

**RESEARCH UPTAKE MANAGEMENT: A STRATEGIC
FRAMEWORK FOR INSTITUTIONALISING RESEARCH UPTAKE
AT THE KWAME NKRUMAH UNIVERSITY OF SCIENCE AND
TECHNOLOGY, KUMASI**

by
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and Social Sciences at Stellenbosch University*



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DECLARATION

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Abstract

This study examined the issue of research uptake and research uptake management with particular reference to how these can be institutionalised within an organisation. The focus was to propose a strategic framework that identifies pathways and activities necessary for research uptake suitable for the Kwame Nkrumah University of Science and Technology (KNUST), Ghana. The broader impact of the study is its implication to the management of research.

Generally, research is aimed at advancing knowledge, influencing policy, improving practice and resolving socio-economic problems. The expectation that knowledge produced by universities and research institutes should affect human life has led to the increasing demand for knowledge utilisation. Ghana's foremost technological institution, KNUST, was set up to provide the necessary technological manpower and knowledge for the labour market. Essentially, its mandate is to provide higher education, undertake research, disseminate knowledge and foster relationships with stakeholders. Undertaking research and disseminating knowledge imply taking research beyond the confines of the laboratory and publication in refereed journals to society. Developmental research for which KNUST is noted has to reach other major stakeholders, such as small and medium-scale industry, farmers and policymakers. The management of research in the university ought to make this a priority.

The aim of the study was to address the problem of research uptake and utilisation by examining the need for a policy framework to institutionalise research uptake at KNUST. The proposed framework takes a critical look at the planning and generation of developmental research at KNUST and the mechanisms and activities necessary for research uptake.

The study, which employed a survey and interviews with researchers at KNUST, established that the expected areas of research impact are solving environment and social problems, influencing policy, influencing practice and solving immediate and technical problems. However, the extent to which researchers have been successful in these areas was found to be below expectation compared to advancement of knowledge and solving theoretical problems, which seemed to be the main focus of researchers. It was found that, although there are several areas where the university can play a role in local and national development, the research agenda and focus of researchers at KNUST as well as of faculties and colleges are aimed at advancement of knowledge and solving theoretical problems. There were however, a few examples of research that had influenced national policy and practice. A policy shift is therefore necessary to correct this if the university is to make an appreciable impact on society.

It was observed that, as far as engagement with stakeholders is concerned, researchers engage mostly with scientists and researchers from other universities and research institutes. The mechanisms and channels of engagement varied from stakeholder to stakeholder and from faculty to faculty. Generally, it seems researchers at KNUST mostly engage through conferences, workshops and seminars. Researchers generally consider it very beneficial if their research provides opportunities for further research, opens avenues for collaboration and funding, their research is used, and if it influences practice. In order for acceptance, adoption and possible use of research findings, researchers largely agree that stakeholders should be involved in the research process at the research formulation and proposal stages. The most common reason given for stakeholders not using research findings that could be beneficial to them was attributed to financial constraints on the side of researchers and stakeholders for dissemination and implementation of research findings.

From the findings, a policy framework for institutionalising research uptake is proposed. This framework incorporates pathways, mechanisms and channels of engagement that facilitate research uptake.

Opsomming

Hierdie studie het die kwessie van navorsingsopname en navorsingsopnamebestuur ondersoek, met spesifieke verwysing na hoe dit binne 'n organisasie geïnstusionaliseer kan word. Die fokus was om 'n strategiese raamwerk voor te stel wat roetes en aktiwiteite identifiseer wat nodig is vir navorsingsopname wat geskik is vir die Kwame Nkrumah Universiteit van Wetenskap en Tegnologie (KNUST), Ghana. Die breër impak van die studie is die implikasie daarvan op die bestuur van navorsing.

Oor die algemeen is navorsing daarop gemik om kennis te bevorder, beleid te beïnvloed, praktyk te verbeter en sosio-ekonomiese probleme op te los. Die verwagting dat kennis wat deur universiteite en navorsingsinstitute gelewer word, die mens se lewe moet verbeter, het gelei tot die toenemende vraag na kennisbenutting. Ghana se voorste tegnologiese instelling, KNUST, is gestig om die nodige tegnologiese mannekrag en kennis vir die arbeidsmark te verskaf. In wese is sy mandaat om hoër onderwys te lewer, navorsing te onderneem, kennis te versprei en verhoudings met belanghebbendes te bevorder. Die onderneming van navorsing en verspreiding van kennis impliseer dat navorsing oor die grense van die laboratorium en publikasie in referentydskrifte na die samelewing plaasvind. Ontwikkelingsnavorsing waarvoor KNUST erken word, moet belangrike belanghebbendes bereik, soos klein en middelgrote bedrywe, boere en beleidmakers. Die bestuur van navorsing in die universiteit moet dit dus 'n prioriteit maak.

Die doel van die studie was om die probleem van navorsingsopname en -benutting aan te spreek deur die behoefte aan 'n beleidsraamwerk te ondersoek om navorsingsopname by KNUST te instusionaliseer. Die voorgestelde raamwerk neem 'n kritiese blik op die beplanning en onderneming van ontwikkelingsnavorsing by KNUST en die meganismes en aktiwiteite wat nodig is vir navorsingsopname.

Die studie, waardeur 'n opname en onderhoude met navorsers by KNUST voltooi is, het bepaal dat die verwagte navorsingsinvloede die oplossing is van omgewings- en sosiale probleme, beleid beïnvloeding, praktyk beïnvloeding en om onmiddellike en tegniese probleme op te los. Die mate waarin navorsers daarin geslaag het, was egter laer as die verwagte vertoning in vergelyking met die bevordering van kennis en die oplos van teoretiese probleme, wat oor die algemeen navorsers se hoof fokus blyk te wees. Daar is bevind dat die navorsingsagenda en fokus van navorsers by KNUST sowel as fakulteite en kolleges op verskeie gebiede waar die universiteit 'n rol kan speel in plaaslike en nasionale ontwikkeling, gemik is op die bevordering van kennis en die oplos van teoretiese probleme. Daar was egter enkele voorbeelde van navorsing wat nasionale beleid en praktyk beïnvloed het. 'n Beleidsverskuiwing is dus nodig om dit reg te stel indien die universiteit 'n merkbare impak op die samelewing sou wou maak.

Wat betref betrokkenheid by belanghebbendes, is daar gevind dat navorsers veral betrokke is by projekte saam met wetenskaplikes en navorsers van ander universiteite en navorsingsinrigtings. Die meganismes en kanale van betrokkenheid wissel van belanghebbende tot belanghebbende en van fakulteit tot fakulteit. Oor die algemeen lyk dit of navorsers by KNUST meestal betrokke is by konferensies, werkwinkels en seminare. Navorsers beskou dit oor die algemeen as baie voordelig indien hul navorsing geleentheid bied vir verdere navorsing, “oop” maniere vir samewerking en befondsing, navorsingsbenutting, en om praktyk te beïnvloed. Ten einde die gebruik van navorsingsbevindings, stem navorsers grootliks saam dat belanghebbendes by die navorsingsproses betrokke moet wees in navorsingsformulerings en -voorstelle. Die mees algemene rede vir belanghebbendes wat nie navorsingsbevindings gebruik wat voordelig vir hulle sou wees nie, is toegeskryf aan finansiële beperkings en die verspreiding en implementering van navorsingsbevindings.

Uit die bogenoemde bevindings word 'n beleidsraamwerk vir die institusionalisering van navorsingsopname voorgestel. Hierdie raamwerk bevat roetes, meganismes en kanale van betrokkenheid wat navorsingsopname sou kon fasiliteer.

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List of abbreviations and acronyms

AGI: Association of Ghana Industries

AgSSIP: Agricultural Services Sub-Sector Investment Programme

ANDi:	African Network for Diagnosis and Drug Discovery Innovation
ARS:	Agriculture Research Station
BIRD:	Bureau of Integrated Rural Development
BNITM:	Ghana, and the Benhard-Nocht Institute for Tropical Medicine
CABE:	College of Art and Built Environment
CANR:	College of Agriculture and Natural Resources
CeCAST:	Centre for Cultural and African Studies
CHS:	College of Health Sciences
CHSRF:	Canadian Health Services Research Foundation
CHSS:	College of Humanities and Social Science
CIHR:	Canadian Institute of Health Research
CLS:	Centre for Land Studies
COE:	College of Engineering
COS:	College of Science
CSIR:	Council for Scientific and Industrial Research
CSS:	Centre for Settlements Studies
DANIDA:	Danish International Development Agency
DFID:	Department for International Development
DRUSSA:	Development Research Uptake in Sub-Saharan Africa
EBM:	evidence-based medicine
EU:	European Union
GAB:	Ghana Association of Bankers
GDP:	gross domestic product
GES:	Ghana Education Service
GETFund:	Ghana Education Trust Fund
Gh:	Ghana
GhIE:	Ghana Institution of Engineers

GIA:	Ghana Institution of Architects
GSS:	Ghana Statistical Service
HES	Higher Education System
HR	Human Resource
ICT:	information and communication technologies
ICU:	Industrial and Commercial Workers Union
IDRC:	International Development Research Centre
IFAD:	International Fund for Agricultural Development
IGF:	internally generated fund
IHSR:	Institute of Human Settlements Research
INGO	International Non-Governmental Organisations
INRM:	integrated natural resource management
IP	Intellectual Property
IPOO:	input-process–output-outcomes (model)
ISTA:	Institute of Science and Technology for Africa
JHS:	junior high school
JUST:	<i>Journal of Science and Technology</i>
K2A	Knowledge to Action
KCCR:	Kumasi Centre for Collaborative Research in Tropical Medicine
KIST:	Korean Institute of Science and Technology
KNUST:	Kwame Nkrumah University of science and Technology
KT:	knowledge transfer
KTE:	knowledge transfer and exchange
KU:	knowledge utilisation
M&E:	monitoring and evaluation
MDA:	ministries, departments and agencies
MDGs:	Millennium Development Goals

MoE:	Ministry of Education
MoFA:	Ministry of Food and Agriculture
MoH	Ministry of Health
NCCDPHP:	National Centre for Chronic Disease Prevention and Health Promotion
NCDDR:	National Centre for the Dissemination of Disability Research
NCTE	National Council for Tertiary Education
NDPC:	National Development Planning Commission
NGO:	non-governmental organisation
NIMS:	National Institute for Mathematical Sciences
NUFFIC:	Dutch Government and Netherland's Foundation for International Cooperation
OECD:	Organisation for Economic Co-operation and Development
OGR:	Office of Grants and Research
OMRU:	Ottawa model of research use
QAPU:	Quality Assurance and Planning Unit
R&D:	research and development
RKI:	research knowledge infrastructure
RU:	research uptake
RUM:	research uptake management
S&T	Science and Technology
SCM:	supply chain management
SDGs:	Sustainable Development Goals
SHS	Senior High School
SIDA:	Swedish International Development Agency
SMMEs:	small, medium and micro-sized enterprises
SMS:	School of Medical Sciences
SPR:	staff publication ratio
SPSS	Statistical Package for the Social Sciences

SU:	Stellenbosch University
TCC:	Technology Consultancy Centre
UENR	University for Energy and Natural Resources
UFH:	University of Fort Hare
UITS:	University Information Technology Services
UN:	United Nations
UNCT:	United Nations Country Team
UNCT-GH	United Nations Country team-Ghana
UNDP	United Nations Development Programme
UNESCO:	United Nations Educational Scientific and Cultural Organisation
UNICEF:	United Nations Children’s Fund
UoM:	University of Mauritius
WAISCL:	West African Institute for Supply Chain Leadership
WHO:	World Health Organisation

CHAPTER 1: INTRODUCTION

1.1 Some historical perspectives and knowledge utilisation in retrospect

Right from the mid-twentieth century, the issue of science, research or knowledge utilisation has engaged the minds of various writers and researchers. Even in an attempt to find reasons for studying science, the issue of knowledge utilisation comes up. Early researchers, such as Wilhelm von Humboldt (1767–1835), the architect of the Prussian education system, have argued that science is studied in order to generate new knowledge and create technologies but also that these technologies must be useful (Gaston & Keniston, 1994). Knowledge is generated mainly through research, and universities are generally accepted as sources of knowledge generation. It is also a known fact that some useful knowledge has been generated from other sources than universities. Examples of such sources are the informal sector (i.e. food processors and artisan, industry and private organisations and government-owned research centres. All these sources play a role in knowledge production and perhaps because the universities often predominantly concentrate on scientific publications the others may consider commercial activities in addition.

According to Gaston and Keniston (1994), the world today has entered a period of accountability, in which governments fund research with the expectation that universities will address the needs of society. They further observe that governments promise to support research, which they consider worthy of helping in order to achieve national goals, such as research that will lead to new products, medicines and even weapons. Researchers on their part have to give government the assurance of performing research that would lead to achieving the goals set by government (Gaston & Keniston, 1994). In other words, the trend has become ‘show us what you can do and its possible uses’ before funding can be provided. If research is expected to solve problems, there must be ways of measuring the outcome of research. There must also be a clear distinction between the various kinds of research and the models for their utilisation.

Between 1945 and 1970, public research and development recognised the autonomy of science, and the emphasis was on basic research (Auranen, 2005). This was referred to as Mode 1 knowledge, which typically refers to knowledge production in the scientific context, mono-disciplinarity or sometimes multi-disciplinarity, demand of accountability to peers and other researchers, and the evaluation of quality inside academic community (Auranen, 2005). From 1970 to the early 1980s, there were calls for relevance in applied science (Auranen, 2005). This

led to more directed science with increased accountability. From the 1980s onward, there was the emergence of strategic science with increased management culture and focus on performance indicators. From this time on, knowledge production became transdisciplinary with a focus on application in response to societal needs and issues bordering on accountability (Auranen, 2005; Gibbons, 2013; Nieminen, 2005).

1.2 Research uptake management

Evidence from the Development Research Uptake for Sub-Saharan Africa (DRUSSA) programme indicates that until recently research uptake management seem not to be popular in sub-Saharan Africa (DRUSSA, 2012). However, a review of available literature indicates that the broader field of knowledge utilisation has existed for decades. The current study examined the issue of research uptake management and how it can be institutionalised within a university. In particular, the study was aimed at designing guidelines for a strategic policy framework, which identifies pathways and activities necessary for research uptake suitable for the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. The broader outcome of the study is that the findings may be applicable to higher education management of research. The framework was intended to direct activities towards knowledge production, the concept of research uptake, and the infrastructure and mechanisms necessary for facilitating dissemination and uptake at the KNUST.

Although an emerging field in the sub-region, a critical look at the research system at KNUST reveals that there are processes within the university that involve research uptake and utilisation. There are examples of innovations and research output at the Technology Consultancy Centre, KNUST, which have been found useful and, in fact, utilised by local communities, farmers and small firms (QAPU, 2017). It is not out of place to expect universities to play a role in the development of innovations even though, for some time now, this seem to be the prerogative of industry and government. Universities, such as the KNUST, have a mandate to produce and disseminate research and train the labour force needed for national development. The private sector, including industry, also plays a role and therefore a partnership between the university and industry could lead to better innovations (Etzkowitz, Webster, Gebhardt & Terra, 2000).

KNUST is one of the 24 universities that participated in the Development Research Uptake in sub-Saharan Africa (DRUSSA) programme. DRUSSA was a five-year capacity-building programme funded by the Department for International Development (DFID) and was

operational between 2011 and 2016. The programme worked with 24 sub-Saharan African universities to improve capacity to manage the uptake of research. DRUSSA provided direct support to the universities at individual, institutional and systems level to improve participation in and influence on policy and practice. The programme was designed to consolidate and strengthen existing capacity that could be sustained in the long term by the universities themselves (DRUSSA, 2012). This study aimed to provide benchmarks for institutionalising research uptake as well as providing guidelines for the management of research.

Research output must not only be well documented and publicised but must also be backed by an appropriate policy framework to ensure its eventual uptake and utilisation (DRUSSA, 2012). This will make research uptake and utilisation a *sine qua non* for any individual researcher and research team. Until the inception of the DRUSSA programme in 2012, KNUST lacked clear-cut mechanisms through which considerations for research uptake could be institutionalised. In 2016, the institution finally completed its research policy, which had been formally approved by the Academic Board in 2016 and endorsed by the University Council in 2017. The policy provides the framework and broad guidelines for research in the university. Some aspects of the results of the initial scoping study by DRUSSA were incorporated in the research policy.

The initial scoping study of DRUSSA conducted in 2010 identified a range of challenges with regard to Research Uptake (RU) and/or Research Uptake Management (RUM), namely:

- Universities in the sub-region acknowledge the need to manage research but there is a lack of awareness and deliberate efforts aimed at strategies, channels and mechanisms to engage in RU strategies (DRUSSA, 2012).
- Universities lacked the capacity to track, record and evaluate dissemination activities. This is an essential component of RU to ensure that the university reports on its achievements and impact in order to justify future funding. Central to the issue of proven accountability is the ability of the university to monitor and assess the level of effectiveness of its research as well the impact of dissemination (DRUSSA, 2012).
- Stakeholders of the university seem unaware of the existence of research findings that could be beneficial to them. They are therefore unable to determine the value of research outputs (DRUSSA, 2012).

The 2012 benchmarking survey conducted by DRUSSA, (2012) revealed that the majority of the 24 participating universities had great potential for contributing to local societal needs through research; however, many universities noted constraints in realising this potential. The

common factors according to the DRUSSA benchmarking survey were limited government funds, under-prioritisation of research and RU at institutional level and donor-driven research agendas. The survey also underscored the need to build capacity both at institutional as well as individual level in order to take research beyond the institution into the public domain for eventual uptake (DRUSSA, 2012).

In 2014, another survey was carried out to map out evidence of change in the various aspects of research uptake, namely research uptake strategy, research uptake process, research communication, and stakeholder engagement (Falk, Harber & Roberts, 2014). The key findings from the survey, which still reveal shortfalls in the various aspects of research uptake, can be summarised as follows:

- Research uptake strategy: Despite some progress in the area of strategy, there are concerns about challenges of composing guidance documents and policies to direct institutions. Furthermore, the institutional machinery with its attendant lack of formal structures slowed down processes for developing appropriate policies to support research uptake (Falk et al., 2014).
- Research uptake process: The survey revealed that, despite some interest across university offices, communication and cooperation between these offices still need improvement. In addition, there is a need for university-wide coordination of RU and strengthening of the role of offices responsible for RU (Falk et al., 2014).
- Stakeholder engagement: Research record keeping remains a hurdle and a hindrance to research management. Another challenge that universities face in this area is how to develop a lasting relationship with stakeholders that will lead to sustained research uptake (Falk et al., 2014).
- Dissemination of research: Research communication strategy is still in its infant stages making it difficult to reach target audiences (Falk et al., 2014).

KNUST was part of the benchmarking survey and therefore the above findings equally applies. Building the needed research capacity is thus a key university action to make the university effective in the delivery of its mandate as a scientific institution. It has been argued, that universities in Africa lack the requisite capacity to make them scientifically vibrant (Mouton, 2008). According to Mouton, the dissemination and uptake of scientific research is a process that requires its own dedicated scientific institutions.

The research database repository of KNUST is stocked with many researches from both academics and graduate students, and yet not much is seen by way of utilisation. This may be due to the fact that research is not disseminated to user groups. This might not be peculiar to KNUST. It can be confirmed elsewhere that, despite the large amounts of knowledge generated or research evidence available in universities in general, relatively little is disseminated and taken up or applied in practice (Becheikh, Ziam, Idrissi, Castonguay & Landry, 2010; Waddell, 2001). This means that available research evidence, which is not taken through the subsequent knowledge transfer processes, will end up not being used (Becheikh et al., 2010).

1.3 Brief history of KNUST

KNUST started as the Kumasi College of Technology by a government ordinance on 6 October 1951. An Act of Parliament converted it into a full-fledged university on 22 August 1961. The Act establishing the university defines its mandate, which essentially is to provide HE, undertake research, disseminate knowledge and foster relationships with outside persons and bodies. The strategic mandate of the university is derived from the reference to Science and Technology in its name. The university started with relatively few students, well-equipped departments and laboratories and well-trained academic and research staff who were mostly trained abroad. KNUST was well placed to achieve its vision of advancing knowledge in Science and Technology through its research activities in order to contribute to the sustainable development in Africa (KNUST Corporate Strategic Plan 2005-2014 (PLAN2K14), 2005).

In a bid to allow some autonomy in the administration of the university to make it more effective, it was reorganised into six colleges in January 2005. Under this system, the existing faculties were appropriately put together to form six colleges, namely:

- College of Agriculture and Natural Resources (CANR);
- College of Art and Built Environment (CABE);
- College of Humanities and Social Science (CHSS);
- College of Engineering (COE);
- College of Health Sciences (CHS); and
- College of Science (COS).

In June 2012, the Faculty of Forest Resource Technology at Sunyani, which used to be part of the College of Agriculture and Natural Resources, became a full-fledged university known as University of Energy and Natural Resources (UENR) and therefore became autonomous.

The university has research centres attached to each of its six colleges. Research centres, such as the Kumasi Centre for Collaborative Research into tropical medicine (KCCR), the Bureau of Integrated Rural Development (BIRD), and the Technology Consultancy Centre (TCC), and indeed a number of academics do some research with potential for uptake. The June 2017 Vice-Chancellor's Report to Congregation (QAPU, 2017) showed that, during the period the 2016/2017 academic year and on average, each college produced close to 200 publications, comprising conference proceedings, research articles and publications in the *Journal of Science and Technology* (JUST). Currently, there are several ongoing collaboratively funded research projects with –

- Purdue University, USA;
- Tropenbos International, Ghana;
- the International Fund for Agricultural Development (IFAD);
- the Dutch government and Netherland's Foundation for International Cooperation (NUFFIC),
- African Knowledge Transfer Partners;
- the Danish International Development Agency (DANIDA);
- the European Union (EU);
- the Swedish International Development Agency (SIDA);
- the Bill and Melinda Gates Foundation;
- the United Nations Educational Scientific and Cultural Organisation (UNESCO);
- the United Nations (UN);
- Issa Lille, France; and
- the International Development Research Centre (IDRC), to name but a few.

The number of doctoral and master's graduates has also been growing steadily over the past nine years. There are two graduation ceremonies each year – one in June and the other in November. The total number of PhD and master's graduates for the past nine years is as shown in Figures 1.1 and 1.2 below.

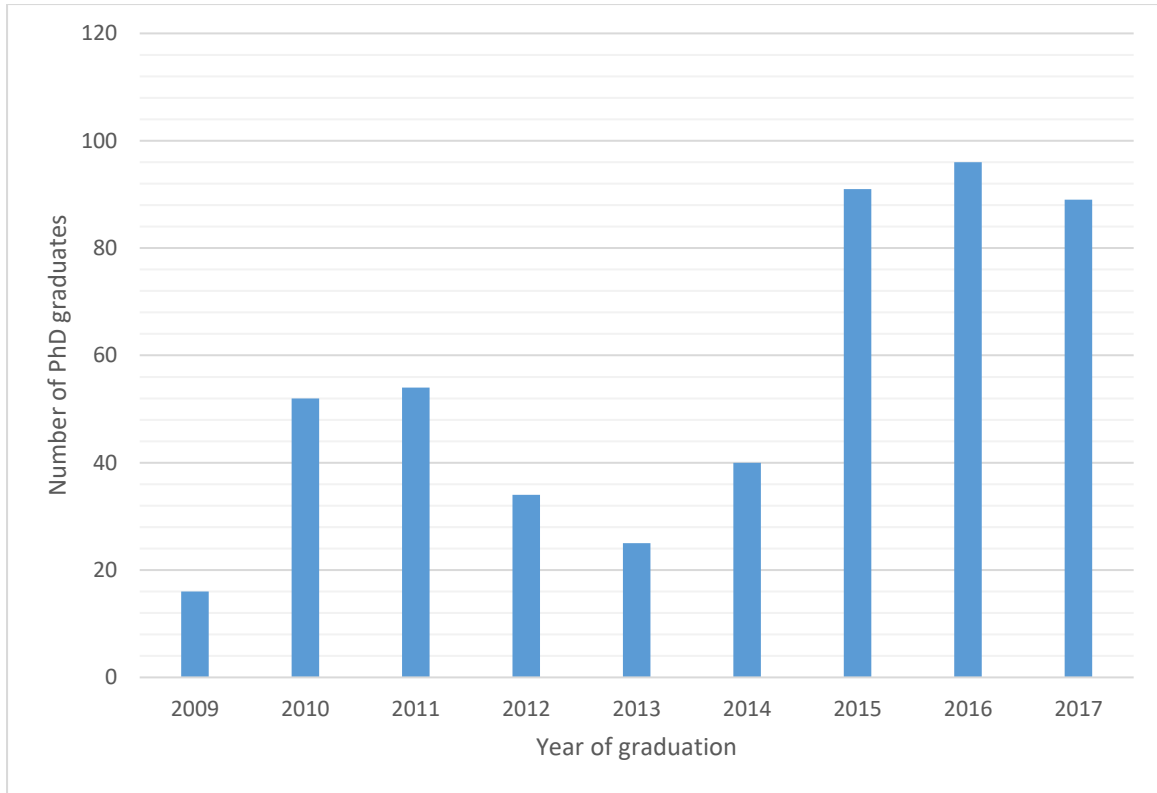


Figure 1.1 Number of PhD graduates produced at KNUST, 2009–2017

Source: Quality Assurance and Planning Unit (QAPU) (2017)

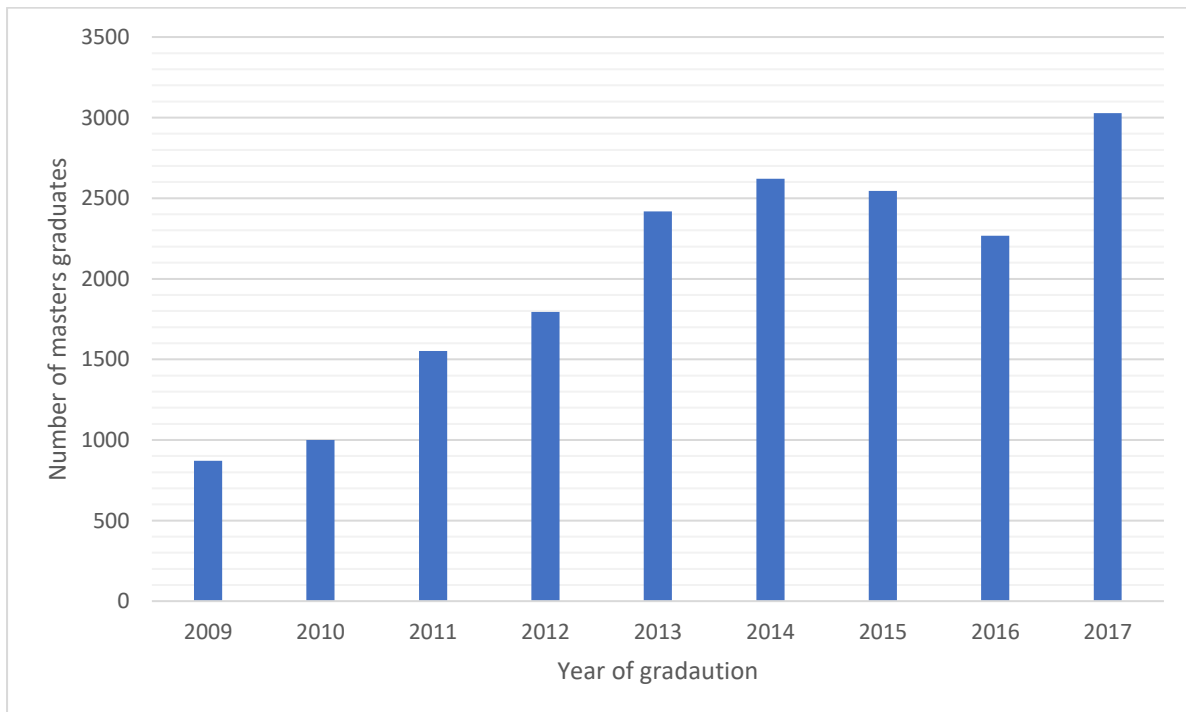


Figure 1.2 Number of master's graduates produced at KNUST 2009–2017

Source: QAPU (2017)

The author is of the firm belief that these efforts still need an institutional framework to guide and ensure optimum research uptake. Given the needed environment, these are major pathways through which research uptake could be facilitated. The environmental scans conducted at KNUST for DRUSSA in 2012 revealed that no significant provision was made for dissemination in the Mission Statement of the university (DRUSSA, 2012). This brings to the fore the need for a framework with policy direction to ensure the uptake and utilisation of research by individual researchers and teams within the university.

1.4 Rationale for study

This section provides a brief background to existing provisions for research uptake at KNUST, which informed the rationale for the current study, the objectives and research questions.

The general expectation is that universities are sites for knowledge production. In certain jurisdictions, they have been known as centres for discoveries, new technologies and innovations, some of which have great commercial value (Kitson, 2009). KNUST, as a knowledge-producing institution, has two categories of knowledge producers. The first category refers to researchers and academics, and the second category to postgraduate students. Research produced by these categories should be aimed at advancing knowledge, influencing policy, improving practice and, resolving socio-economic problems. It is therefore not out of place to expect KNUST to produce knowledge to affect human life. KNUST is a technological institution and by its mandate was set up to provide the needed technological manpower and knowledge for the labour market.

KNUST has a mandate, which essentially is to provide HE, undertake research, disseminate knowledge and foster relationships with outside persons and organisations (QAPU, 2017). Undertaking research and disseminating knowledge imply taking research into the public domain by publishing results in theses and refereed journals to the broader society. Knowledge production, which is mostly reflected in publications, largely benefits academia and elite society. In order to influence practice and address the needs of society, KNUST must ensure that its research, with the potential to influence policy and practice, reaches other major stakeholders, such as small and medium-sized enterprises (SMMEs), farmers and policymakers. Current developments and existing structures do not promote effective dissemination and uptake of research. Despite efforts at encouraging community service, teaching and research are still given more attention than community service (Grobelaar & Kirkland, 2013). As asserted, community service is established as a significant presence

alongside teaching and research but in many cases, universities still place a premium on teaching and research rather than on extension and outreach (Grobbelaar & Kirkland, 2013). This situation is somehow still prevailing. In order to address this anomaly as part of the university's research policy, RU is being given special consideration (QAPU, 2017).

The overarching aim of the current study was to address the problem of research uptake and utilisation by examining the need for a policy framework to institutionalise research uptake at Kwame Nkrumah University of Science and Technology (KNUST), Ghana. A framework that seeks to provide guidelines for a policy direction to improve production of research, dissemination and uptake was necessary. Such a framework would provide for appropriate mechanisms or channels and activities necessary for research uptake. Various pathways, concepts and elements for research uptake have been identified in order to design the conceptual framework. As argued, a useful conceptual framework should draw on existing models which have common elements to promote research uptake and utilisation (Nath & Europe, 2007). Rather than being prescriptive, the framework had to stimulate discussion and solicit ideas on the various options within KNUST that promote research uptake and utilisation. As suggested by Nath and Europe (2007), it is not feasible to identify a 'generic pathway' or steps to ensure research utilisation, but rather to identify common factors (facilitating and impeding) that influence research utilisation.

In order to achieve the aim of the study to propose a strategic framework for institutionalising research uptake, the following objectives were set:

1. to review current scholarship on research uptake and utilisation in order to identify the different forms and modalities thereof;
2. to review existing plans for research uptake at KNUST in order to identify the essential elements for a research uptake strategy and to determine which areas need attention;
3. to identify the strengths, weaknesses and opportunities for knowledge utilisation at KNUST;
4. to identify possible pathways within KNUST through which research uptake could be facilitated;
5. to propose a strategic policy framework for KNUST to implement and institutionalise mechanisms and activities for research uptake; and

The current study also sought to answer, among others, the following core research questions aimed at addressing the problems identified above:

1. What are the areas of local, national and general development focus and objectives where KNUST could play a role? This constitutes some of the external drivers of focus that propels the research agenda of the university.
2. What are the current modes and pathways of research utilisation at KNUST? Here we identified existing as well as non-existing knowledge production and dissemination activities and their implications for research utilisation strategy.
3. What are the barriers and constraints (institutional or systemic) for optimal research uptake and utilisation?
4. How is research (uptake) currently managed at KNUST? Here, we focused on the extent and levels of engagement with the external environment.
5. What are the essential elements to be incorporated into a strategic research uptake framework for KNUST, researchers and policymakers? This is in relation to the above questions, including the form and focus of knowledge production and dissemination, internal drivers, governance and control of the university.
6. What are the key institutional and individual capacity gaps, i.e. human and financial resources (at both management and operational levels), that need to be addressed in order to equip staff at KNUST to maximise the uptake, utilisation and impact of developmental and applied research?

The broader outcome of the study was to provide general guidelines that address the issue of research uptake management and how this can be institutionalised.

1.5 Structure of thesis

This section provides an outline of the structure of the study. The table below gives a summary of the focus areas and processes that were adopted.

Table 1.1 – Structure of thesis: framework analysis phases, issues addressed and in which chapters, research questions and objectives addressed

1. Introduction		
Historical perspectives, background to RUM, brief history of KNUST, and rationale for study		
2. Literature review		
History of the field of RU, research traditions and classic works of knowledge utilisation		Objective 1
3. Literature review		
Universities and research uptake, the role of universities in society, frameworks for RU, pathways to RU, barriers and facilitators to RU, strategies for RU		Objective 2 Research question 3
4. Research efforts at KNUST		
Research outputs and trends and efforts at increasing output		
5. Research design and methods		
Conceptual framework, document analysis, survey instrument frameworks, interviews		
6. Document review and analysis		
Local and national development agenda where the university could play a role		Research question 1 Objectives 1, 2 and 3
Analysis of document review		
Changing control and governance of university	<ul style="list-style-type: none"> Review existing university policy-related documents, such as statutes, research policy, conditions of service and code of ethics in relation to governance, capacity building mechanisms and staff engagement practices. Research Question 6. 	
7. Review of survey and analysis		
Changes in form and focus of teaching	We used a combination of an institutional survey and a review of institutional documents to determine the enrolment gap and widening participation, the way the university works and cooperates with local enterprises, communities and other stakeholders.	
Analysis of document review and survey		
Changes in form and focus of knowledge production and dissemination	A combination of a survey and document search to determine the nature and level of knowledge production, research activities and how these address the developmental role of the university.	Research questions 2, 4 Some aspects of objectives 4 and 5 were covered here
Analysis of document review		
Changes in forms and focus of interaction and engagement	A document review of how universities engage with the external environment and accessibility of knowledge resources. We conducted a survey to determine the extent of involvement and collaboration with stakeholders in curriculum development, teaching and research.	
Analysis of document review, survey and interviews		

Transformation of the university to increase relevance and engagement	An in-depth analysis of all the above factors, the form and focus of knowledge production, internal and external drivers of focus, governance and control.	Research question 3,5 and 6 Objectives 1–4
7. Analysis of survey		
University actions to drive transformation in external environment	An on-campus survey of how the university could link up with governments, communities and other stakeholders and align the university to the need of the external environment (stakeholder expectation).	Research questions 1, 2, 5 Objectives 4, 5 and 6
8. Analysis of survey		
University actions to drive internal transformation, institutionalising RU into the knowledge production processes and support internal drivers of focus, and barriers to change: institutional and system	<ul style="list-style-type: none"> • Analysis of knowledge production and dissemination activities covering areas such as: typical engagements with stakeholders, benefits of engagement, stages of engagement and barriers to research use. • 	
9. Conclusion and recommendations		

CHAPTER 2 – LITERATURE REVIEW: THE CLASSIC WORKS OF THE FIELD OF KNOWLEDGE UTILISATION

2.1 Introduction: The history of research utilisation

This chapter focuses on the classic works of the field of knowledge utilisation as discussed in the literature. A look at these models and authors in the field of knowledge utilisation was deemed necessary since it has been argued that recent developments in the field have been based on the older models. It can therefore be observed that this researcher's proposed framework, discussed in Chapter 9, shows indications of influence by these earlier works. The sections below consider key authors and models in the field of knowledge utilisation and the developments in the different research traditions.

2.1.1 The waves of knowledge utilisation

There have been various waves in the domain of science utilisation and, for that matter, knowledge utilisation. Backer (1991), in his review of the history of knowledge utilisation argues that the field has moved through three waves. He also provides pointers that suggest a possible fourth wave. The first wave (Wave 1), which spanned the period 1920–1960 focused on the adoption and practice of technological innovations (Backer, 1991). The period characterised research into the diffusion of agricultural innovations when agricultural extension officers were used to propagate new knowledge in agricultural practices (Rogers, 2003).

In the second wave (Wave 2), spanning the period 1960s–1980s, there was a shift in focus to dissemination and utilisation of innovations at the time of what was known as the knowledge utilisation movement (Backer, 1991). During this wave, there was a broadening of knowledge utilisation to include the usefulness of social science and health research. Carol Weiss's (1979; 1980) insight into the use of social science research and Robert Rich's (1991) perspectives of knowledge utilisation fall within this period. It was during this period that there was advocacy for individuals and organisations to consider the adoption of innovations (Jacobson, 2007). This suggests how far back the issue of knowledge utilisation dates and provides justification not only for the production of knowledge but also for ensuring that benefits are derived from such knowledge.

Backer's (1991) proposed third wave (Wave 3) started in the 1990s. He describes it as a period where the understanding of knowledge was complex. Policymakers and government agencies had to think through and rationalise their methods of dissemination and utilisation of research (Backer, 1991; Jacobson, 2007). The period saw a renewed interest in knowledge utilisation

with the emergence of evidence-based medicine (EBM). According to Lavis and Robertson (2003), it was during this period that knowledge use emerged as a process by which research messages were ‘pushed’ by producers of research to the users of research (Lavis & Robertson, 2003).

Backer provides pointers and trends that suggest a possible fourth wave (Wave 4). These trends include increased attention to the issues of quality assurance and accountability. Publicly funded research should be reported and funds accounted for (Backer, 1991). From the above discussion, it can be concluded that the field of knowledge utilisation has evolved over a long period, from the 1920s until the present day. As presented in Backer’s (1991) account, four waves of knowledge utilisation have been identified:

Table 2.1: Backer’s four waves of knowledge utilisation literature

Period	Subtopics of knowledge utilisation
First wave: 1920–1960	Diffusion of innovations
Second wave: 1960–1980	Technology transfer and knowledge utilisation in social sciences
Third wave: 1990s–early 2000s	Evidence-based medicine
Fourth wave –	A systems intervention to knowledge utilisation: knowledge translation

The above waves may have contributed to later development of models of knowledge utilisation. As reviewed by Baker, the field of knowledge utilisation also deals with knowledge production, dissemination and utilisation. These issues have been handled by many authors who proposed different frameworks that sought to outline measures by which knowledge can effectively be transferred to end users. Sub-section 2.4 discussed some of the most influential models in the field. There are various means by which knowledge can be transferred from the producers to the users. These means are varied in their approach depending the type of knowledge being transferred. The next sub-section thus provides definitions for some of the terms associated with knowledge utilisation.

2.2 Defining the field

Research uptake (RU) is –

[A] term used to describe a method of conducting research that includes stakeholder identification, engagement, communication and dissemination which results in evidence to influence outcomes that can have impact on the lives of poor people (DRUSSA, 2012:3).

Various terminologies with implications for the use of knowledge have emerged over the years. According to Estabrooks et al., (2008), among the several meanings and terminologies are ‘knowledge utilisation’, ‘knowledge translation’, ‘knowledge exchange’, ‘innovation diffusion’, ‘knowledge communication and dissemination’, ‘knowledge transfer’, ‘technology transfer’, ‘knowledge application and uptake’. Estabrooks et al. (2008) confirm that these domains are substantively similar on the basis that they all address the idea of solving social problems with knowledge. These authors argue that the difference in meanings are as a result of the core problems of concern, knowledge used, audiences of relevance, and sometimes modes of transfer (Estabrooks & Derksen, 2008). The following sections provide insight into some of the terminologies associated with research uptake. These brief definitions have become necessary in order to avoid using some of these terms interchangeably and also to ensure that wherever they appear in the current study they are used in the right sense of the word. This current study focused on research uptake and utilisation for which reason the term research uptake is mostly used in the generic sense to represent knowledge utilisation.

2.2.1. Technology transfer

Bozeman (2000) describes ‘technology transfer’ as the process by which ideas, proof-of-concept, and prototypes move from research-related to production-related phases of product development. He says the knowledge upon which technology is composed, is diffused alongside the technology, and that without the knowledge base, the physical entity cannot be put to use. This is perhaps the reasoning for equating technology transfer to knowledge transfer. The distinction, according to Bozeman (2000), however, is that, whereas knowledge transfer is furthers scientific work using existing scientific knowledge, technology transfer leads to innovations and new product development by others (Bozeman, 2000).

The meaning of technology transfer has been seen to be complicated (Bozeman, 2000). The technology transfer process may simply involve transferring technology from one source to another for the purposes of being used or for further development. Bozeman (2000), however,

argues that it is not easy to define a boundary of technology transfer and that in his view it is impossible to outline the technology transfer process due to many other concurrent processes.

2.2.2 Knowledge adoption

According to Andrews (2012) the term knowledge adoption may be used to imply the uptake of information, concepts, tools or practices (innovations) that have been generated predominantly through research. Knowledge transfer involves stakeholder engagement as well as provision of information (Andrews, 2012). Andrews further argues that managing knowledge for adoption is fundamentally different in approach to technology transfer because knowledge adoption is part of a larger process of change and development, which concerns itself with how to create and share knowledge (Andrews, 2012). He contends that the word ‘transfer’ implies a one-way transaction whereas managing knowledge for adoption is interactive, not linear and active, rather than passive. He argues further that knowledge adoption is driven by need rather than curiosity or push and pull factors (Andrews, 2012).

2.2.3 Knowledge transfer and exchange

Knowledge transfer and exchange (KTE) refers to an interactive interchange of knowledge between research users and research producers (Kiefer, Frank & Ruggiero, 2005). The primary concern of KTE is to promote the incorporation of research evidence into policy and practice (Kiefer, et al., 2005).

2.2.4 Knowledge utilisation

According to Larsen (1980), knowledge utilisation is a complex process involving political, organisational, socioeconomic and attitudinal components in addition to the specific information or knowledge. Knowledge transfer must lead to recognisable changes in order to determine whether a transfer has taken place or not. The assumption is that knowledge utilisation has “occurred when an entire set of recommendations was implemented in the form suggested by the researcher” (Larsen, 1980:421). Davis and Salasin (1975) as well as Larsen (1980) state that utilisation of knowledge may be occurring frequently but researchers may not recognise it if it does not fit into a narrowly predetermined variable and if it does not occur within a specific period (Davis & Salasin, 1975; Larsen, 1980).

2.2.5 Knowledge translation

Grimshaw and Eccles define knowledge translation in relation to healthcare. According to them it is a process of ensuring that research findings get to stakeholders for use in their healthcare

decisions. This definition bears in mind the wide range of stakeholders or the target audience for knowledge translation, including policymakers, professionals (practitioners), consumers, researchers and industry (Grimshaw & Eccles, 2012).

2.2.6 Diffusion of innovation

‘Diffusion innovation’ is another term associated with the spread and adoption of knowledge. An innovation is said to have been diffused if an intervention, a new idea or a method is adopted (Rogers, 2003). Diffusion begins with the initial sending out of innovations, and then continues to examine the spread and adoption of the innovation. Bowen and Zwi (2005) assert that fundamental to the transfer of evidence into practice is diffusion. The process of diffusion is concerned with the spread and adoption (or rejection) of products, practices, programmes, policies or ideas (Bowen & Zwi, 2005). The key components of the process are: the social system through which the innovation moves, the channels of communication, the time it takes for the innovation to spread, and its adoption by stakeholders (Ashley, 2009). Rogers describes ‘innovation diffusion’ as the process by which an innovation is communicated through certain channels over time to members of a social system (Rogers, 2003).

The relevance of the innovation and its adoptability is dependent on the perception of newness and characteristics. An innovation, which has been altered or modified, can also be said to have been adopted (Rogers, 2003). This is supported by diffusion theory, proposed by Ashley (2009) which calls for contextual adaption of innovations.

2.2.7 Dissemination and communication

Dissemination is seen as a generic term for all knowledge transfer or communication activities (Hood, 2002). It is –

[A] process requiring a match among originated knowledge, the needs, contexts, prior experiences, values and beliefs of intended users, and the content, media, formats, and language used in getting the outcomes into the hands, minds, and activities of users. The goal of dissemination is utilisation-the critical element is that the research outcome must be understood and the individual or organisation must incorporate the new information within prior understandings and experiences (Hood, 2002:25).

According to Ashley (2009), dissemination is conceptually preoccupied with the process of sending out innovations. Compared to dissemination “diffusion refers to passive spread, while dissemination is relevant to active and planned efforts to persuade target groups to adopt an innovation” (Ashley, 2009:41). Diffusion is considered to be a broad category representing the

spread of a range of innovations; however, when that innovation is knowledge or research, the spread process becomes dissemination (Ashley, 2009; Graham & Logan, 2006).

These definitions are necessary for us to understand the terms that are associated with research utilisation and the distinctions among them in order to use them appropriately. It also provides an explanation why some of these are sometimes used interchangeably

2.3 Uses of knowledge

Different types of knowledge utilisation have been identified, namely instrumental, conceptual and symbolic (Amara, Quimet & Landry, 2004; Bailey & Mouton, 2005; Landry, Amara & Lamari, 2001; Larsen, 1980; Nelson, 2006; Weiss, 1980). This section presents a brief discussion of the types of research and the three main uses of knowledge, namely instrumental, conceptual and symbolic use. The type of research has implications for the mode of its transfer. As discovered in Chapter 8 of this study it seems that many researchers at KNUST focus more on basic research rather than applied research. This may have contributed to the situation where majority of research findings end up as publications in refereed journals. As discovered in the closing chapters there were some researchers who indicated that their research findings have led to solving environmental problems, influence in practice and changes in policy. Though the current study did not go further to find out what type research was being undertaken by researchers one could deduce that it takes more than fundamental or basic research to solve environmental or immediate technical problems.

2.3.1 Types of research

This sub-section provides brief definitions for the types of research. Basically, we restrict ourselves to three types of research, namely pure research, applied research and evidence-based research with the view to understanding the types of research that staff at KNUST engage in. Pure research or basic research could also be referred to as fundamental research (Bailey & Mouton, 2005) This type refers to “research carried out for the purposes of understanding some fundamental concepts within the scientific field, rather than in search of a particular commercial goal” (DRUSSA, 2012:7). In general, pure research is basically exploratory and does not produce marketable results, but may serve as the foundation or building block for future research, which may be more specific and could have more profitable application. Curiosity and gut feeling are some of the driving forces of pure research (university of Southampton, 2014)

Applied research, on the other hand, refers to further investigation of fundamental research in order to determine whether it might lead to new products, innovations, technologies, processes or services. Applied research also refers to research intended to solve specific problems or to find answers to specific questions. Our interest was in the kind of research that has the potential for uptake and utilisation. This type is usually intended to solve practical problems and find solutions to everyday challenges.

Evidence-based research implies that researchers base their judgement or further research on proven information that can be verified by others (Grand Canyon University, 2014) This type of research has implications for the complexity of the knowledge transfer process.

