structures

27 Are there any policies in place at your university that govern research outputs and the commercialization of research results?

Yes { }

No { }

28. Is there a system in place at the university to monitor that these regulations are followed?

Yes { }

No { }

29. How many teaching and research hours are allowed for University Researchers per week?

i. Teaching hours.....

ii. Research hours.....

30. a) Do you think the amount of time allocated for research is sufficient?

Yes { }

No { }

b) Why? Please explain

.....

……

……

31. a) Is your university encouraging you to publish or acquire intellectual property for your research findings?

Yes { }

No { }

b) If yes, please explain

…….

……..

c) Do you think this will encourage more researchers to commercialize their research findings?

Yes { }

No { }

32. In a scale of 1-5, kindly indicate the degree to which you agree or disagree with the following statements on how your University can increase research outputs and commercialization of research results;

1. **Strongly agree**
2. **Agree**
3. **Not sure**
4. **Disagree**
5. **Strongly Disagree**

	1	2	3	4	5
Train and sensitize on Commercialization and Intellectual property rights (IPR)					
Allocate enough time to Concentrate on Research					
Provide Financial Support for Commercialization					
Develop policy on Commercialization					
Establish well managed Technology Transfer Offices					
Establish Incubation Hubs/Centres					
Offer incentives to publish					
Pay for patents developed by Researchers at University					
Mainstream entrepreneurial skills in University Curriculum					
Seek partnership with Industry to help in Commercialization efforts					
Offer Incentives to those who have Commercialized their Research Results					
Monitoring to ensure that researchers commercialize viable research results					

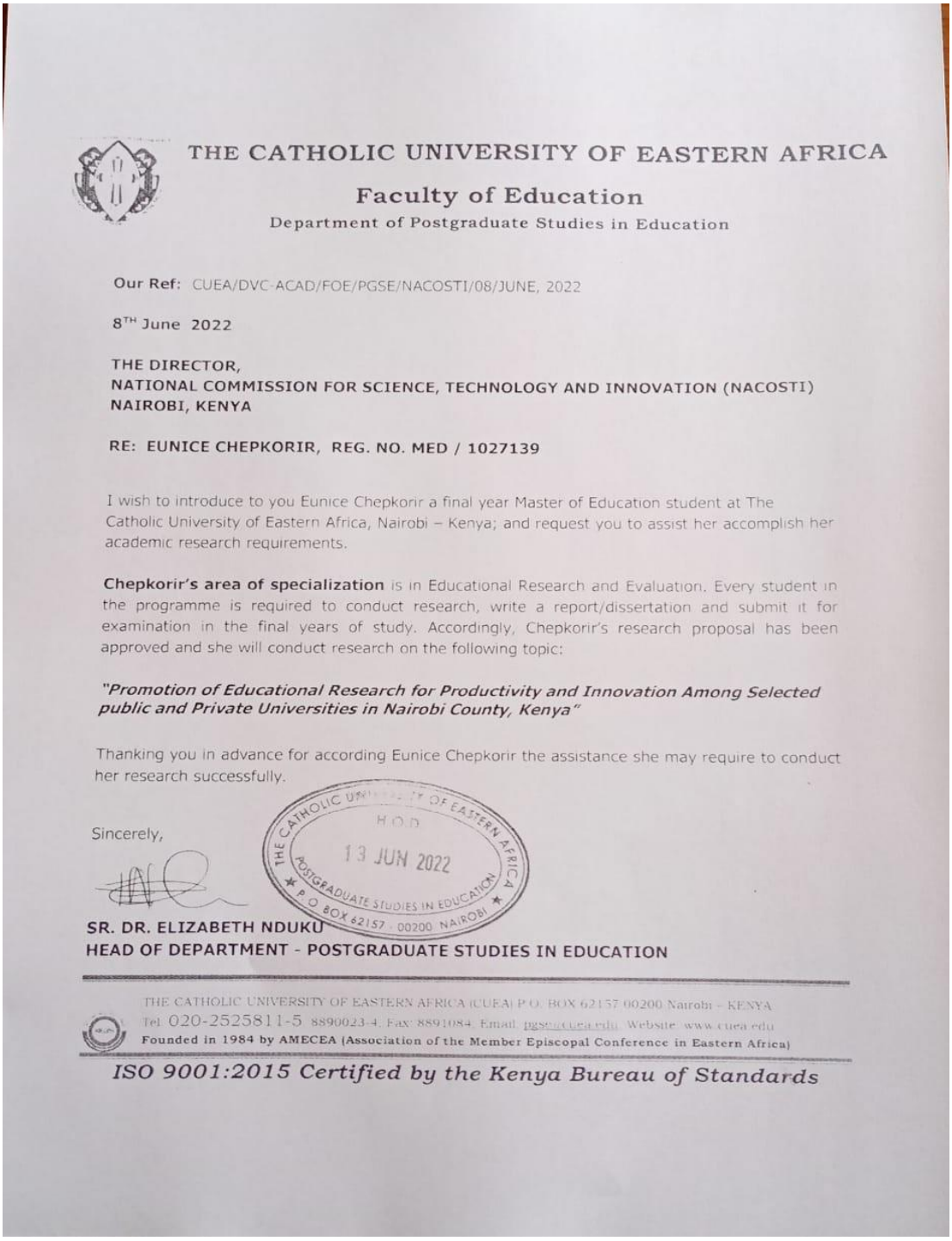
Thank you for taking time to fill out this questionnaire

APPENDIX 11: RELIABILITY TEST

Reliability Statistics

Cronbach's Alpha	N of Items
.714	21

APPENDIX III: RESEARCH PERMIT



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

Faculty of Education

Department of Postgraduate Studies in Education

Our Ref: CUEA/DVC-ACAD/FOE/PGSE/NACOSTI/08/JUNE, 2022

8TH June 2022

THE DIRECTOR,
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION (NACOSTI)
NAIROBI, KENYA

RE: EUNICE CHEPKORIR, REG. NO. MED / 1027139

I wish to introduce to you Eunice Chepkorir a final year Master of Education student at The Catholic University of Eastern Africa, Nairobi – Kenya; and request you to assist her accomplish her academic research requirements.

Chepkorir's area of specialization is in Educational Research and Evaluation. Every student in the programme is required to conduct research, write a report/dissertation and submit it for examination in the final years of study. Accordingly, Chepkorir's research proposal has been approved and she will conduct research on the following topic:

"Promotion of Educational Research for Productivity and Innovation Among Selected public and Private Universities in Nairobi County, Kenya"

Thanking you in advance for according Eunice Chepkorir the assistance she may require to conduct her research successfully.

Sincerely,

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA
H.O.D
13 JUN 2022
POSTGRADUATE STUDIES IN EDUCATION
P.O. BOX 62157 - 00200 NAIROBI

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This is to Certify that Miss.. EUNICE CHEPKORIR of Catholic University of Eastern Africa, has been licensed to conduct research in Nairobi on the topic: PROMOTION OF EDUCATIONAL RESEARCH FOR PRODUCTIVITY for the period ending : 22/June/2023.

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