2.3.2 Instrumental use

Weiss (1980) provides insight into the term ‘instrumental use’ of knowledge. Instrumental use refers to situations where specific research or knowledge influences decision-makers or practitioners to make decisions which hitherto would not have been made had that knowledge not existed (Weiss, 1980). According to Larsen (1980:431), “instrumental utilisation refers to cases in which respondents could cite and document the specific ways in which knowledge was being used for decision-making or problem-solving purposes”. Instrumental use involves the use of hard data by the end user to improve operations or impact policy, in which case it may be possible to link a particular research to a specific intervention (Larsen, 1980; Amara et al., 2004).

Wilson (2003) explains further that instrumental use is direct use which results in changes in practice (Landry et al., 2001:336). Operationally, the measurement of utilisation has centred almost exclusively on the instrumental use of knowledge, that is, the contribution of knowledge to the decisions of practitioners and decision-makers (Landry et al., 2001, Amara et al., 2004).

2.3.3 Conceptual use

When a policymaker’s thinking about an issue is influenced by some knowledge which is not specific or documented, conceptual use is said to occur (Landry et al., 2001). “Conceptual use refers to situations where knowledge provides new ideas, new theories and new hypotheses conducting to new interpretations about the issue and facts surrounding the decision-making contexts without inducing changes in decisions” (Landry et al., 2001:333). Conceptual utilisation interventions can be credited to research information but it is normally not possible to link these interventions to specific knowledge sources (Menon & Varadarajan, 1992).

Where there is application of knowledge information, it is said to have provided ‘enlightenment’ for a decision (Landry et al., 2001). Landry et al. (2001) used the term ‘enlightenment’ to refer to situations where concepts from social science research sift into the policymaking process. The enlightenment model according to Landry et al., (2001) suggests that decision-makers believe it is a good thing to have all kinds of research that make them reflect on their thoughts and assumptions in the course of time (Amara et al., 2004; Landry et al., 2001). This is an example of the conceptual use of knowledge.

2.3.4 Symbolic use

The third type of knowledge utilisation refers to situations where policy makers and other stakeholders or users already hold some view but then use research findings to support these views (Amara et al., 2004; Boshoff, 2013; Estabrooks, Squires, Cummings, Teare & Norton, 2009; Menon & Varadarajan, 1992). This implies that policymakers use research findings to support their standpoint and also as proof of their responsiveness (Boshoff, 2013). It is also possible that policymakers may use academic research as a source of information and ideas, but hardly as straightforward information necessary in the formulation of policies (Boshoff, 2013). Estabrookes and Derksen (2008) indicate that symbolic use of knowledge involves the use of research as a persuasive or political tool to legitimate a position or practice.

It is necessary to understand clearly what we mean by knowledge use since there are many uses as outlined above. The extent of knowledge use also depends on the type of research and intended users. By ‘knowledge use’, therefore, we are not only referring to putting into practice or applying an idea or theory that has been reported on, which is instrumental, but also, we have in mind conceptual as well as symbolic uses (Estabrooks & Derksen, 2008).

2.4 The most influential classic models of knowledge utilisation

According to Rogers (2003), a research tradition comprises a series of investigations on a topic where the following studies are influenced by preceding studies (Rogers, 2003). The current review provides a short overview of the key concepts for each classic research model in the sections below. These models provide an understanding and background to recent developments and have implications for this study. The main goal of this study is to propose a framework suitable for research uptake at KNUST and therefore a general look at the most influential models was necessary. The proposed framework in Chapter 9 therefore has semblances of existing frameworks.

2.4.1 Everett M Rogers – The diffusion of innovation

In the 1960s, Rogers investigated the diffusion of innovations in relation to agriculture by observing how farmers make use of new ideas (Rogers, 2003). He outlines how diffusion of innovations cuts across many fields of endeavour. Rogers defines innovation as any idea (including new knowledge and new product), practice or object that is perceived as new (Rogers, 2003). It has been argued by Rogers, (2003) that the period of ‘knowledge explosion’ and the expectation that knowledge must be put to use led to the evolution of knowledge utilisation as a field of study in the 1960s.

Rogers’s (2003) description of diffusion as a process involves innovations and communication through certain channels over time within a social system. The characteristics of innovation, according to him, play a key role in the innovation diffusion process as well as its adoption. The characteristics of the innovation should include the compatibility, simplicity, and experimentally feasible to try (Rogers, 2003).

According to Rogers, the main criticisms of diffusion of innovations are that of bias since it assumes that the diffusion process is good for everyone to adopt. The process is also individually focused without due recognition of the effect the social system might have on the individual. The diffusion process can again be criticised for possible inaccuracies in reporting the time of adoption (Rogers, 2003).

2.4.2 Ronald G Havelock – Understanding the process of dissemination and utilisation

Havelock conducted a review on knowledge dissemination and utilisation using important features of existing models to develop new ones (Havelock, 1973).

Havelock (1973) identified three models, namely –

- the problem-solving model (focuses on the need of the user);
- the research, development and diffusion model (focuses on the research and the research product); and
- the social interaction model (focuses on how the innovation moves between users and systems).

A fourth model, the linkage model was developed as a two-way interaction process between potential users and producers of knowledge (Havelock, 1973). It is argued that Havelock’s models (Havelock, 1973) of knowledge utilisation served as the foundation for most of the recent models in the field (Becheikh, Ziam, Idrissi, Castonguay & Landry (2010). Becheikh et

al., (2010) thus supported the argument that recent models have been based on Havelock's frameworks as listed above.

2.4.3 Carol Weiss – The many meanings of research utilisation

In the 1970s, Weiss provided insight into what constituted research utilisation at the time when there was general agreement that social research had little or no influence on policy decisions (Weiss, 1979). What really constituted research utilisation presented a paradox (Boshoff, 2013). Weiss interpreted utilisation within the social policy domain by outlining seven models of research utilisation (Weiss, 1979). The seven models of Weiss are:

- The knowledge-driven mode: this is made up of sequentially arranged events, namely basic research, applied research, development research and application (Weiss, 1979).
- The problem-solving model: Weiss also refers to this model as the “policy-driven model” (Weiss, 1979:429). In this model, conclusions are supposed to be based on empirical evidence that could help solve policy problems (Weiss, 1979). Research here is driven by the decision to solve existing problems (Weiss, 1979). This is an example of instrumental use of knowledge.
- The interactive model: in this case and based on an interactive search for knowledge from stakeholders, research is able to enter the policy arena (Weiss, 1979).
- The political model: here the selection of specific research is based on the interest of a particular policy predetermined by policymakers. In this case, research findings can be used to strengthen a predetermined standpoint (Weiss, 1979). This is an example of symbolic use.
- The tactical model refers to situations where the research used has not much bearing on the content of the findings but is used tactfully for political expedience (Weiss, 1979). This is another example of symbolic use.
- The enlightenment model, associated with “knowledge creep” (Weiss, 1980:381), is an example of the conceptual model, and refers to cases where research is used to sensitise decision-makers and to draw their attention to new issues, which hitherto were not problems but which are subsequently regarded as policy problems (Weiss, 1979). In this case, decision-makers are not able to point to any direct research that has influenced their decision but agree that research has contributed to their decisions.

- Finally, Weiss (1979) asserts that where society regards research as intellectual pursuit, it becomes part of an intellectual enterprise of society.

2.4.4 Robert F Rich – Perspectives of knowledge utilisation

Rich (1991) provides information about the historical roots as well some perspectives of knowledge utilisation as a field of study. He argues on the basis that the field of knowledge utilisation has existed since the 17th century irrespective of the fact that the field seems to be relatively new (Rich, 1991).

Rich (1991) offers significant insight into what constitutes knowledge utilisation and how it can be measured and further argues that knowledge utilisation is a process comprising many events. According to him, KU involves receiving information and processing it before applying it (Rich, 1991). This was emphasised by Knott and Wildavsky's (1980) standards of knowledge utilisation, comprising knowledge reception, cognition, reference, effort, adoption, implementation and impact. Some of these arguments have been confirmed from the results of the survey discussed in Chapter 8 of this study.

2.4.5 Nathan Caplan – The two communities' perspective

Caplan's (1979) 'two communities' theory seeks to explain the differences between producers of knowledge and users and the differences in utilisation on the basis of differences in culture (Caplan, 1979). The 'two communities' is explained "in terms of the relationship of the researcher and the research system to the policy maker and the policy-making system" (Caplan, 1979:459). The distinction between cultures among researchers and knowledge users or practitioners leads to a gap in the knowledge to policy interface (Caplan, 1979). This divide has engaged the attention of both researchers and policymakers. What Caplan (1979) refers to as the 'two communities' theory remains the main concern for the science-policy interface (Caplan, 1979). The problem is the divergence between the two communities, which has led to a cultural and behavioural gap (different values, languages, reward systems) (Caplan, 1979). The reason for this gap has been attributed mainly to the disconnect between researchers and policy makers or users. The two communities do not collaborate effectively to increase the chances of the usage of research findings. The lack of intermediary institutions to carry research to policymakers also contributes to the gap between the two communities. In order to overcome this shortcoming, there is the need to strengthen interactions between the two communities. Linkage agents are needed as intermediary actors (third community) between researchers and users (Becheikh et al., 2010).

2.4.6 Huberman – Theory-to-practice model of KU

In his theory-to-practice model, Huberman (1994) established a relationship between ‘diffuser’ and ‘user’. In this classic paradigm, the researcher ‘produces’ knowledge, then ‘transfers’ it to a ‘user’ who ‘uses’ it. Huberman (1994) then established a ‘communication of needs’ links between the producers of knowledge and the users of knowledge. This is to ensure that the needs of the user are taken into consideration before the knowledge production (Huberman, 1994). The implication is that the needs and priorities of users of knowledge are taken from the field into the laboratory or place of research. Huberman (1994) asserts that users of knowledge should not be regarded as illiterates, novices or non-specialists, and hence used as mere targets for use of knowledge or dissemination.

Huberman’s (1994:13) model –

[P]redicts that where there are intermediaries (people active both in research and professional settings), where formal and informal contacts are made during the study, where there is interim feedback on findings and when users are involved during the data collection phase (as informants, in an action research cycle), there will be a stronger push towards use of the findings.

This, Huberman refers to as linkage mechanisms. Furthermore, he proposes what is called ‘dissemination competence’ (see Huberman, 1994), which involves putting out different products for distinct audiences, multiple channels (visual, in print), redundancy of the important messages that the researchers want to get across, in-person contacts, follow-through on those contacts, and actual involvement in the setting beyond the study (Huberman, 1994).

2.4.7 Landry *et al.* –Models of knowledge utilisation

Landry et al. (2001) propose four models for knowledge utilisation. These are the science push (on the supply side), demand pull (on the demand side), dissemination, and interactive models.

The **science push model** follows a linear sequence from supply of research advances to utilisation by decision-makers and practitioners (Landry et al., 2001) where research advances are assumed to find their way into application automatically. The science push model views scientific research and its associated processes and products as the key determinants of knowledge utilisation. The emphasis here is on the supply of advances in research or research outputs. The knowledge producer, mainly the researcher, becomes the central actor in the knowledge production, diffusion and utilisation process (Hargreaves, 1999). In this case, users

are regarded as passive receptors of the findings. The supply of research then becomes the major determinant for utilisation.

The science push model has led to studies that focus on the extent to which knowledge utilisation is determined by the type of research and the researcher's context, be it basic, applied, quantitative or qualitative research (Landry et al., 2001).

Landry et al. (2001) also propose a **demand-pull model** of knowledge utilisation, which starts with the identification of the research problem by the end users, in which case knowledge utilisation is defined only by the needs of the users. They argue –

[U]se of knowledge is increased when researchers focus their projects on the needs of users instead of focusing them only on the advancement of scholarly knowledge. Knowledge transfer must not be assumed to be automatic but must be incorporated as part of the research process by fashioning out dissemination mechanisms to identify useful knowledge and transfer it to stakeholders (Landry et al., 2001:340).

Dissemination mechanisms involves the selection of appropriate mechanisms to bring research findings of interest to stakeholders to their doorsteps. The level of interaction between researchers and stakeholders determines the level of acceptance and the extent of use. Landry and colleagues thus proposed an interaction model as a means to enhance the use of knowledge. The **interactive model** of knowledge utilisation emphasises the intensity of the relationship between the producers of knowledge and the end users of knowledge. The interaction model suggests giving more attention to the relationships between researchers, users of research, decision-makers or practitioners at all the different stages of the knowledge generation process, dissemination and utilisation (Landry et al., 2001).

2.4.8 Conclusion of this sub-section

The above provided a list of key authors in the field of knowledge utilisation, and briefly discussed the models developed by them. It has been argued that current developments in the field of knowledge utilisation seem to be based on the above models. It was the hope that the findings from this study will be in line with these developments and further propose a suitable model within the context of the study.

2.5 Frameworks for research uptake

Many authors have proposed various means by which knowledge can be utilised (Gagliardi & Brouwers, 2011, Lavis & Robertson, 2003). This section discusses some of these frameworks and the domains that seek to promote the use of research. The domains necessary to promote

the use of research are usability, adaptability, validity, applicability, communicability, accommodation, implementation and evaluation (Gagliardi & Brouwers, 2011). With reference to organising KTE, some five elements have been identified, namely message, target audience, messenger, knowledge transfer process and support system, and evaluation strategy (Lavis & Robertson, 2003). These elements seek to answer the questions posed by Lavis and Robertson (2003):

- What should be transferred?
- To whom should it be transferred?
- By whom should research knowledge be transferred?
- How should research knowledge be transferred?
- With what effect should research knowledge be translated?

There are frameworks by Andrews (2012), Gagliardi et al. (2011), Becheikh et al. (2010), Wilson and Petticrew (2010), Mitton, Adair and McKenzie (2007), Sudsawad (2007), Graham and Logan (2006), Eager, Cromwell and Owen (2003), Jacobson, Buterill and Goering (2007) and Bozeman (2000) which emphasise the use of active interactions with stakeholders for KU. Andrews (2012), for instance, asserts that in order for research to be utilised, the research process, stakeholder involvement, communication and micro contextual factors (such as budgeting and capacity building) should be considered (Andrews, 2012).

In addition, evaluation has been suggested in most of the frameworks due to its significance. The use of evaluation as suggested by Pyra (2003) is to refine the knowledge transfer process. Evaluations are based on whether and how knowledge is transferred rather than on the extent to which knowledge was utilised (Eagar, Cromwell & Owen, 2003; Lavis & Robertson, 2003; Mitton, Adair & McKenzie, 2007). The evaluation aspect of the framework also enables researchers to learn about the challenges and environment in which decision-makers operate and determine how to present the information in a manner appropriate to the real-world environment (Rogers, 2003).

The following sections consider some selected KU frameworks and project or individual and organisational or institutional-level frameworks for research utilisation as proposed by various authors.

2.5.1 Bozeman's research utilisation framework

This sub-section attempts to adapt Bozeman's contingent effective model to the design of frameworks for KU. The discussion also focuses on some principles for research uptake by

identifying the various actors, actions and conditions necessary to provide a guide for the design of strategies that could be employed.

Bozeman (2000) argues that knowledge transfer is an integral part of technology transfer. This is because when technology transfer takes place, the knowledge on which the technology is based is also diffused or transferred alongside the technology (Bozeman, 2000). Bozeman's approach acknowledges that there are certain characteristics that affect the process of knowledge transfer with implications for its effectiveness (Bozeman, 2000).

As already discussed earlier in this chapter (literature review), a number of determinants for an effective knowledge transfer have been outlined, namely the characteristics of the transfer agent, transfer medium, transfer object, transfer recipient and demand environment (Bozeman, 2000). Table 2.2 below provides a summary of the various characteristics. The implication is that, for institutional change and effective research uptake, a framework that takes cognisance of these factors is necessary.

Table 2.2 Determinants for effective knowledge transfer

Dimension	Focus and examples	Characteristics
Transfer agent	The institution or organisation engaging in the knowledge transfer, e.g. researchers and research institutions	These include the nature, history and the culture of the institution and how these affect its ability for effective knowledge transfer
Transfer medium	The formal or informal means (the vehicle) by which the knowledge is transferred	These include national laboratories, knowledge brokers and lobbyists, media etc.
Transfer object	The content and form of what is transferred, i.e. the entity	These include products that have commercial value, innovations, basic research upon which to base further research or new applications etc.
Transfer recipient	The organisation or institution receiving the transfer object	These include governments, non-governmental organisations (NGOs), industry among other stakeholders
Demand environment	Factors (market and non-market) pertaining to the need for the transfer object.	Market and non-market forces, economic conditions and government policies have an effect on the demand for knowledge

Source: Bozeman (2000)

2.5.2 Jacobson et al.'s framework for RU

At organisational level, Jacobson, Butterill, and Goering (2007), proposed a framework that seeks to increase researcher's familiarity with the intended user groups and context. The framework was corroborated by the work of Eager et al. (2003), Lavis et al. (2003), Mitton et al. (2007) and Andrews (2012). This proposal seems to base the framework on the interaction model of KU. It emphasises the importance of creating a link of 'sustained interactivity' between producers and users of knowledge. It has been demonstrated by Jacobson et al., (2003) that key to research use is interpersonal links spread through the life of the knowledge production process, which allows for contact between all stakeholders of the KU interface during and after the research (Huberman, 1994; Jacobson et al. 2003)).

The interaction model of KU contends that no matter how good and powerful research findings are, they are short-lived and can decay over a period (Jacobson et al., 2003). The recommendation is that parties involved in the research stay together long enough to sustain their mutual interest and even go further to explore other research areas over a period (Jacobson et al., 2003). Furthermore, it is argued that 'sustained interactivity' is the vehicle of choice for combining the fruits of research with the understanding and skills of professional practitioners (Jacobson et al., 2003). We can establish clear similarities between the frameworks, most of

which emphasise the need for effective interaction between knowledge producers and potential users of knowledge.

These interventions have been applied in some specific contexts, programmes and projects. Many health-related projects have adapted some of these frameworks for specific health care interventions while others have been generally applied (Wilson, Brady & Lesesne, 2011). The National Centre for Chronic Disease Prevention and Health Promotion (NCCDPHP)'s knowledge to action (K2A) framework was designed to be applicable generally by scientists, administrators, policymakers and support systems (Wilson, Brady & Lesesne, 2011). The framework comprises a three-phase process involving:

- research (this includes developing and testing scientific advances to determine their suitability);
- translation (involves the process needed to ensure widespread implementation of evidence-based programmes); and
- institutionalisation (involves the maintenance of the intervention programmes, policy and practice as an established activity or norm within an organisation).

According to Wilson, Brady and Lesesne (2011), these phases allow for decision making to set up relevant infrastructure for dissemination of research findings and to transform research into products that stakeholders can use. The implementation is facilitated when communities, organisations and practitioners making the decision to adopt have sufficient supporting structures and resources to move effectively towards action (Wilson et al., 2011). Wilson et al. (2011) framework, designed for public health researchers and practitioners as well as other professionals, holds some lessons of good practice for the African context.

2.5.3 Sudsawad's framework for RU

Sudsawad (2007) provides some additional insight into the context within which knowledge is applied. He describes the process of knowledge transfer to include “knowledge dissemination, communication, technology transfer, ethical context, knowledge management, knowledge utilisation, two-way exchange between researchers and those who apply knowledge, implementation research, technology assessment, synthesis of results with global context, and development of consensus guidelines” (Sudsawad, 2007:2). His framework for KU is based on this broad understanding of the KU process. It provides various characteristics of knowledge transfer, which cover almost all the steps to knowledge translation as outlined by Becheikh et

al. (2010), discussed in sub-section 2.2.6, that is, all the processes that one needs to go through from knowledge production to knowledge utilisation.

Sudsawad (2007) proposed interaction-focused framework for KU was derived from the work of Jacobson et al. (2003). Sudsawad (2007) identified guidelines for use by researchers and others to guide the establishment of interactions required for KU. The framework, based on the conceptual guide for the overall knowledge translation process as proposed by the Canadian Institute of Health Research (CHIR) (2005), contains five domains necessary in establishing interactions with users, namely:

- the user group (this involves understanding the group’s operational context, attitudes and practices) (Sudsawad, 2007);
- the issue (this has to do with the characteristics and context of the issue to be resolved with research and researchers) (Sudsawad, 2007);
- the research (refers to research characteristics, its relevance and compatibility) (Sudsawad, 2007);
- the researcher–user relationship (refers to the description of the relationship between the researcher and users or user groups) (Sudsawad, 2007); and
- the dissemination strategies (involves practical strategies for disseminating the research knowledge) (Sudsawad, 2007). Sudsawad argues that knowledge transfer encompasses all steps between knowledge creation and its utilisation in order to yield maximum output.

Table 2.3 below provides a summary of the domains that establish interactions with users.

Table 2.3 Framework for establishing interaction with users

DOMAIN	COVERAGE AND FOCUS
The user group	The focus is on understanding the group’s operational context, attitudes, decision-making practices, access to information sources, attitudes towards research and researchers, and experiences of knowledge translation
The issue	Refers to the characteristics and context of the issue to be resolved by research and researchers, the user group orientation towards research and the relevance, congruence and compatibility of the research to the user group
The research	Refers to research characteristics, their relevance and compatibility.
The researcher–user relationship	The focus here is on the description of the relationship between the researcher and users or user groups
The dissemination strategies	Involves practical strategies for disseminating the research knowledge

Source Sudsawad (2007)

The above interaction-focused framework for knowledge translation was proposed to serve as a guide for establishing interactions between some six opportunities identified within the research cycle for which interactions, communications, and partnership that help to facilitate knowledge translation can occur (Sudsawad, 2007). The six opportunities are:

- defining your research questions and methodology;
- conducting the research;
- publishing the research findings in plain language and accessible formats;
- placing research findings in the context of other knowledge and socio-cultural norms;
- making decisions and taking action informed by research findings; and
- influencing subsequent rounds of research based on inputs of knowledge use (Sudsawad, 2007).

Within the research cycle, due cognisance should be given to the interactions and interconnections between the above opportunities that present themselves for an effective knowledge translation. (Sudsawad, 2007) The interconnections are such that KU can be flexibly facilitated using the proposed framework. In the context of this study, we examined existing characteristics of knowledge translation and their suitability for possible adaptation of the proposed framework. Some of the characteristics outlined in the literature were that KT should

—

- involve multidirectional communicators;
- be an interactive process;
- seek ongoing collaborations among relevant parties;
- include multiple activities;
- be a nonlinear process;
- emphasise the use of research-generated knowledge;
- involve diverse knowledge user groups;
- be user- and context-specific;
- be impact-oriented; and
- be an interdisciplinary process (Sudsawad, 2007).

These characteristics seem to fall in line with the two main components proposed by Graham and colleagues, namely, knowledge translation and suitability for adoption.

2.5.4 Graham and Logan's framework

Within the context of evidence-based medicine (EBM), Graham, Logan, Harrison, Straus, Tetroe, Caswell and Robinson, (2006) also proposed a knowledge-to-action framework at individual level. This framework emphasises the collaboration between producers of knowledge and users of knowledge. The two main components of the framework are 'knowledge creation' and 'action' with each component having several phases (Graham et al., 2006). The knowledge creation component involves knowledge inquiry, knowledge synthesis and knowledge tools/products (Graham et al., 2006). The assumption is that, by the time the knowledge goes through these processes, it would have been refined and made more useful to stakeholders (Graham & Logan, 2006). The action component of the KU framework refers to activities required for applying the knowledge (Graham et al., 2006). This begins with problem identification and ends with appraisal of knowledge in terms of its usefulness, validity and whether or not it fits the local context as illustrated in Figure 3.1 below (Graham et al., 2006).

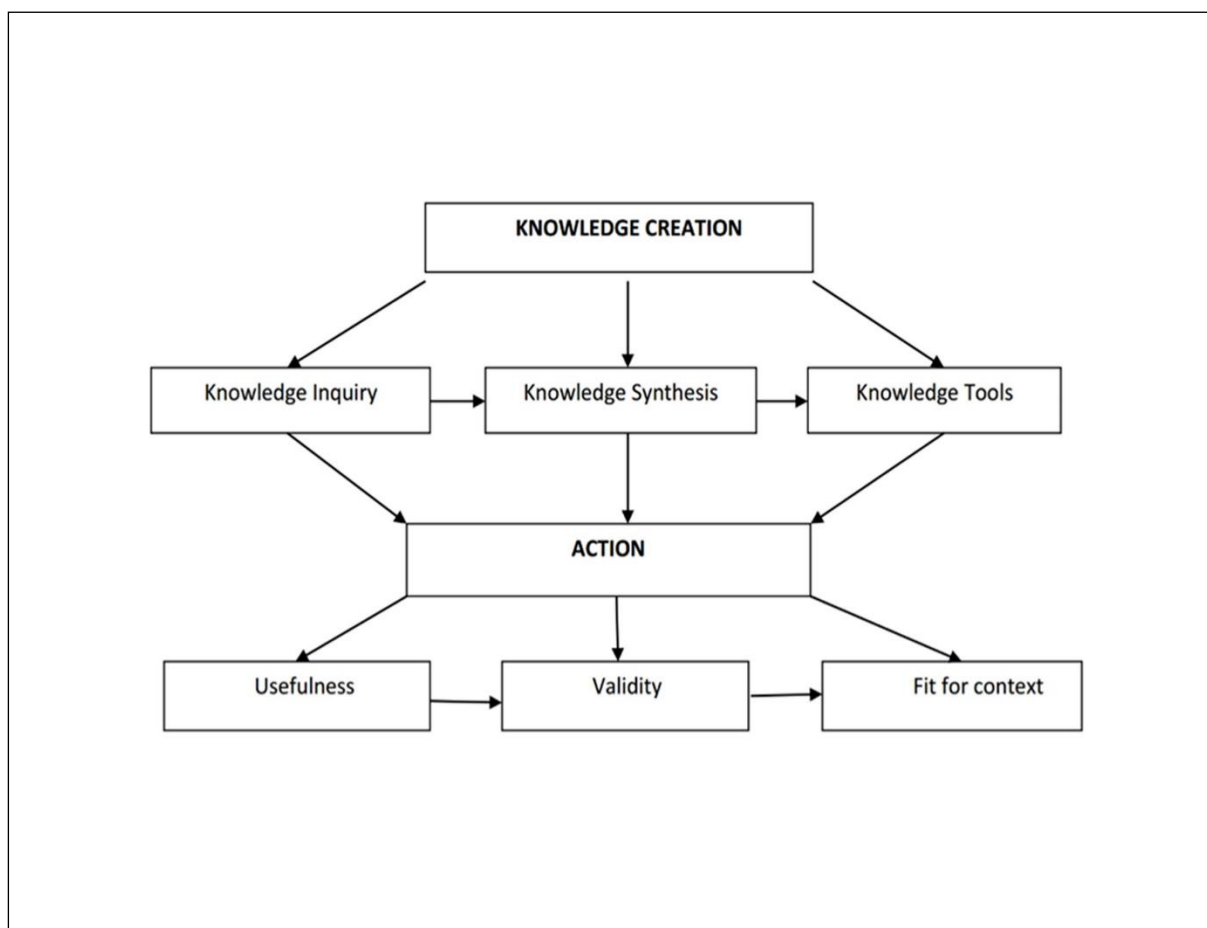


Figure 2.1 Derived from knowledge-to-action framework

Source: Graham et al. (2006)

From Figure 2.1 above, we observe the interconnection between the various components. At the knowledge creation phase, inquiry feeds into synthesis, which leads to knowledge tools, which are then moved into the action phase. At this phase, the knowledge or research becomes useful and fit for context only if it is considered useful and valid by potential users.

Another framework developed by Graham and colleagues view research as an interconnected process of individuals taking actions which are motivated by decisions (Graham et al., 2006). This is an interactive framework referred to as the Ottawa model of research use (OMRU). This framework was designed mainly to address issues of implementation of research knowledge. The modified framework consists of six elements, namely:

- evidence-based innovation;
- potential adopters;
- the practice environment;
- implementation of interventions;
- adoption of innovation; and
- outcomes resulting from implementation of innovation (Graham et al., 2006; Sudsawad, 2007).

Each of these components is subject to monitoring and evaluation at every stage of the KU process (Sudsawad, 2007). After the monitoring and evaluation of the innovation, barrier assessment is carried out to ensure all barriers are at least addressed before the innovation is passed on to potential adopters and the practice environment (Sudsawad, 2007). At this point, another M&E takes place before the selection of the implementation plan and introduction of implementation. The M&E process continues to the outcomes of implementation for a final M&E (Sudsawad, 2007). The periodic M&E component at each of the stages ensures effective implementation (Sudsawad, 2007). It should be noted that the six elements of the framework are closely linked and interconnected. The interconnection is demonstrated in Figure 2.2 below as produced by Graham et al. (2006).

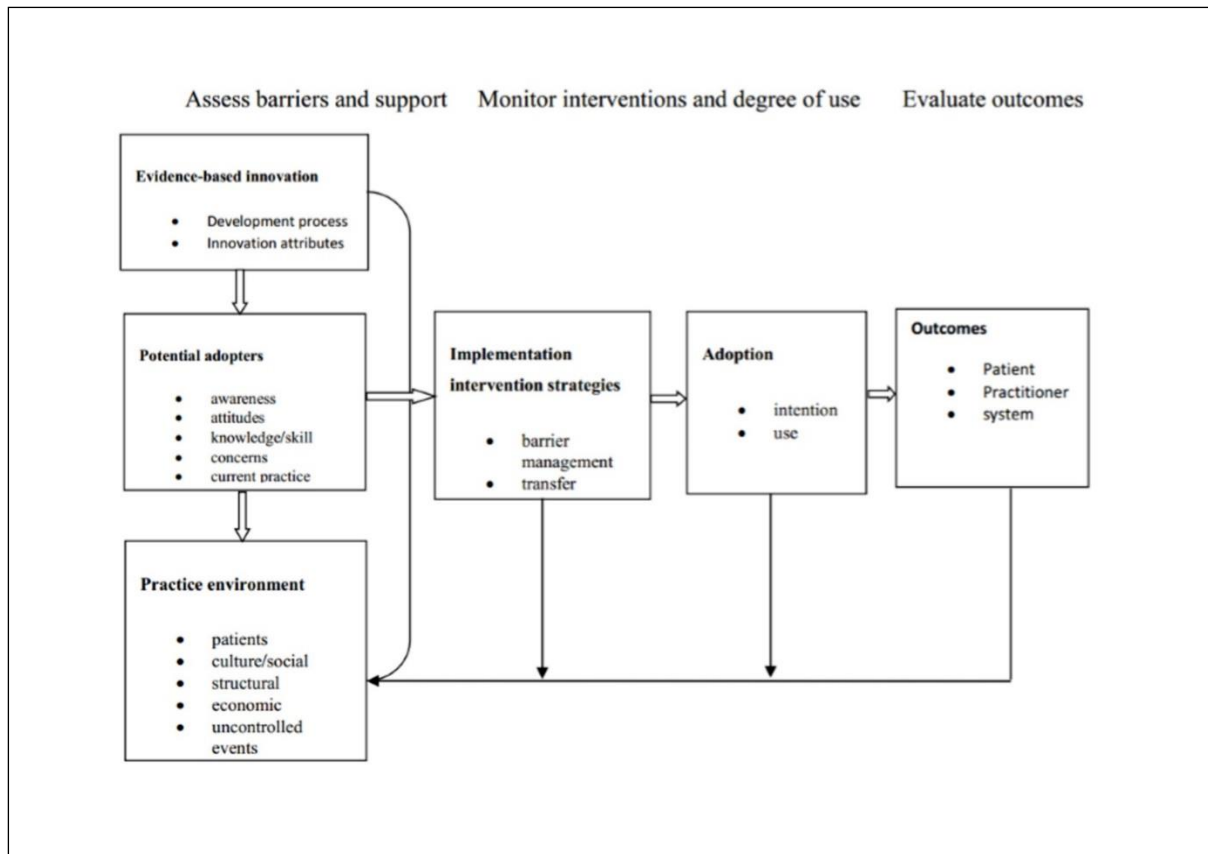


Figure 2.2. Ottawa model of research use

Source: Copied from Sudsawad (2007:12)

2.5.5 Landry et al. and Lavis et al.'s frameworks

Landry, Amara, and Lamari (2001) proposed a framework comprising four alternatives of models of KU, namely science push (on the supply side), demand pull (on the demand side), the dissemination model and the interaction model (Landry et al., 2001). The interactions between these factors and the related engagements along the KU process continue to engage the research utilisation discourse (Becheikh et al., 2010; Nath & Europe, 2007). Along these same lines, Lavis et al. (2006) developed a framework comprising four elements for assessing country-level efforts to link research to action at institutional level:

- The first element assesses the general climate (how those who fund research, universities, researchers and users of research support or place value on efforts to link research to action) (Lavis et al., 2006).
- The second element addresses the production of research (how priority setting ensures that users' needs are identified and how scoping reviews, systemic reviews and single studies are undertaken to address these needs) (Lavis et al., 2006).

- The third element addresses the mix of four clusters of activities used to link research to action. These are: push efforts, efforts to facilitate ‘user pull’, ‘user pull’ efforts and exchange efforts (Lavis et al., 2006).
- The fourth element addresses approaches to evaluation (how support is provided for rigorous evaluations of efforts to link research to action) (Lavis et al., 2006).

2.5.6 Becheikh and Ziam’s framework for RU

Organisational level reviews have been carried out in education to examine the determinants of the knowledge transfer process (Becheikh & Ziam, 2010). More specifically, it has been determined, within the European context, that among the central actors, linkage agents, such as lobbyists, play a very critical role in the knowledge transfer process (Becheikh & Ziam, 2010). These linkage agents help to adapt the knowledge produced or research output in order to make it easier for its adoption and utilisation by stakeholders. They therefore play an integral role in the effectiveness of the research uptake process. Becheikh and Ziam (2010) argue that the effectiveness of the knowledge transfer process hinges on several factors, which they have grouped into three main categories, namely determinants related to the transferred-knowledge attribute; determinants related to actors involved in the knowledge transfer process; and determinants related to transfer mechanisms (Becheikh et al., 2010). These are not detached from Bozeman’s framework as discussed in sub-section 3.2.1 and Mouton’s principles (Mouton, 2012).

A six-step framework for the knowledge transfer process has been proposed by Becheikh et al. (2010), comprising knowledge generation, knowledge adaptation, knowledge dissemination, knowledge reception, knowledge adoption, and KU. The first three are attributed to researchers whilst the last three are attributed to users.

Figure 2.3 below provides a summary of the linkages between the various components. The process begins with knowledge generation, which consists of the creation of knowledge by researchers. This is followed by the knowledge adaption stage where research results are made accessible and put in a way that can be understood by potential users. The knowledge dissemination stage is associated with the transfer of research results to communities of practice (Becheikh et al., 2010). This is followed by the knowledge reception stage where users first come into contact with the knowledge generated, adapted and disseminated by the researcher. Becheikh et al. (2010) proposed that knowledge adoption – which refers to the path used to pass through the process of creating awareness, forming an attitude, making a decision,

implementing the idea and confirming it. It is expected that knowledge application will then occur at this point, where users receive and adopt knowledge in order to achieve specific goals and objectives (Becheikh et al., 2010).

It is advised that at the stage of utilisation, some feedback be given to the researchers for the purpose of improving and modifying future research (Becheikh et al., 2010). The feedback enables both researchers and users to improve upon the findings and plan for future research. As suggested by Graham and Logan (2006), if the knowledge is not used as expected, it becomes necessary to review the strategies and plan again in order to improve utilisation. The framework must make provision for such improvements as illustrated in Figure 2.3 below (Graham & Logan, 2006).

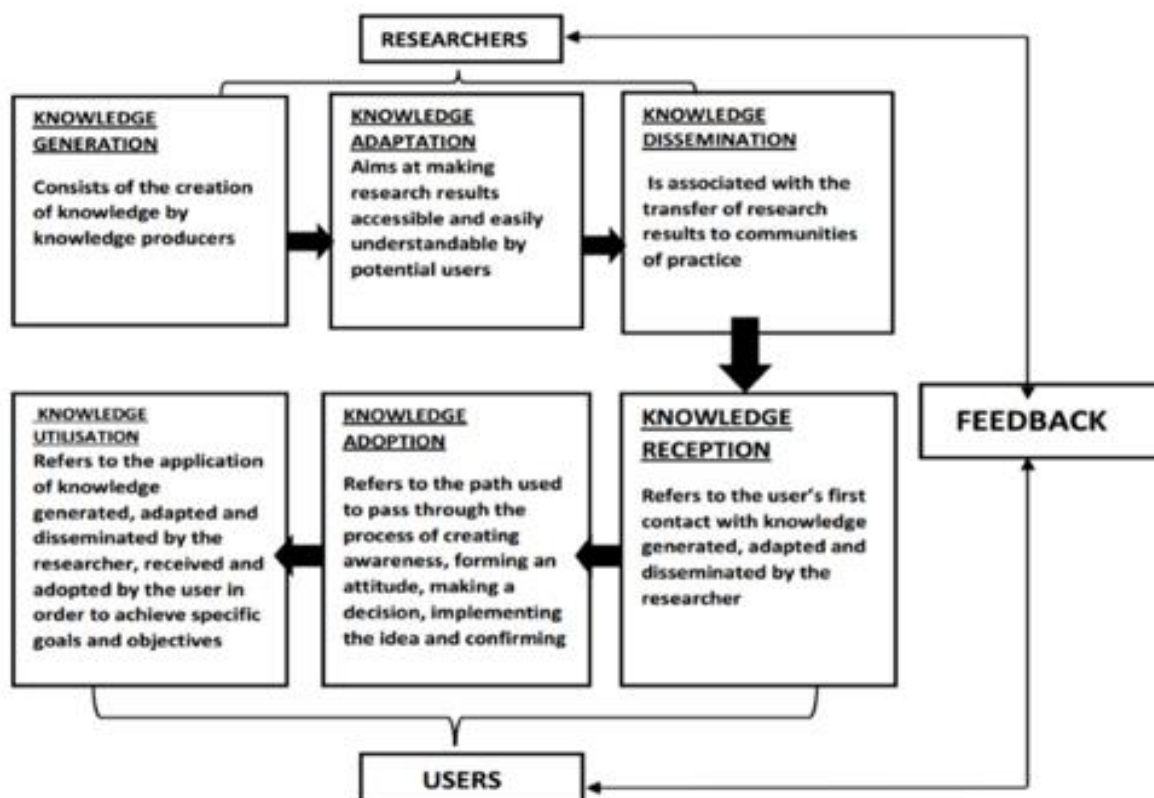


Figure 2.3. Steps to the knowledge transfer process.

Source: Adapted from Becheikh et al. (2010)

2.5.7 Wilson and Petticrew's framework for RU

This sub-section outlines an organisational-level framework for KU as proposed by Wilson and Petticrew (2010).

Systematic reviews have been carried out by Wilson and Petticrew to identify and describe conceptual or organising frameworks designed to be used by researchers to guide their dissemination activities and to identify and describe any conceptual or organising frameworks relating to the knowledge translation continuum (Wilson and Petticrew, 2010) (see also sub-sections 2.2.1 to 2.2.6 above) that provide enough detail on the dissemination elements that researchers could use to guide their dissemination activities (Wilson & Petticrew, 2010). Wilson and Petticrew (2010) propose that there are intrinsic characteristics of research that determine the rate of uptake arguing that research uptake takes through phases from knowledge production through adoption to confirmation (Wilson & Petticrew, 2010). The authors also identified some theoretical foundations on which to establish frameworks for the dissemination of knowledge. These are; persuasive communication, diffusion innovation and social marketing. These domains notwithstanding, systemic and institutional dynamics have a considerable influence in whether or not these can be workable within the context of the current study. In the context from where this framework was derived (i.e. the health sector), it has been proved to yield positive results. The current study explored various options that were suitable within the context of the study.

2.5.8 Ellen et al.'s framework

In a qualitative study of determining research knowledge infrastructure (RKI) for healthcare systems, Ellen, Lavis, Ouimet, Grimshaw and Bédard (2011) proposed possible organisational-level components of an RKI. This was developed to outline components that a health system would require to support its RKI. Although specific to healthcare systems, the framework may be applicable in many ways to our particular circumstances. Four components of the RKI identified are:

- climate for research use;
- research production;
- activities to link research to action; and
- evaluation efforts (Ellen et al., 2011).

Acknowledging challenges within the health sector, Ellen et al. (2011) argue that knowledge transfer approaches and activities ought to keep pace with constant evolutions occurring within the sector. Drawing on the work of Lavis et al. (2006), three approaches to knowledge transfer that target health system managers and policymakers were identified (Ellen et al., 2011). These approaches are in line with the four categories identified above. The three approaches are:

- ‘Push’ activities – “activities undertaken by researchers to package and disseminate research evidence outside the scholarly community” (Ellen et al., 2011:2);
- ‘Pull’ activities – efforts by users of knowledge and policymakers to access and use research evidence (Ellen et al., 2011; Lavis et al., 2006); and
- ‘Exchange activities’ – focuses on “building and maintaining relationships between researchers and managers and policy-makers” (Ellen et al., 2011:2).

According to Ellen et al. (2011), these are the key components of the activities used to link research to action, which happened partly to be the aim of this study but beyond that, we sought to design a strategic policy framework for research utilisation and management.

2.5.9 Cherney et al.’s framework

Similar to the framework of Lavis et al. (2006), Cherney, Povey, Head, Boreham and Ferguson (2012) categorised the independent variables influencing research use under supply-side and demand-pull factors as well as dissemination and interaction variables. The science push model (supply side) follows a linear sequence from supply of research advances to utilisation by decision-makers and practitioners (Landry et al., 2001), one where research advances are assumed to find their way into application automatically. Cherney, Povey, Head, Boreham, Ferguson (2012) view scientific research and its associated processes and products as the key determinant of KU (Cherney et al., 2012). The emphasis here is on the supply of advances in research or research outputs. The knowledge producer, i.e. the researcher, becomes the central actor in the knowledge production, diffusion and utilisation process (Hargreaves, 1999). Researchers research into topics that originate with them and which are considered in terms of available evidence (Cherney et al., 2012). Users, in this case, are regarded as passive receptors of the findings.

Demand pull also follows a linear sequence but here the users are the ones who identify the research problem according to their needs (Cherney et al., 2012). Demand pull concerns itself with whether the end user sees the research as being credible, important and capable of meeting needs and being delivered timely. This model seeks to improve on the criticisms of the science push model by focusing attention on the users of knowledge rather than on the producers and their research advances. Researchers merely respond to the needs of users by turning their scholarly attention towards providing the requested knowledge (Cherney et al., 2012). The initiative shifts from researchers to decision-makers or practitioners who then become the main source of ideas for directing research (Cherney et al., 2012; Rich, 1991). Landry et al. (2001)

assert that the approach generates a customer–contractor relationship where the practitioners and decision-makers behave like customers who define which research they want, and where the researchers behave like contractors in exchange of payments (Cherney et al., 2012). Here, knowledge is produced on demand, and for this reason, there is a high certainty for its use. The criticism, however, is that there is a possibility that, although research is produced on demand, it may not necessarily be compatible with the organisational interest of the user (Cherney et al., 2012).

From the above, four broad categories, covering both linear and interactive models, can be identified as follows:

- science push (supply side);
- demand pull (on demand side);
- dissemination; and
- interactive models.

2.5.10 Grobbelaar and Harber’s framework

From the above, we can so far identify the following components from the literature as necessary ingredients for the framework of research utilisation:

- the university’s mission and vision (Lavis & Robertson, 2003);
- research policy (Lavis & Robertson, 2003);
- research stakeholders or users (Jacobson et al., 2007; Mitton et al., 2007);
- capacity building (Andrews, 2012);
- communicating research or accessibility of research (Andrews, 2012);
- budget (Andrews, 2012); and
- M&E of uptake (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007).

These components are discussed in detail in section 3.4 (the section on developing strategy for research utilisation). In the development of a strategic research uptake framework, all contextual factors need to be considered at both project and organisational level.

Table 2.4 below provides a summary of the organisational level frameworks for KU as discussed above.

Table 2.4: Organisational level frameworks for RU

Lavis et al. (2003)	Jacobson et al. (2003); Mitton et al. (2007)	Wilson et al. (2010)	Gagliardi et al. (2011)	Andrews (2012)
Organising KTE via the message, target, audience, the messenger, knowledge transfer process and support system, and evaluation	Sustained interactivity between producer and users of knowledge	Systemic reviews to guide dissemination activities via five-phase innovation process: <ul style="list-style-type: none"> • knowledge, • persuasion, • decision, • implementation and • confirmation 	Domains for implementation: <ul style="list-style-type: none"> • usability, • adaptability, • validity, • applicability, • communicability • accommodation, • implementation; and • evaluation 	Stakeholder involvement, communication, budgeting and capacity building

The above frameworks have been given a further impetus by the work of Ellen et al. (2011) and more recent works by Grobbelaar & Haber (2014). Along these lines, Grobbelaar and Haber (2014) proposed a framework based on the work of Ellen et al. (2011), aimed at conceptualising systems based on institutionalisation of research uptake within sub-Saharan Africa. They developed five focus areas necessary for strengthening research uptake capacity, namely:

- **Climate for RU and the institutional research context** (referring to the organisational processes, such as mission, vision and goals that support RU, culture, context, policy, capacity, incentives) (Grobbelaar & Haber 2014). In line with the mission, vision and goals, a review of existing RU plans and identification of pathways for RU helped with the determination of the right climate conducive enough to withstand existing institutional barriers and constraints.
- **Institutionalising RU into the knowledge production processes** and support (referring to the integration of research uptake activities into the institutional research cycle, including the process of knowledge production and dissemination (Grobbelaar & Haber, 2014). A survey was conducted to identify various pathways to RU alongside the strengths and opportunities for RU within KNUST to provide direction for an appropriate research production and dissemination strategy.
- **Facilitating push factors** through exchange (referring to factors leading to engaging policymakers and governments) (Grobbelaar & Harber, 2014). Through stakeholder

engagement, we are able to plan to some extent a suitable research dissemination approach and the essential elements to be incorporated in the RU strategy.

- **Facilitating pull factors** through exchange (this refers to factors that promote the demand for research) (Grobbelaar & Harber, 2014). Here again, there is the need for stakeholder engagement in order to determine their specific research needs.
- **M&E efforts** (referring to initiatives at institutional level to evaluate the effectiveness of RU activities) (Grobbelaar & Harber 2014). Due consideration is given to the differences in the mode of knowledge production as a result of the different fields (Mouton, 2012).

In pursuance of developing an appropriate policy framework for institutionalising RU, there was a need to –

- incorporate the creation of the necessary climate for RU at organisational level;
- examine possible ways of institutionalising RU into the knowledge production processes and support; and
- find ways to facilitate push factors through exchange as suggested by Grobbelaar and Harber (2014).

The above suggested a scheme for reviewing the state of RU at KNUST and providing some guidelines for the development of the institutional framework. Table 2.5 below provides a summary of the key focus areas as discussed above.

Table 2.5: Conceptual framework for institutionalising research uptake

FOCUS AREA	ISSUES TO BE ADDRESSED	KEY AUTHORS
Climate for RU and the institutional research context	Organisational processes, such as mission, vision and goals that support RU, culture, context, policy, capacity, incentives	Landry et al. (2001), Lavis et al. (2006), Ellen et al. (2011), Cherney et al. (2012), Grobbelaar and Harber (2014)
Institutionalising RU into knowledge production processes and support	Integration of RU activities into the institutional research cycle, including the process of knowledge production and dissemination	Landry et al. (2001), Lavis et al. (2006), Ellen et al. (2011), Cherney et al. (2012), Grobbelaar and Harber (2014)
Facilitating push factors through exchange	Factors leading to engaging policymakers and governments	Landry et al. (2001), Lavis et al. (2006), Ellen et al. (2011), Cherney et al. (2012), Grobbelaar and Harber (2014)
Facilitating pull factors through exchange	Factors that promote the demand for research	Landry et al. (2001), Lavis et al. (2006), Ellen et al. (2011), Cherney et al. (2012), Grobbelaar and Harber (2014)
M&E efforts	Initiatives at institutional level to evaluate the effectiveness of RU activities	Lavis et al. (2006), Ellen et al. (2011), Cherney et al. (2012), Grobbelaar and Harber (2014)

Source: Grobbelaar & Haber 2014

From the above, we acknowledge that a suitable and probably workable institutional strategy for RU and RUM should aim at providing the right institutional research climate, integrate RU activities into its research cycle, provide avenues for engaging stakeholders, promote demand for its research, and ensure M&E of its research activities.

Prior to this framework, Grobbelaar and De Wet (2013) suggested a transformational pathway that could possibly promote the achievement of the university mission. This framework is in line with the above. It portrays the different transformational pathways of the university, as briefly outlined below.

- The ecological and external drivers of focus: this is with particular reference to the drivers that make the university relevant through the influence of its activities on communities, and dependent on factors, such as the history, industrial structure, participation in higher education and enrolment gap, poverty and income level among others (Grobbelaar & De Wet, 2013).

- Barriers and changes in control: has to do with extrinsic and intrinsic barriers (i.e. internal organisational and external barriers). There are cultural- and funding-related barriers that inhibit the university from performing its developmental role.
- Governance of higher education: policy-related changes, structure, infrastructure and engagement activities are listed here as some of the factors that influence the governance system of higher education (Grobbelaar & De Wet, 2013).
- The form and focus of teaching and knowledge production: this informs how the university works with local enterprise and communities for the training and acquisition of relevant skills. It addresses the issue of participation and enrolment gaps (Grobbelaar & De Wet, 2013).
- Form and focus of knowledge production and dissemination: the strengthening of this aspect enhances the developmental role of the university. It focuses on the nature and level of knowledge production, research activities and how these address the developmental role of the university (Grobbelaar & De Wet, 2013). This is the central theme of the current study.
- Change in form and focus of industry and community engagement: the university's engagement with the external environment and particularly its stakeholders is dependent upon the availability of knowledge resources, networks and extension activities. The changes in form and focus of the university as far as engagement is concerned, have implications for the way in which the university engages with the external environment and the accessibility of knowledge resources in the university to outside players. Such considerations may include having a wide view of extension, using not only staff to the maximum, but also students and community members (Arocena & Sutz, 2007). These transformational pathways formed the basis for the conceptual framework of the current study.

2.5.11 Mouton's principles

At project level, the focus and characteristics of the dimensions provided above with implications for effective KU have been explored further. Following on from the work of Bozeman (2000), there are some principles (Mouton's principles) to follow to ensure optimum utilisation of research. Mouton's principles acknowledge the differences in the various scientific fields in the design of frameworks. In his review of the work of Bozeman (2000),

Mouton (2012) derived some principles that are likely to be encountered by researchers in the process of research utilisation, namely:

- Considering the differences in the modes (Mode 1 and Mode 2) of knowledge production (see Mouton, 2012). Here, the researcher needs to decide where to put emphasis regarding the type of research, be it basic, applied or developmental or strategic that will help fulfil its vision (Mouton, 2012). Research active staff need to identify with their stakeholders in order to determine the type of research suitable to them.
- Mouton's second principle calls for epistemological considerations in the design of strategy due to its implications. There is a need to consider factors such as the various disciplines, the purpose of research, and whether or not other actors will be needed in the knowledge production and utilisation process.
- The pathways to RU will depend on the modes of knowledge production (Mouton, 2012). For example, basic research will be especially applicable to the academic community and fellow researchers, whereas developmental research will be relevant to external stakeholders (Mouton, 2012). Mouton therefore recommends that RU planning should acknowledge the different adoption pathways in order to ensure proper alignment of uptake support mechanisms to the nature of the research.
- In the various scientific fields, RU activities will differ and the context within which the research is applied, will also differ (Mouton, 2012). Mouton argues that, since there are different research projects, different models of research, disciplinary differences, and pathways, the way they are evaluated must take into consideration these differences (Mouton, 2012). In view of these peculiarities of disciplines, the RU strategy must be clear about the context, purpose, intended use and impact expected.

Researchers and research teams interested in the uptake of their research need a strategy that takes these principles into consideration. As indicated by Mouton (2012), subject peculiarities, modes of research and adoption pathways should all be taken into consideration in the strategy for RU and RUM.

2.5.12 Conclusion of this section

Although most of the existing frameworks and strategies were developed in the Euro-American context, they could serve as guides or good practice since there are some similarities in the

educational and socio-cultural systems. Once we identify these similarities, it places us in a situation where we can contextualise some of Mouton's (2012) principles. Hemsley-Brown and Oplatka, (2005) have argued that in order to cross fertilise ideas and clarify problems it is necessary to identify similarities and differences between systems (Hemsley-Brown & Oplatka, 2005).

It must be pointed out that wholesale adoption of these frameworks was not likely to be useful within the context of the current study. In view of this, the study solicited ideas from the university community, most especially academic staff and research staff, leading to the design of the most appropriate framework necessary for use within our context. The framework, which encompasses the most appropriate processes for KU, drew on some of the best practices applied in the above frameworks. The more applicable of these frameworks are those that address issues of active interactions between the producers of knowledge and users of knowledge. Frameworks that seek to address capacity gaps in the knowledge production and utilisation process seemed more appropriate for the current study. This is because at organisational level, it has been identified, within the research utilisation process, that universities within sub-Saharan Africa lack capacity in internal management (Kirkland, Mouton & Coates, 2010).

CHAPTER 3 – UNIVERSITIES AND RESEARCH UPTAKE

Current trends give indications that more and more universities are becoming developmental by contributing to national economic, environmental and social developments, in their quest to fulfil their mission and vision. Societal expectations of universities require adaptations and conformities to global trends in order to become more relevant. This chapter continues the literature review on the paradigms and role of universities in society, pathways to research utilisation as well as project and organisational-level frameworks for research utilisation. The barriers and facilitators to research uptake (the processes leading to how research is put to use by user groups or stakeholders), approaches to developing strategy and examples institutional level strategies are also considered.

3.1 The role of universities in society

This sub-section looks at societal expectations of the university, and what the university is capable of doing for society. Over time, there has been increased pressure by governments, funders and society for universities to play more meaningful roles. The relevance of the university in addressing societal needs was becoming an issue of public concern leading to a

series of adjustments by universities in an effort to address the economic and developmental needs of society.

Universities the world over have mission and vision statements, which spell out their mandates. In most cases, the mission is to fulfil national as well as local needs. Cloete, Maasssen and Bailey (2015) summarise the historical and indigenous roles of the developmental university as follows:

- Universities reflect the ideological apparatus, which provides values and ‘social legitimation’. According to Cloete et al. (2015) universities in Africa were modelled after the European tradition of church-based theology schools. Apart from this, there were also non-church-based universities that also concentrated on the production of social and ethical values.
- Universities were set up for the selection of the dominant elite, who sought to establish codes of ethics between them in order to distinguish them from the rest of society.
- Universities existed to provide in the need for manpower by training the labour force of society.
- Universities existed to provide scientific knowledge.

Apart from these roles, universities seek to achieve their developmental role through the transformation of society and the production of new knowledge. They are said to play a political role through large-scale training of people as well as engaging in knowledge production for economic influence (Castells, 1994). Furthermore, there are functions related to consumption, namely general education, community life and a holding operation (Castells, 1994). Issues about citizenship, such as socialisation, critical evaluations and democratisation, are all seen as part of the functions of universities (Cloete et al., 2015). Similarly, Castells (1994) argues that universities contribute to social equality as well. Apart from their contribution to economic growth, universities bring about cultural renewal and cultural innovation. Universities are therefore expected to lead the way in the production of knowledge for the benefit of society. Public universities, especially, are under obligation to respond to national needs through their activities. There are various reasons why the university is important to national economic and social advancement.

With globalisation, economic competitiveness is increasingly dependent on innovation, and therefore universities are expected to produce market-relevant innovations that address specific

human needs (Etzkowitz, 2004). According to Etzkowitz, Webster., Gebhardt & Terra (2000), innovation draws upon technological and scientific knowledge, and universities, as primary sources of new scientific knowledge, have an opportunity to play a more central role in contributing to innovation and hence competitiveness and economic development. The university, as a knowledge-producing and knowledge-disseminating institution (Etzkowitz et al., (2000), is expected to play a role in industrial innovation, which hitherto has been the preserve of either industry or government, or, depending upon the social system, it may have been a bilateral interaction between these two spheres (Etzkowitz et al., 2000). Florida argues that the shift towards “knowledge-based capitalism makes the university ever more critical as a provider of critical resources such as talent, knowledge and innovation” (Florida, 1999:5).

The next sub-section discusses the importance of putting research to use as a means to emphasise the importance of the university in development.

3.1.1 The importance of knowledge utilisation

Estabrooks and Derksen (2008) assert that society is becoming increasingly dependent on knowledge and the way it can be used to improve human lives. A major source of knowledge can be found within universities, which have two main actors in the process of knowledge production, namely researchers or academics and post-graduate students. Generally, research is aimed at advancing knowledge, influencing policy, improving practice and, to some extent, resolving socio-economic problems. Knowledge production arising out of research is therefore expected to solve problems or influence decisions, hence the increasing demand for KU (Estabrooks & Derksen, 2008). The demand for KU has led to many economies in the world looking up to universities to provide holistic solutions to societal challenges ranging from food security to the provision of portable drinking water (Estabrooks & Derksen, 2008). Similarly, governments are putting measures and policies in place to maximise social impact. Some of these measures demand efficiencies in higher education (HE) systems (Wood, 2013). Wood argues that, despite being labelled ‘ivory towers’, the walls around university campuses are coming down as they engage more closely with local civil society.

Faust (2010), in her paper on the role of universities in a changing world, argues that “knowledge is replacing other resources as the main driver of economic growth, and education has increasingly become the foundation for individual prosperity and social mobility” (Faust, 2010:1). She thus, emphasises the vital role of universities and for that matter the importance

of knowledge to society and economies. Her views on the role of universities may be summarised as follows (Faust, 2010):

- broader economic growth;
- individual success;
- solving challenges that cross borders;
- unlocking and harnessing new knowledge;
- building cultural and political understanding; and
- modelling environments that promote dialogue and debate.

This view of society about the university can be seen in a positive light should universities play their developmental roles more effectively. Adopting a developmental approach to research is thus essential. The next sub-section considers the role of the developmental university, specifically within the African HE system.

3.1.2 Developmental university and the African context

The pressure for relevance of universities has contributed largely to the eventual evolution of developmental and entrepreneurial universities (Etzkowitz et al., 2000). Whereas the developmental university plays a direct instrumental role in the national developmental agenda (Etzkowitz et al., 2000), but not necessarily through the production of knowledge, the entrepreneurial university (Etzkowitz et al., 2000) on the other hand focuses on knowledge production as well as innovation and technology, and how it can best be put to commercial use. This sub-section is intended to discuss the developmental role of universities and how this has evolved within the African context.

It may be deduced that universities have evolved as a result of efforts at seeking to address specific national, developmental or social problems. According to Ajayi, Goma and Johnson (1996), evidence shows that, before the establishment of formal institutions, some form of traditional knowledge systems existed in Africa (Ajayi et al., 1996). With the introduction of formal education, the role of universities in sub-Saharan Africa started focusing predominantly on teaching and research. Current developments, however, give an indication of an expansion in the role. A check on the mission statements of many universities in Africa gives an indication that ‘community service’ has been made part of the mission statements of African universities. Current developments are such that community service is gaining more recognition though to a large extent more time is dedicated to teaching (Grobbelaar & Kirkland, 2013). True as this assertion may be, community service is yet to make that significant impact for society to

acknowledge the role of the university. In our particular case (KNUST), this is expected of every academic staff as a matter of duty. What constitutes community service and the academic staff's perception and understanding of it, is a matter of further investigation.

The role of higher education in Africa has seen changes from pre-colonial through colonial to the post-colonial era. Many universities in sub-Saharan Africa have a research history based on a colonial heritage. In Ghana, for instance, due to colonial domination, research was carried out by British scientists basically to address the problems of settlers and to facilitate the smooth running of the colonial administration, hence emphasis was put on research in tropical medicine and agriculture (Chatelin, Gaillard & Keller, 1997). This was because, at the time, there were tropical diseases which were inhibiting the work of the colonial settlers and so there was a need for research to find ways of controlling these diseases (Chatelin et al., 1997). In the case of agriculture, the aim was to improve land use and cultivation, and primarily develop better cropping systems and high yielding varieties of cash crops (Chatelin et al., 1997). The post-independent era has seen no significant change in the research focus of the country. According to Woldegiorgis and Doevenspeck (2013), African universities have been performing various roles but at the same time continue to execute foreign roles, largely a product of European colonial frameworks, which have not been owned by African societies.

The history of the developmental university started after independence in Africa in the 1960s when universities in Africa were expected to play key roles in the human development in the countries where they are located (Cloete, Bailey, Pillay, Bunting & Maassen, 2011; Cloete et al., 2015). This was to cater for human resource shortfalls after the colonial era and the subsequent departure of colonial expertise. Since then, there have been moves for African universities to be developmental with calls on governments as well as academics to lead the developmental agenda (Cloete et al., 2011). Steps by African governments to promote the developmental role of the university have led to some modest gains.

The developmental role of the university in Africa, after independence, was expected to cut across all spheres of life, including Africanisation, nation-building, engines of knowledge economy, economic development, social and environmental development (Cloete et al., 2011; Woldegiorgis & Doevenspeck, 2013). The need for universities to pursue a developmental agenda was underscored (Cloete et al., 2015:7). That notwithstanding, it has been recorded that African governments did little by way of promoting the declaration due to a lack of a coherent developmental model, inadequate funding for institutions, power struggles and external politics (Cloete et al., 2015).

It is argued that, “in Africa few issues are more important than environment-related problems of food, security, poverty, disease, land degradation, water security, climate change, conflicts, deforestation, natural disasters, and urbanisation” (Lulat, 2007:245). HE systems exist primarily not only for knowledge creation but also to address practical issues of life. Especially, for public-funded HE set-ups, the national developmental agenda is a top priority. Governments therefore have a say in the programmes of study as well as curriculum development. The role of the developmental university has therefore been argued to be informed by the core mission of HE systems, namely teaching research and service to community, which have the potential of influencing society leading to sustainable development (Mbabane, 2010).

African universities have been advised to play active and meaningful roles in the production of national manpower in their communities by contributing to building ‘social capital’ (Cloete et al., 2011). Communities in the vicinity of universities can only feel the effect of higher education if it plays a meaningful role in the community. Universities should be able to address challenges that communities face. It should be possible to hold community-based fora, and community-based research should appeal to the people within the communities.

It was the hope that African universities would increase their relevance by contributing to the continent’s developmental needs through innovations and strategies. They should further seek to inculcate moral and ethical values, leading to lifestyle and behavioural changes necessary for the socio-economic development and positive societal transformation (Lulat, 2007). One strategy adopted by African universities for social transformation is to raise the level of literacy (Lulat, 2007). Universities could raise literacy levels through activities of their learning centres; thus, increasing employability skills, which would lead to higher productivity, higher salaries and technological advancements (Bloom, Canning & Chan, 2006). Bloom and colleagues reviewed evidence that sub-Saharan African tertiary education could have an influence on economic growth and reduction in poverty levels. They confirm the existence of the potential within African HE to influence socioeconomic development granted that the needed structures are put in place (Bloom et al., 2006).

A major challenge to the developmental role of African universities is that of funding. Africa has seen a gradual erosion of funding for higher education. The reduction in funding is such that academic research output in the region is said to be among the world’s lowest and that many African countries struggle to maintain even low enrolment levels (Bloom et al., 2006). At some point, there was a shift in focus towards primary education due the cost of tertiary

education and the argument that the returns on primary education are higher. Funding was therefore, re-aligned to primary education, which contributed to the reduction of funding for higher education (World Bank, 2009). There is some level of improvement in funding higher education but this is not significant (UNESCO, 2018). The dwindling resources to tertiary education, and for that matter to universities, may be attributed to the shift in focus towards primary education. The World Bank, however, supports funding for higher education to cater for a limited number of skills required by the market. There is therefore some level of government funding for higher education and encouragement for private sector participation (UNESCO, 2018). UNESCO had actually issued a statement calling on governments in African to play a leading role to enable universities to become developmental (Cloete et al., 2011). In Ghana, the government provides funding for public universities, which covers all fees and some administrative costs. Research is funded mainly through internally generated funds, including school fees.

The need for a massive capital injection into higher education in Africa cannot be overemphasised. Universities across Africa have gained recognition as potential vehicles for economic and political development and therefore require the needed funding to maximise their ability for economic growth and poverty alleviation (Bloom et al., 2006).

Another factor hampering the developmental role of higher education in Africa has to do with the cultural setting within which the institution operates. Among the cultural issues that lead to underperformance of higher education in Africa are a lack of focus and academic leadership resulting in misdirected research that have no direct bearing on the social needs of the community (Cloete et al., 2015). The underperformance of the developmental role of African higher education has been attributed by Cloete et al., (2015) to a lack of generation of new knowledge or research. Harnessing academic capabilities to the advantage of development has therefore been a barrier to the developmental role of universities in Africa (Cloete et al., 2015). There is the need to prompt researchers occasionally on the need to be nationalistic and concerned about developmental needs and the way their expertise could be used to address those issues. Individualism, a lack of teamwork and a lack of collaboration with other researchers could hamper the effective developmental role of higher education (Cloete et al., 2015).

As already mentioned, the weak research infrastructure has contributed to the lack of show by African HE systems. Cloete and Maassen (2015) assert that institutional and structural reasons, such as a lack of funds and a lack of centres of excellence for specialised research have

contributed to a lack of interest by high-calibre researchers in the African HE system. Thus, the expertise needed to perform cutting-edge research does not exist, and even where it does exist, the institutional climate hampers the performance of academics (Cloete & Maassen, 2015). The unattractive institutional climate contributes largely to the loss of talented researchers to foreign institutions (Cloete & Maassen, 2015). Coupled with this unfavourable condition is the inability of African universities to manage the political systems that tend to interfere with the running of universities (Cloete et al., 2015).

In particular reference to the African HE system, a process for the transformational pathway of the developmental university has been developed to enhance the transformational role of universities (Grobbelaar & De Wet, 2013). The table below, adapted from Grobbelaar and De Wet (2013), provides a summary of four thematic areas of the transformational pathway of the developmental university.

Table 3.1. Transformational pathway of the developmental university

Changes in focus and governance of the university	Change driven by control and governance through policies, structures, infrastructure and engagement mechanisms (Grobbelaar & Kirkland, 2013).
Change in form and focus of teaching	This may be affected in terms of addressing the enrolment gap and widening participation, cooperation with local enterprises and communities for relevant skills development and continuous education and training (Arocena & Sutz, 2007).
Changes in form and focus of knowledge production and dissemination	Here change is driven by focusing the research agenda – including the nature and level of knowledge production – on specific social concerns.
Change in form and focus of industry and community engagement	Change driven by a sustained interaction with stakeholders and drawing on their knowledge to enrich the curriculum and research agenda.

Source: Adapted from Grobbelaar and De Wet (2013)

The above roles were necessary for the current study because they enforce the need to find ways to optimise the use of knowledge for the benefit of society. Specifically, within the context of this study, these emerging trends were yet to be systematised due to a lack of managerial capacity and several other situation-specific influences (Canadian Health Services Research Foundation [CHSRF], 1999a; Ellen, Lavis & Ouimet, 2011; Humphries, 2014;

Larsen, 1980; Oliver & Innvar, 2014). Closely related to the developmental university is the emergence of the entrepreneurial paradigm, which seeks to enhance the role of the university through entrepreneurship. Castells provides a range of objectives for the developmental university, namely producing values and social legitimation, selection of the elite, training of the labour force, production of scientific knowledge and providing degrees for the labour market (Castells, 1994). Universities fulfil their roles through the different categories of universities, namely ancillary, self-governing, as an instrument and as an engine of growth (Castells, 2009). Another way by which universities could fulfil their roles in society is through the entrepreneurial approach. The next sub-section discusses this entrepreneurial paradigm.

3.1.3 The entrepreneurial paradigm

This sub-section discusses the entrepreneurial university as a strategic means to KU. The entrepreneurial paradigm, a conceptual framework on organisational level, has emerged as a strategic approach to KU, thus enhancing the role of universities. Apart from emphasising the role of universities in society, in considering a strategic framework for KU, universities may consider the entrepreneurial approach to enhance their push, pull and exchange efforts towards KU (Etzkowitz et al., 2000)

Over the centuries, there have been various paradigms in the university system, which have engaged the minds of scholars. Authors such as Etzkowitz et al., (2000) have discussed issues arising from the academic revolutions that have taken place over the centuries. Prominent among these are the transition from teaching universities to research universities and from research universities to entrepreneurial universities (Etzkowitz et al., 2000). This section considers the transition from teaching universities to research universities, a range of current trends in HE, and then introduces the entrepreneurial university, which has implications for various research utilisation strategies being adopted by universities in Africa.

Grobbelaar, (2013) argued that universities began as teaching institutions, but with the first academic revolution (Grobbelaar, 2013) it became necessary to incorporate research into the mission of the university (Grobbelaar, 2013). The classification of universities into three categories, namely teaching universities, research universities and technical or professional universities is with the view to fulfilling their mandates not only through production of knowledge but also through technological innovations. Etzkowitz et al. (2000) explain the emergence of the entrepreneurial university as a response to the increasing importance of knowledge in national and regional innovation systems, and the recognition that the university is a cost-effective and creative inventor and transfer agent of both knowledge and technology

(Etzkowitz et al., 2000). According to Etzkowitz (2004), the third mission of the university i.e. economic and social development, has been added to the traditional role of teaching and research since the second half of the 20th century. This confirms the assertion that, within the context of broader economic transformation, universities have become economic and social institutions (Florida, 1999). They are now seen as innovation hubs and ‘knowledge factories’ (Florida, 1999) with a potential to generating wealth due to their entrepreneurial nature (Gibb, Haskins & Robertson, 2009).

According to Etzkowitz (2004), this shift became necessary because of a need to preserve knowledge and conduct further research on existing knowledge. The philosophical and ideological underpinnings implied that the introduction of research into the university system raised issues relating to time needed to do research and at which levels. It was thought that academics or professors devoted much of their time to research at the expense of teaching (Etzkowitz et al., 2000). In order to make time for their core business, graduate students were used for most research to allow the professors adequate time for teaching. As a result, more emphasis was placed on postgraduate studies leading to less emphasis on undergraduate teaching (Etzkowitz et al., 2000). This seeming error of over-emphasis on postgraduate studies has since been addressed to bring a balance between postgraduate and undergraduate studies (Etzkowitz et al., 2000).

By a systematic approach using the input–process–output–outcomes model (IPOO model), Salamzadeh, Salamzadeh and Daraei (2011) explain that the entrepreneurial university is a –

[A] dynamic system, which includes inputs (Resources, Culture, Rules and Regulations, Structure, Mission, Entrepreneurial Capabilities, and Expectations of Society, industry, government and market), process (Teaching, Research, Managerial Processes, Logistical Processes, Commercialisation, Selection, Funding and Financial Processes, Networking, Multilateral Interaction, and Innovation, research and development activities), outputs (Entrepreneurial human resources, Effective researches in line with the market needs, Innovations and Inventions, Entrepreneurial networks, and Entrepreneurial Centres) and aims to mobilise all its resources, abilities and capabilities in order to fulfil its ‘Third Mission’ (Salamzadeh et al., 2011).

This approach to KU requires that universities plan and follow specific strategic pathways in order to achieve the goals set out in their research policies, including the commercialisation of results (Gibbons, 2013).

In an entrepreneurial university, research groups become business-oriented, leading to the creation of liaison offices, technology transfer offices, business incubators in order for research results to be transferred through various organisational structures to the stage of commercialisation (Etzkowitz et al., 2000). The introduction of entrepreneurship into the academic scene affects the educational and research missions of all institutions of higher learning to a greater or lesser degree (Etzkowitz et al., 2000). It has become a strategic issue, a source of funding for university research and a policy tool for economic development (Geuna & Muscio, 2009). Knowledge transfer is enhanced through university–industry relationships (Geuna & Muscio, 2009). It is reported among university scientists that interacting with industry brings about better basic research, and gives opportunity for a different perspective, which could sometimes be an inspiration for innovative research (Geuna & Muscio, 2009; Siegel, Waldman, Atwater & Link, 2003). To determine the importance of this argument, respondents to the survey used in the current study needed to provide feedback on the benefits of engagement with various stakeholders, including industry.

Many universities in developed countries have plans to engage industry in their research, innovation, technology transfer and dissemination efforts (Gibb & Hannon, 2006; Mowery, Nelson, Sampat & Ziedonis, 2004). With an improved university–industry relationship, it is believed that KU will be enhanced as well as improvement in the quality of knowledge produced (Gibb & Hannon, 2006). The emergence of the ‘entrepreneurial university’ is aimed at fostering university–industry relationships (Etzkowitz et al., 2000) with the likelihood of the products of research being utilised more often. This study therefore examined the extent to which researchers at KNUST engage with stakeholders, including industry, and the effect of those engagements on research output and utilisation. The way these various stakeholders interact with researchers also has implications on the extent to which research can be used. The next sub-section discusses evolving interaction processes needed for the enhancement of research use.

3.1.4 The triple helix, quadruple helix and quintuple helix

The ‘triple-helix’ refers to a highly interactive process of engagement between university, industry and government that could lead to successful innovations (Etzkowitz et al., 2000). According to the triple-helix model (Etzkowitz et al., 2000), the relationship between universities, industry and government becomes increasingly intertwined, creating activities of collaboration where the different rationalities of university, industry and government are

bridged and merged (Gjerding, Wilderom, Cameron, Taylor & Scheunert, 2006). These relationships have led to the enhanced use of research (Gjerding et al., 2006).

There is a paradigm, which seeks to bring together institutional bodies, researchers, businesses or entrepreneurs and citizens in order to derive greater economic impact. This paradigm is based on the quadruple helix (Carayannis & Campbell, 2010) where government, industry, academia and civil participants team up to bring about economic and social development, which surpasses what they could hitherto have done individually (European Union [EU], 2015). By employing the principle of shared expertise, the participants are able to network, collaborate and cooperate among themselves. There is thus cross-fertilisation of ideas with a better outcome. The quadruple helix blends in the perspective of a media-based and culture-based public (Carayannis & Campbell, 2010).

Another emerging paradigm, which seeks to frame knowledge and innovation in the context of the natural environment for sustainable development and social ecology, is the quintuple helix (Carayannis & Campbell, 2010). It builds upon the quadruple helix by bringing in the dimension of the natural environment (Carayannis & Campbell, 2010). These paradigms although proposed and applied in developed contexts have the potential of being conceptualised for the African context.

Research institutions, with a focus on impact, could strengthen their relationships with industry and governments in order to ensure that research is not only produced but also used. The criticism is that in an environment of low industrial capacity, universities are unable to foster a good relationship that will inure to the benefit of both parties (Gjerding et al., 2006). Indeed, Ghana does not have a strong industrial base for this kind of relationship. KNUST has had some level of collaboration with government and industry but this relationship was not developed fully to the level of being expressed by the helixes (QAPU, 2017).

Elsewhere in Europe and America, it can be said that there is increased reliance on knowledge giving universities opportunities to transfer knowledge into productive and economic ventures (Geuna & Muscio, 2009). To engage in commercialising research, is to make the issue of research uptake and KU an integral part of the university's internal organisational system. It is advised that universities making such efforts should not feel that they are deviating from their core mandates by entering into commercial ventures (Guena & Muscio, 2009). It is argued that the products of knowledge or creative innovative products have commercial value and that they have become intellectual property of the university (Marlin-Bennett, 2004). Considering

constraints on resources, research commercialisation is one means of generating income for further research, infrastructural development and administrative support.

3.1.6 Conclusion of this sub-section

In concluding this section, we find that there is growing expectation of universities to play meaningful roles in society. It is trusted that they will fulfil the mandate for which they have been set up. It has been suggested that universities could achieve their mission by focusing on their developmental role and learning from recent paradigms by becoming entrepreneurial. The entrepreneurial science paradigm, although yet to take root within sub-Saharan Africa and for that matter KNUST, holds some prospects worth considering. KNUST can weigh its options to see which paradigm is more applicable to follow as pathway to fulfil its mission. The introduction of entrepreneurship into university systems has been tried elsewhere and has proved worthwhile. Whether or not one chooses to be developmental or entrepreneurial, the caution is that universities must be careful not to focus too much on economic gains to the detriment of their core mandate of teaching, research and community service. This notwithstanding, learning from best practice is worth pursuing despite possible challenges.

3.2. Pathways to research uptake

The frameworks discussed in section 2.5 provided some key focus areas needed to form the basis for a structural plan and guide for our strategic RU framework. These are a means to an end, which require that the university employs certain strategies in order to achieve its goal. In addition to these, there are a series of events necessary for the university to achieve its developmental role in society. The role of the university in national development is discussed in chapter 6. The following sub-sections however, discuss some pathways necessary for research use. In addition, some statements of good practice that could enhance the use of research are outlined.

3.2.1 Pathways to the developmental role of the university

In order to achieve their developmental role, universities use research for societal impact through community engagement (Carden, 2009). Research is targeted at improving the quality of life of immediate communities and society in general. Various mechanisms are employed by universities to achieve their aim of societal influence (Carden, 2009). These roles of universities in society cannot be achieved fully without adopting the appropriate pathways and frameworks. This sub-section discusses some pathways to research utilisation that can be identified in the literature. In discussing pathways to KU, we are specifically looking at the

series of events by which research can contribute to policy, socioeconomic development and human endeavours in general. Carden (2009) identified three key areas by which research can contribute specifically to policy. He therefore proposes the following steps:

- encouraging open inquiry and debate;
- empowering people with the knowledge to hold governments accountable; and
- enlarging the array of policy options and solutions available to the policy process.

According to Gibb et al. (2009), the universal approach to KU has been through knowledge transfer institutions and pathways. such as:

- the creation of science and technology parks adjacent to and sometimes owned by universities;
- the development of the role of intermediaries, such as industrial liaison offices (Gibb et al., 2009);
- the opening of technology transfer and information offices (Chapple, Lockett, Siegel & Wright, 2005);
- the development of student and staff incubators (Ylinenpää, 2001);
- the launching of new venture programmes for staff and students;
- the development of clearer intellectual property (IP) policies and arrangements for licensing and patenting university know-how (Baldini, Grimaldi & Sobrero, 2006);
- the organisation of spin-off activities, such as small firms or companies and entrepreneurs and
- the creation of venture and loan funds.

Hitherto, these were foreign to the African context but now we see traces of the same within the sub-Saharan African region. It is argued, however, that evidence has proved that this is not enough, and that the key to successful knowledge transfer is a process of continuous dialogue, building up social networks (Nicolaou & Birley, 2003), development of strong personal as opposed to institutional relationships over time leading to the creation of trust.

Two approaches have been identified from the literature with regard to identification of pathways for KU. The first approach, referred to as the 'connection approach' (Mitton et al., 2007:734) seeks to promote KU by focusing on intermediary institutions who take knowledge out to enhance policy and practice (Mitton et al., 2007). Vingilis, Hartford and Schrecker (2003) and Mitton et al. (2007) refer to people who help potential knowledge users determine their knowledge needs and help researchers translate, influence and initiate KTE as

‘connectors’. These intermediaries, also referred to as knowledge brokers, boundary-spanners, gatekeepers or translators are trained in information management and exchange (Mitton et al., 2007; Vingilis et al., 2003). Intermediaries are lobbyists, think tanks, advisory boards, platforms, associations, research institutes, the media and university departments among others (Mitton et al., 2007). These knowledge brokers function as channels or conductors by transferring knowledge and insights to decision-makers or practitioners and rechannelling the needs of decision-makers to researchers. They have contact with both researchers and users of knowledge and have the ability to build bridges, thus enhancing the interaction between them. This approach aims at connecting research to policy issues by active flow of information before the decision-making and implementation phase. Clearly, this approach ties in directly with the interactive frameworks discussed in the earlier sections (see sections 2.2.7, 2.2.8 and 2.2.9), where emphasis was placed on active engagement and interaction with possible users of knowledge.

The second approach, referred to as ‘collaboration approach’ (see Mitton et al., 2007:735), similarly involves active interaction and interpersonal contacts between researchers, policymakers and practitioners with the aim of producing knowledge that is relevant to all parties (Thompson, Estabrooks & Degner, 2006). Gibbons (2013) argues that users or potential beneficiaries of research may also hold relevant knowledge, and so need to be involved in the innovation process from the outset (Gibbons, 2013). There is evidence to support the fact that when academic researchers and policymakers interact closely in the formulation and execution of research projects, the likelihood of influence on policy is high (Cherney et al., 2012; Cordingley, 2008; Cousins & Simon, 1996; Huberman, 1990; Nutley, Walter & Davies, 2007). However, collaboration alone is not sufficient for uptake and use of research due to the influence of a range of variables (Landry et al., 2001). Despite those influences, in the field of KU, the collaborative approach is seen as the most flexible. There is dynamism in the relationship between all stakeholders. Each party leaves behind its individual boundaries in order to establish new ones (Cherney et al., 2012). The limitation to this approach, it is argued (Cherney et al., 2012), is that the need for relevant knowledge could be based on other factors and not necessarily on experience.

These pathways are necessary in tracking the developmental role of the university and in the development of frameworks and strategies for KU. How research is used to influence society needs to be an integral part of any RU strategy. We noted that many of these series of events were largely applicable in foreign contexts but they still hold some key principles, which may

be applicable in the African context. Since the overarching aim of this current study was to develop a strategic framework for research utilisation it was needful to identify the most appropriate pathways necessary for the formulation of a framework that is of relevance to KNUST. We endeavoured to sift out and determine which pathways for KU existed in our context and were applicable in the context of the study. The next section looks at some strategies, which have originated within some universities in sub-Saharan African as a result of the DRUSSA programme.

3.2.2 DRUSSA statements of good practice

As part of a strategic approach to research utilisation, DRUSSA outlined a number of strategic statements. These ‘Statements of Good Practice’ (DRUSSA, 2012) are meant for participating universities to consider in the design of their research strategies, especially in the area of capacity building. The statements take into consideration the climate for RU and the institutional research context within 24 sub-Saharan African universities. The statements as outlined below provide support for research utilisation on the institutional level (DRUSSA, 2012:62).

3.2.2.1 Strategy and mission

The statements for strategy and mission are as follows:

- The overall mission and strategy of the university must reflect the need to produce research findings for stakeholders within and outside the university community.
- The university must have a clear research strategy, which recognises the importance of research for social, economic and development needs.
- The university’s research strategy must explicitly recognise the need to support RU activity.
- There should be in place a high-level committee to monitor research strategy at regular intervals.
- Progress towards research strategy, including RU, should be coordinated by a senior university official (at the level of pro-vice-chancellor).
- Research strategy (including RU) must be actively communicated to staff.
- There is the need for a distinct policy document bringing together different strands of RU support and policy, which could be involved in the process.
- Clear policies should exist for the ownership and management of intellectual property and publications generated by university staff.

- Policies must be in place to ensure that ethical issues in RU are covered, including any conflict of interest for university staff.
- The institution should collect sufficient information on RU activity to inform future policy.
- Research strategy and RU policy documents must be in place and taken into account in allocating internal resources.

3.2.2.2 Staffing for research uptake

The statements of good practice in terms of staffing for RU are as follows:

- RU and related activities must be clearly included in the job descriptions of academic staff at the university.
- Clearly designated professional staff in the university should have the responsibility for promoting RU amongst staff.
- Staff with responsibility for RU must have access to designated budgets.
- Staff with responsibility for RU should report at a senior level in the university.
- Staff with RU responsibility must be at a sufficiently senior level to communicate effectively with academic staff.
- Where professional staff with RU responsibilities are based in different offices, clear mechanisms should exist for them to meet with each other.
- Each college must have at least one person with professional expertise in research management.

3.2.2.3 Internal organisation and promotion of research uptake

The statements of good practice for the above are as follows;

- The university should have a mechanism in place to identify research with uptake potential at an early stage.
- The university should maintain an active database of research activities and the research specialisations of academic staff.
- Academic staff must have access to training in RU issues.
- RU should be included in relevant staff induction or postgraduate training programmes.
- Mechanisms should be in place to ensure that academic staff have time to engage in RU where appropriate.
- Clear processes must exist for decisions to be taken about the level of support available for RU in specific cases.

- Clear processes must exist to determine where responsibility lies for RU, between the academic/research team, the university and any external sponsor.
- Clear processes must exist for determining the nature of research activity in specific cases (for example, the possibility of commercial protection through patents) and the extent to which such decisions are delegated to academic staff.
- Clear and accessible budgets must be made available for RU activity.
- Academic staff must have appropriate incentives to engage in RU activity.
- Activity on RU should be included in criteria for the promotion and re-grading of academic staff (this will mean redefining what constitutes service to community).
- Central mechanisms must exist to record successful RU activity, and to learn from the lessons of previous projects.
- Where professional support is available for RU activity, these services must be actively publicised to staff.

3.2.3 Conclusion of this section

In concluding this discussion on pathways to research utilisation we need to emphasise the point that while it is worth considering the existing relationships and interactions within the institutional set-up, teaching, knowledge production and dissemination, the barriers and facilitators to KU, it is essential to define and identify context-relevant pathways to research utilisation. It was trusted that this study could define, from its survey, the most suitable and context-relevant pathways. Doing so will make it necessary to consider the systemic and institutional barriers and facilitators that could influence the effectiveness of the framework. The next section considers barriers and facilitators to research utilisation.

3.3 Barriers and facilitators to research utilisation

Barriers and facilitators to research utilisation have been identified mostly in higher education in general, the agricultural sector, and healthcare system among others. These have implications to the type of framework and strategy necessary for research utilisation at both project and organisational level. This section discusses the most prominent barriers and facilitators identified in the literature within specific contexts and their implications for research utilisation.

3.3.1 Barriers to research uptake

Humphries (2014) conducted a study to identify potential barriers and facilitators experienced by managers to the use of evidence in programme management within the healthcare system. Five categories of barriers and facilitators identified from the literature are as follows:

- Information (related barriers include research without relevance or clarity, misunderstanding and wrong perceptions of research, limited access to research information or availability, and timely delivery of research) (Humphries, 2014; Oliver, Innvar, Lorenc, Woodman and Thomas, 2014).
- Organisational structure and process (related barriers include a lack of resources to support research and cost, a lack of human resource capacity, financial constraints, a lack of data, inadequate and sometimes an absence of planning processes, a lack of support from management, and poor communication) (Humphries, 2014; Oliver et al., 2014; Sedlacko, Pisano, Berger & Lepuschitz, 2013).
- Organisational culture (related barriers include decision-making culture, crises management culture, resistance to change, political influence on decisions) (Humphries, 2014; Sedlacko et al., 2013).
- Individual (barriers identified include inadequate skills and experience of policymakers in research literacy, and a lack of formal training in research management) (Humphries, 2014; Oliver et al., 2014).
- Interaction (barriers identified relate to interactions between decision-makers and researchers, and the gap between them due to a lack of contact and mutual understanding) (Humphries, 2014).

These barriers, related to the use of evidence in health sector management, have far-reaching consequences in the broader sense across many policy areas. As clearly outlined, some of these barriers occur at project level while others cover organisational levels.

According to Ellen et al. (2011), a common challenge or barrier in terms of knowledge translation that all decision-makers face, relates to a lack of knowledge management skills and infrastructure (i.e. the sheer volume of research evidence currently produced; access to research evidence; time to read evidence sources; and skills to appraise, understand and apply research evidence). This is corroborated by Grimshaw and Eccles (2012). These authors argue further that better knowledge management is necessary but perhaps not sufficient to ensure knowledge

translation given other challenges that may operate at different levels (Grimshaw & Eccles, 2012). The challenges to knowledge translation include a lack of facilities; financial disincentives; inappropriate knowledge, skills and attitudes; poor oversight of research applicability; declining, non-existent, and unreliable sources of research funds; weak policy designs; absence of M&E procedures and administrative and management shortfalls (Carden, 2009; CHSRF, 1999a; 1999b; Grimshaw & Eccles, 2012; Mitton et al., 2007).

The CHSRF (1999a), Carden (2009) and Mitton et al. (2007) have re-enforced the above arguments when they asserted that KU challenges arise in situations where –

- policy designs are weak;
- there is a lack of knowledge in the research process;
- in appropriate academic format of communication;
- research is not relevant to practice-based issues;
- there is a lack of timely results; and
- there is inadequate administrative, legal or management capacity in execution and an absence of monitoring and accountability procedures.

Other factors contributing to the implementation challenges are a lack of confidence in researchers by policymakers, a lack of hard data to support policy, a lack of demand for research, and also a lack of skills or limited competencies (Hemsley-Brown & Oplatka, 2005), the capacity to use knowledge, and resistance of practitioners to adopt new knowledge (Kirst, 2000), among others.

Hemsley-Brown and Oplatka (2005) as well as Becheikh et al. (2010) suggest, one of the key barriers to the non-use of research findings is that findings are not applicable to the users. Hemsley-Brown and Oplatka (2005) also support the idea that transferred knowledge should be relevant, credible, interesting, timely and applicable to the context for which it is intended in terms of values, practices and needs. The time allowed for knowledge transfer activities is seen by some authors as a critical factor in the success of the transfer (Becheikh et al., 2010). It has been proved that a lack of time for linkage agents to read, understand, adapt and disseminate results is one of the factors hindering the KU process. In a study conducted by Koivula, Tarkka and Simonen (2011), aimed at describing how nursing teachers utilise research on nursing education and its connections to teachers' background, further education and research activity variables, it was found that effective use of technology, education level,

adequate access and time for information exploring and difficulties in understanding statistical analysis were among the barriers to research utilisation (Koivula et al., 2011).

From the field of EBM, methodological barriers have been identified with implications for the implementation of science efforts. Two of these barriers have been identified as being a lack of agreement regarding constructs hypothesised to affect implementation success, and identifiable measures of these constructs (Chaudoir, Dugan & Barr, 2013). A systematic review to identify measures designed to assess constructs representing a five-factor framework affecting the implementation of evidence-based innovations has been conducted (see Chaudoir et al., 2013). The framework by Chaudoir et al. (2013) suggests five broad types of factors representing structural-, organisational-, provider-, patient- and innovation-level characteristics.

- Structural: constructs that assess aspects of the larger socio-cultural context or community in which the specific organisation is nested (e.g. political norms, policies, relative resources/socioeconomic status).
- Organisational: constructs that assess aspects of the organisation(s) in which the innovation is being implemented (e.g. culture, norms, organisational endorsement).
- Provider: constructs that assess aspects of the individual provider who will be implementing the innovation (e.g. attitudes, self-efficacy, experience).
- Patient: constructs that assess aspects of the individual patient(s) who will receive the innovation directly or indirectly (e.g. perceived utility, feasibility of innovation).
- Innovation: constructs that assess aspects of the innovation that will be implemented (e.g. adaptability, quality of evidence).

The search by Chaudoir et al. (2013) identified 33 scales that assess one or more of these factors. Organisational-, provider- and innovation-level characteristics have the largest numbers of measures available for use, whereas structural- and patient-level characteristics have the least (Chaudoir et al., 2013). The onus is then on researchers to select the most reliable predictors of implementation outcomes. Critically, it is suggested that there is a need to increase capacity of researchers to conceptualise and measure constructs that could influence dissemination and implementation outcomes.

Other significant concerns that need attention, according to Sumner, Crichton, Theobald, Zulu and Parkhurst (2011), are that research is too theoretical and that researchers easily assume that users will buy into their findings once the results are ready

In this case, there will be no agreement and acceptance, and the research could face an outright rejection (Summer et al., 2011). There should be a departure from theory with more emphasis on developmental and applied research that is appealing to stakeholders (Summer et al., 2011).

Concluding on this aspect, we notice that at institutional level, barriers exist because organisations are heterogeneous, non-hierarchical and dynamic (Auranen, 2005; Gibbons, Limoges, Nowotny, Schwatzmann, Scott & Trow, 1994; Nieminen, 2005); hence, their influence on the KU process. The organisational climate and setup affect the pathways to KU and subsequently the framework. Bowen and Zwi (2005) as well as Greer (1997) recommend a system of KU, which helps to understand –

- how individuals in an organisation receive, adopt and adapt evidence;
- the factors of the organisation that constrain or facilitate the adoption or implementation of the evidence; and
- the interests and values at play within organisations that influence responses to the evidence/policy issue (Bowen & Zwi, 2005; Greer, 1977).

The above barriers notwithstanding, there are activities that facilitate the use of research. The next sub-section discusses some of these facilitators to research utilisation.

3.3.2 Facilitators to research utilisation

In their systematic review, Oliver, Innvar, Lorenc, Woodman and Thomas (2014) provide direct antidotes to the above barriers in terms of facilitators to RU. Key among the facilitators are:

- making research accessible and available with improved dissemination (Oliver et al., 2014);
- enhancing joint or collaborative research (Oliver et al., 2014; Sedlacko et al., 2013);
- providing reliable and relevant research findings with clarity (Oliver et al., 2014);
- building a strong relationship between researchers and policymakers (Oliver et al., 2014);
- providing managerial support and capacity (Oliver et al., 2014); and
- making material and financial resources available to support RU activities (Oliver et al., 2014).

Participation in research by all stakeholders adds relevance to the research and creates ownership and better appreciation of the research outcome with a greater likelihood of utilisation. Post-normal science encourages public participation in the sense that stakeholders

are engaged in the decision-making process or in the quality assessment of scientific knowledge production (Hessels & Van Lente, 2008).

A series of interactive processes have been identified to facilitate knowledge production and utilisation. One such process is to put knowledge production into context. Policymakers and users of knowledge are to be made active participants in determining which kind of knowledge is needed and suitable. Researchers should not shy away from actively engaging decision-makers, politicians and the policy community (Carden, 2009). The process endorses the use of dialogue, contacts and interaction between the two communities to derive knowledge that fits into the context of the world of policy and practice. Porter and Hicks (1995) argue that this interaction takes science to the public domain and makes the product of science more meaningful and usable to stakeholders. The gap between knowledge creation and knowledge use may be reduced significantly if an active relationship between researchers and practitioners is encouraged and promoted.

Shaxton (2013) describes three products of research that in themselves could facilitate use.

- The first is: whether it is theoretical, policy-focused or based on policy implementation.
- The second is whether the topic is currently necessary for policy issues.
- The third is whether the research is well set in the institutional context and whether there is a coherent group of people and processes that will be able to take up the results and use them (Shaxton, 2013).

Carden (2009) argues that developmental research is more likely to find use and action if the intent to influence is expressly included in the objectives. By ‘intent’, Carden is referring to the method used, which includes vocabulary, how the results will be reported, and the intended policy arena. Carden further argues that, creating a network of researchers with a shared purpose, could help address some of the common challenges, because these networks can assist each other through pooling resources, sharing experiences and discoveries in order to increase the chances of utilisation. Researchers have to cultivate extensive relationships despite the bureaucracies to broaden their network (Carden, 2009). Researchers must train themselves to simplify complex research into a form that the ordinary person can understand (e.g. using lay language) to attract the attention of decision-makers (Carden, 2009). There is value in establishing good relationships between knowledge producers and policymakers based on trust and confidence in order to speed up the movement of research into the policy domain (Carden, 2009).

There is furthermore a dynamic interaction between knowledge and policy where the possibility of political influence on research exists (Carden, 2009). Research can shape the political environment by generating interesting solutions to policy problems in which case there is a win-win situation once the research is utilised (Liverani, Hawkins and Parkhurst (2013). Researchers derive more advantage when policymakers who have authority to influence change see the need for new knowledge, in which case utilisation is given priority (Liverani et al., 2013) (Liverani et al., 2013). The researcher is accorded the due audience, trust and respect, provided the results are coherent and contextually appropriate (Liverani et al., 2013).

Credibility issues have also been raised regarding the type of research and who is best fit to transfer research knowledge (Liverani et al., 2013). Stakeholders and beneficiaries of research have the right to question the types of knowledge being transferred and by whom (Oliver et al., 2014). Researchers therefore need to build credibility over time to enhance knowledge translation (Oliver et al., 2014). Knowledge translation should be carefully planned in such a way that the issues of credibility and trust are addressed. These issues may not be completely eliminated by the design and implementation process but could be minimised (Oliver et al., 2014). Views have been expressed to the effect that design and implementation can never fully anticipate all contingencies (Carden, 2009), implying that, despite efforts to address the issues raised at the design stage, one can still expect to have some challenges (Oliver et al., 2014).

Shaxton (2013) outlines related facilitators to KU in the area of policy as follows:

- research must be geared towards decision-making and should be policy-based, focused and directed;
- users of research must show interest and willingness to adapt change;
- researchers and policymakers should not live in separate worlds but should have connections and must collaborate;
- the quality of research and users' expectations must be considered; and
- the research must be set within the institutional context.

Management skills are needed to improve understanding and utilisation of knowledge by creating awareness of the existence of research knowledge and to close the existing gap between researchers and users of knowledge by fostering a better atmosphere for cooperation (Oliver et al., 2014). The management system must meet the requirements of both internal and external stakeholders. Internal stakeholders include researchers, research teams and

management within the institution. External stakeholders include funders and beneficiaries of research.

Andrews (2012) outlines processes that facilitate KU ranging from engagement to provision of information, encouraging practices such as participatory research methodologies, tailored workshops for targeted stakeholder groups, media releases and websites. He argues that barriers related to lack of trust in the research outcome may be minimised if these processes are applied (Andrews, 2012).

The effectiveness of knowledge transfer and utilisation is determined by factors such as the accessibility of research findings. Research information must be easily accessible (both physically and intellectually) to practitioners to enable its use. Accessibility is a major is therefore a necessary ingredient for research use. An effective RU management (RUM) system must ensure that research findings are accessible by communicating and disseminating knowledge through appropriate means to users. In addition to making knowledge accessible, it must be packaged in a form that is easy to understand by the user. It should be appropriate, simple and precise and captured in clear language with examples that are familiar to the user (Becheikh et al., 2010; Kilgore & Pendleton, 1993; Kirst, 2000).

Peter Weingart, (2013) argues that universities need autonomy to operate effectively in the education market place. This can be possible if political interference in the operations of the university and its KU process is avoided or limited as much as possible (Weingart, 2013). The fundamental principle is that the best people to decide on the operations of a university and its strategies are those responsible for its success (Weingart, 2013). He believes that universities should be free to decide on their policies, design pathways and frameworks for research utilisation, manage budget and strategies. However, with freedom comes responsibilities (Weingart, 2013). Government support is needful but university management should be held accountable for use of public funds and adherence to set performance metrics (Weingart, 2013). The question is whether universities are prepared for complete autonomy and ready to shoulder the huge financial challenge that comes with university governance Weingart, 2013).

Some of these barriers and facilitators identified mainly outside the African context, hold relevant implications within the context of the current study. The question is whether we are aware of their existence and which efforts and measures can be put in place to address them. The current study attempted to uncover the level of awareness of the existence of barriers and facilitators to research utilisation among academic and research staff of KNUST. This had to

help in the design of the most appropriate strategic framework for research utilisation at the institutional level.

Finally, any conceptual framework for research utilisation must be contextualised taking into consideration indigenous knowledge, practices and experiences in order to make it more acceptable. As observed by Okolie (2003:235),

Development policies and programs in Africa have been shaped by knowledge and knowledge production that is primarily Euro-American centered, and as a result tends to be exclusionary and often contemptuous of other knowledge and ways of knowing, including the lived experiences of the targets of development.

The consequence, Okolie (2003) argues, is that local communities that are expected to benefit from such policies and programmes fail to derive the needed benefit leading to negative effects. Involving the local people in the generation of knowledge and tapping into their experiences are more likely to lead to acceptance of interventions (Okolie, 2003). It is therefore, imperative that in order for research to be acceptable and applicable, stakeholder involvement in the entire research cycle is necessary for acceptance.

Table 3.2 below provides a summary of the barriers and facilitators to RU as outlined by Andrews (2012), Carden (2009), Humphries (2014), Oliver et al. (2014), Sedlacko et al. (2013) and Shaxton (2013).

Table 3.2: Barriers and facilitators to research utilisation

PROCESS	BARRIERS TO RU	FACILITATORS TO RU
INFORMATION-RELATED	Research without relevance/clarity, misunderstanding and wrong perceptions of research, limited access to research information, non-availability, and timely delivery of research	Making research available, providing reliable and relevant research findings, quality of research must meet users' expectations
ORGANISATIONAL STRUCTURE AND PROCESS-RELATED	A lack of resources to support research and cost, a lack of human resource capacity, financial constraints, a lack of data, inadequate and sometimes an absence of planning processes, a lack of support from management, and poor communication	Research must be policy-based, provision of managerial support and capacity, making material and financial resources available, websites, media releases
ORGANISATIONAL CULTURE	Decision-making culture, crisis management culture, resistance to change, political influence on decisions	Research must be set within institutional context
INDIVIDUAL	Inadequate skills and experience of policymakers in research literacy, and a lack of formal training in research management	Users of research must show interest, tailored workshops
INTERACTION	Interactions between decision-makers and researchers, and a gap between them due to a lack of contact and mutual understanding	Enhancing joint collaboration; researchers and policymakers must connect and collaborate Building a strong relationship between researchers and policymakers

Source: Compiled from Andrews (2012), Carden (2009), Humphries (2014), Oliver et al. (2014), Sedlacko et al. (2013) and Shaxton (2013)

3.4 Strategies for research utilisation

This section discusses various strategies that may be adopted in the quest to ensure research utilisation. This is against the backdrop of the barriers and facilitators identified in the previous section, and the DRUSSA Statements of Good Practice. The discussion focuses mainly on organisational-level strategies for research utilisation.

3.4.1 Research uptake strategies at institutional level

This section is intended to cite a few examples of institutional-level strategies for RU. Jenkins and Healey (2005) outlined some institutional-level strategies expected to enhance the use of research. The proposed strategies cover four broad areas, namely:

- developing institutional awareness and institutional mission;
- developing research policies and strategies;
- developing pedagogy and curricula; and

- developing staff and university structures (Jenkins & Healey, 2005).

Table 3.3 provides a summary of what may constitute an institutional-level strategy for RU and RUM. The concept was developed from Jenkins and Healey (2005) institutional strategies to link teaching and research. Jenkins and Healey (2005) focus on the teaching–research nexus and provides an analytical framework to bring teaching and research together (Jenkins & Healey, 2005). The adaptation of the framework is with the view to incorporate some of the ideas to enhance the research–RU or utilisation interconnection. One can observe common strands between the research–research utilisation and the teaching–research nexus proposed by Jenkins and Healey (2005) as they focus on policy, planning, dissemination and M&E (Jenkins & Healey, 2005). These ideas may be adapted and contextualised to make them more applicable to our particular system. Table 3.3 below summarises the strategies for RU as proposed by Jenkins and Healey (2005).

Table 3.3: Institutional strategies for research uptake: Research uptake management framework

DEVELOPING INSTITUTIONAL AWARENESS AND INSTITUTIONAL MISSION	DEVELOPING PEDAGOGY AND CURRICULA TO SUPPORT THE NEXUS
<p>STRATEGY 1: State that linking research and RU is central to the institutional mission and formulate strategies and plans to support the research–utilisation interconnection</p> <p>STRATEGY 2: Make it the mission and deliver it</p> <p>STRATEGY 3: Organise events, research studies and publications to raise institutional awareness</p> <p>STRATEGY 4: Develop institutional conceptions and strategies to effect research and its utilisation</p>	<p>STRATEGY 5: Develop and audit research policies and practices and implement strategies to strengthen research and RU</p> <p>STRATEGY 6: Use strategic and operational planning and institutional audit to strengthen the research–utilisation interconnection</p> <p>STRATEGY 7: Develop short courses in RU and utilisation</p> <p>STRATEGY 8: Develop special programmes and structures</p>
DEVELOPING RESEARCH POLICIES AND STRATEGIES TO SUPPORT THE NEXUS	DEVELOPING STAFF AND UNIVERSITY STRUCTURES TO SUPPORT THE NEXUS
<p>STRATEGY 9: Ensure links between research centres, research teams and users of knowledge</p>	<p>STRATEGY 10: Ensure the nexus is central to policies on inducting and developing new staff and strategies to support the professional development of established staff</p> <p>STRATEGY 11: Ensure RU and utilisation are central to policies on promotion and reward</p> <p>STRATEGY 12: Ensure effective synergies between units, committees and structures for research and users of knowledge</p> <p>STRATEGY 13: Link with related university strategies STRATEGY 14: Participate in national programmes STRATEGY 15: Support implementation at department level</p>

Source: Developed from Jenkins and Healey (2005)

As derived from Jenkins and Healey's framework (2005:22), there are some key factors that should be considered in the design of strategy at organisational level. Moreover, in agreement with the DRUSSA Statements of Good Practice, the literature (DRUSSA, 2012; DRUSSA, 2015) confirms strategic focal areas necessary for the facilitation of research utilisation. The Research Utilisation Tool Kit (K4Health, 2015b) also outlines similar strategies, which may be applicable in different contexts. The RU Tool Kit suggests that in some cases, a combination of many strategies may be more effective. Again, it is advised that different phases of KU may require different strategies. Key among the strategic focal areas are:

- the university's mission and vision (Jenkins & Healey, 2005; Lavis & Robertson, 2003);
- research policy (Jenkins & Healey, 2005; Lavis & Robertson, 2003);
- research stakeholders and users (Jacobson et al., 2007; Mitton et al., 2007);
- capacity building (Andrews, 2012);
- communicating research (Andrews, 2012);
- accessibility of research (Andrews, 2012);
- budget (Andrews, 2012); and
- M&E of uptake (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007).

In the following sections, the researcher reflects on the above-mentioned areas and relates these to the insight drawn from the literature review.

Mission and vision of the university

According to the literature, university mission and vision should be summed up in its approach and commitment to generate knowledge that will meet societal needs (Lavis & Robertson, 2003). As already indicated in this review (see section 3.1) most universities' missions refer to teaching, research and service to the community. However, in the African context, the research component seems not to receive adequate attention and remains under-resourced (Robertson, 2003). Furthermore, the mission and vision regarding research utilisation are not adequately supported. The specific focus of getting research into use is missing in pursuit of the mission (DRUSSA, 2014). The 2014 DRUSSA Benchmarking Report (DRUSSA, 2014) indicates that teaching has remained the topmost priority of most sub-Saharan African universities to the detriment of clear strategies to get research into use.

It has been proposed ((Grobelaar & De Wet, 2013) that a strategic framework for RU should be guided by an analysis of the institutional dynamics with a critical examination of the

mechanisms and activities that are necessary to facilitate the achievement of the university's mission. Grobbelaar and De Wet (2013:22) in a case study to explore pathways towards the integrated development role of the university emphasise, "the conditions under which universities attempt to accomplish their three missions of teaching and learning, research and community engagement in a coherent manner, have significant impact on the institutional form, structure and character of universities". These authors then call for the creation of the right climate and institutional culture to facilitate and promote the achievement of the institutional mission.

Policy of the university

As advocated, university policies must seek to operationalise their mission and vision.(Grobbelaar & De Wet, 2013) The mission and vision must spell out the conditions and relevance for RU (Lavis & Robertson, 2003). The institutional policy should cover areas such as communication, human resources, public engagement, intellectual property, patents and copyright, which are part of the RU and management process (DRUSSA, 2014).

In 2012, KNUST set out to develop an institutional research policy (DRUSSA 2012) which was completed in 2016 and approved by the University Council in 2017 (QAPU, 2017). The current research policy (QAPU, 2017) as it stands now incorporates plans for RU. The policy states that the university will ensure it develops a research culture "that encourages and rewards excellence in Research Innovation and Development, builds research capacity that will encourage and empower staff to manage, conduct, disseminate and report research results" (KNUST, 2012). The intention for RU and RUM may be implied in the statement. The existence of a research policy provides support to the mission, vision and goals of the institution. It provides guidelines for an appropriate reward system and promotes the institutional research culture (DRUSSA, 2014).

The introduction of the 2012 draft research policy of the KNUST (see KNUST Research Policy, 2012:8)

[T]he University and researchers employed by the University acknowledge that research has to take place within a particular academic value system. The generation of resources and the establishment of procedures to manage and use research resources effectively, efficiently and fairly will form part of the research culture. The University also acknowledges the need to increase graduate research activity. Again, it is expected that the existence of a rich research culture will go a long way to build knowledge which enhances

and encourages the research-teaching nexus and other external/outreach activities and leads the University towards the realisation of its Vision and Mission.

This statement seems to pave the way for the right climate for RU to take place. Other issues raised in the research policy document to facilitate research activities seek to achieve the following:

- aid decision-making in the conduct of research;
- help in setting goals and strategies for research;
- provide a framework for assuring quality standards, regulation and, accountability in the conduct of research;
- provide strategic direction for research activities at KNUST; and
- guide any related research activity that will promote research at KNUST (KNUST, 2012).

These statements set the research agenda for the institution. The potential to create the climate for RU (right culture and context) exists, although it is not explicitly stated as such (Grobbelaar & Haber, 2014). Activities towards institutionalising RU into the knowledge production process and support as well as facilitating push factors through exchange are not cogently stated. This leaves a gap that ought to be considered in the design of the strategic framework for institutionalising RU (Grobbelaar & Haber, 2014).

Research stakeholders

Establishing a good relationship through stakeholder engagement and collaborative research is said to have proved to be an effective means of KU (K4Health, 2015b). This includes identifying the appropriate persons to be involved in the KU process. KNUST and indeed all other research and academic institutions have stakeholders who may have an interest in the research that takes place within the institution. Stakeholders must have a say in the research process, from conception to dissemination, so that the products of research would be more acceptable and applicable to them (Jacobson et al., 2007; K4Health, 2015b; Mitton et al., 2007). This approach promotes the utilisation of research since stakeholders are involved in problem identification as well as in sharing and disseminating of research results (Mitton et al., 2007).

Key among the stakeholders are peers, students, government, policymakers, industry, users of technology, small and medium-sized enterprises, NGOs, the health sector, the agricultural sector, entrepreneurs, chiefs, opinion leaders and professionals among others (DRUSSA, 2014). It has been suggested in the RU Tool Kit (K4Health, 2015) that it is necessary to identify

a key person (champion) within the society of implementation. According to the research utilisation tool kit (K4Health, 2015a:25), the term ‘champion’ refers to “a charismatic, influential, or respected individual who visibly and vocally supports evidence and promotes its application among his or her peers”.

Another group of stakeholders are knowledge brokers, and these also fit into the category of champions. (K4Health, 2015a)

Among the stakeholders of KNUST are the Association of Ghana Industries (AGI), Ghana Institution of Engineers (GhIE), Ghana Institution of Architects (GIA), Ghana Association of Bankers (GAB), Industrial and Commercial Workers Union (ICU), the business community, small and medium-sized enterprises, and surrounding communities.

Communication and advocacy

Communication, which is a means to make research information accessible to stakeholders, should be a key integral part of the institutional research strategy (Andrews, 2012). Evidence-based practices and research results when identified need to be communicated to stakeholders (Andrews, 2012). Priority areas for advocacy can be identified when stakeholders are fully engaged by researchers (K4Health, 2015b). This should provide avenues for public engagement and promotion of the image of the university. The social media and other modern technologies exist to make communication more effective. Research institutions may consider the use of radio, television, libraries, digital repositories, journals, technical reports, newspaper-sponsored advertisements of research, websites, podcasts, documentaries, science cafes, newsletters, institutional repositories, open days, exhibitions, science and technology fairs, technology transfer centres, incubation centres, science parks, information centres among others (Andrews, 2012; DRUSSA, 2014).

Capacity building

In order to design an appropriate RU strategy, there is the need to identify capacity gaps. Capacity shortfalls have accounted for the lack of RU activities in sub-Saharan Africa (DRUSSA, 2012). It has been strongly proposed that capacity shortfalls ought to be addressed to demonstrate practically and tangibly that natural and social challenges facing communities can be addressed through research (Andrews, 2012). Training programmes for the needed skills should be organised to build sufficient capacity to manage research (DRUSSA, 2014). Skills and human capacity development is key in the management process (Oliver et al., 2014).

University managers are advised to develop both their competence as well as character. (Oliver et al., 2014)

According to the DFID (2013:8), “internal capacity for research uptake includes the knowledge, skills and attitudes needed to access, use, create and communicate research information”. Moreover, a lack of absorptive capacity has been identified as a major challenge in the facilitation of pull factors through exchange (Becheikh & Ziam, 2010; Ellen et al., 2011; Grobbelaar and & Harber, 2014).

Some of the key capacity requirements outlined by the DFID include:

- information literacy (i.e. skills in finding and appraising academic literature);
- knowledge of research methodologies;
- internal communication (including effective use of email);
- internal knowledge management;
- academic writing and summarising skills; and
- skills in communicating with non-specialists.

According to the DFID (2013:9) –

[External capacity for RU] includes the knowledge, skills and attitudes needed to understand and use research information. If your key stakeholders lack the capacity to make use of your research results, then you are unlikely to have impact no matter how good your research is. Some key areas to consider include: Understanding of research and skills in finding and appraising evidence; thematic topic knowledge; and incentives (or disincentives) to consider evidence.

Budgeting

Funding for RU is another important ingredient in the research utilisation process and requires particular attention as far as the strategy for research utilisation is concerned. Landry et al. (2001) argue that sources of funding influence the use of knowledge, and predict that projects based on university internal funding are less likely to be utilised compared to projects that are externally funded. This implies that universities must make conscious efforts to attract the needed external funding to produce the kind of research that can be utilised to the benefit of society and industry (Andrews, 2012). This does not mean that universities should not strive to raise funds from within to promote their research agenda (Andrews, 2012).

Human resources and scientific services or research facilities (libraries, media services, specific scientific services, technological and knowledge transfer) should be budgeted for (Santalo,

2004). There must be guidelines on how to mobilise funds to support these. Apart from government's direct subvention and support from industry and others, academic and residential facility user fees are seen as a major source of funding. It has been argued (see Wood, 2013; Robinson, 2014) that there is so much political and social pressure on senior university managers that they have to expand significantly, either in terms of student numbers or by increasing their so-called 'relevance' in areas such as research and innovation, or by making a greater 'social impact' through community and industry engagement (Wood, 2013; Robinson, 2014). True as this assertion may be, the question arises whether the quality of teaching will not be compromised with increased student numbers.

Care must also be taken that the university does not exploit its already limited resources just for the sake of uptake. Research dissemination aimed at utilisation and uptake is one way in which the university, through its research activities, reaches out to the rest of society; however, there is a need for administrative oversight to be developed to ensure that these activities do not merely exploit the resources of the university but that they also add value (Jacob, 2001). By adding value, more resources will be generated to support more research.

It is becoming increasingly competitive to source external funds (Jacob & Jones, 2007). In order to compete successfully for funding, institutions need to show they are accountable and that their research has influence. Accountability is necessary because donors want to see active results for their work, partly because there is an increased requirement to be accountable for the way in which money is spent (Jacobs & Jones, 2007; Weigart, 2013). This will require improved capacity in universities to manage and facilitate the RUM process, to demonstrate the influence of research effectively and to ensure that it is effectively utilised to increase available funding for research.

Monitoring and evaluation

M&E is a strategic issue and must be encouraged right from the outset of the research process for optimum utilisation (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007). One tool that can be used for M&E, is a logframe and this must be embedded with research utilisation indicators (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007) There is evidence from our local science journal (Journal of Science and Technology ,JUST) and other publications where KNUST sometimes reports activity relevant to RU but this is mostly done on an ad hoc basis with a lack of capacity to track, record and evaluate dissemination activities.

From the above discussion, we can conclude that policy plays a key role and can play a pivotal role in terms of the development of strategy for research utilisation. We acknowledge the implications for neglecting the other factors but that notwithstanding, one may conclude that it takes policy to give direction and expression to strategy.

Phipps, Jensen and Myers (2012) refer to an example of an existing strategic approach to research utilisation, which emphasises policy. The key components of this strategic approach are planning, dissemination, execution and M&E. These are however, encapsulated in a strong institutional policy (Phipps, Jensen & Myers, 2012). Policy then serves as the engine, which drives the other factors within the research cycle.

The planning phase of the research should include aspects of consultation, fostering partnerships and creation of avenues for user input through a research forum (Phipps et al., 2012). Dissemination is inclusive of institutional publications and repositories, media and policy fairs. Execution is carried out through intervention studies, industries, technology hubs and spinoff firms, among others. Another important aspect factored into the research cycle is that of M&E, carried out through surveys, expert panels and case studies. All these aspects are directed by the institutional policy. Figure 3.1 below provides a summary of a strategic approach to RU built around the institutional policy.

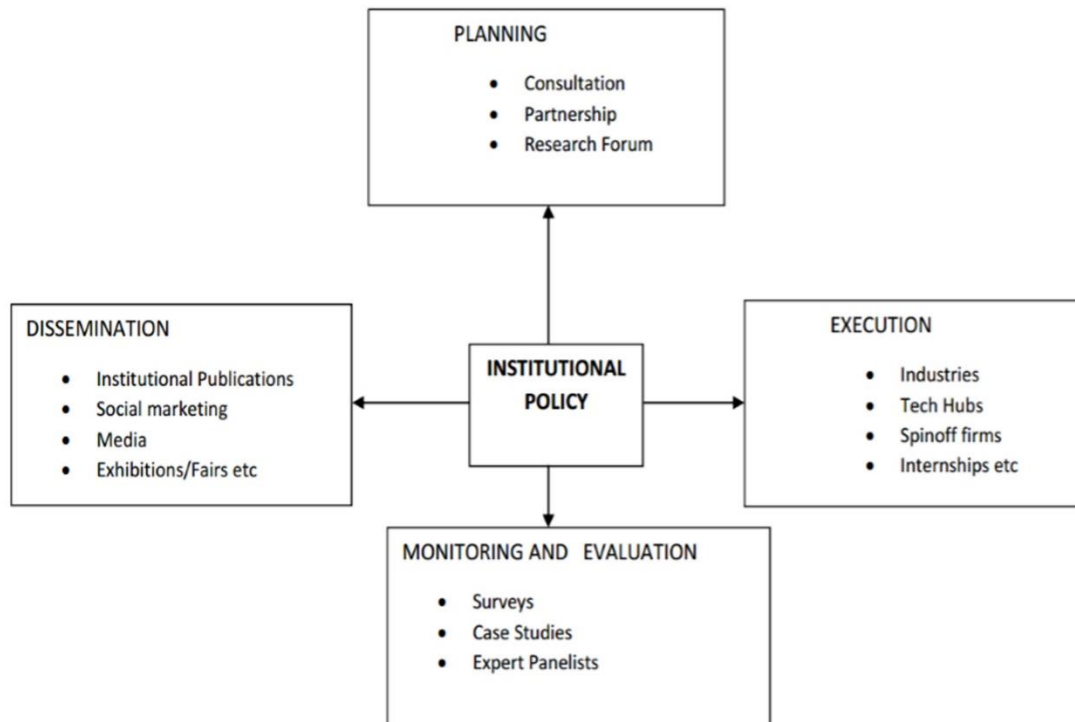


Figure 3.1: A strategic approach for research uptake

Source: Adapted from Phipps et al. (2012)

Figure 3.1 above places the burden on leadership or management working through the institutional policy to ensure that knowledge is utilised. The institutional policy is expected to spell out the staff engagement and incentive criteria of the institution while management ensures that the needed infrastructure is in place (Phipps et al., 2012). It is trusted that these, together with effective stakeholder engagement activities as well as M&E could provide the bedrock for a RU and management strategy (Phipps et al., 2012). It can be observed that, within the context of this study, the above suggestions may be applicable depending on the climate and institutional culture. For this reason, this study attempted to solicit ideas through a survey to determine the usefulness or otherwise of the above strategies. There are however, some examples of strategies within the sub-Saharan Africa that may offer input into a contextualised strategy. The next sub-section provides a few examples of existing strategies that have originated from the sub-region.

3.4.2 Examples of institutional level RU strategy

This sub-section looks at practical examples of institutional-level strategies aimed at achieving institutional goals of getting research into use.

The above strategies (see sub-section 3.4.1) notwithstanding, there is a need to find out what exists on the ground in order to assess the practice situation. A few examples of institution-level strategies being adopted by some universities within sub-Saharan Africa are discussed here. Three DRUSSA universities (University of Fort Hare, University of Mauritius and University of Ghana), which developed their strategies as a result of the programme, are being cited as examples to illustrate the fact that there are indications of efforts to make research accessible to stakeholders and also to tailor research towards national developmental needs (DRUSSA, 2015).

Recent efforts and suggestions seem to set the tone for the right climate for an institutional strategy as far as KU is concerned. As part of recommendations towards the development of strategy for research, Effah and Addae-Mensah (2013:23) suggested –

[C]omprehensive national research policies should be developed as a matter of urgency to guide research. Collaboration of all stakeholders is necessary in this regard. Universities, industry, research councils and civil society should play their respective roles, with government taking the leadership position. Research policies should reflect national development priorities.

To Effah & Addae-Mensah (2013) research policies are top priority approach to research strategy. Effah and Addae-Mensah's experience at top level management of higher education, as executive secretary to the National Council for Tertiary Education and vice-chancellor respectively, makes this suggestion most likely to be acceptable and contextually focused. Here again, the focus is on policy and how it directs the research agenda for HEIs.

As proposed by Phipps et al. (2012), developing strategy from the angle of policy enhances application and use. It is after the policy issues have been taken care of that an individual university can dovetail and align its strategies to that of national priorities. The researcher suggests that if these strategies are developed in the right socio-economic environment, they will be feasible in the Ghanaian HEIs and the principles are likely to be applicable to higher education in sub-Saharan Africa. Some universities within the sub-region are making efforts to outline some of these strategic approaches to enhance the utilisation of their research.

As part of its RU strategic mission, the University of Fort Hare (UFH) seeks to promote among others:

- meaningful and critical participation in the social, economic and political development of society;
- contributing to the enhancement of knowledge that is socially and ethically relevant; and
- applying knowledge that contributes to the scientific technological and socio-economic development of the nation and the wider world (UFH, 2009).

Clearly, activities towards RU, such as communication and stakeholder engagement, are outlined in the university's strategic RU policy. The researcher believes that for research to have any influence, it must be culturally relevant, meaningful and acceptable to users. There are efforts at UFH at aligning research with national developmental needs. The UFH example seems to follow a transformational path of assisting the state to achieve its developmental agenda with implications for economic development (Cloete et al., 2011).

The 2009–2015 Operational Plan for the Research Strategy of the University of Mauritius (UoM) (UoM, 2009) has a national focus. Its research goal is “to foster research to sustain economic development and growth” (UoM, 2009:1) with the hope of conducting research that is aligned with national priorities. Although the issue of RU is not explicitly stated in the strategic plan, it may be inferred that once research is aimed at addressing national priorities, uptake and utilisation may be incorporated in the planning and execution of the research findings. UoM has made it a matter of policy to engage in research geared towards achieving national priorities.

The University of Ghana, located in Legon, Accra, has also initiated some strategic moves to ensure that research is utilised in the long run (University of Ghana (UoG), 2014). Therefore, as part of its strategic research priority outlined in the Strategic Plan 2014-2024, the university hopes to create “a vibrant intellectual climate that stimulates relevant cutting edge research and community engagement ” (UoG, 2014:12). Moreover, the UoG have sought to provide guidelines to ensure that research meets the national development priorities (UoG, 2014).

Similarly, KNUST was also set up to ensure that the scientific and technological needs of the nation are met as spelt out in its strategic mandate, mission and vision (QAPU, 2017). Similar priority targets exist in all the public universities in Ghana set up by successive governments with the aim of meeting specific national priority needs (QAPU, 2017). It is clear that there is

a national expectation that ought to be met for which reason universities are to plan their activities to meet these expectations. Whether or not research institutions or universities are meeting these expectations is an issue to be investigated. This study sought to establish whether researchers and indeed senior academic and non-academic staff are aware of existing national priority needs. Again, we sought to investigate the institutional culture and climate and how this has informed current RU strategies. There are however, some essential elements that needed to be emphasised and these are discussed in the next section.

3.4.3 Key elements of research uptake

This sub-section examines the essential elements of KU. The processes through which research use can be operationalised and the elements of research are closely linked and interdependent (Cherney et al., 2012). The interactions between these elements have the potential to affect the extent of usage.

According to Cherney et al. (2012), research use can be operationalised through a cumulative process that progresses through stages, including –

- transmission (the research is transmitted to end users);
- cognition (the research is understood by end users);
- reference (the research is cited in reports and strategies by the end user);
- effort (efforts have been made to use the research);
- influence (the research has influenced decisions and choices of end users); and
- application (the research has been applied by end users).

In our quest to design a framework for KU, there was a need to understand the processes through which research use can be operationalised in order to identify which parameters to look out for in measuring the influence of research.

The above stages form part of the variables to look out for in determining knowledge use (Cherney et al., 2012). However, the way KU and influence are measured is still a big issue due to its definition as a process and sometimes as outcome (Belkhodja & Amara, 2007; Lester, 2005). Another issue has to do with specifying the variables needed to define the use of knowledge (Belkhodja & Amara, 2007; Lester, 2005). The way knowledge influences policy or solves problems is said to be “more of process than product”, a current of activities and relationships interacting with each other (Carden, 2009:8). In order to determine the extent of usage, there are some essential elements in the knowledge transfer process for which one ought to look out (Cherney et al., 2012).

The National Centre for the Dissemination of Disability Research (NCDDR) (1995) identified four key elements in knowledge transfer, namely source, content, medium and users.

- **Source** refers to the academic, researcher or the person(s) generating knowledge that is focused, credible and acceptable.
- **Content** refers to the message of information being transferred. The content must be clear, unambiguous, applicable, valuable, uncontested, simple and not complicated.
- **Medium** is the way the knowledge is transferred. This must be suitable to users of knowledge. It can be written documents, such as scientific journals, information reports and best practice guides. Modern trends seem to shift towards the use of information and communication technologies, such as emails and blogs.
- The **target audience or users** of knowledge who may have been part of the knowledge generation process are referred to as ‘users’. This includes decision-makers and practitioners (NCDDR, 1995).

Bozeman’s contingent effectiveness technology transfer model (Bozeman, 2000) with implications for KU spells out five broad dimensions of effectiveness:

- characteristics of the transfer agent;
- characteristics of the transfer media;
- characteristics of the transfer object;
- characteristics of the demand environment; and
- characteristics of the technology transfer recipient (Bozeman, 2000).

These characteristics, although not exhaustive, are in direct agreement with the elements enumerated above, that is, the source, the content, the way in which the knowledge is transferred and the target audience or users of the knowledge (NCDDR, 1995).

Larsen (1980) provides related characteristics as follows:

- organisational characteristics;
- characteristics of knowledge or information;
- characteristics of potential users;
- characteristics of the knowledge producer or knowledge source;
- strategies for dissemination;
- linkages between the knowledge and the user; and
- the relationship of all these to multiple utilisation indicators (Larsen, 1980).

Personal contact between researchers and policymakers, clear summaries of research findings with recommendations for action, good-quality research, and research that includes effectiveness data are some of the facilitators of knowledge transfer (Innvaer & Vist, 2002).

A summary of elements necessary in the RU process is provided as follows:

- characteristics of transfer agents (Bozeman, 2000);
- characteristics of media (Bozeman, 2000; NCDDR, 1995);
- characteristics of object, knowledge and/or content (Bozeman, 2000; NCDDR, 1995);
- characteristics of producer and/or source (Bozeman, 2000; Larsen, 1980; NCDDR, 1995);
- characteristics of recipient and/or users (Bozeman, 2000; Larsen, 1980; NCDDR, 1995);
- characteristics of demand environment (Bozeman, 2000).

These elements are essential within the RU process and may be necessary for integration into the KU framework. The dynamics at organisational or institutional level within which KU occurs have implications for any strategy aimed at achieving optimum use of knowledge. For instance, in an environment of lack of funding, low morale, lack of experience, low level of education, lack of interest, no budgetary allocation for RU, low commitment to RU practices, KU is not optimised (Andrews, 2012; Bozeman, 2000). It is therefore necessary to understand the characteristics of the agents and/or essential elements of the knowledge production and utilisation process to inform strategy (Andrews, 2012; Bozeman, 2000).

3.5 Conclusion

In conclusion, mainstreaming RU and its management requires a policy framework with leadership showing commitment to any strategic mission. Leadership and management structures of the institution play significant roles in fostering a congenial atmosphere for researchers to engage in activities leading to utilisation of research outcomes (Andrews, 2012). Staff engagement strategies and knowledge management skills are necessary ingredients to the management of the KU processes (Ellen et al., 2011). Institutional strategies to create awareness about RU must be in place. Carefully designed incentives and award schemes that recognise research and research activities should be instituted (DFID, 2013). Furthermore, through promotion and acknowledgement of achievements, it should be possible to bring RU into the mainstream of the activities of the university. Academics and researchers should also be made aware of the requirements for effective RU while their needs, for example, funding

and support, are taken into consideration. Budgetary allocation should be made for RU during the planning for dissemination and uptake (Andrews, 2012). All the above sections have been discussed to help us determine the best strategy for RU and RUM.

CHAPTER 4 – RESEARCH EFFORTS AT KNUST

4.1 Introduction

Since its establishment, the Kwame Nkrumah University of Science and Technology (KNUST), in Kumasi, Ghana, has had teaching, research and service to the community as its mandate (QAPU, 2017). Every academic staff member employed by the university is therefore expected to perform the three core functions of teaching, research and service. The reality, however, is that prevailing conditions have forced academics to allocate time disproportionately to these functions. Teaching seems to take most of the time leaving little time to do meaningful research let alone extending efforts to communities in need (DRUSSA, 2014). That notwithstanding, academics are also under pressure to carry out research with the aim of publishing in peer-reviewed journals to be eligible for promotion and career progression.

This chapter is intended to report on an examination of the research profile of the university and efforts to date to increase the research output of the university, which has direct implications for RU and utilisation efforts.

4.2 Background on the research system in Ghana

This sub-section provides a background to the research system in Ghana. Since independence in 1957 the research system in Ghana has been dominated by a focus on health and agriculture ((UNESCO, 2009b). This is largely attributed to the continuing colonial legacy (UNESCO, 2009b). Many of the research institutes were established during the colonial era with a clear indication of the colonial approach (Chatelin et al., 1997). Across Africa, one can see a replication of institutes such as the Crops Research Institute, in many previously colonial territories. The Cocoa Research Institute in Ghana is one of the oldest research institutes in the country (Council for Scientific and Industrial Research [CSIR], 2017). The Aburi Botanical Garden in Accra, Ghana, one of many sites, which used to conduct research into plant and other related research, still exists today. These institutions encouraged research, which principally focused on agriculture and other practically oriented scientific fields. They are largely influenced by the colonial model of science (Cloete et al., 2011). Scientific councils were set up in those days to ensure that science and technology followed a colonial regional approach

(Chatelin et al., 1997). These were in charge of policy formulation and allocation of funds for research.

Research in tropical medicine and agriculture has been the main focus during the colonial era (Chatelin et al., 1997). This emphasis was due to the mission of the settlers at the time as there were tropical diseases, which were inhibiting their work; hence, the need to direct research to find a solution to these diseases (Chatelin et al., 1997). Emphasis on agriculture was focused on improving the use of land and cultivation, and also to develop better farming systems that would lead to higher yields of a variety of cash crops (Chatelin et al., 1997; Eisemon & Davis, 1991). Priority was given to export crops, such as cocoa, rice, maize and oil palm (Eisemon & Davis, 1991).

The post-independence era did not witness any major shifts in research and development in general across Africa, despite efforts to revitalise research (Cloete & Maassen, 2014) and so was the case of research in agriculture. There was emphasis on the production of food crops but export crops like cocoa were still dominant. The colonial authorities, having been the main sponsors of research activities, and ultimate beneficiaries, still had influence on post-colonial research (Chatelin et al., 1997). Funders are regarded as the core of the research process and its findings because they provide research funding, scientific equipment and skilled human resources (Chatelin et al., 1997). The local researcher then remains at the periphery by depending on the donors or funders who ultimately benefit due to their advance capacity to disseminate, absorb and act upon the knowledge produced (Boshoff, 2009). Boshoff (2009) refers to this as the dependency theory and the interdependency theory in the field of international economic relations. According to the author, dependency theory emphasises the unequal aspect of the scientific relationship between the core and periphery (Boshoff, 2009). With the existence of many research institutions in Ghana, one may expect interconnectivity, linkages and strong collaboration between the various research centres, but this is not the case. Although some are known to make use of each other's facilities, such as laboratories for research activities, there are few interconnections and linkages between sector ministries; hence, the possibility of duplication and overlapping roles. For instance, one may expect formal linkages and strong collaboration activities between the public universities and the Council for Scientific and Industrial Research (CSIR). In reality, this is not officially the case, save for some collaboration that exists between individual scientists and research teams. A classic example is the Crops Research Institute and the Cocoa Research Institute where facilities are shared between individual scientists. Whereas funding and oversight responsibility for crop

research is channelled through the CSIR of the Ministry of Environment, Science and Technology, that for cocoa research is administered directly through the Ghana Cocoa Board by the office of the president. One wonders why cocoa research is not integrated into crops research. There may be good reasons though why cocoa is given such high priority, being the nation's number one foreign exchange earner (Ghana Statistical Service [GSS], 2017b, 2017a).

There is a possibility of duplication of roles, which calls for an effective collaborative and coordinative approach to research for a more productive output. It is good to know that partnerships exist between the public universities in Ghana to make use government hospitals for the teaching of nurses, medical doctors and other paramedics, hence the adopted name teaching hospitals. The University of Ghana makes use of the Korle Bu Teaching Hospital in Accra for clinical training of medical doctors, dentists, nurses and other paramedics. Similarly, KNUST also makes use of facilities at the Komfo Anokye Teaching Hospital in Kumasi. The University for Development Studies uses the Tamale Hospital in the Northern Region of Ghana for clinical training. These hospitals are fast becoming good sites for research. Many of the specialist doctors in charge of doctors in training are staff of the universities and hence under obligation to carry out research. Granted that these research outputs are towards solving health related problems or for specific knowledge and skills, uptake and utilisation can be guaranteed to some extent. The hospitals have research and development funds that provide some minimal support for research. In the past, the central government provided funding for research at the teaching hospitals but this has dwindled over the years. Hospitals have to rely on internally generated funds to support research activities.

A research system with a national character is most likely to have semblance or traces of colonial elements. A departure from this will require a paradigm shift with a focus on national priorities. Research must not only aim at knowledge creation but also KU that must be geared towards the national developmental agenda. The nation's public universities are currently the main producers of research. A few years after independence, Ghana set out to develop a science governance framework with policy statements. A 'seven year plan for national reconstruction and development' was published in 1964 (UNESCO, 2009a), which sought to give priority to national science and technology developments (UNESCO, 2009a). This initial effort has undergone several policy shifts and reorganisations with science and technology coming under different ministries over the years. In the 2009 UNESCO report (UNESCO, 2009a) on recent trends in governance and policy development in science and technology, Ghana was named as one of the countries that have gone through two waves of science and policy development.

During the first wave (not too long after independence, in 1960) a first science and technology (S&T) policy was developed but during the subsequent years was allowed to become dormant and ineffectual (UNESCO, 2009a). A second wave of policy revision in recent times was aimed at capturing the essence of the science policy goals (UNESCO, 2009a). The country was not able to revise its policies effectively; hence, the creation of a policy and funding vacuum (UNESCO, 2009a). In February 2010, the Ministry of Environment, Science and Technology (MEST) published the National Science, Technology and Innovation Policy. This was backed by a February 2011 Strategic Actions for Implementing the national science, technology and innovation (STI) policy 2011–2015 (MEST, 2011).

The UNESCO (2009a) regional report on sub-Saharan Africa observed that the national mode of scientific production in some African countries has certain characteristics. Firstly, that science is for the public good. In fact, science must seek to address the specific and most pressing needs of the country and hence have the ability to appeal to society. Secondly, that the state assumes a major responsibility for financing research and development activities (UNESCO, 2009a). Thirdly, the characteristic of a national science mode is that research scientists – and particularly the scientific elite – are mostly civil servants with the right to pursue careers. These professionals are imbued with national values as well as professional ones. Lastly, that besides the peer community, the recipients of the products of research are principally the public authorities. The direct users of the product are hardly involved. On paper, one can testify to the existence of a national policy on S&T but also a lack of resources and the political will to give expression to the laudable goals and objectives have rendered these documents less effective (UNESCO, 2009a).

A strong research system or well-functioning national research system is expected to have certain characteristics. In the first place, there must be the requisite human capital for research and development, which must consist of trained researchers and professors. Human resource (HR) development in science and technology has been a daunting task due to poor pay and worsening conditions of service (Stellenbosch University [SU], 2016). It is a well-known fact that public and private sector workers and indeed academics and researchers will look elsewhere for jobs that have better conditions of service. There must be adequate research infrastructure consisting of functional laboratories to support research and development. Poor research infrastructure with obsolete laboratories and equipment seems to be the lot of our institutions; hence, the current state of research and development (R&D). Science communication infrastructure including Internet access, publications or publishing houses, and

journals are all very necessary to support R&D (Cloete et al., 2015). Long-term financial support from all stakeholders, government, the private sector and industry is one of the pillars for a viable national research system (Cloete et al., 2015). There is a need for support for R&D by robing in government functionaries and policy makers to fashion out relevant policies and build capacity to facilitate R&D in order to achieve set research targets (Cloete et al., 2015). With limited resources, it is prudent for research institutes and researchers within the public universities to collaborate extensively in the use of facilities and shared experiences in order to maximise R&D. The next sub-section focuses on research trends at KNUST and the implications for national development.

4.3 Research trends at KNUST

KNUST has research units and/or centres established in each of its six colleges. These were established with the view to undertaking research to generate information and produce technologies that will affect the socio-economic well-being of stakeholders. The research units and centres are:

- Technology Consultancy Centre (TCC);
- The West African Institute for Supply Chain Leadership (WAISCL) – KNUST: this is a supply chain management (SCM) unit focused on education, research and training within the KNUST Business School;
- Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR);
- Bureau of Integrated Rural Development (BIRD);
- The Agriculture Research Station (ARS);
- Dairy/Beef Cattle Research Station;
- Integrated Natural Resource Management (INRM);
- Centre for Settlements Studies (CSS);
- Centre for Land Studies (CLS);
- Institute of Human Settlements Research;
- The Energy Centre;
- Institute of Science and Technology for Africa (ISTA);
- National Institute for Mathematical Sciences; and
- Centre for Cultural and African Studies (CeCASt).

Current trends have necessitated gradual increases in research output from the various colleges. Many of the research centres work in collaboration with other research institutes both locally

and internationally. One interesting centre, the KCCR, an international platform for biomedical research, operates based upon a close collaboration between the KNUST School of Medical Science (SMS), Ghana, and the Bernhard Nocht Institute for Tropical Medicine (BNITM), Hamburg, Germany. Scientists and researchers from other institutions are given access to the Centre provided their project includes Ghanaian partners (KCCR, 2017). The main objective of the centre is to develop a series of world standard research programmes through the acquisition of research grants for the development of training facilities and educational programmes for Ghanaian postgraduates and technical staff (KCCR, 2017). As a result of the centre's effort in pursuit of this objective, the KCCR in 2011 was named as an African Network for Diagnosis and Drug Discovery Innovation (ANDi) centre of excellence for applied biomedical research for a five-year period (KCCR, 2017). The objective is to bring both scientific ideas and their respective scientists in a network to conduct research in tropical diseases (KCCR, 2017). The next section examines research output trends for the 2012 to 2016 academic years.

4.3.1 Research profile of KNUST

This sub-section discusses the research output profile of the university over a five-year period, 2012 to 2016 using bibliometrics. Scopus data was used to extract the overall research performance of KNUST for the period 2012 to 2016. The Scopus data indicates that, over the period, there has been a gradual increase in the overall research output of KNUST, as shown in the figures below.

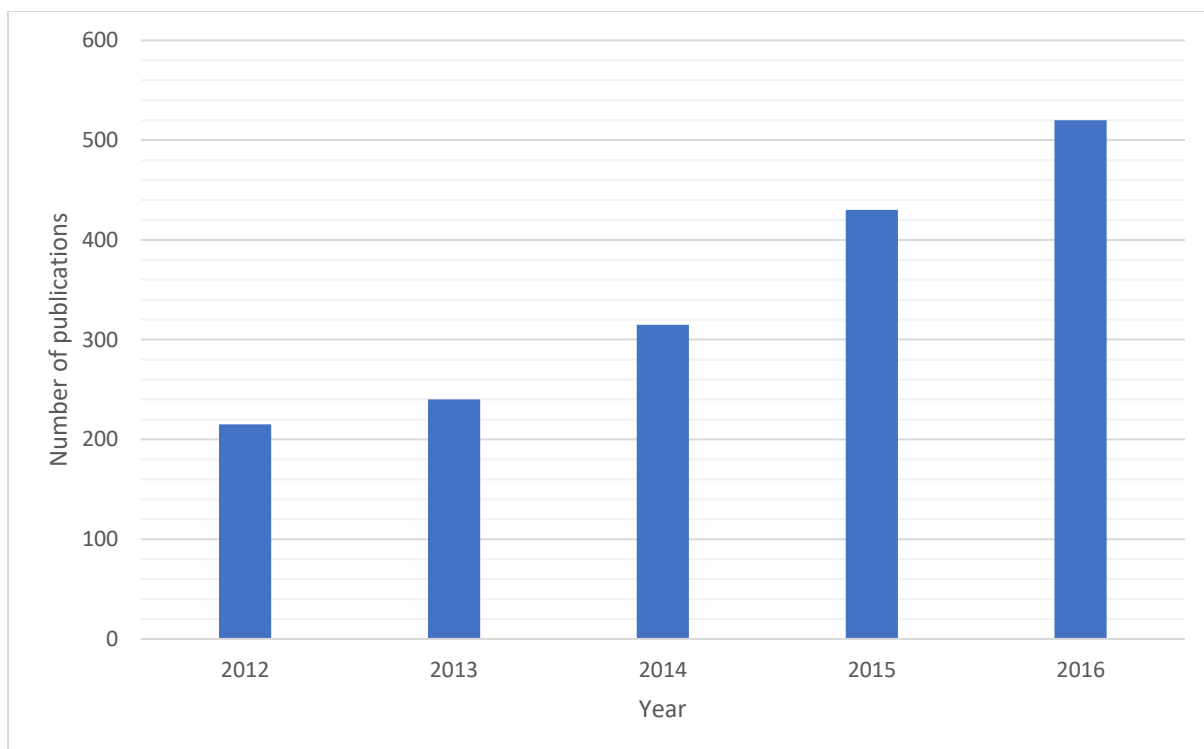


Figure 4.1 Research publications for KNUST.

Source: Scopus, (2017)

The result for the period analysed by subject areas indicated a total of 1 717 scholarly publications (mainly journal articles) with the breakdown as illustrated in Figure 4.2 below. The subject areas considered were: Material Science; Business Management and Accounting; Immunology and Microbiology; Pharmacology, Toxicology and Pharmaceutics; Biochemistry, Genetics and Molecular Biology; Engineering; Social Sciences; Environmental Science; Agricultural and Biological Sciences; Medicine and others.

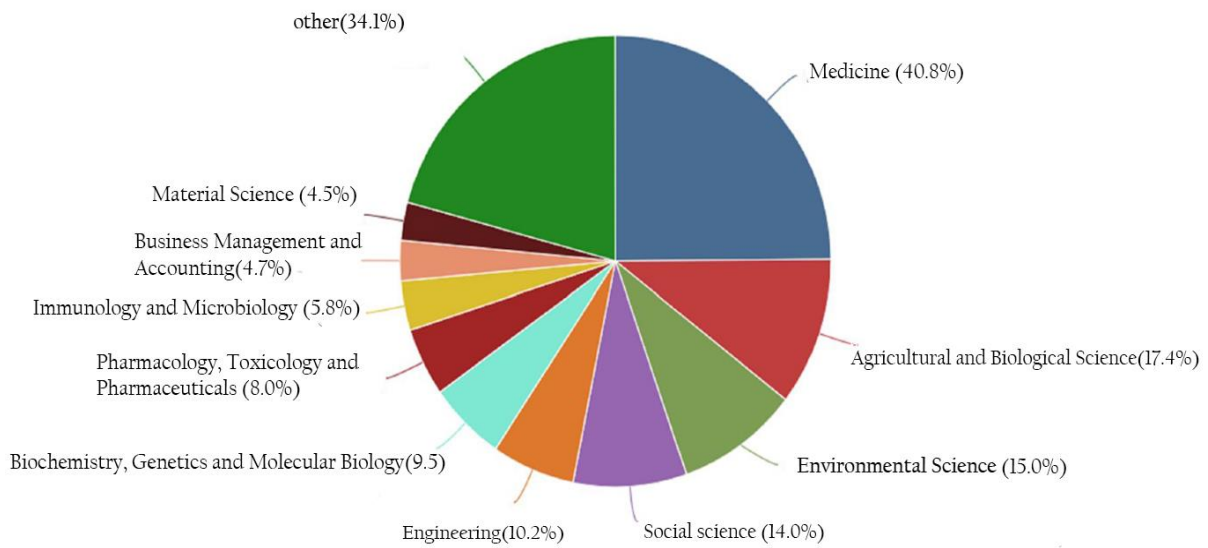


Figure 4.2 Research publications for KNUST.

Source: Scopus (2017)

The dominant departments in terms of publications are Medicine 40.8%, Agriculture and Biological Sciences 17.4%, Environmental Science having 15% and Social Sciences 14%. A look at Scopus (2017) database gives an indication that the CiteScore for the period has been growing steadily. These results from Scopus compare favourably with similar analysis obtained from SciVal (Scopus, 2017). For the period 2012 to 2016, there were 1 827 scholarly outputs from 1 478 authors with a citation count of 25 162 and citation per publication being 13.8. The overall research performance is as provided in Figure 4.3 below.

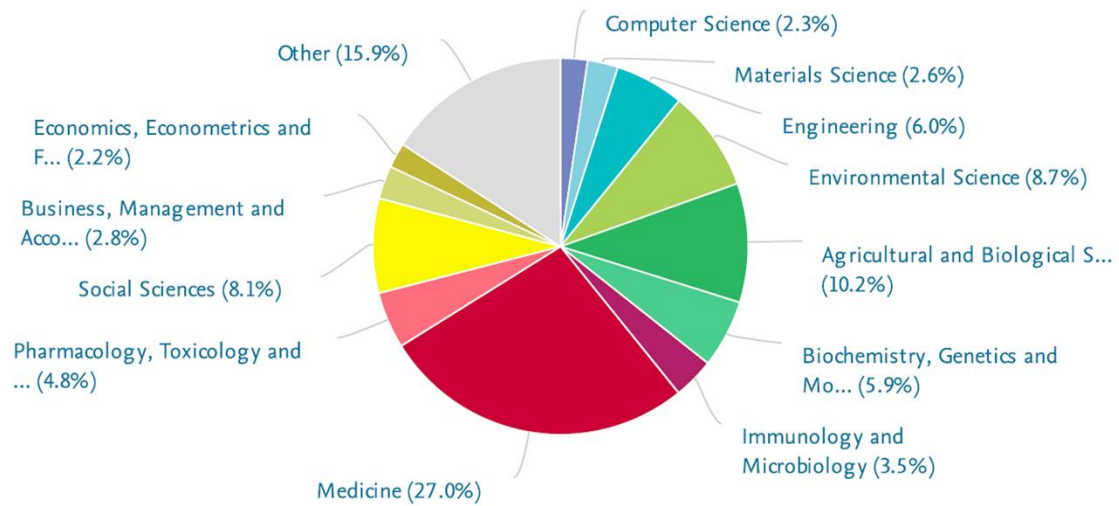


Figure 4.3 Research publications for KNUST.

Source: Scopus (2017)

Medicine had the highest output of 27%, followed by Agricultural and Biological Sciences 10.2%, Environmental Science 8.7% and Social Sciences with 8.1%. As explained in section 4.4, there seems to be more funding for medical research (including KCCR) than for all other departments, and that could account for the high research output. The above analysis gives an indication of the research output in internationally reputed journals for the university (KNUST) over the period 2012 to 2016.

The data for the different fields obtained from Scopus were rearranged to correspond to the collegiate system of KNUST. Figure 4.4 below shows the publication output of the colleges.

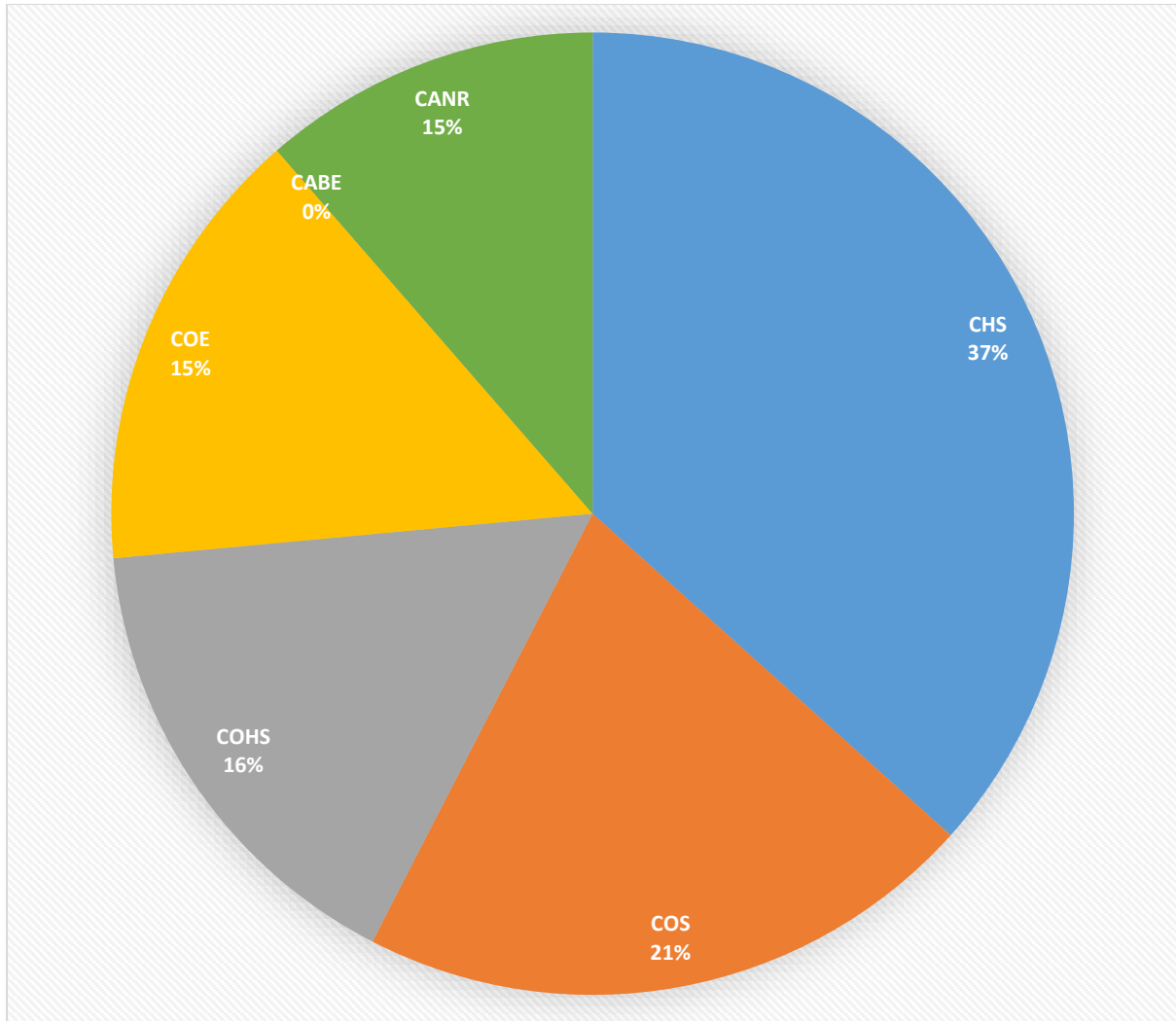


Figure 4.4 Publication output by colleges

Source: Compiled from Scopus, 2017

The figure indicates that 37% of KNUST's publication output came from the College of Health Sciences (CHS), followed by the College of Science (COS) with 21% and Agriculture and Natural Resources (CANR) with 15% (Scopus, 2017). As explained in section 4.4 there seems to be more funding from government and donor partners for the natural and applied sciences than for the other fields.

The next sections discuss the research output data available in the university as provided by the Quality Assurance and Planning Unit (QAPU).

4.3.2 Staff publication ratio for the colleges of KNUST

This sub-section provides an analysis of the staff publication ratios from the six colleges of for the 2015/2016 academic year. The research outputs are with particular reference to publications in refereed journals, published conference papers, unpublished conference papers, books and

book chapters. Table 4.1, Figures 4.5 and 4.6 below provide the breakdown for staff publication ratio by colleges.

Table 4.1: Staff publication ratio for the colleges

COLLEGE	Total number of publications	Total number of lecturers	Staff publication ratio
CANR	209	116	1.8017
Humanities and Social Sciences	290	176	1.6477
Art and Built Environment	157	111	1.4144
Engineering	217	164	1.3232
Health Sciences	462	203	2.2757
Science	394	146	2.6986
Total	1729	916	11.1613

University Average: 1.860217

Source: Publication output from QAPU; Total number of academic staff from 2016 KNUST Budget) (QAPU, 2017)

Staff publication ratio (SPR): Total number of publications, Total number of lecturers (QAPU, 2017)

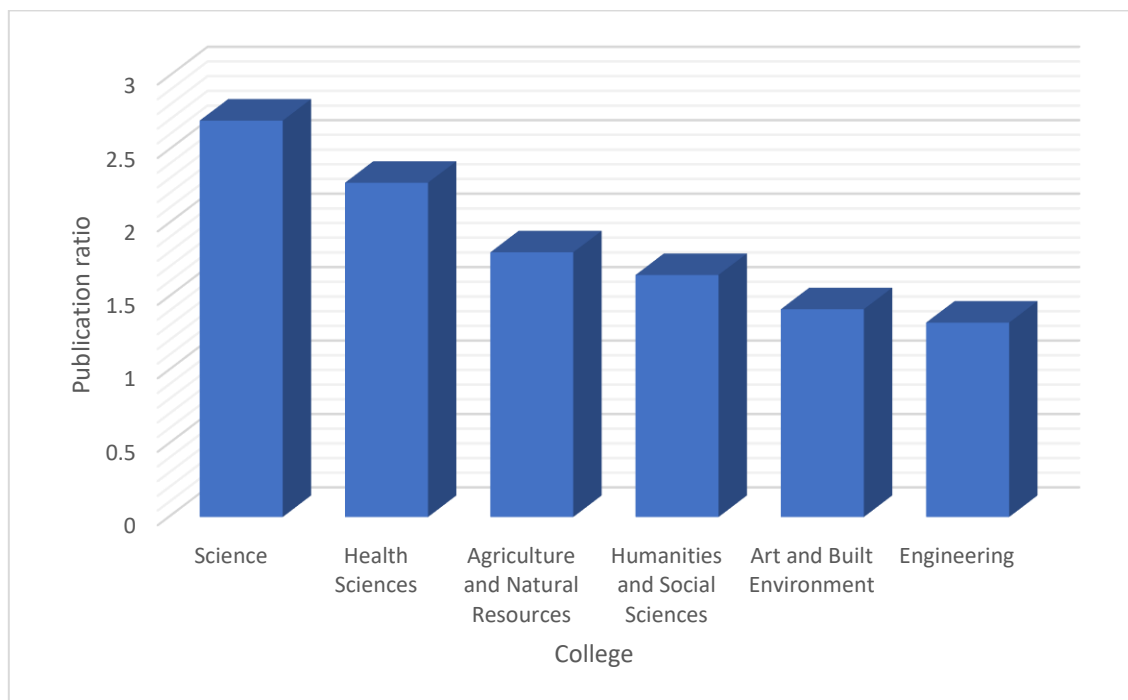


Figure 4.5 Staff publication ratios for colleges.

Source: QAPU (2017)

The publication ratios put the COS slightly ahead of the CHS compared to data from Scopus and SciVal. However, a look at the actual publications for the period 2012-2016 put the CHS ahead as shown in the figure below. For a better understanding of the production levels, a five-year trend analysis was carried out and is reported in the next sub-section.

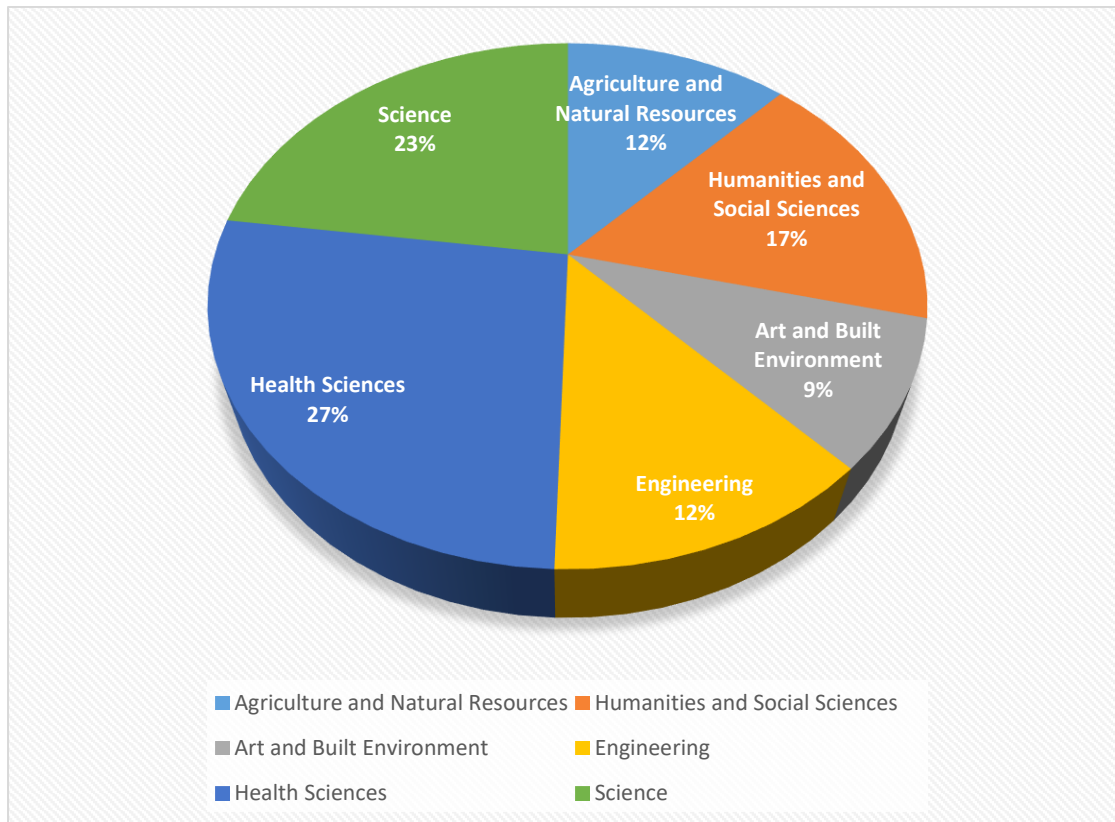


Figure 4.6: Staff publication ratio for the year 2015/2016.

Source QAPU (2017)

4.3.3 Five-year trend analysis of research output (2011/2012 to 2015/2016)

This sub-section discusses the five-year research outputs according to data obtained from QAPU (QAPU, 2017). The trends are in the same range as those abstracted from Scopus and SciVal and allow for comparisons. Table 4.2 and Figures 4.7 and 4.8 below provide the trend analysis.

Table 4.2: Five-year trend analysis of research output (2011/2012-2015/2016).

COLLEGE	2011/2012			2012/2013			2013/2014			2014/2015			2015/2016		
	R	C	T	R	C	T	R	C	T	R	C	T	R	C	T
CANR	110	23	133	112	62	174	144	53	197	125	29	154	156	43	199
Art and Built Environment	60	39	99	33	35	68	89	48	137	72	44	116	133	15	148
Humanities and Social Sciences	87	16	103	116	4	120	242	81	323	168	56	224	252	16	268
Engineering	55	24	79	48	9	57	98	19	117	118	24	142	216	1	217
Health Sciences	173	37	210	174	17	191	285	45	330	300	52	352	420	33	453
Science	48	39	87	80	4	84	177	53	230	231	49	280	318	74	392
Total	538	184	722	566	134	700	995	146	1334	1014	251	1268	1495	182	1677

R: Refereed journals, books published and book chapters

C: Published and unpublished conference papers

T: Total

Source: QAPU (2017)

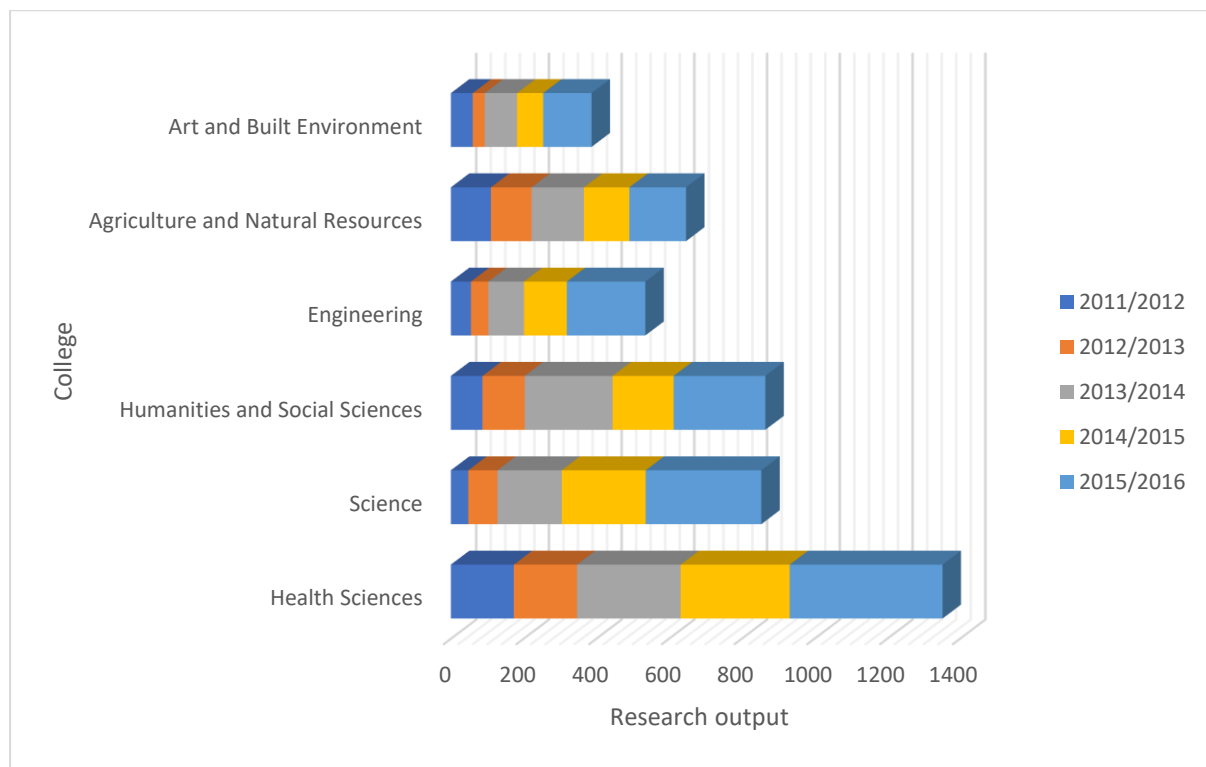


Figure 4.7: Five-year trend analysis of research output in refereed journals (2012-2016).

Source: QAPU (2017)

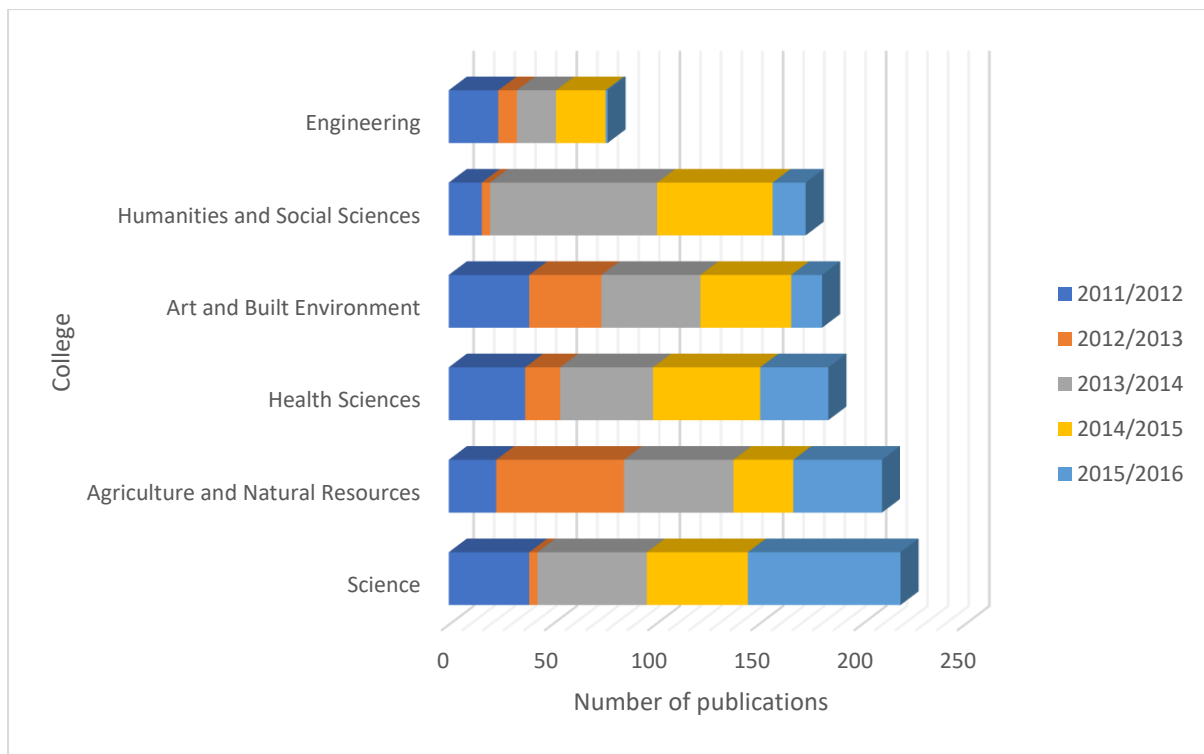


Figure 4.8: Five-year publication trend analysis published/unpublished conference papers for research output (2012–2016).

Source: QAPU (2017)

In Figure 4.8 above, reflecting total outputs in refereed journals for the period 2012 to 2016, the College of Health Sciences had the highest output, followed by the COS and the College of Humanities and Social Science. Figure 4.8 above provides the total outputs for published and unpublished conference papers for the period 2012 to 2016 where the COS had the highest output, followed by the College of Agriculture and the College of Health Sciences.

The dominance of the CHS, confirmed by Scopus/SciVal data, is largely attributed to external and internal funding support and many collaborative research studies with external bodies. National developmental-focused research and the presence of many professors and experienced researchers have also contributed to the increase in research output at the college. Similar to the data obtained from Scopus and SciVal, the COS (Biology and Environmental Science inclusive) comes second in terms of research output followed by Humanities and Social Sciences and Engineering, in the same sequence as provided by Scopus/SciVal. This is despite the inclusion of unpublished conference papers and the use of local journals in the QAPU data.

In Table 4.2 above, it can be observed that there has been a gradual increase in the overall research outputs for the period across almost all the six colleges. This may be due to efforts by

the university over the years to place more emphasis on research as a community responsibility or service to community. In a bid to enhance their profile for the purposes of career advancement, researchers at KNUST are beginning to form research teams, engaging in collaborative research and consultancies. Data from Scopus/SciVal confirms co-authorship with external researchers for publications in high-impact journals. We may also attribute the growth in research output to the growth in the number of experienced researchers and academics over the years. In the context of this current study it can be confirmed that there is a direct correlation between research output and age, experience, field of study and access to research funding. This is discussed in detail in Chapters 7 and 8 of this study.

Recent efforts at showcasing R&D to the outside world and to make research more impactful have led to the setting up of an Office of Grants and Research (OGR) (KNUST Research Report, 2015). This centralised office was set up among others to aid the “development of appropriate policies, processes and systems for effective grants management and conduct of research” (KNUST Research Report, 2016:10). In addition, the office coordinates the university’s research training opportunities. The OGR provides pre- and post-award support services to researchers, provides training, ensures compliance with institutional, funder and legal requirements, liaises with funding agencies and maintains research and grant information (OGR, functions 2018). Over the short period of its existence, from 2013 to date, the office has contributed significantly to the research efforts of the university. In addition to these efforts, the university has made available some seed fund to support research through KNUST Research Fund (KReF) (KNUST Research Report, 2016). It is hoped that with time, the office will be well resourced to improve on the research efforts of the university (KNUST Research Report, 2016). Efforts will also be made to support colleges whose research output have not been significant. As a fallout from the setting up of a central OGR, colleges of the university have set up their own offices to manage grants and research. The OGR thus coordinates and oversees the activities of the grant offices located at the colleges. These efforts have yielded some positive results in terms of research outputs. These modest gains notwithstanding, there are other factors that lead to low research output. These factors include, aging staff, inadequate infrastructure and lack of funds. To confirm the above trends in research output further, we examined figures covering a six- to seven-year period of publications in the JUST. The next sub-section examines the QAPU data for the period 2009 to 2015 with an expansion on what constitutes publications.

4.3.4 Publication trends from 2009 to 2015

Table 4.3 and Figure 4.9 below consider trends from the 2009/2010 academic year to the 2014/2015 academic year, a period of about six years. Publications here have been expanded to include refereed journals, conference proceedings, books and book chapters.

Table 4.3 Publication trends by colleges (2009–2015).

Publications trends by colleges (2009-2015)					
College	Number of publications				
	2009/2010	2010/2011	2012/2013	2013/2014	2014/2015
CANR	25	67	197	201	221
College of Architecture and Planning (now College of Art and Built Environment)	28	73	72	136	194
College of Art and Social Sciences (now College of Humanities and Social Sciences)	24	70	212	333	237
College of Engineering	65	94	86	112	161
CHS	73	202	205	338	650
COS	63	99	105	226	315
Total	278	605	877	1 346	1 778

Source: QAPU (2017)

The overall yearly totals give a good picture of significant annual growth year by year. The college-by-college performance gives a slightly different picture from the previous analysis due the expansion in publication. The addition of books and book chapters as publications may have contributed to the consistent growth in publications by the College of Humanities and Social Sciences. The CHS and the COS maintained their consistent growth in production levels and lead as illustrated in Figure 4.9 below.

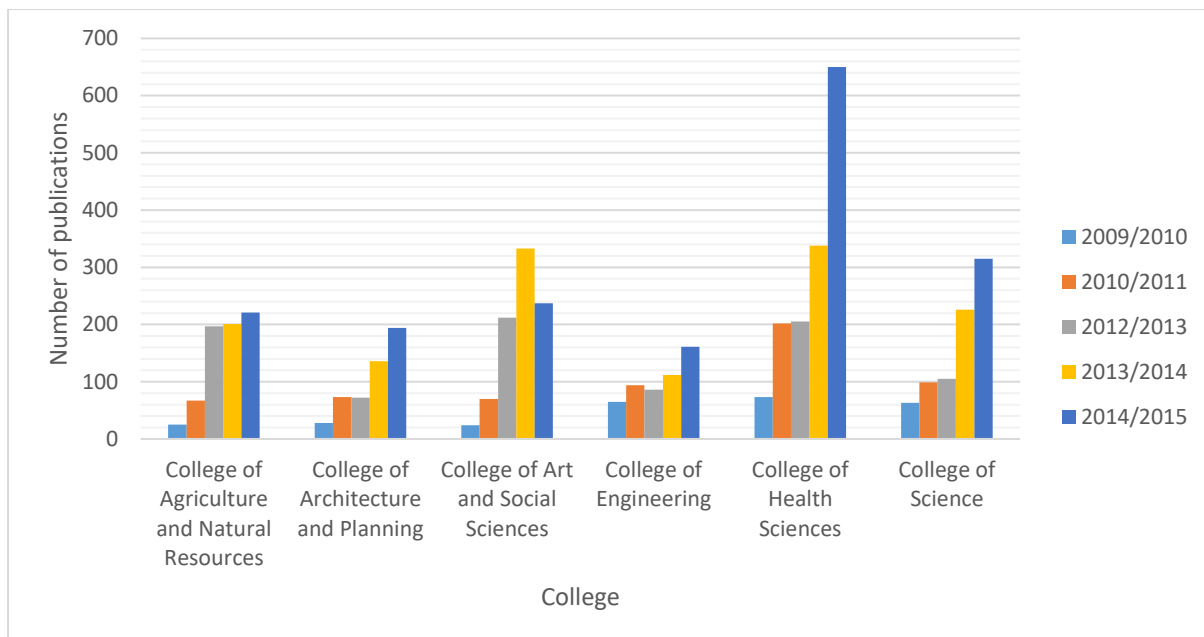


Figure 4.9: Publication trends by colleges (2009–2015)

Source: QAPU (2017)

4.4 Research funding at KNUST

This sub-section discusses the issue of funding for research. There is a direct correlation between funding and research output. Good research does not come cheap, and the same argument goes for activities leading to uptake and utilisation of research. It is a fact that government funding alone is not sufficient for meaningful research. Universities therefore tend to enter into collaborations, partnerships and other sources that bring in some funding for research (Cloete, 2011).

Until recently, KNUST has had no centralised research-coordinating unit with a responsibility to source funding for research. Apart from government's annual research grant paid to every academic staff, the university has a seed grant of GHC (Ghana cedis)10,000 for "pilot or exploratory research" (KNUST Research Report, 2016:29). To qualify for this, one has to apply formally to the Research and Conference Committee for consideration. The level of support depends on how convincing the proposal is, and on the expected after-effect on teaching, research and service to community. Whether one is seeking funding for research or to attend a conference, there must be ample evidence by way of a proposal, paper to be presented, acceptance letters among others.

The main financier of public research is government through the various ministries (Cloete, 2011). The CSIR together with all its subsidiary research centres obtain government subvention

through the Ministry of Environment, Science and Technology. The activities of the Centre for Scientific Research into Plant Medicine are supported through the Ministry of Health whereas the public universities, including KNUST, obtain funding through the Ghana Education Service (GES) and the Ghana Education Trust Fund (GETFund) facilitated by the National Council for Tertiary Education (NCTE).

Government subvention for the public universities covers mainly emoluments, administration and service, staff development and training with little left for research. Universities therefore have to depend heavily on internally generated funds (IGFs) and strategic partners to obtain the needed funding for R&D. KNUST, for instance, has benefitted from several such collaborative efforts and research support from corporate organisations and foreign donors. IGFs are made up of school fees, income from semi-commercialised units, such as the University Printing Press, university hospital, photocopy unit, guesthouses and shuttle services. The breakdown of the university's sources of income in terms percentages are as follows:

- Public funding from government subvention = 55.56%
- Private funding = 37.85%
- Investments = 06.59% (KNUST budget, 2017)

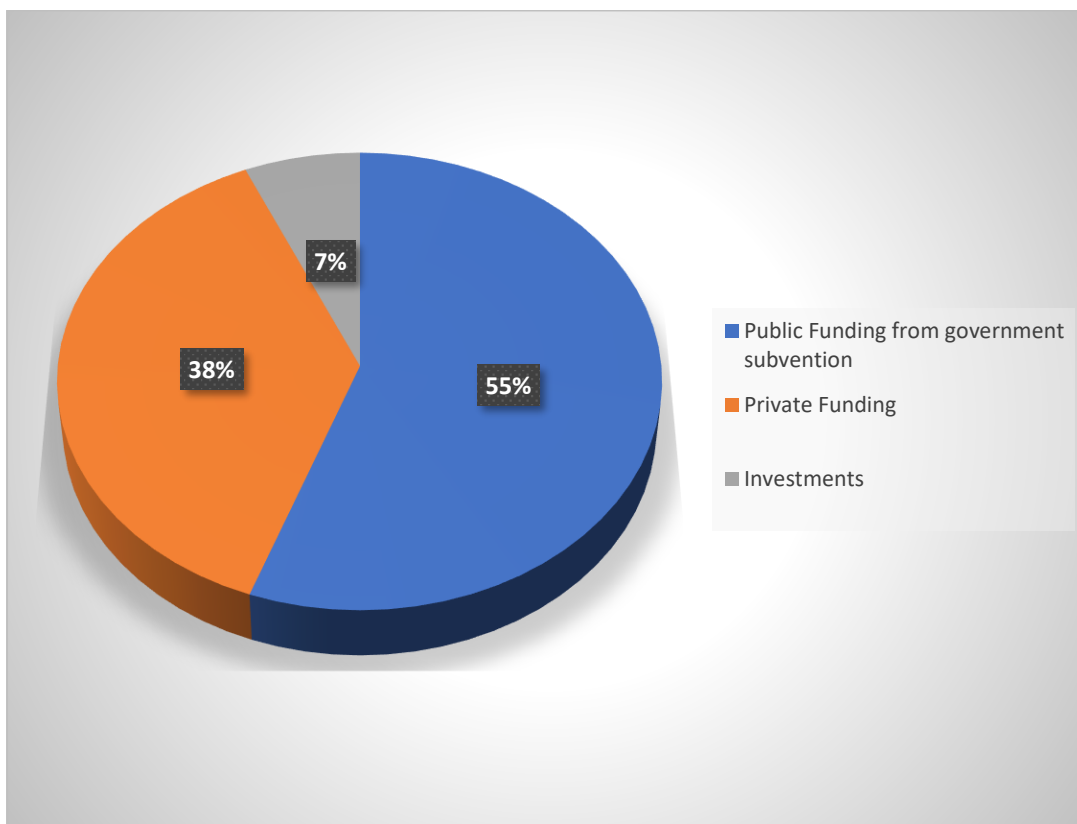


Figure 4.10 Funding sources for KNUST. Source: KNUST budget (2017)

Funding for R&D is a major challenge but there are a number of success stories arising out of collaboration with strategic partners. In the case of KNUST, there are several completed and ongoing collaborative research activities and projects. Information available at the OGR confirms the existence of such funding sources and projects (see KNUST Research Report, 2016), examples of which are given in Table 4.4 below.

Table 4.4 Examples of funded projects for KNUST

NAME OF PROJECT	DEPARTMENT	FUNDER	AMOUNT	PERIOD
Soils of Forest Island in Africa	Crop and Soil Science	Imperial College, UK	£1 132 162.00	2015–2020
Development of Innovative Project Based mode and modules to train dairy producers and processors in Ghana	Animal Science	Council for Technical and Vocational Education and Training (COTVET)	GHC (Ghana cedis) 1000000	2016
Upgrading Education and Research Capacity in Renewable Energy Technologies (UPERC-RET)(NMBU-KNUST)	The Energy Centre	Norwegian Agency for Development	NOK (Norwegian krone) 8.5 million	2015–2019
Enhanced protective immunity against filariasis (EPIAF)	KCCR	European Union	€227,000	2015–2016
The efficacy of Rifapentine and Moxifloxacin against onchocerciasis (MORION)	KCCR		€150,000	03/2015–04/2016
Genome Wide Association (GWAS)	KCCR	Bill and Melinda Gate Foundation	€348,700	12/2015–11/2018
Coendemicity of malaria with schistosomiasis (TRANSMAL)	KCCR	German Research Council (DFG)	€218,610	09/2015–08/2018
Tuberculosis Drug Resistance Survey in Ghana (TB DRS)	KCCR	Global fund through national TB programme, Ghana	\$149 930	04/2015–08/2018
Ebola training	KCCR	Federal Ministry of Foreign Affairs, Germany	€280,000	01/2015–12/2015
Organ damage in sickle cell disease (ORRDISS)	KCCR	University of Pittsburgh	\$250 000	2015–2019

African Research Network for Neglected Tropical Diseases	KCCR	VW Foundation	€64 000	2015–2019
Strengthening injury control research in Ghana and West Africa	Surgery	Fogartory International Center	\$135 615	2016–2020
Severe typhoid in Africa project (SETA)	KCCR	Bill and Melinda Gates Foundation International Vaccine Institute (IVI)	\$700 000	01/12/15–31/12/1
New Materials for Sustaining Energy Future: Linking computation with Experiment	Chemistry	Royal Society-DFID/Cardiff University	£1 243 000	01/2015–02/2020
Developing Application for Development in Solar Cells	Chemistry	Royal Society-DFID/University of Manchester	£1.25 million	2015–2019

Source: OGR (2017)

The university has benefitted greatly from many such collaborative efforts from its strategic partners both locally and internationally (KNUST Research Report, 2016). This support notwithstanding there is still a huge funding gap that needs to be filled. External funding is mainly project-oriented but there is a need for capital inflow for individual researchers and research teams within the institution to undertake developmental research in fulfilment of the university's mandate and to meet societal needs.

With diminishing resources to fund scientific activities, universities, and the main research centres have had to adopt coping strategies such as increased student intake to raise funds. The rapid growth in enrolment coupled with diminishing resources has necessitated new ways of reconciling the pressures for mass higher education with selective development of high-quality scientific training and research (UNESCO, 2009a; 2010). It has been argued by Eisemon and Davis, (1991) decades ago that the poverty of local government bodies and the absence of voluntary associations, local philanthropic foundations and private business with enough financial prowess to support universities, have compelled governments to accept responsibility for higher education (Eisemon & Davis, 1991). The argument continues that economic conditions have forced governments to reduce expenditure on higher education and to shift a higher percentage of the direct costs on to the students; hence, the increases in student intake (Martin & Etzkowitz, 2000). An imbalance results with increased focus on teaching. Higher student intake therefore creates a weakening of the relationship between research and teaching; thus, posing a threat to the very existence of the university (Martin & Etzkowitz, 2000).

4.5 Conclusion

The demand on universities for relevance and accountability, the quest by researchers for career progressing, and, to some extent, the need to solve societal challenges and influence policy have led to some significant increases in the research output of KNUST over the past five years (2013 - 2017). Despite some indication of a drop in the production of knowledge across the colleges at certain times, the overall picture shows a gradual increase in research production in the past five to six years (2013-2017). Data from the QAPU was corroborated to some extent by bibliometric analysis using Scopus and SciVal.

Research must be available in the first place before thinking about how uptake and utilisation can take place. With the availability of some research in the university, the next step is to examine the issue of uptake and utilisation and the activities that lead to that. From Scopus and SciVal, we noticed some level of citation of publications, which to some extent is an indication of research use. The essence of the study was to look at the mechanisms in place and those absent, and then to then fashion a framework for institutionalising RU. KNUST researchers engage in varied fields of research, so it was envisaged that there would be varied modes of knowledge production as well as extent of utilisation.

From the foregoing discussion, the availability of research was clear, but many questions remain unanswered regarding which kind of research, the focus, whether the research findings have the potential for uptake, whether the research findings are targeted at any specific external audiences or stakeholders, and what the levels of engagement are. These questions are addressed in Chapters 7 and 8.

CHAPTER 5 – RESEARCH DESIGN AND METHODS

5.1 Justification

Recent developments in sub-Saharan Africa have necessitated surveys leading to efforts at building capacity for RU and RUM at individual and institutional level. We have outlined findings from surveys conducted under the DRUSSA programme to help identify how universities in sub-Saharan Africa currently approach or manage RU. The surveys sought to identify any current structures and processes that may be in place, both formally or informally, highlighting examples of good practice and noting any areas that the university feels could be strengthened (DRUSSA, 2012). Beyond what was discovered by DRUSSA, this current

research set out to explore best practice, theories, frameworks and strategies from the literature in order to adapt an analytical framework that had to form the basis for a survey that will enable the design of a strategic framework for institutionalising RU. This chapter provides justification for the conceptual framework, outlines the key issues and focus areas, and provides for the research design in three phases, including adaption of a framework for the analysis.

In order to achieve the overarching aim of this study a conceptual framework which addresses the question of how an organisation could transfer its knowledge more effectively to users and stakeholders is necessary. The framework defines its objective in terms of its research focus, its users, by whom and how its knowledge is transferred, and the expected outcome (Lavis & Robertson, 2003). Taking these into consideration, the conceptual framework paves the way for an organisational strategic framework for an RU and RUM strategy that may also be relevant and applicable to the broader HE setting and other research institutions.

A selected research utilisation conceptual framework was intended to provide an opportunity for comparing what already exists against what is proposed by various authors in order to tailor-make one that is contextually applicable. Already existing knowledge in the field of KU can be tested and validated against views sampled from academics and research staff as well as top-level management staff. In order to achieve objective 5 of this study (see sub-section 1.4) a validation process in this context had to involve both internal and external stakeholders of KNUST.

The conceptual framework is the starting point for reflecting on the content of the study, providing understanding of RU and RUM within the KNUST context and how it can be communicated effectively. Accordingly, the reflections can be reviewed and reformed for further investigation. The next section reports on the key issues and areas of focus as discussed in the literature (sub-section 3.5.3) which enabled the design of an appropriate research method and the development of the primary data gathering survey instrument, to direct the collection and analysis of relevant data, which in turn, directed the proposed final strategic framework.

5.2 Key issues and focus

This section considers a range of areas and key issues raised in the previous chapters that needed to be considered during the design of the conceptual framework.

The way the author arrived at answers to the research questions have been addressed with the research objectives in mind. This author believes that, in determining the type of research suitable for local, national and general development, one needs to review national development

plans. Following that, we could determine our research focus and purpose as well as the kind of stakeholders with whom to engage. Mouton's (2012) recommendation to acknowledge the different adoption pathways provided pointers to the possible modes and pathways for research utilisation and also how the planning of an RU strategy for KNUST had to be done. RU activities and the context of application differ depending on the scientific field, and these have implications to the essential elements for uptake (Mouton, 2012). The survey therefore had to cover researchers from various fields across the six colleges of the university. These colleges engage in different modes of research in various disciplines.

Knowledge production and dissemination activities ought to be evaluated, but how they are evaluated is affected by the differences in modes of production and the discipline (Mouton's) (2012) principles. A critical look at the different approaches to RU for different fields was therefore necessary. The current research was designed to consider the key capacity gaps, barriers and facilitators to RU, and how these influence research activities.

From the literature (see Chapter 2), it was established that RU and RUM can be carried out effectively if it is made an integral part of the institutional culture. In order to create this culture, one needs an RU framework that encompasses processes, such as knowledge generation, knowledge adaptation, knowledge dissemination, knowledge reception, knowledge adoption and then finally knowledge utilisation (Becheikh et al., 2010). From these, we identify opportunities that define the research question, conducting the research and publishing the results. These processes take us through some pathways and approaches to knowledge production and utilisation. In line with objectives 1 and 3 (see sub-section 1.4), we reviewed existing plans for RU at KNUST and also sought to identify existing modes and pathways for which RU can be facilitated. An appropriate survey instrument designed for research active staff would seek to establish which of the common approaches in the KU process, namely the interactive or connection approach and the collaborative approach (Landry et al., 2001; Sudsawad, 2007) are being practiced or have the potential for adoption (Sudsawad, 2007). A documentary review was therefore necessary to solicit answers to questions that seek to determine areas of local and national and national needs where KNUST could play a role.

It has been established that, apart from facilitators to KU, there are certain barriers that needed to be considered in the strategic approach to KU (Humphries, 2014; Oliver et al., 2014). These barriers and facilitators had implications for the intended strategic approach of this current study. Some strategic approaches found from the literature included: effective planning, dissemination, execution and M&E. An institutional strategy had to be facilitated through the

university's mission, research policy, research stakeholders, capacity building, communicating research, budgeting and M&E (DRUSSA, 2014). The existing institutional approaches to RU and how they address the issue of institutional barriers and facilitators to RU and its management were factored into the research design, discussed in the sections below. This also addressed the issue of the strengths, weaknesses and opportunities for KU within the institution. In order to bring together all these essential areas of focus, the next section reports on and maps out a framework for the study.

5.3 Conceptual framework

This section is intended to identify and map out a general framework that identifies the various elements necessary for RU.

Grobbelaar and Haber (2014) designed a framework for RU, which incorporates the works of Cherney et al. (2012), Ellen et al. (2011), Landry et al. (2001), Lavis et al. (2006), as discussed in the literature review in Chapter 2. Figure 5.1 below is a pictorial representation of the framework with the various elements considered.

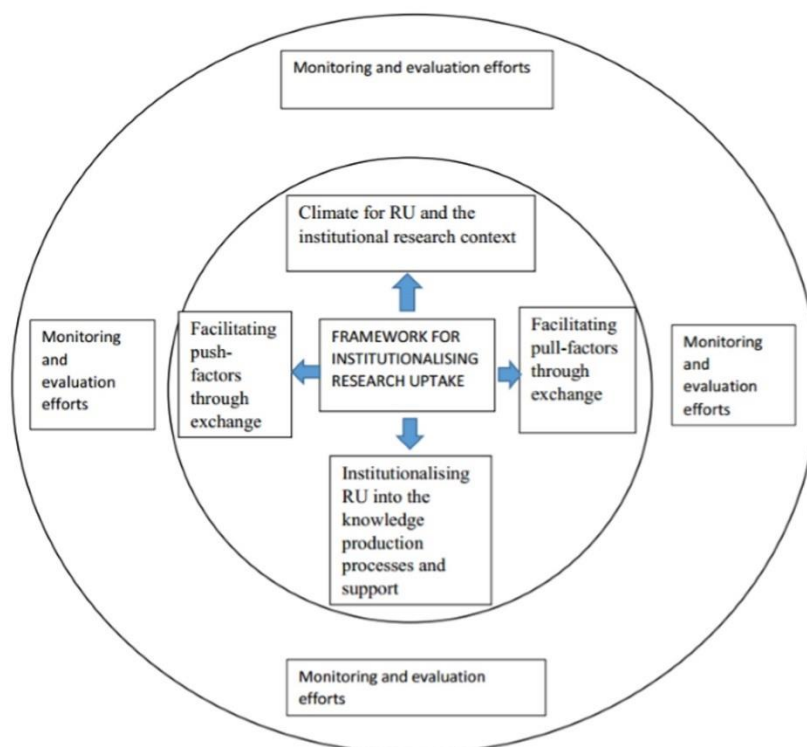


Figure 5.1 Conceptual framework for institutionalising RU

Source: Adopted from Grobbelaar and Haber (2014)

This framework covers important areas that need attention as far as the issue of RU and its management is concerned. It is worth noting that M&E efforts, as portrayed in the diagram, are necessary for each element and should be carried out at each stage of the RU process. For the purposes of this study it was necessary to adapt an analytical framework suitable for the university environment to guide the analysis of data obtained from the survey and subsequent interviews.

Along the lines of the above conceptual framework a similar framework for analysing the transformational pathway of the university environment was developed by Grobbelaar and De Wet (2013). This analytical framework provides a scheme towards the analysis of institutional change aimed at achieving the university's mission. The range of areas includes the choice of mechanisms, facilitators to change in addition to the form and focus of specific activities, as discussed in section 2.5.10. The visual aid, presented in Figure 5.2, which summarises the change process for the university was adopted as the analytical framework for this study.

5.4 Analytical framework

For the purposes of our survey, we adopted the framework below.

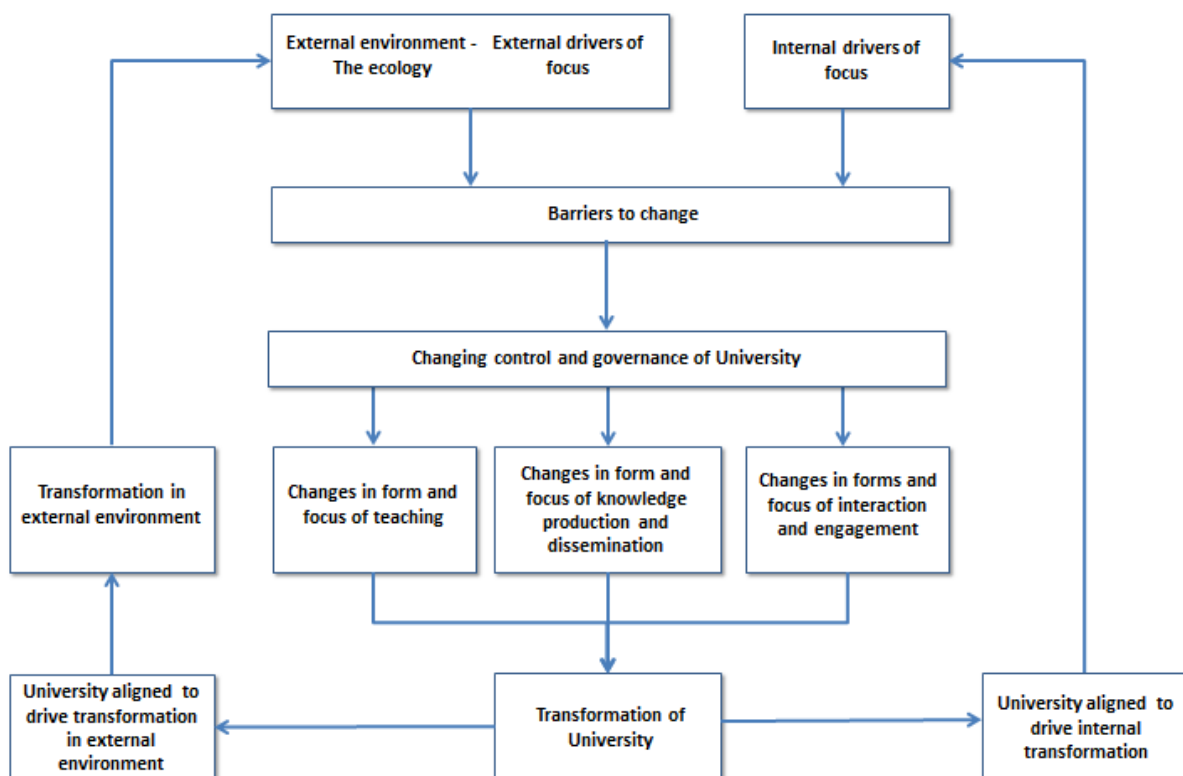


Figure 5.2: Framework for the analysis of the transformation pathway of the university environment. Copied from Grobbelaar and De Wet (2013:7)

The above analytical framework illustrated in Figure 5.2 served as the main framework for analysis in this study in order to propose a framework suitable for RU within the context of the study. This current study however, established connections between the two frameworks, Figure 5.1 and Figure 5.2, that broadened the scope of the survey and therefore the analysis. The climate for RU and the institutional context examined along the lines of the ecology and external drivers of focus defines and outlines activities aimed at making the university relevant. This includes the university having a strategic vision with set goals to pursue its mission. The needed culture, context and policies that govern the operations of the university should also be in place since they have implications for its relevance. Provision should be made in any strategic framework towards addressing barriers, such as a lack of appropriate policies and capacity for RU. The various capacities that needed to be developed along the lines of the above elements of the analytical framework are listed in Table 5.1 below.

Table 5.1: Key capacities to be developed

Framework component	Capacity	To be developed
1	External environment – the ecology and external drivers of focus	Build capacity for a liaison with the requisite skills to serve as an intermediary between the university, industry and government.
2	Internal drivers of focus	Build capacity in knowledge dissemination and lobbying for funding.
3	Barriers to change: institutional capacity	Development of leadership capabilities to link academic activities
4	Changing control and governance of university	Training leaders or academics in governance mechanisms to build synergy between teaching, research and engagement. Training M&E specialists to carry out M&E.
5	Changes in form and focus of teaching	Development of relevant skills, continuous education and multi- and trans-disciplinary training
6	Changes in form and focus of knowledge production and dissemination	Training in trans-disciplinary research approaches including dissemination, policy, advocacy and management
7	Changes in forms and focus of interaction and engagement	Skills training in multi-stakeholder initiatives for effective public engagement

The control and governance of the university, the form and focus of teaching, the form and focus of knowledge production and dissemination and the changes in form and focus of interaction and engagement all have significant influence on the climate for research utilisation (Grobbelaar & De Wet, 2013). In line with objective 1, the review of scholarly works lent credence and provided support for these elements of the frameworks.

Institutionalising RU into the knowledge production process and support is aimed at promoting internal drivers of change (Grobbelaar & De Wet, 2013). The organisational processes within the university should aim at institutionalising RU activities into the institution's research cycle. The likely barriers to the knowledge production process and dissemination include policy-related changes, the institutional structure and engagement activities (Carden, 2009; CHSRF, 1999a; 1999b; Grimshaw & Eccles, 2012; Mitton et al., 2007). When RU is integrated into the institutional research cycle, it will affect the training and acquisition of skills (form and focus of teaching) (Grobbelaar & De Wet, 2013). The university's engagement practices with its stakeholders would also be influenced positively if the processes for knowledge production and dissemination are well integrated into the institutional processes. The plans for RU and pathways as sought by objectives 2 and 4, the need to identify the current modes and pathways for RU in answer to research question 2, and the way RU is currently managed according to research question 4, could be addressed considering these particular elements.

Among the factors that make the university relevant are the push factors, how the university engages policymakers and government (Grobbelaar & De Wet, 2013). This adds to the relevance of the university. All policy-related changes and engagement practices must be in place to facilitate this. Training and acquisition of relevant skills, engagement with the community and other stakeholders are all push factors that must be taken into consideration (Grobbelaar & De Wet, 2013). A survey was necessary to ascertain these facts and also to identify any possible barriers to the push factors. Objective 4 and research question 5 on how best to facilitate RU and the essential elements needed for any RU strategy were considered among the push factors necessary for optimal RU.

Conditions that promote demand for research (pull factors) in effect promote drivers for change and relevance (Landry et al., 2001). These are also policy-dependent and they require structural changes. The governance of the institution is therefore a critical issue. In addition, how the university positions itself to market its research is also essential. The form and focus of industry as a major stakeholder have the potential of influencing the demand for research and therefore the need for the university to determine the possible barriers and work towards overcoming

them. Further exploration of the strengths and opportunities for KU along with the key capacity gaps at both individual and institutional level needed attention in achieving objective 3 and in answer to research question 6.

Finally, there was the need for M&E of all these processes to ensure a possible modification and adjustment of the RU processes. The internal and external drivers of change, the governance of higher education, the form and focus of teaching, the form and focus of industry and community engagement require regular reviews at institutional level in order to evaluate the effectiveness of the RU activities (Grobbelaar & De Wet, 2013). At the stage of M&E, one is able to validate any strategic framework according to its effectiveness in achieving maximum impact. Again, the barriers and facilitators of RU and utilisation were examined critically and necessary remedial measures suggested. This last section provided an answer to research question 3.

In concluding this section, we note that these elements are an essential component of a framework for an RU strategy. The analysis provided benchmarks and pointers for the survey to explore further and arrive at concrete conclusions within the context of the study. What to look out for and the appropriate questions to be asked all depended on the analytical framework. In the end, we arrived at answers to the research questions and hence the main objectives of the study.

5.5 Overarching research design mapping exercise

This section maps out the overarching plan for the research. Here we link the research questions to the framework components as given in Table 5.2 below.

Table 5.2: Mapping of research questions and objectives

Research question	Framework component	Documentary analysis	Survey	Interviews
Question 1: What are the areas of local, national and general development focus and objectives where KNUST can play a role? This constitutes some of the external drivers of focus that propel the university's research agenda. Objectives 1, 2, 3	1 – yes	yes	yes	yes
	2 – yes	yes	yes	yes
	3 yes	yes	yes	yes
	4 – yes	yes	yes	yes
	5 – yes	yes	yes	yes
	6 – yes	yes	yes	yes
Question 2: What are the current modes and pathways of research utilisation at KNUST? Objectives 2, 4, 5	2- yes	yes	yes	
	6- yes	yes	yes	
Question 3: What are the barriers and constraints (institutional or systemic) for optimal research uptake and utilisation? Objective 3	2- yes		yes	yes
	3- yes		yes	yes
	5- yes		yes	yes
Question 4: How is research (uptake) currently managed at KNUST? Objectives 4, 5	4- yes		yes	yes
	7- yes		yes	yes
Question 5: What are the essential elements to be incorporated into a strategic RU framework for the university, researchers and policymakers? Objective 5	3 – yes		yes	yes
	5- yes		yes	yes
	7- yes		yes	yes
Question 6: What are the key institutional and individual capacity gaps, human and financial resources (at both management and operational levels) that need to be addressed in order to equip staff at KNUST to maximise the uptake, utilisation and impact of developmental and applied research? Objective 3	1 – yes		yes	yes
	2 – yes			
	3 – yes			
	4 – yes			
	5 – yes			
	6 – yes			

5.6 Survey instrument framework

As a follow-up to the above mapping exercise, this section outlines how the framework was applied in the document analysis, developing the survey questions and carrying out the interviews. The interviews were intended to clarify and give further feedback obtained from the survey. It was therefore targeted at the same people who took part in the survey and it was intended to be a face-to-face activity. Details of how the analysis of the document review, survey and interviews was carried are described in the sub-sections below.

5.6.1 Document analysis

This sub-section outlines how the document review was carried in order to arrive at answers to some of the research questions. It also explains how we teased out information to direct the focus in analysing the content of existing documents necessary for the scheme of work.

We first outline the criteria for the selection of documents; second, justify the choice of document; and third, discuss the scientific method behind the document review, how the information was obtained and provided justification for the information. Existing documents and Internet sources were consulted for relevant information.

Documentary review was carried out on official university documents such as recorders (official policy and/or decision documents of the university published from time to time), reports, policy documents and journals. Also available for review were government records in the form of projections, plans and reports, which were not classified and were available in print and online. This was with the view to examine external drivers of focus as far as policies, mission and vision were concerned. These external drivers of focus have implications for the university's research activities. The document review helped to identify the changes in focus and governance of the university. The aspects of change driven by control and governance through policies (Grobbelaar & Kirkland, 2013) could also be identified. The appropriate climate for RU and the right institutional culture demanded that organisational processes such as mission, vision, goals and policies that support RU be in place (Grobbelaar & Harber, 2014). Moreover, the existence of M&E efforts aimed at ensuring the effectiveness of any existing RU activities could be ascertained through a document review.

To increase the level of accuracy the documentary review was carried out using the data triangulation method (Lauri, 2011). With this, information is cross-verified from other sources in order to ascertain its veracity. For example, in order to consider how the university could play a role in national development, it was necessary to look at what the university had set out

to do as far as its aims and objectives were concerned. These objectives were then compared to national projections and policies regarding developmental projects in order to match them up. These pieces of information could then be compared with existing trends.

It was fairly easy to quantify the data and information obtained, and this could be used to contrast this research with other research. The analysis of such quantitative data was more specific in helping to create new theories and test existing hypotheses.

The university has three main sources of information as far as research publication is concerned, namely the *Journal of Science and Technology* (JUST), the *Technocrat Magazine* and the quality Assurance bulletins. These are the main sources available for staff to publish their research internally. JUST aims primarily to publish articles resulting from original research – pure or applied – in the various aspects of academic endeavour, broadly classified as science (physical or biological), technology and the humanities. JUST also publishes technical notes and reviews. Technical notes give opportunity to present preliminary but meaningful results on how certain problems are solved. Reviews give opportunity to experts to provide readers with a thorough review and analysis of issues in a subject area of relevance.

Publications in JUST are not restricted to any particular college but covers all research submitted by researchers across the colleges of the university. For an article to be published, only those that are shortlisted and sent for external review end up being selected. To ensure good-quality publication, the primary criterion is that these articles must contribute to the advancement of knowledge in the respective fields. Articles submitted to other publishing houses are not accepted although manuscripts published in un-refereed magazines, proceedings or elsewhere may be accepted subject to satisfying the requirements for publishing in JUST (Books and Publications Committee, 2015).

The Quality Assurance Bulletin of the Vice-Chancellor's Office (QAPU, 2017) is an annual compilation of all research that has taken place within the six colleges of the university. It does not publish the details neither the abstracts of the research but merely provides a reference list of all research titles carried out during the year under review. Therefore, to ascertain the quality and details with reference to research in the Quality Assurance Bulletin there was a need to refer to other documents either within or outside the university. The *Technocrat Magazine*, a science and technology magazine, on the other hand, features some research works of staff of the university but does not feature full academic articles. The criteria for selecting articles for publication in the *Technocrat Magazine* are not as rigorous as those of JUST.

In order to validate the data and information from any of these three publications a cross-verification was done from other sources. For example, data taken from the *Quality assurance basic statistics* booklet (QAPU, Basic Statistics, 2017) was verified from the source, that is, the college or department from where it originated. This was done with the view to strengthen the current study and give more credibility and validity to the data. The data triangulation method used in this case was therefore that of data source triangulation, in which case we used data or information from different documents within the university. To validate some of the information obtained from these documents further, the author carried out interviews involving key personalities and researchers who had been involved directly with the data or information gathering for the publication.

The adaptation of the data source triangulation method (Lauri, 2011) put the author in a position to gain more insight into the information being gathered. This helped to reduce the margin of error or the level of inadequacies as against using one data source. This method gave more complementary, comprehensive, valid and verifiable data and information with fewer inconsistencies.

The university documents that were used in this study were approved by the Academic Board of the university and are published here by authority of the university. They therefore have the necessary legal backing and thus can be relied upon as authentic data. That notwithstanding, efforts were made to verify and authenticate all information used from these sources.

The element of the ecology and external drivers of focus comprise analysis of the extent of involvement of the university in the national development planning and implementation process, discussed in Chapter 6 of the study. This informed what to look out for in the documents that were reviewed providing answers to the research questions and objectives as outlined in the framework. The first research question (see sub-section 1.4) had to do with national and local development plans where the university could play a role. In the document review, we looked out for sector-specific research areas within the university and matched those with national and local research objectives. In the case of the university, the Quality Assurance Bulletin and JUST were good sources of information. Nationally, the National Development Planning Commission (NDPC) had documented plans and reports that contained the national and local developmental needs and goals (NDPC, 2006; NDPC, 2014). For example, in the agricultural sector, pest-resistant crops are a problem to local farmers as well as at national level. The Ministry of Agriculture hopes to resolve such challenges among others. We therefore considered the preparedness of the university to help resolve this challenge by

looking out for agriculture-related research within the university that are applicable to national needs. We also considered research publications with the potential for uptake at national and local level. In effect, we hoped to find answers to what the local and national research needs are and what the university is currently doing or is capable of doing to address these national needs.

The table below presents a summary of how the document review was carried out with particular reference to the research questions, areas of focus, what we looked out for and how these contributed to the study.

5.6.1.1 Source 1: Document analysis

Table 5.3 below provides a summary of document review necessary for research questions 1, 2 and 4.

Table 5.3: Summary of analysis of document review

Research questions addressed	Framework component	Specific documents analysed	Focus areas and implications
1. What are the areas of local, national and general development focus and objectives where KNUST could play a role? This constitutes some of the external drivers of focus that propels the university's research agenda.	1: external drivers of focus.	Official university documents such as statutes of the university, which spell out its mission and vision. <i>Journal of Science and Technology</i> (JUST: 2004–2014), <i>Technocrat Magazine</i> and the Quality Assurance Bulletin of KNUST. NDPC's development plans and reports (2006–2015)	We reviewed these documents to determine: -what makes the university relevant; its history, activities in communities, participation in higher education; -the organisational processes; mission, vision, goals, policy and capacity; and -government's development focus. It is from these that we then established the point of convergence whether or not the university is playing a role in the national developmental agenda and in which specific areas.
2. What are the current modes and pathways of research utilisation at KNUST? Here we identified knowledge production and dissemination activities being used and those not being used at KNUST and their implications for research utilisation strategy.	Internal drivers of focus	Reviewed existing university policy-related documents, such as statutes, research policy, conditions of service and code of ethics.	The organisational processes within the university should aim at institutionalising RU activities into the institution's research cycle.
4. How is research (uptake) currently managed at KNUST?	Internal drivers of change	Reviewed existing university policy-related documents such as statutes, research policy, conditions of service and code of ethics.	We focused on reviewing existing policy documents and how they promote RU and utilisation

5.6.2 Survey

This section outlines the structure of the survey instrument, the questions and areas of focus, the survey process, and what it intended to achieve. Details about the survey process are

provided as well as the target audience and questions asked. A structured campus survey, which involved the administration of questionnaires and structured interviews involving academic staff (lecturers and research fellows), was carried out at KNUST.

There were three categories of staff, comprising:

- senior members (lecturers or research fellows, senior lecturers, professors and their equivalents of administrative and professional staff);
- senior staff (mainly first-degree holders who serve as administrative assistants and junior technicians); and
- junior staff. (made up of secondary school leavers and below)

Our focus was on those who were expected or required to undertake research. The survey sought to solicit the input of staff to ascertain the mechanisms and activities necessary for RU. Structured questionnaires were used to solicit inputs from academic and research staff. As a follow-up to the survey, interviews were conducted for selected categories of research staff in order to validate the inputs from the survey.

Pilot testing of the questionnaires was carried out to ascertain possible misconceptions. In terms of data coverage, only a sample of the staff of the university was covered. All information about this target population was available and could be accessed with permission. Electronically designed questionnaires were therefore administered to over 600 staff comprising academics and research fellows. The design of the questionnaire focused on stakeholder identification and engagement, channels and mechanisms of engagement, importance and benefits of engagement, and the barriers and facilitators to RU.

From the research questions, the survey instrument teased out existing knowledge production and dissemination activities within KNUST and also identified some knowledge production practices outlined in the literature but not being used at KNUST. This was with the view to establish existing modes and pathways to research utilisation. Besides, the instrument was also intended to establish and confirm the barriers, constraints and facilitators for optimal research utilisation and how these can be addressed.

In view of the above, respondents to the survey had to address questions like:

- What kind of stakeholders or audiences do you engage with? In other words which stakeholders directly or indirectly do you involve in your research activities?
- What are your channels or mechanisms of engagement with these stakeholders? At what stage of your research do you involve your stakeholders?

- What are the benefits of stakeholder engagement?
- What do you consider as the major constraints to research uptake?

These were some of the questions that were asked and, in most cases, follow-up questions were added in order to obtain unambiguous answers. These questions helped unearth, among others, the nature and scope of knowledge production, different approaches to RU in different fields of study, the barriers, constraints and facilitators to RU, and how these influence research activities.

The nature and level of knowledge production, research activities and the form and focus of teaching were uncovered through this structured survey covering academics expected or required to engage in research activities. Appropriate questions to elicit responses unearthed how academics and researchers go about research activities, including determination of the content of academic programmes. The ecology as well as external and internal drivers of focus was addressed by looking at the university's community engagement programmes along the lines of its vision and mission. This researcher conducted an interview with the operators of the Vice-Chancellor's Community Impact Programme to obtain some insight into its activities. The university's engagement with the external environment, particularly communities and stakeholders, was examined at this point. Other issues relating to history, participation in higher education, enrolment gap, poverty and income levels were extracted from existing documents. As indicated, the university statutes, policy documents and journals were good sources of information because they are legally approved and published by authority of the university. Policy-related changes and structure were also considered here.

The element of the form and focus of teaching and knowledge production led us to establish how the university works with local enterprises and communities. Once we had determined this through our survey, we arrived at an answer to the question on the pathways of RU and knowledge production activities at the time of this research. The form and focus of knowledge production and dissemination enhances the developmental role of the university and thus provided pointers to the essential elements to be incorporated into the RU strategy framework. These two elements moreover led us to determine how RU was managed at the university at the time of this research. With regard to the systemic and institutional barriers to RU, we looked at the element of barriers and changes in control of governance of the university. Here, the appropriate survey questions as outlined above had to tease out existing barriers or constraints to RU as well as the institutional capacity gaps that needed to be addressed. One constraint was the availability of knowledge resources and extension activities for which a solution had to be

found. These have implications for the university's engagement with the external environment and stakeholders and thus the need to consider the element of the form and focus of industry and community engagement.

The survey process comprised a combination of web-based and personal interviews covering all six colleges of the university, namely CANR; College of Art and Built Environment, College of Engineering, CHS, College of Humanities and Social Science, and COS. Together these colleges run a total of 79 academic programmes across several fields. Since each college runs programmes in different disciplines, the pathways to RU are likely to be different. Capacities at institutional and individual level also vary from college to college. The main focus however was on three out of the six colleges, namely CHS, CANR and COS. These colleges have been at the forefront of most research with the potential for uptake. The Faculty of Agriculture, for instance, has had significant influence on the nation's economy through the training of extension officers, development of crop varieties and advocacy for good agricultural practices. Similarly, the CHS and COS through their graduates and research activities have also had some impact on society. A survey across these colleges provided us the benefit of assessing the context of application for knowledge production and RU activities in the various fields.

Academic and research staff in the colleges by the terms of their appointment have a responsibility towards teaching, research and service to community. In addition, there are research fellows, whose core mandate is research, working in the research centres attached to each of the colleges. At the time of this research, there was a total of 1 121 senior members in the university, comprising 987 academic senior members and 134 administrative and professional senior members. The main target of the survey was to reach research-active academic staff but a sample of the administrative and professional staff was necessary to validate the outcome of the academic survey. The sampling plan involved targeting at least 300 research-active staff. A quota sample of at least 50 was selected from each of the six colleges, with a proportionate sample picked from each department within the college. A response rate of over 60% was expected due to the procedure adopted.

The main procedure for the survey was a web-based administration of a questionnaire. However, in order to increase the response rate, eight carefully trained field assistants (postgraduate students) went from college to colleges to administer the questionnaire. These were adequately informed about the objectives of the survey so they could appreciate issues relating to the respondent's understanding of the questions. Equipped with a laptop and Internet access, the field assistants could enter the responses directly into an Internet-based programme.

In most cases, the interview dates and meeting times were prearranged for the convenience of the respondents. Questions ranging from stakeholder engagement, channels and mechanisms of engagement, barriers and constraints to research activities and how these can be addressed had to be responded to. It was required that respondents be given enough time to think through their answers while follow-up questions were asked in order to determine the respondents' understanding and interpretation of questions (Organisation for Economic Co-operation and Development [OECD], 2012). An early pretesting of the survey, i.e. piloting, was carried out with a small sample of 20 for identification of any possible weakness in the survey, and subsequent refining of the instrument was done as proposed by OECD (2012) and Shelley (2001). Table 5.5 below reflects a summary of the survey framework.

5.6.2.1 Ethical considerations

As is typical of such surveys, the necessary permission and approval was obtained from the institution (Koivula et al., 2011). As already indicated, the samples used comprised mainly university staff who have email addresses; hence, they were informed about the survey electronically. The sensitivities of staff were taken into consideration and the survey was carried out in accordance with laid-down principles of conduct. An effort was made to guarantee and protect anonymity in administering the questionnaires and carrying out the interviews. Participation in the survey was voluntary.

5.6.2.2 Source 2: Survey framework

The survey framework is as given in Table 5.4 below.

Table 5.4: Survey framework

Research questions addressed	Framework component	Survey target audience	Questions asked and possible deductions
1. What are the areas of local, national and general development focus and objectives for which KNUST can play a role? This constitutes some of the external drivers of focus that propels the university's research agenda.	1: external environment – external drivers of focus.	The category of staff surveyed comprised mainly Senior Members, namely lecturers, research fellows, senior lecturers, senior research fellows, professors and their equivalence of administrative and professional staff.	Some of the survey questions first sought to find out who the audiences were and whether or not this referred to government agencies, namely ministries, departments and agencies. The specific ministries and agencies provided pointers to the areas of national development.
2. What are the current modes and pathways of research utilisation at KNUST?	2 and 6: internal drivers of focus, change in form and focus of knowledge production and dissemination	Senior members of the university	Questions centred on the channels and mechanisms of engagement with specific stakeholders or audiences helping to determine existing knowledge production and dissemination activities and those not in practice. We asked questions on how researchers engage with stakeholders by providing a wide range of options covering dissemination activities, their importance and benefits. Also examined were the extent of engagement and at which stages of the research process researchers engage with stakeholders.
3. What are the barriers and constraints (institutional/systemic) for optimal research uptake and utilisation?	3: barriers to change	Senior members of the university	Questions referred to what researchers considered barriers and constraints to RU with options on barriers both at individual and institutional level. Listed among the barriers were capacity gaps that could hinder the utilisation of research. These included financial constraints, HR challenges, relevance of research to stakeholders and resistance to change.
4. How is research (uptake) currently managed at KNUST?	4: changing control in governance of the university	Senior members of the university	Questions were aimed at determining in which specific activities researchers at the university engaged for optimum RU. This concerned how researchers and the university relate with external stakeholders. Here we deduced the means to improve stakeholder engagement.

<p>What are the essential elements to be incorporated into a strategic research uptake framework for the University, researchers and policy makers?</p>	<p>5 and 7: form and focus of teaching, form and focus of interaction</p>	<p>Senior members of the university</p>	<p>How does the university engage with local communities? Deducing which of the following were considered necessary in the research process:</p> <ul style="list-style-type: none"> • involving users in research design; • involving users in the entire research process; • communicating research to external audiences; • publishing research in refereed journals; • public forum to discuss research. <p>How can stakeholder engagement be improved to bridge the gap between knowledge production and utilisation?</p> <p>How does one relate with your stakeholders?</p> <p>To what extent does the university involve these stakeholders in its activities?</p>
<p>5. What are the key institutional and individual capacity gaps, human and financial resources (at both management and operational levels) that need to be addressed in order to equip staff at KNUST to maximise the uptake, utilisation and impact of developmental and applied research?</p>	<p>All</p>	<p>Senior members of the university</p>	<p>Which of the under-listed do you consider as barriers to research uptake?</p> <ul style="list-style-type: none"> • Funding/resources • Attitude • Lack of awareness of research • Lack of dissemination activities • Lack of capacity in RU • Lack research policy design • Lack of knowledge in research process • Lack of development focused research • Any others?

5.6.2.3 Sources of options to survey instruments

The sub-headings, A to F below provide a brief review of the literature sources for the various options provided for in the questions of the survey instrument. Specifically, we list the references from which the various options were derived as response categories for the survey questions. As outlined in the literature review and other sections of the study, respondents were provided with various options to questions in order to deduce specific aspects of research activities in relation to specific audiences. The survey instrument was divided into six main sections, details of which are discussed below.

A. Demographics

This first sub-section of the survey instrument consisted of nine demographic questions, which sought to determine the title of researcher, his or her gender, year of birth, department, position, highest educational qualification, where obtained and year obtained. These had direct implications for knowledge production and dissemination activities, necessary for the purposes of analysis. The gender of the respondent was necessary for us know the extent of involvement by male and female academics. The year of birth gave us the age profile to determine active age group and whether or not age has a role to play in research activities. The department of the person gave the subject area of specialisation and this helped us know which subject area had more research active academics than other at the time of this research, and which was making more impact. In terms of position or status, it could be expected, for example, that a professor, due to his or her experience would have a higher level of stakeholder engagement than an inexperienced young or early career researcher. Academic qualifications determine the area of specialisation, skills and focus of research and effectiveness in engagement activities. This sub-section comprised questions 1–9, designed to give respondents the opportunity to provide their background information.

B. Stakeholders of research

The second sub-section had just one component, which examined the kinds of stakeholders with whom researchers interact or involve in their research and dissemination activities. The specific question was, “What kind of stakeholders or audiences do you engage with? In other words, which stakeholders directly or indirectly do you involve in your research activities?” A five-point scale of responses (Always, Usually, Sometimes, Rarely and Never) was provided for the options as derived from Sudsawad (2007), namely:

- communities (both within and outside the university);

- private sector (this included industry or large firms and SMMEs);
- government (ministries, departments and agencies [MDA]) and parastatals;
- researchers and scientists (this included other universities and research institutes); and
- non-governmental organisations (NGOs), such as charities and funders. Sudsawad (2007) refers to these stakeholders as ‘user groups’ whose operational contexts, attitudes and practices have implications for the extent of KU (Sudsawad, 2007).

Similarly, Grimshaw and Eccles (2012) in examining stakeholder awareness and use of research evidence listed the following as users or stakeholders:

- policymakers;
- professionals;
- consumers;
- industry; and
- researchers (Grimshaw & Eccles, 2012).

We noted that these options fall directly in line with those of Sudsawad (2007) as the main stakeholders with whom researchers have to do business.

The DRUSSA Benchmarking Survey reports 2014 and 2016 listed the following among the stakeholders with whom universities frequently engage:

- government, ministries, departments and councils;
- research funders and donors;
- enterprise and industry;
- media agents;
- teachers and educators;
- farmers and agriculturists;
- health and medical professionals;
- publishers;
- Non-governmental organisations (NGOs), international non-governmental organisation (INGOs) and international associations;
- other universities (domestically and internationally);
- informal sector; and
- environmental groups and agencies (DRUSSA, 2014; 2015).

It must, however, be noted that the extent of stakeholder relationships for each of the above varies according to research type and areas of specialisation, as can be deduced from Section

A, on demographics. The survey question on the extent of stakeholder engagement was intended to prioritise stakeholder relationships. Question 10 of the survey instrument therefore sought to identify the key stakeholders of researchers and how often they interact with them. The summary of the literature sources is provided in Appendix B.1.

C. Channels and mechanisms of engagement with communities

This third sub-section was intended to look at channels and mechanisms of engagement with communities. The sub-section was divided into four components, namely channels of engagement with communities, benefits of engagement with communities, stages of involving communities, and barriers associated with RU as far as communities are concerned.

The first component required of respondents the channels and mechanisms through which they engaged with communities around the university. A five-point scale of responses (Always, Usually, Sometimes, Rarely and Never) was provided for the options adapted from Hood (2002), Becheikh and Ziam (2010), Cherney et al. (2012) and DRUSSA (2014; 2015). According to Cherney et al. (2012), research use is operationalised through a cumulated process, progressing through stages, namely:

- Transmission – refers to means by which research is transmitted to various stakeholders or audiences, for example social media, publication in journals, exhibitions, research fairs, conferences and workshops (Becheikh & Ziam, 2010; Cherney et al., 2012; Hood, 2002).
- Cognition – refers to the stage where the research is understood by the stakeholder groups to whom it was intended and therefore the likelihood of the research being used is high (Cherney et al., 2012).
- Reference – refers to situations where the research is cited in reports and strategies.
- Effect – refers to where there are efforts to utilise the research.
- Influence – refers to where the research has influenced decisions and choices of end users
- Application – refers to when the research is applied (Cherney et al., 2012)

Similarly, Hood (2002) argues that there are channels and mechanisms of dissemination with the aim of getting research into use. These involve processes that consider the following:

- needs;
- context;
- prior experiences;

- values;
- beliefs of intended users;
- content;
- media;
- formats;
- language used; and
- activities of users (Hood, 2002).

Some of the specific channels and mechanisms include:

- exhibitions;
- publications in refereed journals;
- public forum;
- curriculum development;
- community-based research;
- community-based networks;
- adopting communities for research;
- use of social media; and
- drama or theatre.

Becheikh and Ziam (2010) also emphasise the determinants for knowledge use as attributes of the transferred knowledge, actors in the knowledge transfer process and the transfer mechanisms as outlined above.

The DRUSSA Benchmarking Report of 2014 outlined the priority mechanisms listed below to engage with external stakeholders:

- collaborative research with other universities;
- industry or private sector representation on research boards and/or councils;
- government or public sector representation on research boards and/or councils;
- stakeholder consultations in setting the research agenda; and
- stakeholder consultations at the research dissemination stage (DRUSSA, 2014).

Broadly speaking, these priority mechanisms can be adapted to suit community-based engagements. Specifically, we adapted the above mechanisms as follows:

- collaborative research with communities;
- community representation on research advisory boards and councils;

- involving communities in setting research the agenda; and
- consulting with or involving communities in research dissemination.

Research question 11 of the survey instrument therefore sought to determine which of the above means researchers use in their engagement with communities around the university. The summary is provided in Appendix C.1.

The second component of the survey sought to determine from respondents the benefits that can be derived from engagement with communities. Here again, a five-point scale of responses (Very beneficial, Somewhat beneficial, Of little benefit, Of no benefit and Not applicable) was provided for the options as derived from Bozeman (2000), Jacobson et al. (2007), Sudsawad (2007) and Cherney et al. (2012).

According to these authors, the operational context within which knowledge is transferred is should be conducive enough to obtain positive results. Among the operational context were attitudes, decision-making practices, access to information sources, stakeholder's attitudes towards researchers, experiences of researchers towards knowledge transmission, compatibility of research to user groups or stakeholders, relationships between researchers and user groups (DRUSSA, 2014).

The expected benefits accruing from the above included chances that the research will be used to solve problems, for modification of research, as opportunities for further research, to influence policies and decisions of policymakers, to open avenues for collaboration, provide opportunities for innovations and justification for funding as part of fulfilling their contract agreement (Bozeman, 2000; Jacobson et al., 2007; Sudsawad, 2007). Question 12 of the survey instrument sought to emphasise benefits that arise from engagement with communities. The summary is provided in Appendix C.2.

The third component of the channels and mechanisms of engagement required of respondents to indicate the stages at which they involve communities in their research process. A five-point scale of responses (Always to Never) was provided for the various options. Researchers are expected to involve stakeholders in their research process for the needed acceptance and subsequent research use (Nicholson-Cole & Whitmarsh, 2008). The stages at which this is done, vary from researcher to researcher. There is also the possibility that some researchers and research types do not involve stakeholders at all. The question here is to determine the stages of involvement of stakeholders if any. The DRUSSA Benchmarking Report 2014 and 2016 listed some stages of stakeholder involvement in the research process as follows:

- involvement in setting the research agenda, research design stage and research dissemination stage;
- the research proposal or development stage;
- data collection and analysis stage;
- during the research process, during the research report drafting stage, during the final report and dissemination stage; and
- at all stages of the research process (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole and Whitmarsh, 2008).

Question 13 of the survey instrument was designed to find the stages of involvement. Appendix C.3 presents a summary of the sources.

The fourth and last component of channels and mechanisms of engagement with communities considers individual and institutional barriers that are associated with RU and utilisation at community level. Question 14 of the survey was intended to identify some of the common barriers. Here again, a five-point scale of responses was used, and some options adopted from Humphries (2014), Sedlacko et al. (2013), Oliver et al., (2014) are provided with 'Other' as the last option.

Humphries (2014), Sedlacko et al. (2013), Oliver et al., (2014) outline the following barriers to the use of evidence in management within the healthcare system:

- information (related barriers as far as communities are concerned include research without relevance or clarity, misunderstanding and wrong perceptions of research) (Humphries, 2014; Oliver et al., 2014);
- organisational structure and process (related barriers include a lack of resources to support research and cost, a lack of HR capacity, financial constraints, inadequate planning processes and sometimes even an absence of such processes, a lack of support from management, and poor communication) (Humphries, 2014; Oliver et al., 2014; Sedlacko et al., 2013);
- organisational culture (related barrier here is mainly resistance to change by communities, which may be due to the cultural influences) (Humphries, 2014; Sedlacko et al., 2013);
- individual (related barriers include inadequate skills and experience on the part of researchers to disseminate research, a lack of personal motivation on the part of researchers to disseminate research) (Humphries, 2014; Oliver et al., 2014);

- interaction (barrier identified relates to the gap between researchers and users due to a lack of contact and mutual understanding among them) (Humphries, 2014). Appendix C.4 provides a summary.

D. Channels and mechanisms of engagement with private sector

This sub-section looks at the channels and mechanisms of engagement with the private sector which includes industry, large firms, and SMEs. Similar to Section C above, this section comprises four components, namely channels of engagement with the private sector, benefits of engagement with the private sector, stages of involving the private sector, and the barriers associated with RU.

These components require respondents to indicate on a five-point response scale their channels and mechanisms of engagement with the private sector, the benefits and stages of involvement and the barriers to research use. The options available are adapted from the same literature sources as in the case of communities but with some additions.

As already discussed, (see sub-section 3.2), the NCDDR (1995) and Bozeman (2000) expanded on some elements of the knowledge transfer process that need attention in considering the channels and mechanisms of engagement with stakeholders. Key to this is the fact that the researcher must provide knowledge that –

- is credible and acceptable to the user or stakeholder;
- addresses specific issues; and
- of which the content must be clear, applicable, unambiguous, simple and non-complicated.

When there is an effective collaboration between researchers and users, the possibility of research use is high. According to Cherney et al. (2012), one needs to look out for the following in the knowledge production and dissemination process: research is transmitted to end users, understood by users, cited in reports, used in strategies, there are efforts to use research, research has influenced policy, decisions or choices, conferences, workshops, technical reports (Cherney et al., 2012). These may be seen as advantages or benefits to an effective translation of research.

Research ought to be transferred through means that will make it reach the stakeholders. The mode of transfer includes conferences, publications or journals, written documents, social media, joint research, commissioned research, serving on boards and councils (Becheikh et al., 2010). Due consideration must be given to the characteristics and attributes of the transferred

knowledge, actors in the knowledge transfer process (researchers, users, knowledge brokers, lobbyists, linkage agents), and the transfer mechanisms as already outlined above.

Huberman (1994) expounded on the “linkage mechanisms” to knowledge translation (Huberman, 1994:13). Huberman (1994) argues that, for research to be utilised, there is a need to determine knowledge needs of users, introduce “intermediaries” and “informants” to help researchers collect data and provide feedback (Huberman, 1994:13). Such intermediaries include lobbyists, think tanks, advisory boards, platforms, associations, the media, research institutes and university departments (Mitton et al., 2007). Much earlier, Larsen (1980) argued that effective transfer of knowledge is influenced by the organisational characteristics, the characteristics of the knowledge produced, the characteristics of the stakeholders and users, the characteristics of the source, strategies for dissemination, linkages between the researcher and users among others. These have been corroborated by Innvaer and Vist (2002). The strategies for dissemination include joint research, collaborations, contract and commissioned research, workshops, conferences as well as serving on boards and councils (Innvaer & Vist, 2002).

In terms of the stages of involvement, it is argued that stakeholders ought to be involved at all stages of the research process, from conception, through to the research process, including data collection, dissemination and final report writing (Bozeman, 2000; NCDDR, 1995). Similar arguments are advanced by Nicholson-Cole and Whitmarsh (2008) and the DRUSSA Benchmarking Reports 2014 and 2016 as already explained in the previous section.

In addition to the points elaborated on in C above, information-related barriers include limited access to research information or availability and timely delivery of research results. Organisational structure-related barriers here would include a lack of data, organisational culture-related barriers such as decision-making culture, crisis management culture and political influence on decisions; individual barriers include a lack of formal training in research management; and interaction barriers (Humphries 2014, Sedlacko et al. 2013, Oliver et al., 2014). It is further argued that there are barriers associated with the research, the extent of stakeholder involvement, communication and other factors, such as a lack of capacity to disseminate and use research and a lack of budget lines for research activities (Andrews, 2012).

Questions 15–18 of the survey instrument examined the channels of engagement with industry, the benefits of engagement, stages at which stakeholders are involved in the research process, and the barriers to RU as far as the private sector is concerned. A summary of the options adapted from the literature for all the components are presented in Appendices D.1–D.4.

E. Channels and mechanisms of engagement with government and parastatals

This sub-section discusses the channels and mechanisms of engagement with government (MDA). As in the case of sub-section D above, this sub-section is divided into four components:

- channels of engagement with government measured with a five-point response scale (Always to Never);
- benefits of engagement with government measured with a five-point response scale (Very beneficial to Not applicable);
- stages of involving government in the research process measured with a five-point response scale (Always to Never); and
- barriers to RU as far as government is concerned also measured with a five-point response scale (Always to Never).

As expounded in the sections A-D above, the options for the four components were adapted from the same authors with further expansion on the individual and interaction barriers. Additional barriers in this case were inadequate skills and experience of policymakers in research literacy, a lack of formal training in research management and a lack of interactions between decision-makers and researchers (Humphries 2014; Sedlacko et al. 2013; Oliver et al., 2014). Appendices E.1–E.4 reflect the summaries. Questions 19–22 of the survey instrument addressed these issues. An option for ‘Other’ was listed at the end of each of the components to enable respondents to state other options if any.

F. Channels and mechanisms of engagement with scientists and researchers of other universities and institutes

Similar to the previous sub-sections, this sub-section discusses the sources of the options in the survey instrument. Specifically, we consider channels and mechanisms of engagement with scientists and researchers of other universities and research institutes. Similar arguments are advanced here in terms of the literature on the options provided for the questions in the survey instrument. We therefore adapted the options from the literature to suit the purposes of the discussion.

As in the case of sub-section E above, this sub-section is also divided into four components, namely:

- Channels of engagement with scientists and researchers from other universities and research institutes. A five-point response scale (Always to Never) was used.

- Benefits of engagement with scientists and researchers from other universities and research institutes, using a five-point response scale (Very beneficial to Not applicable).
- Stages of involving scientists and researchers from other universities and research institutes in the research process, measured using a five-point response scale (Always to Never).
- The barriers to RU as far as scientists and researchers from other universities and research institutes are concerned. Again, a five-point response scale (Always to Never) was used with an option for ‘Other’ for respondents to add if any. Questions 23 to 26 of the survey instrument addressed these issues. The summaries of the options are provided in Appendices F.1–F.4.

In concluding this sub-section, it must be stated that these literature sources are not exhaustive in themselves. Several other authors in the KU field (Cordingley, 2008; Ellen et al.; Andrews, 2012; Boshoff, 2013; Grobbelaar, 2013; DRUSSA, 2012, 2014, 2016) discussed issues about stakeholder mapping, stakeholder engagement and dissemination practices with implications for RU. The above options notwithstanding, the researcher envisaged that respondents may have other options. For this reason, options for ‘Other’ were provided for in all the sub-sections in the survey instrument. It was trusted that the five-point response scale would provide sufficient feedback for the analysis.

5.6.3 Interviews

In order to confirm some of the views articulated during the survey further, interview sessions were conducted for selected researchers who had given their consent during the survey. This sub-section provides some description on the interview procedure and the line of questioning.

Face-to-face interviews: To validate and elaborate the findings of the survey, face-to-face interviews were conducted with 20 of the respondents to the survey questionnaire. The interviews were recorded in order to enhance the flow of discussion and to reduce the risk of subjectivity during note-taking. Face-to-face interviews are necessary because during the analysis there is opportunity to refresh one’s memory by going over the recorded material (Yin, 2009; Shelley, 2001; Lauri, 2011). Table 5.5 below provides a summary of the interview framework.

5.6.3.1 Source 3: Interviews framework

A summary of the interview framework is given in Table 5.5 below.

Table 5.5: Framework for interviews

Research questions addressed	Interviewee	Framework components	Questions asked and deductions
1. What are the areas of local, national and general development focus and objectives for which KNUST can play a role? This constitutes some of the external drivers of focus that propels the university's research agenda.	Senior members of the university; lecturers, research fellows, senior lecturers, senior research fellows, professors and their equivalents.	1	<p>Questions were aimed at establishing which research staff were engaged in active research and how they had been used by stakeholders, including government. This was done to determine which role the university could play in national development.</p> <ul style="list-style-type: none"> • To what extent do you think government is using research produced by the university? <p>In order to determine how the university might contribute to national development we asked interviewees what, in their opinion, the university could do in order for government and other stakeholders to use research findings.</p>
2. What are the current modes and pathways of research utilisation at KNUST? Here we identify existing as well as non-existing knowledge production and dissemination activities and their implications for research utilisation strategy.	Senior members of the university	2 and 6	<p>We asked interviewees how they went about their research and whether or not they thought stakeholder involvement was important.</p> <ul style="list-style-type: none"> • Can you please explain how these engagements came about? • Can you please tell me how your research has been used?
3. What are the barriers and constraints (institutional/systemic) for optimal RU and utilisation?	Senior members of the university	3	<p>Follow-up questions were asked on the most common reasons why stakeholders do not use research that could be beneficial to them.</p> <ul style="list-style-type: none"> • Why do you think your stakeholders do not use research findings? • Can you elaborate on how you were successful with stakeholders using your research?
4. How is RU currently managed at KNUST? Here, we focus on the extent and levels of engagement with the external environment.	Senior members of the university		<ul style="list-style-type: none"> • How often do you engage with the following stakeholders: communities outside the university, private sector including industry, government and parastatals, NGOs? <p>Interviewees had to elaborate on the mechanisms of engagement with the stakeholders and how beneficial these had been.</p>
5. What are the essential elements to be incorporated into a	Senior members of the university	5 and 7	<p>We sought to establish the most frequently used channels and mechanisms of engagement with</p>

strategic RU framework for the university, researchers and policymakers? This is in relation to the above questions, including, the form and focus of knowledge production and dissemination, internal drivers, governance and control of the university.			stakeholders, the extent of research use and what the facilitators of research use were. The following elements were considered among the options: policy, governance, financial resources, dissemination activities, stakeholder engagement, capacity building, M&E and any other issues considered relevant.
6. What are the key institutional and individual capacity gaps, human and financial resources (at both management and operational levels) that need to be addressed in order to equip staff at KNUST to maximise the uptake, utilisation and impact of developmental and applied research?	Senior members of the university	All	<ul style="list-style-type: none"> • What are the key institutional and individual capacity gaps, human and financial resources (at both management and operational levels) that need to be addressed in order to equip staff at KNUST to maximise the uptake, utilisation and impact of developmental and applied research? <p>Follow up questions arose from the responses provided.</p>

5.6.4 Data analysis

The data obtained from the above approaches, i.e. document search, questionnaires and interviews were individually analysed and integrated into the overall analysis. Data triangulation was used for the verification of information gathered from documents during the document review while interviews were carried to validate the responses obtained from the survey. The statistical analysis and evaluation of the information from the survey was carried using Statistical Package for Social Sciences (SPSS) also known as Predictive Analytics Software (PASW), a standard statistical package for quantitative analysis. ATLAS.ti, a qualitative analysis software, was used for the analysis of the interviews. This includes all coding and derivation of themes, examination of trends, expectations and emerging networks and relativities.

5.7 Administration of survey and interviews

The administration of the survey took about seven weeks. The survey instrument (questionnaire) was converted into an online web-based questionnaire by a qualified survey administrator. The web-based questionnaire, administered through SurveyMonkey, used software that was able to convert all responses into an Excel file, which could be downloaded.

The system was pre-tested and piloted with ten academic staff and was validated to be an effective means to reach the target audience. Thereafter, an email was sent to the target audience explaining the objectives of the survey. The university has a directory, which contains the names, designation, email addresses and telephone numbers of all staff. At the time of the survey, this was being revised to update and capture the details of all new staff who had joined the university since the last publication in 2014. At the time of this research, the University Information Technology Services (UITS) unit was host to the mailing list for staff and this was available for use with permission.

The first batch of emails were sent via the university mailing system (those using knust.edu.gh addresses) and was expected to reach about 600 academic staff. However, it was found that some staff did not receive the mails due to system failure, official email addresses being redundant and inactive email addresses. We therefore had to resort to the use of private email addresses such as Yahoo mail, Gmail and Hotmail. These proved to be a bit more effective with many receiving their invitations. The emails included a hyperlink for respondents to click on in order to access the survey.

Participation in the survey was voluntary and anonymous, and respondents could opt out at any time should they wish to do so. Respondents were also assured that the information they provide would be confidential. The survey offered the option for respondents to provide their names and email addresses for the purposes of possible follow-up interviews of those who willingly wish to grant further interviews. Respondents who were not comfortable with providing their names, year of birth and addresses were allowed to do so although these were only 4.5% of the valid sample.

The first batch of emails was sent out in the middle of May 2017 and the last batch in the first week of July 2017, a period of about seven weeks. These mails were expected to reach about 600 academic staff taking into consideration the number of inactive email addresses and about 15% that bounced back. During the period of administering the survey, three reminders were sent while there were one-on-one contacts for those who wished to complete hard copies, which were later entered into the web-based system. The one-on-one contacts and selective phone calls gave an indication that, although many received the invitations via email, they could not find time to complete them online. This might have been due to the timing of the survey. At the initial launch of the survey, examinations were in progress and academic staff were occupied with examinations. Shortly thereafter, there were demands for examination scores to enable final-year students' graduation in about two months after completion of the

examinations. The situation brought an enormous pressure on academic staff. This, apart from general apathy, may have contributed to the initial slow inflow of responses but eventually ending up with a fairly good response rate.

5.7.1 Analysis of the survey

Out of 228 responses received from the survey, there was some duplication of names and similar email addresses, which had to be cleaned up. The remaining 202 responses were found to be sound and valid. The 202 valid responses, out of the mailing list of 669, therefore, constituted a 30.2% response rate. The respondents were fairly evenly distributed across the six colleges and specialisation areas. Of the respondents, 100% provided their department or faculty, position, highest qualification, the year the highest qualification was received and the institution from which the highest qualification was obtained.

The Excel file with the cleaned data obtained from the survey was imported into SPSS Version 16.0, a software program for the analysis of quantitative data. Univariate analysis, involving frequency tables and summary statistics, was carried out as discussed in the subsequent sections of this chapter. In addition, bivariate analysis, involving cross-tabulations, was carried to examine the relationships between variables. The correlations between variables are discussed in section 7.4.

5.7.2 Analysis of interviews

As already discussed in detail earlier in this chapter, interviews had to be conducted after the survey. In order to validate and seek further clarifications on some of the responses from the survey, 20 respondents were selected for interviews based on the following criteria:

1. interviewees had to be respondents to the survey;
2. they had to indicate willingness to be interviewed;
3. they had to be research active and should have had research outputs ranging from at least 1–5 (determined by question 10 of the survey);
4. the overall value of their research should be at least beneficial to some extent (question 11);
5. they should have engaged sufficiently with their selected stakeholders at least annually (question 12 & 13);
6. there had to be an indication of their mechanisms of engagement with stakeholders being somewhat beneficial (question 14);

7. they had to show an indication of having involved their stakeholders at some point in their research process (question 15); and
8. they should have identified the most common barriers and constraints to the use of research by their stakeholders (question 16).

Those who met the above criteria were selected and spread across the various positions, namely:

- lecturer/research fellow;
- senior lecturer/senior research fellow;
- associate professor and equivalents; and
- full professor.

Another important consideration in the selection of interviewees was the different fields of research, and this was given due attention during the selection process since the different fields had different forms of engagement. Respondents were therefore selected from the different fields and as much as possible for different positions and gender. Table 5.6 below gives the distribution of selected interviewees.

Table 5.6 Distribution of interviewees

INTERVIEWEE	COLLEGE	GENDER	RANK	DEPARTMENT
R1	COS	Female	Professor	Food Science
R2	COS	Female	Senior lecturer	Applied Biology
R3	COS	Male	Senior lecturer	Applied Biology
R4	COS	Male	Senior lecturer	Biochemistry
R5	CHSS	Female	Chief technician	Integrated Rural Art
R6	CHSS	Male	Senior lecturer	General Arts Studies
R7	CHSS	Male	Lecturer	Integrated Rural Art
R8	CABE	Male	Associate professor	Planning
R9	CABE	Male	Senior lecturer	Architecture
R10	CANR	Female	Lecturer	Horticulture
R11	CANR	Female	Lecturer	Horticulture
R12	CANR	Male	Lecturer	Animal Science
R13	CHS	Female	Senior lecturer	Pharmacy
R14	CHS	Male	assistant lecturer	Child Health
R15	COE	Male	Senior lecturer	Civil Engineering
R16	COE	Male	Senior lecturer	Civil Engineering
R17	COE	Male	Professor	Materials Engineering
R18	COE	Male	Senior research fellow	Technology Consultancy Centre (TCC)
R19	CHSS	Male	Lecturer	Economics
R20	CABE	Female	Lecturer	Planning

The interviews were conducted over a four-week period and were recorded. The recorded interviews were transcribed into a Word document. The transcriptions were between five to seven pages per interviewee. The documents were qualitatively analysed using ATLAS.ti, Version 8, a qualitative data analysis software program. Coding for the analysis was done based on the research questions. A report was then generated from the ATLAS.ti software and

transferred into an MS Word document. Relevant portions of the report were used in the analysis that follows.

5.8 Conclusion

This concluding section of the chapter summarises the scheme related to how information or data was gathered as far as the framework elements were concerned. The study was essentially a case study of RU practices at KNUST. As is typical in case studies (Yin, 2009), a multiple-method approach was used for the data collection. As envisaged and outlined in the forgoing discussions (see sub-sections 5.6.1, 5.6.2, 5.6.3), the following methods have been found to be the most appropriate: document analysis, survey and interviews, as recommended by Shelley (2001), Yin (2009) and Lauri (2011).

The study followed a quantitative research design and required that data be gathered on site. The data collection took place by means of a survey conducted among university teachers and researchers. The survey was based on activities towards RU, barriers and facilitators to RU. Specific areas considered along the lines of the analytical framework were:

- identification of stakeholders;
- channels and mechanisms of engagement to identify the existing pathways for RU;
- stages at which stakeholders are involved in the research process;
- the importance and benefits of engagement; and
- the individual and institutional barriers and constraints to RU.

The administration of the survey and interviews was on the campus of KNUST involving those with the responsibility to teach and conduct research. Considering the fact that there are six colleges, the survey took about seven weeks to collect the data. At least six field assistants were involved in the data collection. The field assistants scheduled visits with staff and visited them in their offices to administer the survey for those who preferred hard copies.

Essentially, the answers to research questions 2 and 3 were provided for by the survey, which was conducted within the university covering over 600 academic and research staff, many of whom were research-active at the time of this study. These questions partly covered objectives 2, 3 and 4. Objective 1 was catered for in Chapters 2 and 3 of the thesis.

The issue of key institutional and individual capacity gaps (at both management and operational level) was dealt with in Table 5.1. These capacity gaps were addressed with the aim to equip staff at KNUST to maximise the uptake, utilisation and outcome of developmental and applied research. For the purposes of our analysis, the framework for the analysis of the

transformational pathway of the university environment was adapted, as proposed by Grobbelaar and De Wet (2013).

In conclusion, we have sought to link the research objectives and questions to the literature in order to adopt the most appropriate conceptual framework as far as the aim of the study was concerned. We noticed however that much of what had been proposed and reviewed in terms of frameworks had been developed outside sub-Saharan Africa, except for those of Grobbelaar and De Wet (2013) Ellen et al., (2011) and Grobbelaar and Haber (2014), who adapted existing frameworks to suit the African context. Besides, the literature has not been explicit in terms of RU strategy for HE systems in sub-Saharan Africa. We acknowledge, also that some of the principles discussed could be relevant and applicable within the context of the study. In order to propose a culturally relevant RU strategy framework for the African HE system, and in particular Ghana, the survey went beyond just establishing and confirming what already existed by seeking to design a strategy for RU and RUM suitable for KNUST and for that matter higher education in Ghana. This primary phase provided a guide to the development of the data collection instrument and also provided answers to the research questions, leading to the attainment of the stated objectives. The data sample was obtained from academics and administrators at the KNUST in the hope that the analysis would lead to context-relevant conclusions.

It is acknowledged that different fields of study would have varying modes of research production and dissemination processes; therefore, the current design took these into consideration (Mouton, 2012). KNUST runs several academic programmes ranging from humanities to science, agriculture, medicine and engineering. Researchers are spread across six colleges running these different programmes, which afforded us the opportunity to analyse the different modes of knowledge production in different fields. In the end, we sought to adopt and adapt some aspects of existing knowledge in the field of knowledge production to propose a policy framework for RU and RUM applicable for HE institutions within sub-Saharan Africa. It is trusted that with this policy framework, knowledge generation will go beyond the boundaries of its producers into the corridors of society for impact.

CHAPTER 6 – NATIONAL AND LOCAL DEVELOPMENTAL FOCUS WHERE THE UNIVERSITY CAN PLAY A ROLE

6.1 National development planning

This section aims to answer the research question on the local and national developmental focus where the university can play a role. It discusses the establishment, role and objectives of the Ghanaian National Development Commission (NDPC), which has the responsibility for planning and execution of national development plans. Also discussed are the specific national goals and objectives where universities, in particular KNUST, could play a role in order to address the element of the external environment, the ecology and the external drivers of focus.

6.1.1 The national development planning commission

The National Development Planning Commission (NDPC) in Ghana was established as part of the government under Articles 86 and 87 of the 1992 Constitution (NDPC (System) Act, 480 of 1994). The legal framework for its establishment and the performance of its functions are enshrined in the NDPC Act, 479 of 1994 and the NDPC Act, 480 of 1994 (NDPC, 2014). Under these provisions, the NDPC is mandated to advise the President of the Republic of Ghana on the developmental strategies of the country and their planning. In this wise, the NDPC is mandated to carry out the following functions:

- study and make strategic analyses of macro-economic and structural reform options;
- make proposals for the development of multi-year rolling plans taking into consideration the resource potential and comparative advantage of the different districts of Ghana;
- make proposals for the protection of the natural and physical environment;
- make proposals for ensuring the even development of the districts of Ghana by the effective utilisation of available resources; and
- monitor, evaluate and coordinate development policies, programmes and projects (NDPC, 2014).

In addition to the above mandates the President could assign any other roles as deemed fit (NDPC, 2014). One most recently assigned responsibility of the NDPC is to coordinate and report on issues relating to the sustainable development goals (SDGs). The NDPC is expected to operate along the lines of the African Union's Agenda 2063 to build and expand an African knowledge society through transformation and investments in universities, science, technology, research and innovation; and through the harmonization of education standards

and mutual recognition of academic and professional qualifications” (ACU, 2015:15). The next sub-section discusses the national focus as far as national development is concerned.

6.1.2 The national development focus

In its quest to achieve the national strategic developmental goals, the government of Ghana through the National Development Planning Commission (NDPC) sought to place all its developmental endeavours within a long-term development framework, having in mind the Millennium Development Goals (MDGs) (NDPC, 2006). The NDPC then set out to develop the 2007–2015 development plan (NDPC, 2006). It was with the expectation that this plan would provide direction to the path of national development along the expectations of government.

Over the past few years since independence in 1957, it has been noted that Ghana’s economic growth has been relatively slow with an economy largely dependent on the export of a small number of commodities, such as cocoa, gold and timber (UNCT, 2017). The economy has not been robust enough to withstand international trends and shocks (UNCT, 2017). National resource distribution has also not been uniform; thus, depriving many sectors of the needed development. To date, some regions remain economically and socially challenged (UNCT, 2017). There have been efforts by previous governmental development plans to bring equity into national development but these have not been successful. The aim of the 2007–2015 development plan was to influence socio-economic development broadly across the country within the shorter term (NDPC, 2006). Accordingly, it was expected that the plan would achieve rapid and sustained socio-economic growth across the country by 2015 when the country would have met the respective MDGs. The final report published by the United Nations Development Programme (UNDP) in September 2015 indicated –

[O]nly slow progress was made on full and productive employment (MDG 1B), equal share of women in non-agriculture wage employment and women’s involvement in governance (MDG 3), reducing under-5 and child mortality (MDG 4), reducing maternal mortality (MDG 5), reversing environmental resource loss and improving sanitation (MDG 7) (UNDP, 2015:vi).

The unattained MDGs have since been dovetailed into the SDGs and are to be addressed in the context of the SDGs (UNCT-GH, 2017).

The 10-year development plan (UNCT-GH, 2017) of the NDPC (2006). focused on the following four areas;

1. industrial development for a small open economy;
2. modernising agriculture;
3. human capital development for structural transformation of Ghana's economy; and
4. human settlement for a changing economy (NDPC, 2006).

In all four focal areas, the current researcher is of the view that the KNUST can play a meaningful role if the necessary collaborative efforts are put in place. The research arm of government, the CSIR, established by government in August 1958, has a mandate to coordinate scientific research in Ghana (CSIR, 2017). It has 13 affiliated research institutions that provide the necessary national research requirements. The mandates of the CSIR are well spelt out. Notable among these are the fact that the Council is expected –

[T]o encourage the national interest and scientific and industrial research of importance for development of agriculture, health, medicine, environment, technology and other service sectors and to this end to encourage close linkage with the productive sectors of the economy (CSIR, 2017:2).

In addition, the Council has the mandate to coordinate “all aspects of scientific research in the country and to ensure that the Council, the research institutes of the Council and other organisations engaged in research in Ghana, coordinate and cooperate in their research effort” (CSIR, 2017:2). This researcher believes that these are well-thought-out mandates with a potential for national development, should all the arms, which include the university, play their respective roles effectively.

The national development agenda comes into sharp focus with the current SDGs (UNCT, 2017:3). Notable areas among the 17 SDGs where the university could play a role are:

- Good Health and Well-Being (SDG 3) (UNCT, 2017:3),
- Quality Education (SDG 4) (UNCT, 2017:3),
- Clean Water and Sanitation (SDG 6) (UNCT, 2017:3),
- Affordable Clean Energy (SDG 7) (UNCT, 2017:3),
- Industry, Innovation and Infrastructure (SDG 9) (UNCT, 2017:3) and
- Climate Action (SDG 13) (UNCT, 2017:3).

A science and technology-based university, such as KNUST, could play a significant role in achieving these goals. This is corroborated by the United Nations Country Team (UNCT), which says –

[S]cience provides the foundation for new and sustainable approaches, solutions and technologies to tackle the challenges of reducing poverty and achieving sustainable development. For example, it has enable access to safe drinking water, reduced deaths caused by water borne diseases and improved hygiene to reduce health risks related to unsafe drinking water and lack of sanitation (UNCT, 2017:5).

KNUST has assisted in various communities in this respect with the sinking of boreholes for safe drinking water. In addition, the TCC produced an energy-efficient cookstove intended to cut down on smoke emission and the use of fuel wood (see KNUST Research, 2016). The stove is currently being used by many second-cycle schools in the Kumasi metropolis and beyond. To cut down on food wastages, the Department of Food Science and Technology at the university has been training various groups in postharvest practices (KNUST Research Report 2016). The Department of Agriculture, Crop Science and Horticulture have also been engaging various stakeholders on issues relating to good planting and harvesting practices (KNUST Research Report 2016).

These examples are some indications that the university – by its establishment and mandate – could play a role in the improvement of life. The university can reposition itself and partner with stakeholders, including the CSIR, to pursue the 17 SDGs (UNCT, 2017).

6.1.3 The agricultural sector and the role of the university

This sub-section reports specifically on the agricultural sector, its national focus and the role the university could play. As far as the agricultural sector is concerned, the 10-year development plan (UNDP, 2015) the MDGs and the SDGs have outlined agriculture-specific goals to tackle hunger and poverty. These goals can be summarised as follows:

1. facilitate swift accumulation of technological capabilities in industry and agriculture;
2. mechanisation and irrigation as key factors in modernising Ghana's agricultural sector;
3. enhance the productivity of human capital as a means of generating higher income and reducing the incidence of poverty;
4. facilitate the development of a human settlement pattern that facilitates access to national, regional and international markets for agricultural and industrial development as well as agro-industry development; and
5. support private sector development to invest actively in agriculture, industry and agro-industry (UNCT, 2017; UNDP, 2015)

The above strategies are expected to depend on strengthening partnerships between the public and private sectors, including the universities.

The university is a key development partner in the triple-helix, quadruple and quintuple helixes (Etzkowitz, 2004) and therefore should not be underrated in the growth of any sub-sector of the country. The agricultural sector, expected to propel economic growth, is one sector where the university could play a major role, especially, in the area of mechanised agriculture and irrigation (UNDP, 2015). A recent innovation by researchers at KNUST is the fabrication and production of a mechanised cassava harvester (KNUST Research Report, 2016) This was designed to support large-scale commercial harvesting of cassava, especially during the dry season. It has the ability to harvest a cassava plant per second compared to the 5 to 10 minutes by manual labour (KNUST Research Report, 2016). Several other research results in effective cropping, varieties of pest-resistant crops and high-yielding varieties among others have been developed. The national development plan 2007–2015 (NDPC, 2004) and the SDGs acknowledge the need for an improved variety of seeds, fertiliser and machinery, areas where the university could adequately assist (UNCT, 2017). Recent efforts have led to some slight improvement in the agricultural sector. The year-on-year gross domestic product (GDP) growth rate for agriculture was 10.0% for the third quarter of 2017 as against the previous year's performance of under 10% growth (Ghana Statistical Service [GSS], 2017b).

This researcher is convinced that an effective collaboration between the university and the Ministry of Agriculture will most likely yield more economic dividends. The research units of the university have done much over the past few years but due to a disconnect between the sector ministries and the research units not much has been utilised. A review of research articles in JUST, published by the university, over the past ten years provided us with areas of research covering government priority areas. Table 6.1 below shows the number of published research articles in JUST from 2004 -2017 and the specific areas where they can be applied to national development.

SUMMARY OF JUST PUBLICATIONS 2004 TO 2017

Table 6.1: Summary of JUST publications (2004 to 2017) KNUST

VOLUME/YEAR	AGRICULTURE	ENGINEERING	HUMANITIES	MEDICINE & PHARMACY	APPLIED SCIENCE	TOTAL
Vol. 24/2004	4	5	15	1	3	28
Vol. 25/2005	4	3	13	4	5	29
Vol. 26/2006	5	10	16	10	10	51
Vol.27/2007	11	13	8	9	12	53
Vol. 28/2008	7	12	12	9	9	49
Vol. 29/2009	12	9	9	2	14	46
Vol. 30/2010	7	10	14	5	10	46
Vol. 31/2011	12	7	19	5	5	48
Vol. 32/2012	2	4	17	10	5	38
Vol. 33/2013	7	2	12	4	7	32
Vol. 34/2014	5	5	10	2	9	31
Vol. 35/2015	4	11	6	4	3	28
Vol. 36/2016	1	10	7	7	3	28
Vol. 37/2017	0	2	5	0	3	10
Total	81	103	163	72	98	517

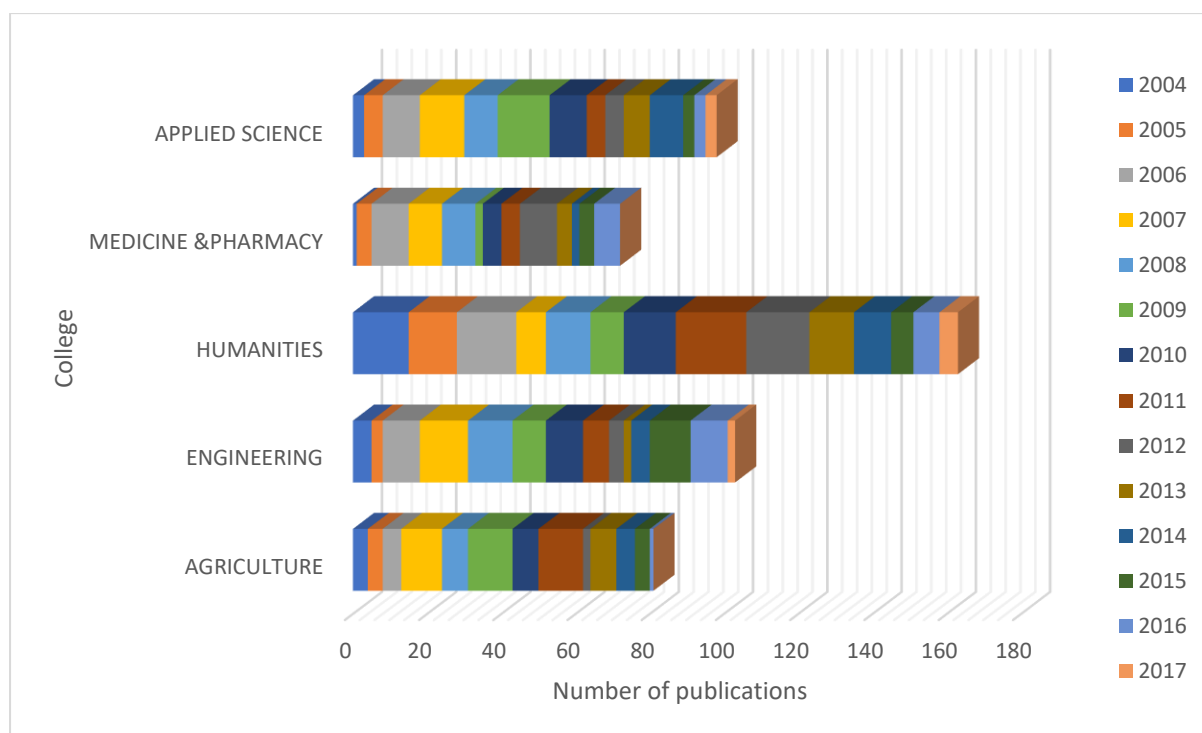


Figure 6.1a Trend analysis of JUST publications (2004–2017)

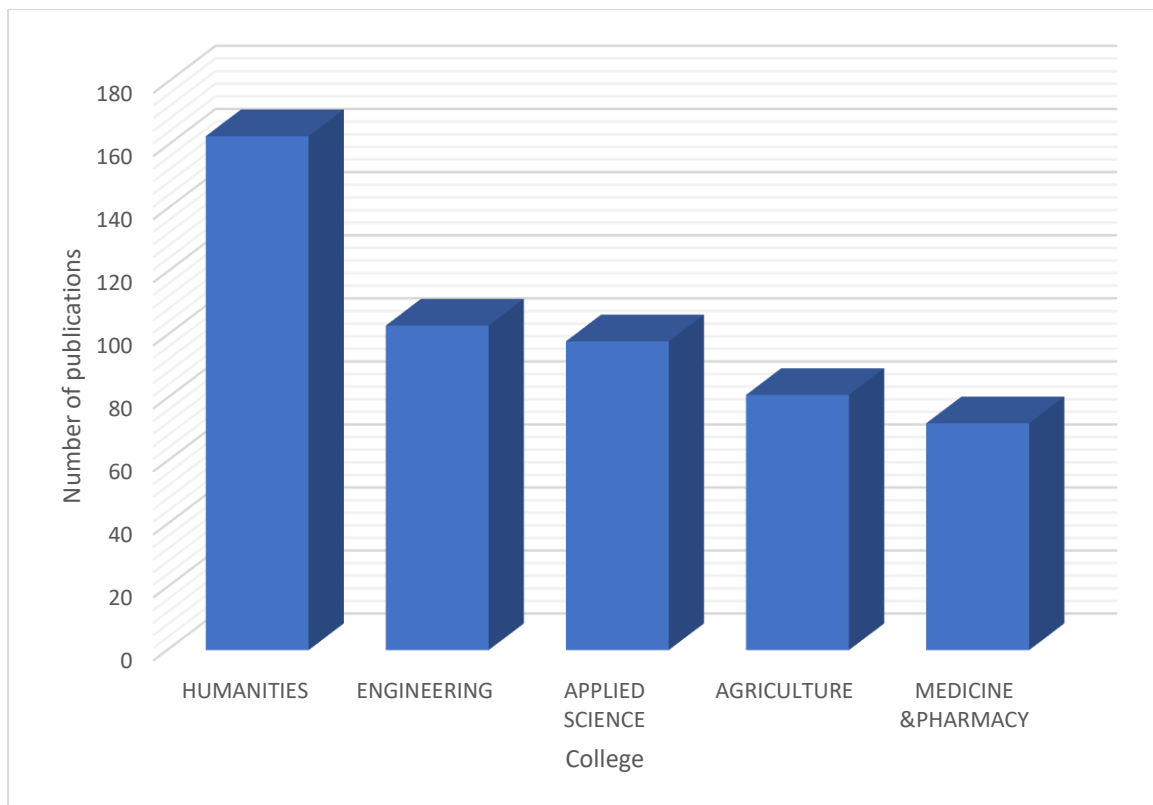


Figure 6.1b Summary of JUST publications (2004–2017)

From Table 6.1 and Figure 6.1b above, the trend indicates that JUST publishes mostly in the humanities, followed by engineering and applied science. The year-by-year publications by fields are however not consistent, as shown in Figure 6.1a above. The drop in the outputs from 2008 to 2017 has been attributed to software challenges in the migration to online submission of research articles. Furthermore, the criteria for submission of articles have been tightened making it more challenging for staff to submit articles for publication. On average, the total number of publications per year for the period 2004 to 2017 is about 36. This figure is for the JUST, an on-campus journal, only. As discussed in Chapter 4, there are many other publications in the various fields of study in other journals, both locally and internationally. Although the numbers are not encouraging as portrayed by the bibliometric analysis, it will be interesting to know how many of these research findings have actually been utilised at local and national level for development purposes. The interview report discussed in Chapters 7 and 8 gives some few examples of research used.

The Sustainable Development Goals (SDGs) proposes the inclusion of the private sector, including universities to contribute their quota towards achieving the SDGs (UNCT, 2017). This is an open invitation to universities in Ghana to play their part in national development. The SDGs makes the university's involvement in national development imperative. The

KNUST should therefore update itself with the sector specific needs for the country, and channel its research and choices towards national goals. These efforts ought to be conscious and sustained. The public sector, including the university, must translate into reality the expectation to provide the private sector with economic and social infrastructure, such as land reform and research support. As a public sector entity, the university's role in providing support for the informal sector ought to be clearly outlined in the national development plan. The projection for a change from the dominance of subsistence agriculture to that of an industrially linked entrepreneurial business, spearheaded by the private sector, is believed to be a recipe for structural change and economic development (NDPC, 2014). This may not necessarily be the case looking at the current infrastructural defects of the private sector. That notwithstanding, the industrial sector of the country is reported to have experienced some marginal growth between 2003 and 2005, with an increase of between 5.1% and 5.6% (NDPC, 2014) but during the first quarter of 2017, the GDP for the industrial sector stood at 16.6% (GSS, 2017a; 2017b). The next section discusses in detail the role that the university could play to contribute to the local industrial sector. Even with its current infrastructural challenges, the university is in a position to contribute towards improved modern and cost-effective inputs for better economic growth.

6.2 The role of the university in local industrial growth

In this section, we consider the industrial goals of Ghana and the role and place of the university. There is no doubt that much research resources exist in the university. An industrialised economy requires a strong research backbone as well as HR capacity. This implies that, for greater industrial growth, there should be a concerted effort from industry, government, the university and other stakeholders to provide the needed research infrastructure and human resource required for industrial development (NDPC, 2014). This demands a strategic plan and policy regime that provide the various interventions with a well-coordinated approach to sustained economic development and growth.

The university has been contributing to the industrial sector through the building of HR capacity for the sector. Over the years, KNUST has trained several graduates and post-graduate students who can be found in most industries in Ghana. The university can still do a bit more in training individuals to be entrepreneurs who can start small businesses and industries with the potential for expansion. At a recently held higher education conference in South Africa,

delegates called for emphasis in entrepreneurial training and setting up of hubs since it has the potential to reduce unemployment and contribute to national growth (Wilton Park, 2017).

A 2017 overview by the World Bank Group indicates a steady growth in the industrial sector in Africa, recording the highest growth of 11.5%, compared to 1.8% in 2016, a significant contribution to this coming from mining and petroleum (World Bank Group, 2017). It can be confirmed that there are KNUST alumni in almost all the mining industries (KNUST Research Report, 2015). Again, from the post-survey interviews, we noticed that researchers of the university provide consultancy services for the mining and industrial sectors. Over the years, the NDPC and the GSS have been recording a steady improvement in the number of industries assisted to undertake R&D leading to an increase in the number of research findings as well as the number of research findings adopted by industry. The university has been directly and indirectly involved in these achievements. University stakeholder engagement with industry, discussed in Chapter 8, gives an indication of the involvement of researchers with industry at various levels. These engagements can be improved for better industrial growth. Besides, university–industry linkages must be made regular and structured. The university should further examine issues such as the skills that employers need and that which the university provides for its graduates. As has already been discussed (see sub-section 3.1) there are many research findings in the university, which may be useful for economic growth. These must be put in the public domain and made available to the sector ministries for possible adoption and use.

6.3 The role of the university in education

In this section, the researcher discusses issues about education and their implication for economic and social development. We further examine the role that the university could play in order for this sector to achieve its set objectives. This is an issue in the external environment that is directly related to human development with direct implications for productivity and thus socio-economic development. The UNCT (2017) reported that Ghana made significant progress in education at the primary and junior high school levels (UNCT, 2017).

Access to basic social services, such as education, has been a challenge to the nation's developmental agenda due to its inadequacy (UNCT, 2017). There have been many policies in this area but there remains little evidence that it has made the expected impact over the years despite annual projections and efforts at achieving these goals (UNCT, 2017). According to the 2013 annual progress report of the NDPC on the implementation of the Ghana Shared

Growth and Development Agenda (GSDA) (NDPC, 2014) the nation's policies and programmes on education are aimed at the following;

- increasing access to education at all levels;
- bridging the equity gap in access to education;
- improving the quality of education; and
- enhancing the delivery of education services (NDPC, 2014).

These programmes still hold valid as they reflect somehow in the SDGs (UNCT, 2017). Accordingly, progress was monitored using indicators like growth, net enrolment ratios and completion rate. Progress was monitored for kindergarten, primary school (PS), junior high school (JHS), senior high school (SHS) and tertiary-level education. Significant increases were recorded at the basic level from 2008 to 2017 (UNCT, 2017) but the figures start to dwindle as one progresses towards higher levels of education. Recent reports from UNESCO and the GSS show a gradual growth in enrolment figures from basic schools to tertiary institutions. For the year-on-year growth rates of the various subsectors for the third quarter of 2017, education was among the subsectors that recorded a double digit growth of 14.4%, which was over and above the real GDP for the third quarter of 2016, which stood at 9.3% (GSS, 2017b, 2017a). Data compiled from the UNESCO Institute of Statistics also confirms modest increases in enrolments for the various levels of education (UNESCO, 2018). The Figures 6.2-6.9 below illustrate the gross enrolment ratios for the various levels covering a ten-year period, excluding 2010 for which figures were not available.

GROSS ENROLMENT RATIOS PER LEVEL OF EDUCATION, 2008–2017

The gross enrolment ratios for the various levels of education are illustrated in Figures 6.2 to 6.9 below.

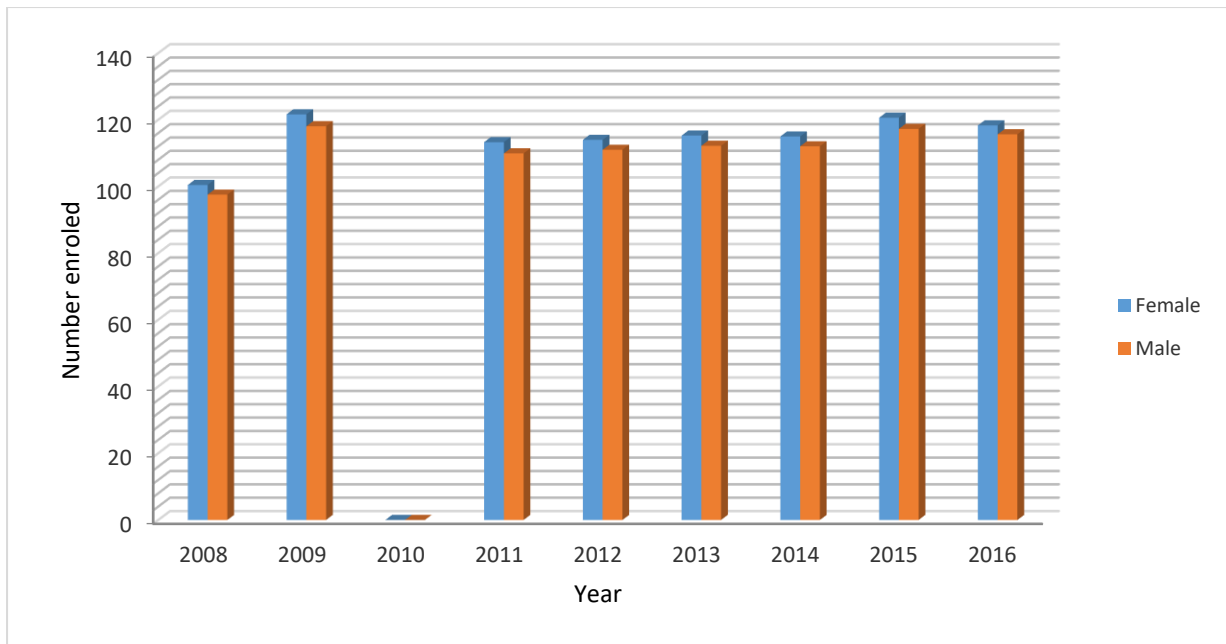


Figure 6.2 Gross enrolment ratio by gender for pre-primary education.

Source UNESCO (2018)

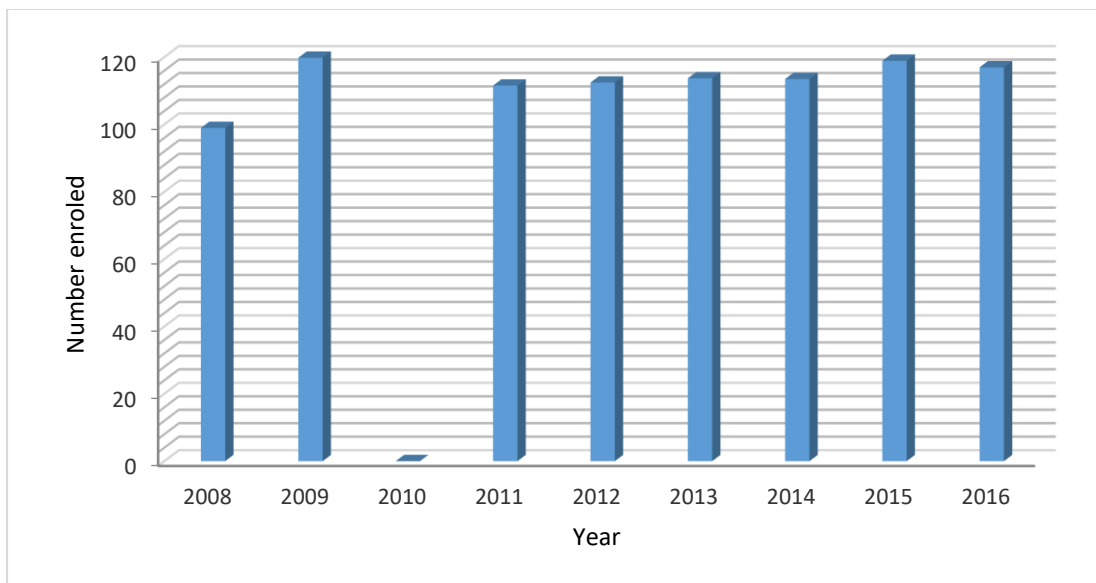


Figure 6.3 Gross enrolment ratios for pre-primary education.

Source UNESCO (2018)

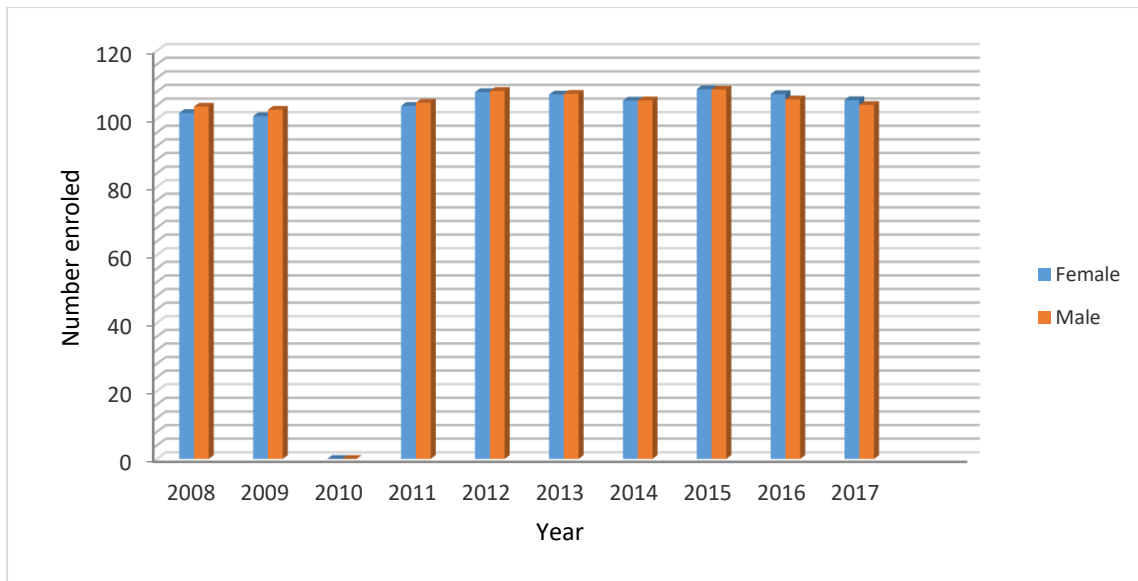


Figure 6.4 Gross enrolment ratio by gender for primary education.

Source UNESCO (2018)

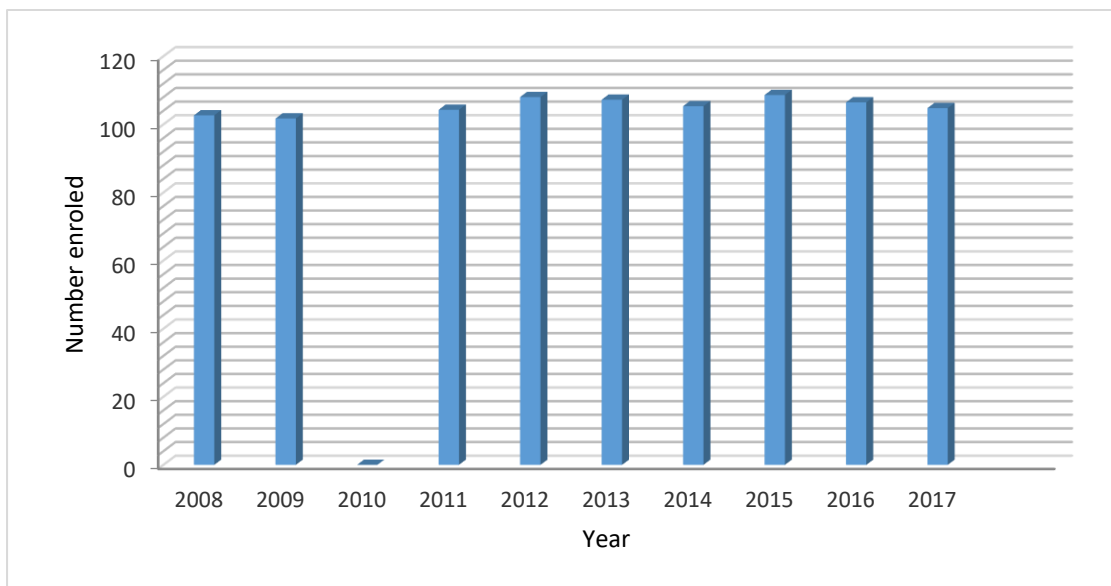


Figure 6.5 Gross enrolment ratios for primary education.

Source UNESCO (2018)

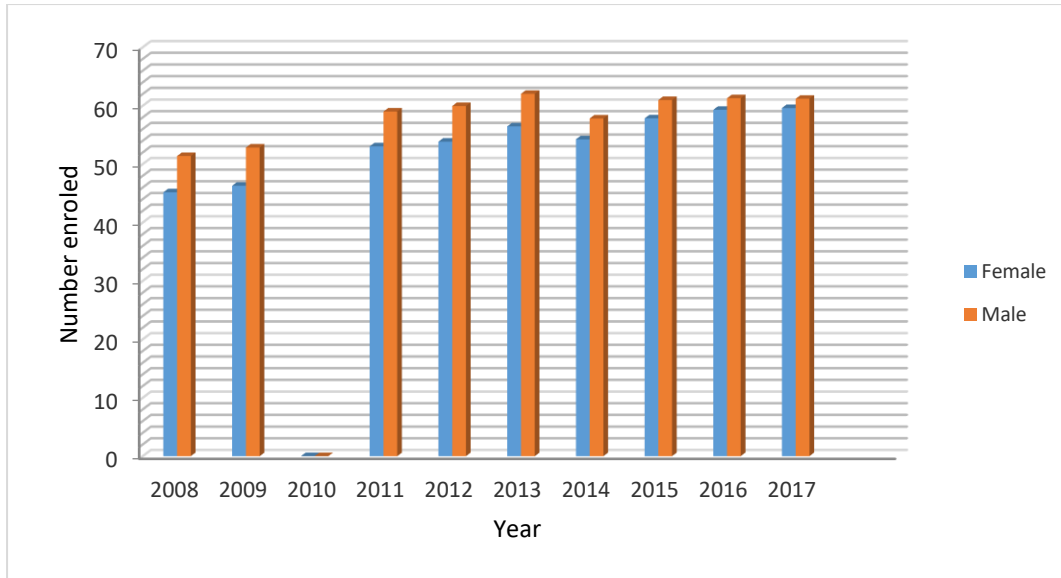


Figure 6.6 Gross enrolment ratios by gender for secondary education.

Source UNESCO (2018)

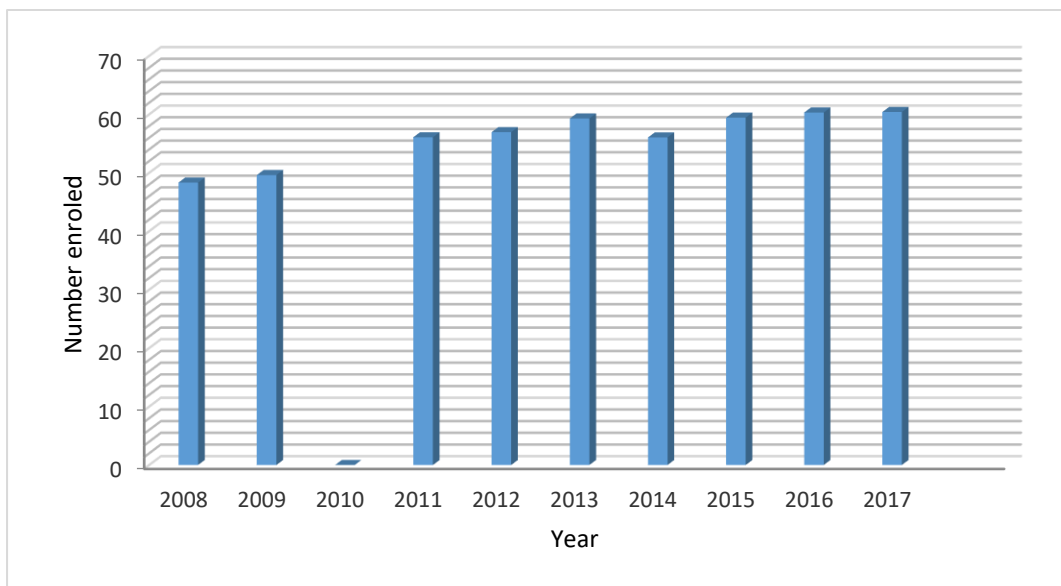


Figure 6.7 Gross enrolment ratios for secondary education.

Source: UNESCO (2018)

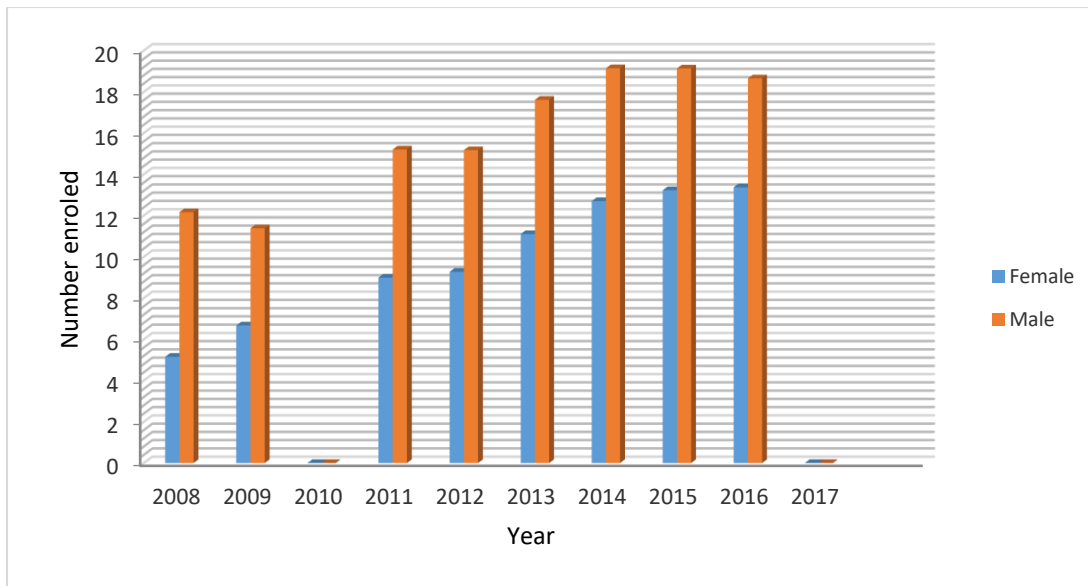


Figure 6.8 Gross enrolment ratios by gender for tertiary education.

Source: UNESCO (2018)

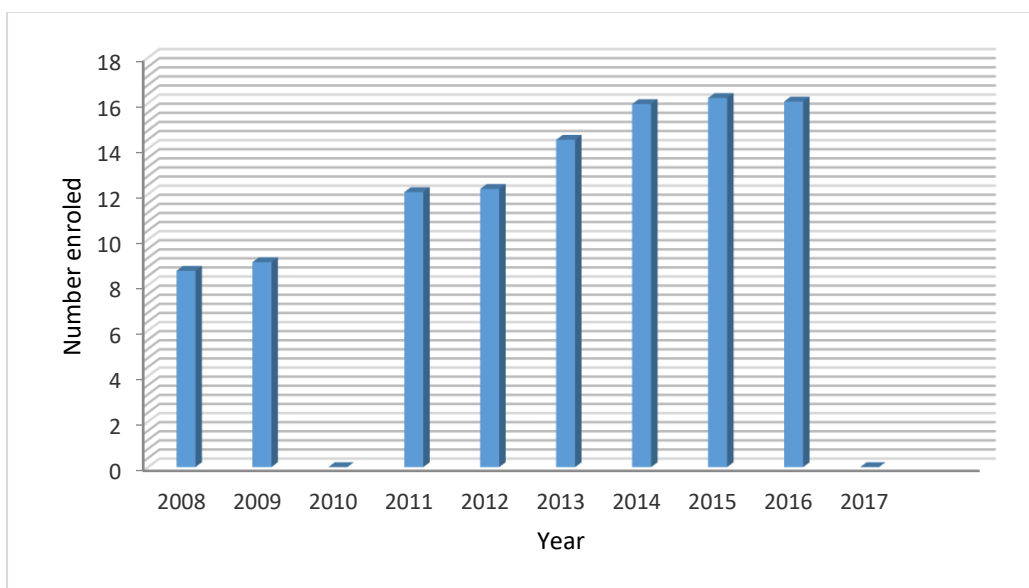


Figure 6.9 Gross enrolment ratios for tertiary education.

Source UNESCO (2018)

In the above figures, we notice significant increases at all the levels over the period 2008 to 2017. The obvious reasons are population growth and perhaps some government interventions, such as the school feeding programme, free uniforms, free exercise books and grants to basic schools (PS and JHS). Interestingly, however, the trend is different vertically for each year as one climbs the education ladder, from pre-primary to tertiary, where there is a reduction in these interventions. The number of dropouts from one level to the next is very significant. Moreover, the dropout rate for females is higher than that of males. Several factors may account

for this dropout rates, including cost of higher education and other social factors affecting both sexes but disadvantaging females more than males.

Of interest to us however, is tertiary education where the increases have been consistent over the years. The role of the university in this sense has been to determine how to accommodate these increases without compromising on quality. As already indicated in sub-section 6.2, the university through its training of manpower, contributes directly to national development by the kind of graduates it produces. The massification of higher education must therefore be an issue of concern for HE managers in order not to water down the training of the skilled labour needed for the world of work and by implication social and economic development. The fact remains that, with various interventions – both nationally and globally – the number of school enrolments at basic level will continue to grow and feed into the tertiary education sector.

Over the years, KNUST has not been able to admit all qualified applicants who apply for admission. The same goes for all the other public universities in Ghana. Figure 6.10 below illustrates the trends for KNUST over the past ten years. Clearly, the university has not been able to admit all qualified applicants, and hence, there remains a considerable enrolment gap. Besides, it is not all those who are admitted who actually enrol and register for the programmes offered to them. Between 2012 and 2014, the intake into universities in Ghana were doubled to absorb a backlog created as a result of changing the number of years for SHSs from four to three years. This came with its own challenges of overcrowding of lecture halls and halls of residence.

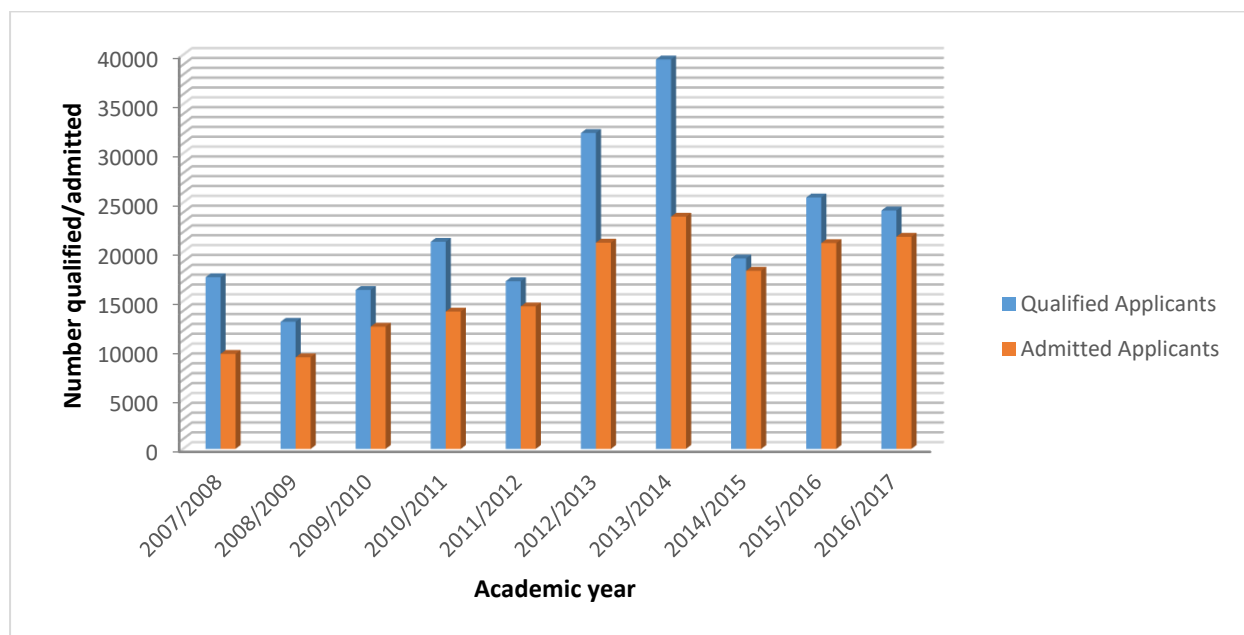


Figure 6.10 Enrolment trends for KNUST 2007–2017

The author believes that some of the productive workforce needed for economic and social development can be provided by tertiary education sector. From the above trends, we notice an enrolment gap from the pre-tertiary level to the tertiary level despite efforts by the university to increase its intake. This may be attributed to inadequate government subsidies and other interventions at pre-tertiary level. Besides, the challenge of inadequate staff and space caused by inadequate infrastructure, such as lecture rooms, laboratories and other teaching and learning materials, accounts for the restricted numbers of students admitted into tertiary programmes (QAPU, 2017). Manpower development in Ghana, directly linked to socio-economic development, is suffering as a result of a non-expanding economy, which is unable to absorb even the small numbers of graduates from our tertiary institutions. Having said that, the growth and expansion of the economy are factors that ought to be given serious attention because evidence exists to show that there is a high level of graduate unemployment in the country (UNCT, 2017). All the same, tertiary education, especially at post-graduate level, produces part of the skill set and research infrastructure necessary for national development.

6.4 The role of the university in healthcare

This section examines the health sub-sector and the role the university could play to help achieve its set objectives of providing adequate healthcare for all Ghanaians. In 2017 the health and social work sub-sector recorded the highest year-on-year quarterly GDP growth rate of 24% (GSS, 2017b). In Ghana, the health sector is no different from the educational sector in terms of the existence of pragmatic interventions but less than expected returns [GSS], 2017b). This sector has not fully utilised the expertise that exist within the university [GSS], 2017b). The existence of health research in the university is in no doubt but the question still remains about the awareness of research findings and how and where they can be applied. It is on record ([GSS], 2017b), though, that the health sector, unlike the agricultural and educational sectors, has benefited from research carried out by the university. A case in point is the Kumasi Centre for Collaborative Research (KCCR) of the School of Medical Sciences (SMS) at KNUST. KCCR is an international platform for biomedical research, which brings together a network of researchers and scientists to conduct research in tropical diseases. As part of its objectives, the centre develops world-standard research programmes for post-graduates and technical staff (KCCR, 2017). Its operations are based on close collaboration between KNUST SMS and the German Benhard-Nocht Institute for Tropical Medicine (BNITM). Scientists and researchers from other institutions are given access to the Centre to carry out research which in the long run benefits the nation (KCCR, 2017).

The Ghana National Healthcare Policy Strategy 2017–2021 reflects a healthcare strategy which calls for improved healthcare at all levels through coordinated health related activities (Ministry of Health [MoH], 2016). Accordingly, one of the key areas to address in improving quality healthcare initiatives is to involve the private sector and teaching hospitals to implement some health initiatives. The Ghana Health Service, responsible for the provision of healthcare delivery, has been working hand in hand with the nation's teaching hospitals, namely Korle-Bu Teaching Hospital in Accra, Komfo Anokye Teaching Hospital in Kumasi, and the Tamale Teaching Hospital in the northern part of the country. These hospitals have academics and researchers responsible for the training of medical doctors, pharmacists, nurses and other paramedics. Research carried out by these researchers goes directly into teaching and practice, and therefore goes a long way to improve the health delivery system of the nation. The university and its researchers who work with these teaching hospitals, make significant contributions towards healthcare delivery and thus national development in the long run.

The Ministry of Health's 2014 holistic assessment of the health sector programme of work indicated modest and mixed performance of the health sector (MoH, 2014). For example, there was improvement in child mortality ((MoH, 2014). Infant mortality was said to have reduced from 50 to 41 per 1 000 live births (MoH, 2014)), and under-5 mortality dropped from 80 per 1000 to 60 per 1 000 live births (MoH, 2014). One reason that was cited for the mixed performance of the health sector was financial challenges leading to poor implementation of key milestone activities. The MoH in 2014 recorded a performance Scale ranging from 0–5, i.e. from severely underperforming (0–1), underperforming (1–2), stagnant (2–3), moderately performing (3–4) to highly performing (4–5), which is below expectation (MoH, 2014). The overall score of the sector for 2104 was 3, representing a moderately performing health system (MoH, 2014). Applying the same scale to the six objectives of the ministry gave mixed assessment scores. In its 2016 annual report, the Ghana Health Service, the largest public sector agency, under the MoH, responsible for the provision of healthcare in the country, indicated an overall slight improvement in the delivery of healthcare (Ghana Health Service, 2017). Targets were met for some services (such as neonatal mortality) while others (such as immunisations) fell short of expectation. The MoH fell short of its projected reduction of the mortality rate from 19.6% in 2015 to 18% with neonatal mortality instead increasing by 18%. It however, achieved 90.6% coverage in national immunisation in 2016 (Ghana Health Service, 2017). Table 6.2 below gives the performance scale for the health system in Ghana for 2014.

Table 6.2: Performance scale for the health system

PERFORMANCE SCALE OF THE HEALTH SYSTEM IN GHANA, 2014. SCALE: 0–5	
OBJECTIVE	SCORE OUT OF 5
Bridging the equity gap in geographical access to health services	2.9
Ensuring sustainable financing for health care delivery and financial protection for the poor	4.1
Improving efficiency in governance and management of the health system	2.8
Improving quality of health services delivery including mental health services	2.6
Enhancing national capacity for attainment of health-related MDGs and sustain the gains	3.0
Intensify prevention and control of non-communicable and other communicable diseases	2.5

Source: MoH (2014)

One of the interventions with direct implication for health delivery is the national health insurance scheme (MoH, 2014) which ensures that the poor and vulnerable have access to basic health delivery (UNCT, 2017).

We conclude this sub-section by stating emphatically that the university (KNUST) has a role to play in the healthcare system of Ghana through the training of its work force and by contributing through research and community services.

6.5 Conclusion

The role of the university in national development cannot be overemphasised. Examples have been cited of countries such as South Korea, which has made tremendous strides in industrial and technological advancement by setting up specialised institutions to propel science, technology and innovation, which has led to economic growth and development (Appiah-Adu & Bawumia, 2015). Institutions such as the Korean Institute of Science and Technology (KIST), the Korean Advanced Institute of Science, and the government support system of their Ministry of Science and Technology have contributed significantly to that nation's economic and social development (Appiah-Adu & Bawumia, 2015). This underscores the fact that the university has a major role to play in economic and social development. Through its research units, a university could contribute to the country's educational drive, healthcare, environment and sanitation, agricultural growth, industrial and infrastructural development (Appiah-Adu & Bawumia, 2015). A well-endowed and coordinated HE system with emphasis on post-graduate

training and research can be a strong backbone for sustainable national development (Appiah-Adu & Bawumia, 2015).

Another classic example of how the university could contribute to national development is seen in the recent DRUSSA Policy Fellowship scheme which assigned researchers from the university to specific ministries to facilitate the inclusion of academic research into policy making (DRUSSA, 2015).

From the above discussions of the various national priority areas, we can conclude that the university has a meaningful role to play in almost all sectors of national development. In terms of research output, the university can boast of some modest achievements in the Faculties of Agriculture, Engineering, Humanities, Science, Medicine and Pharmacy. Other areas of research within the university have led to innovations such as water filters, fuel efficient cook stoves and ovens. By synchronising local and national research needs to those of the university, greater benefits will be derived from research and innovations. For example, the installation of the biomass cookstove in some secondary schools in the Ashanti Region of Ghana has led to a significant reduction in the dependence of fuel wood; thus, the forest is protected from being over-exploited for fire wood.

There is the need for better synergy in scientific collaboration among universities and government ministries. The university's strategic goals aim at socio-economic development much the same way as the strategic goals set by government but there is a disconnect between the two. What remains to be done, is the harnessing of the rich resources that already exist in the nation's tertiary institutions. Clear-cut policy regimes and the political will are needed to tap these potentials. Universities in Ghana – and indeed KNUST – could play meaningful roles in all areas of national development. This will however depend on the extent of the levels of engagement between the university and development partners. As discussed in the previous chapters, there is the need to strengthen the triple helix to ensure proper synergy and effective collaboration, which will lead to achieving mutual goals. Again, the channels and mechanisms of stakeholder engagement, discussed in Chapter 8, are worth considering.

CHAPTER 7 – SURVEY RESULTS AND ANALYSIS

7.1 Introduction

This chapter discusses the demographic responses of the survey, and incorporates relevant portions of the follow-up interviews that support and confirm the outcome of the survey. It provides an analysis of the correlation between the demographics, research outputs and the success of researchers in their research by establishing the relationships between gender, year of birth (age), departments and/or faculties, position and academic qualification versus research output of respondents over the previous three years. We also consider the implications of these outputs for knowledge production, dissemination and uptake along the lines of the study framework. In addition, we report on the research focus of the different faculties of the university and how successful they have been in terms specific outcomes.

7.2 Distribution of researchers by faculties

Available statistics at the QAPU of the Vice-Chancellor's Office indicated that there were 1 018 academic senior members in the university (KNUST 2017) The summary is as provided in Figure 7.1 below:

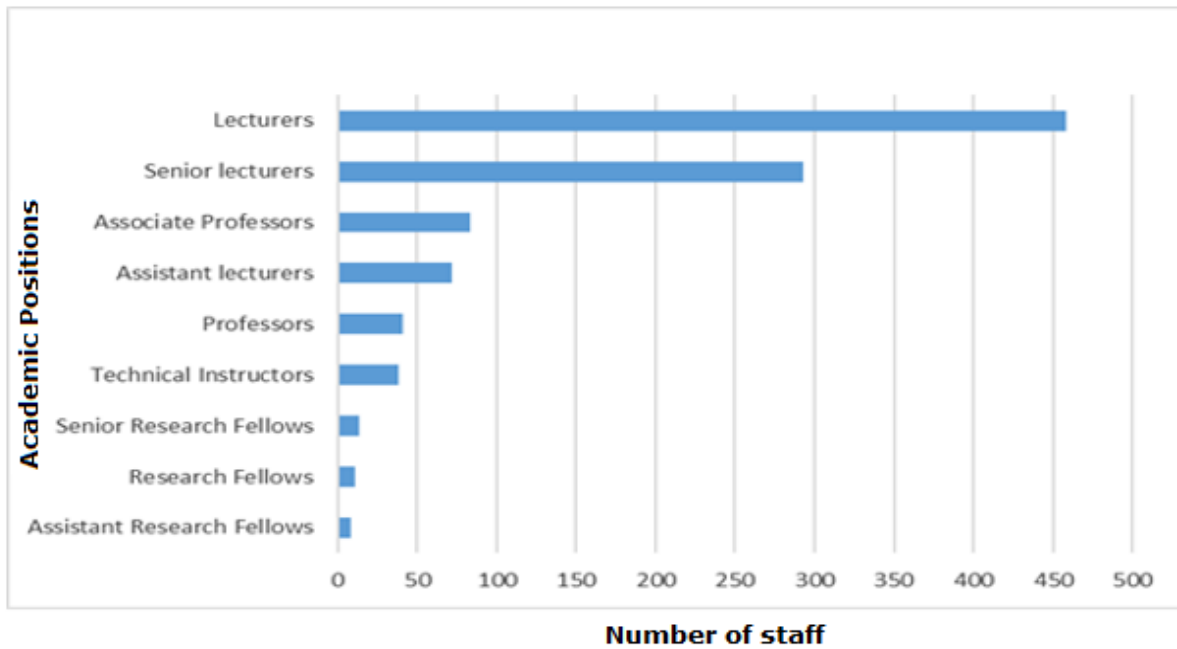


Figure 7.1 Number of faculty members across 6 colleges of KNUST

Table 7.1 below gives the population of research staff for each faculty, institute of KNUST or school and the respective responses from the survey.

Table 7.1 Distribution of research staff by faculties or schools and institutes and survey responses

COLLEGE	FACULTIES	POPULATION Count	RESPONDENTS Frequency and percentage
College of Art and Built Environment (CABE)	Art	82	16 = 19.5%
	Built Environment	77	22 = 28.6%
	Institute of Land Management and Administration	7	**
	SUB-TOTAL	166	-----
College of Agriculture and Natural Resources (CANR)	Agriculture	68	11 = 16.2%
	Forest Resources Technology	13	1 = 7.7%
	Renewable Natural Resources	48	8 = 16.7%
	Bureau of Integrated Rural Development	7	**
	SUB-TOTAL	136	-----
College of Engineering (COE)	Civil and Geo-Engineering	59	9 = 15.3%
	Electrical and Computer Engineering	30	2 = 6.7%
	Mechanical and Chemical Engineering	69	10 = 14.5%
	Technology Consultancy Centre	4	**
	SUB-TOTAL	162	-----
College of Health Sciences (CHS)	Allied Health Sciences	29	5 = 17.2%
	Dental School	9	4 = 44.4%
	Pharmacy and Pharmaceutical Sciences	49	6 = 12.2%
	School of Medical Sciences	136	20 = 14.7%
	School of Public Health	2	1 = 50%
	School of Veterinary Medicine	17	1 = 5.9%
	SUB-TOTAL	242	-----
COLLEGE OF HUMANITIES AND SOCIAL SCIENCES (CHSS)	Law	18	No respondents
	School of Business	43	11 = 25.6%
	Social Sciences	115	15 = 13.0%

	Centre for Cultural and African Studies	4	**
	SUB-TOTAL	180	-----
College of Science (COS)	Biosciences	73	24 = 32.9%
	Physical and Computational Sciences	90	29 = 32.2%
	SUB-TOTAL	163	
	** For all research centres together	22	8 = 36.4%
	GRAND TOTAL	1 049/100%	-----

For the Faculty of Social Sciences, the population included 21 library staff, considered to be academic staff who engage in research.

There were respondents from all faculties, schools and institutes of the university, except the Faculty of Law, where there were no respondents. This did not affect the analysis of the results in any way in the sense that there were respondents from the School of Business and the Faculty of Social Science, which also form part of the CHSS, implying that all colleges were represented in the outcome. As shown on Table 7.1, the relative percentages of responses from each faculty, school or institute varied largely, ranging from as low as 5.9% to a high of 50%. The School of Public Health had the highest percentage (50%) being half of the staff population of two. This was followed by the Dental School with 44.4% and the Research Centres with 36.4%. These percentages formed the basis for subsequent analysis.

7.3 Demographics and their correlation to research outputs

The sub-sections below consider the demographics and how they relate to research outputs of respondents over the last three years.

7.3.1 Research outputs over last three years

This sub-section examines the responses for research outputs over the last three years. There were 202 respondents of whom 19 did not provide answers for research outputs. Figure 7.2 below illustrates the various levels of output for 1–5 outputs. In the figure, 1–5 research outputs are ordered from the highest to the lowest for better visualisation. For 1-5 research outputs, 59.6% of respondents, being the highest, reported having made presentations at conferences to predominantly academic audience, followed by 55.2% outputs for conference papers published in

proceedings. For 6-10 research outputs, 13.7% of respondents reported having research outputs for conference papers published in proceedings, while 10.9% reported on research reports. For 11+ research outputs, the highest percentage of 13.1% reported outputs for articles published in popular journals or magazines or essays or in newspapers or other public outreach media followed by 12.0% for presentations at conferences to predominantly academic audience. The other outputs follow in ascending order as illustrated in Figure 7.2 below.

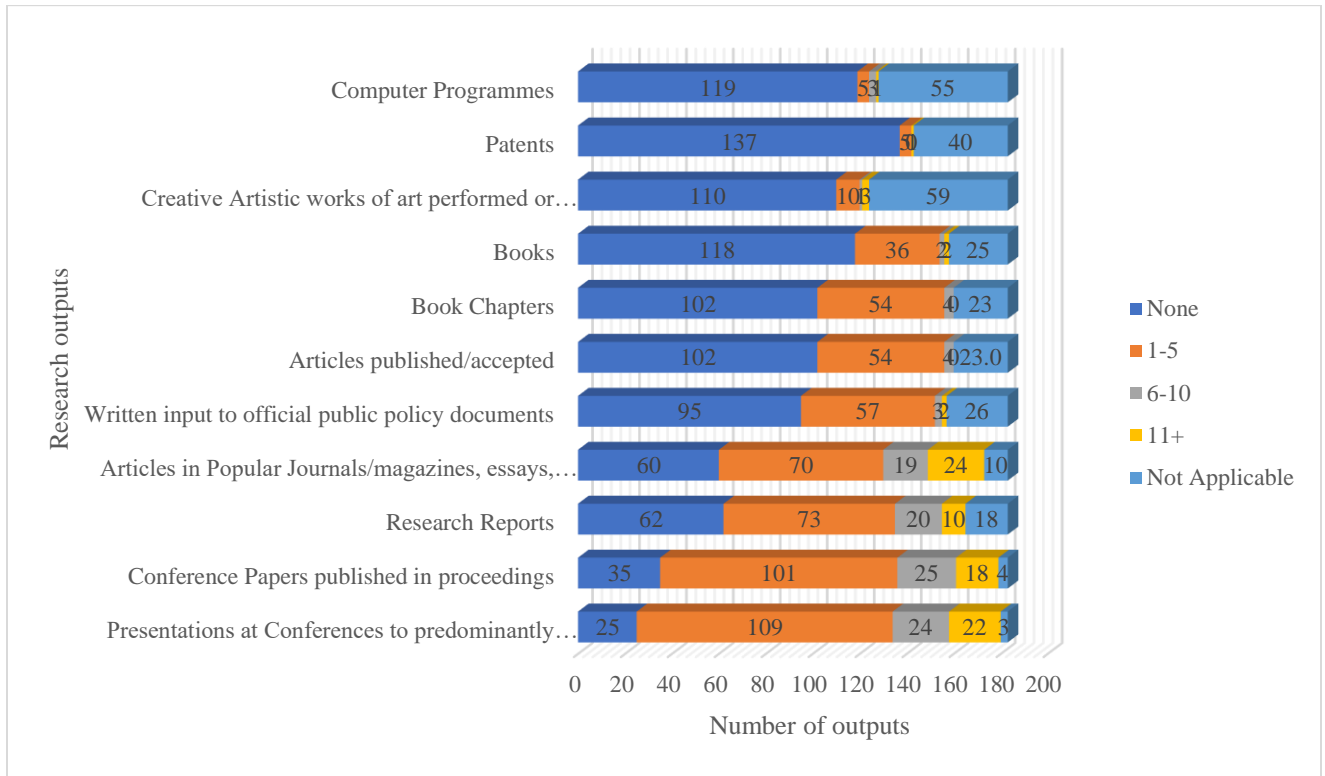


Figure 7.2 Research outputs for the last three years (ordered 1–5) N=202

In Table 7.2 below and the illustration in Figure 7.2 above, it can be observed that in terms of percentages, the highest number of research outputs over the last three years for 11+ outputs comprised articles in popular journals or magazines, essays or in newspapers or other public outreach media. The second highest was presentations at conferences to predominantly academic audiences. In the first two instances, that is 1–5 and 6–10 research outputs, the top three output areas included articles published or accepted, presentations at conferences to predominantly academic audiences and conference papers published in proceedings. These areas of research output also feature prominently for 11+ outputs in addition to articles in popular journals or magazines, essays or in newspapers or other public outreach media. These results provide the main areas of research focus by researchers and academics of the university.

Table 7.2 and Figure 7.3 below provide the results for research output areas for the most productive to the least productive areas.

Table 7.2 Research outputs of staff over the last three years

Number of research outputs	Research Outputs										
	Conference papers published in proceedings	Presentations at conferences to predominantly academic audiences	Research reports	Articles in popular journals or magazines, as essays or in newspapers	Articles published or accepted	Book chapters	Written input to official public policy documents	Computer programs	Books	Creative artistic works of art performed or exhibited	Patents
None	35	25	62	60	102	102	95	119	118	110	137
1–5	101	109	73	70	54	54	57	5	36	10	5
6–10	25	24	20	19	4	4	3	3	2	1	0
11+	18	22	10	24	0	0	2	1	2	3	1
Not applicable	4	3	18	10	23	23	26	55	25	59	40

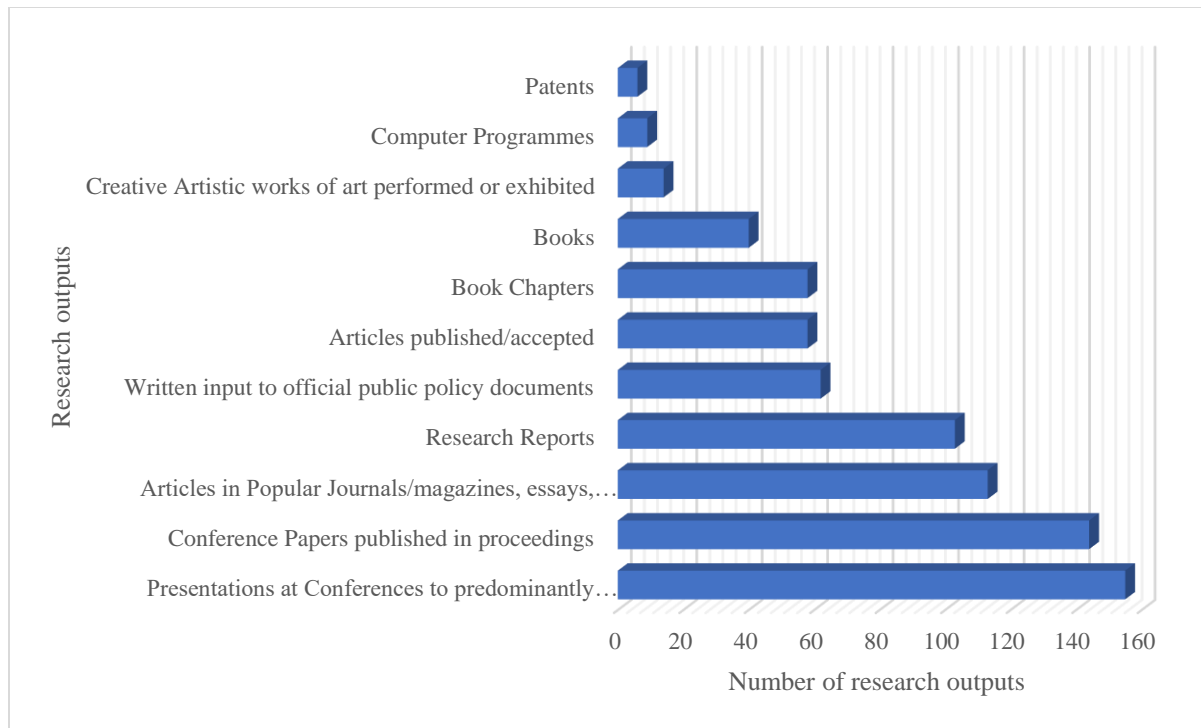


Figure 7.3 Research output of staff over the last three years

From the above analysis, it can be deduced that researchers aim mainly at articles published and presentations at conferences to predominantly academic audiences. It can be concluded that academics prioritise academic channels and outputs. This might also be due the fact that publication in journals and conference proceedings is one of the three assessable areas for promotion in the university, in addition to teaching and service to communities. This was confirmed from the interview report, which gave indications of concentration on published articles, presentation at conferences, and conference papers published in proceedings. The underlying driving force seems to be the desire to advance in their career. Some of the drivers of research mentioned by interviewees were as follows:

For these articles, they were articles generated mainly from a PhD research work then of course being in academics, if you do not publish, you perish (Respondent, R1).

[T]he core mandate is for us to teach, research and use some of these extension services for our communities (Respondent, R5).

They came about through either by research that I did as part of my PhD work, some of them through supervision of my MSc students (Respondent, R10).

My research outputs over the last three years has been as a result of collaboration between some of my colleague lecturers (Respondent, R8).

[The] desire to also rise a little bit and for promotion purpose and career development (Respondent, R2).

The desire for academic progression seems to drive the research agenda of the university, and this needs to be considered by management. Though it is a good thing to engage in research, there is the need to examine the type of research, its dissemination, how it is utilised, and its impact.

7.3.2 Other research outputs

There were 16 respondents who indicated that they produced some research outputs other than those listed in the questionnaire. These are –

- design and creativity workshops for craftsmen and designers (3);
- manuals (4);
- commercially viable industrial formula (7);
- exhibitions (1);
- factsheets (5); and
- new food products developed, transfer of technology, training workshops and workshops for artisans as shown in the figure below.

The numbers in brackets indicate the number of research outputs presented by the interviewees.

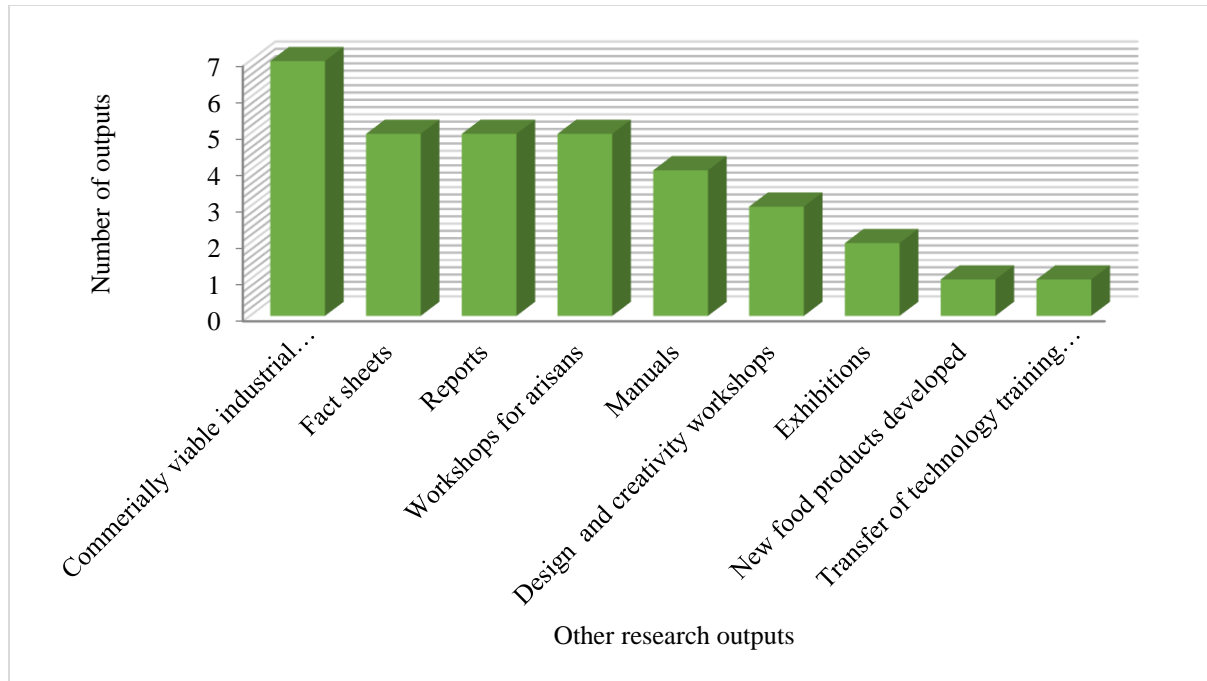


Figure 7.4 Other research outputs

It must be noted that some researchers from the Faculty of Art and the Technology Consultancy Centre (TCC) engage their stakeholders through design and creativity workshops, which seem more interactive and involve the stakeholders throughout the research process. In such instances, the stakeholders feel part of the entire process and there is joint ownership of the results leading to utilisation and uptake.

7.3.3 Number of respondents by position

The number of respondents by position reduces towards the higher ranks with the number of full professors being the lowest. The junior ranks, being the majority, occupied the base of the pyramid. This is to be expected since there are more members of staff within the junior ranks than in senior positions. The responses by position are given in Figure 7.5 below.

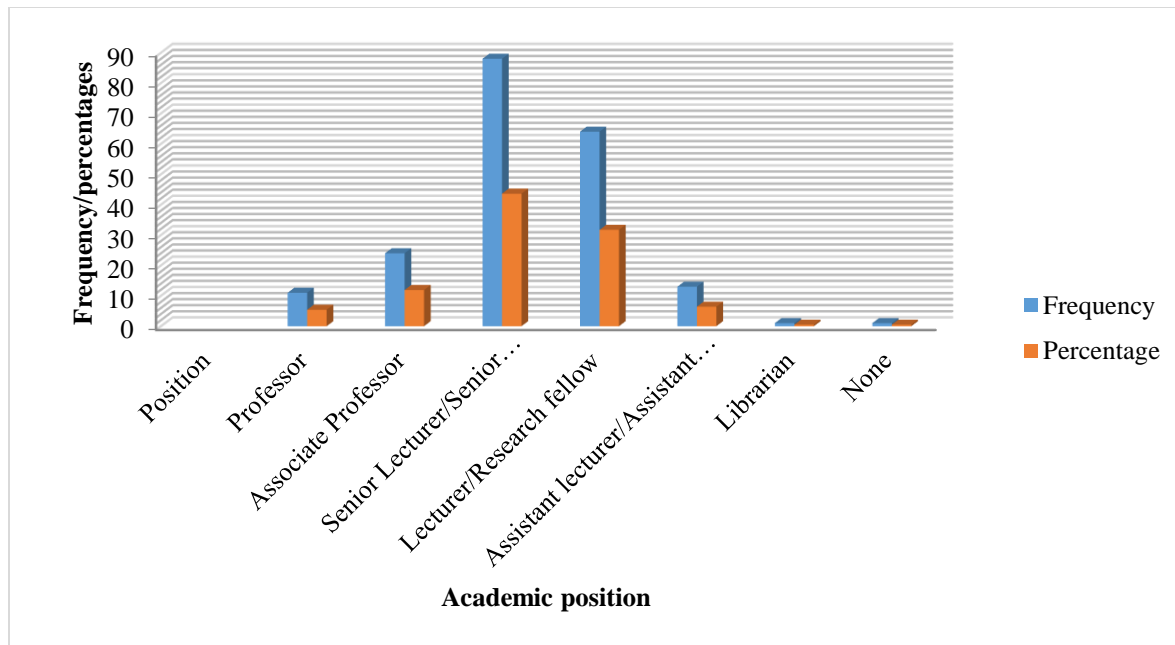


Figure 7.5 Responses by position

The academic position of the researcher has the potential of influencing research output. The impact of academic position on research is discussed in section 7.4.8 below.

7.3.4 Number of respondents by academic qualification

The distribution of the highest qualification of respondents is shown in Table 7.3 and Figure 7.6 below. The majority of respondents (74.3%) held a doctorate, 23.8% had masters' degrees and 2%, first degrees.

Table 7.3 Highest qualification of respondents

Highest qualification	Frequency	Percentage
First degree	4	2.0
Master's	48	23.8
Doctorate	150	74.3
Total	202	100.0

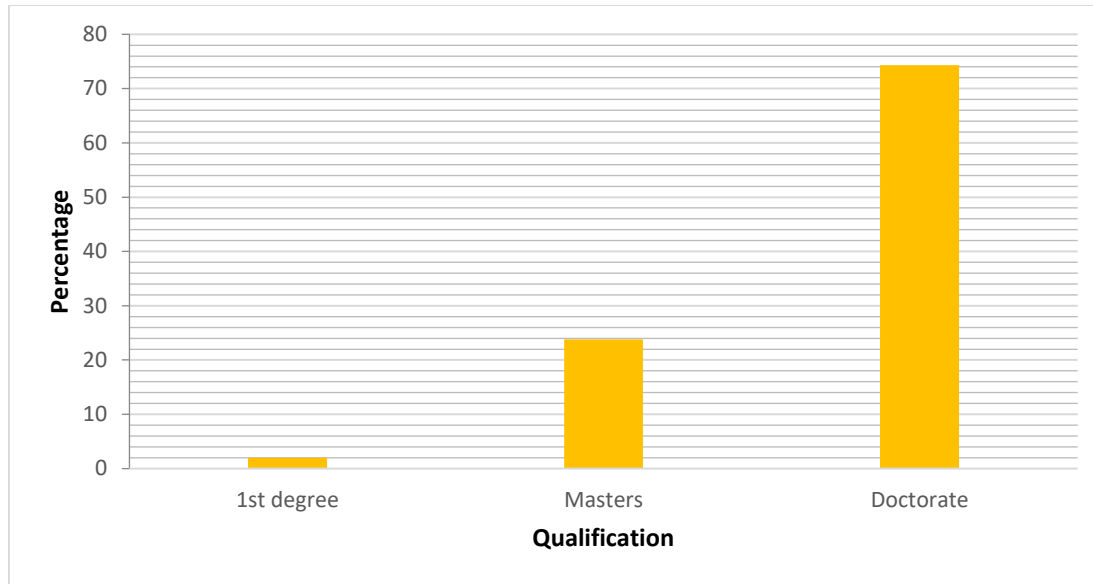


Figure 7.6 Highest qualifications of respondents

7.3.5 Gender and research output

This sub-section reports on the gender distribution of the respondents and their corresponding research output. Of the 202 valid respondents, 160 (79.2%), were men, while 42 (20.8%) were women. The respective percentages are as provided in Table 7.4 and Figure 7.7 below.

Table 7.4 Respondents by gender

Gender	Frequency	Percentage
Female	42	20.8
Male	160	79.2
Total	202	100.0

The ratio of female to male responses was about 1:4. According to the QAPU, there were 137 female academic staff members and 677 male members at the time of this research, a ratio of about 1:5. This implies that the survey did not have a gender bias.

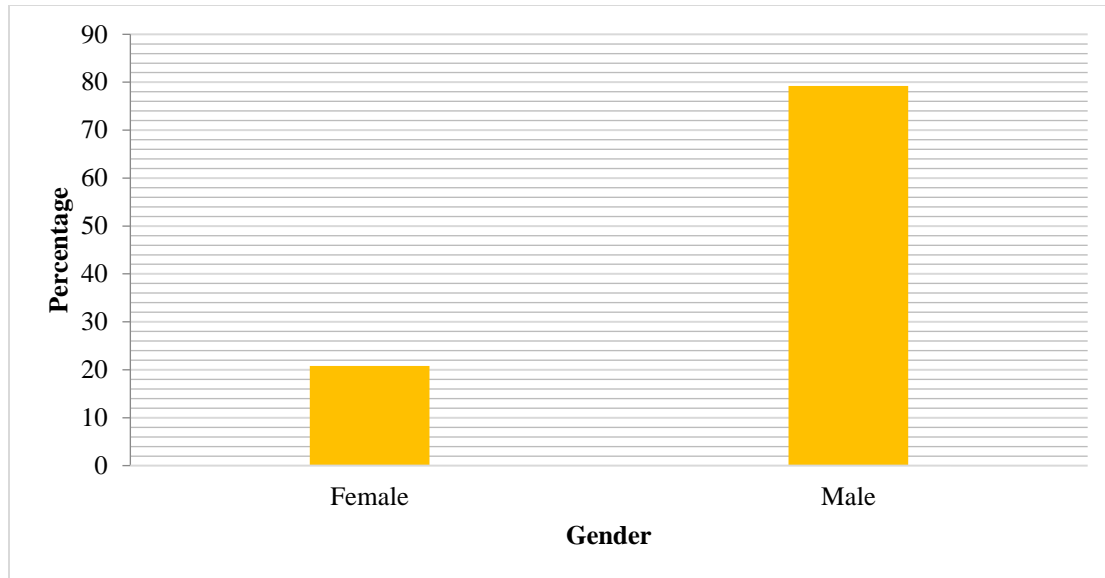


Figure 7.7 Number of respondents by gender

For the purposes of comparison of research outputs by gender, a cross-tabulation of gender versus research output was carried out using SPSS. Out of the various research outputs, we picked up responses with the most significant chi-square values. Two of the most significant chi-square values were for gender versus articles published or accepted (including co-authored) with a chi-square value of 0.001 and gender versus research reports (contracts and consultation) with a chi-square value of 0.006, also significant, as shown in Tables 7.5 and 7.6 and Figures 7.8a, 7.8b and 7.9 below.

Table 7.5 Cross-tabulation for gender versus articles published or accepted

Gender	Number of articles published or accepted					Total
	None	1-5	6-10	11+	Not applicable	
Female	3	20	8	3	0	42
	60.0%	27.0%	16.0%	5.7%	0.0%	20.8%
Male	2	54	42	50	1	160
	40.0%	73.0%	84.0%	94.3%	100.0%	79.2%
	5	74	50	53	1	202
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

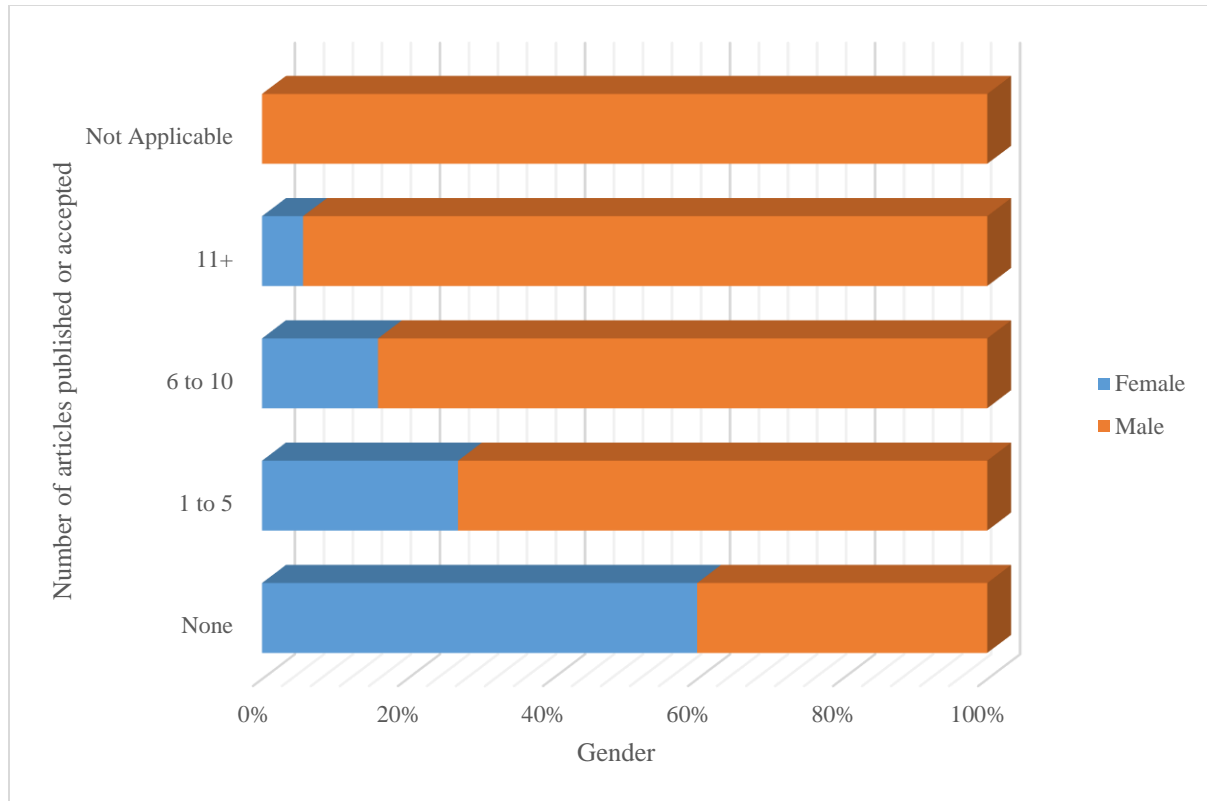


Figure 7.8a Gender versus articles published or accepted (including co-authored)

Figure 7.8a indicates that in terms of frequencies, male respondents seemed to be ahead of their female counterparts for all the counts in articles published or accepted. Figure 7.8b below gives a different picture.

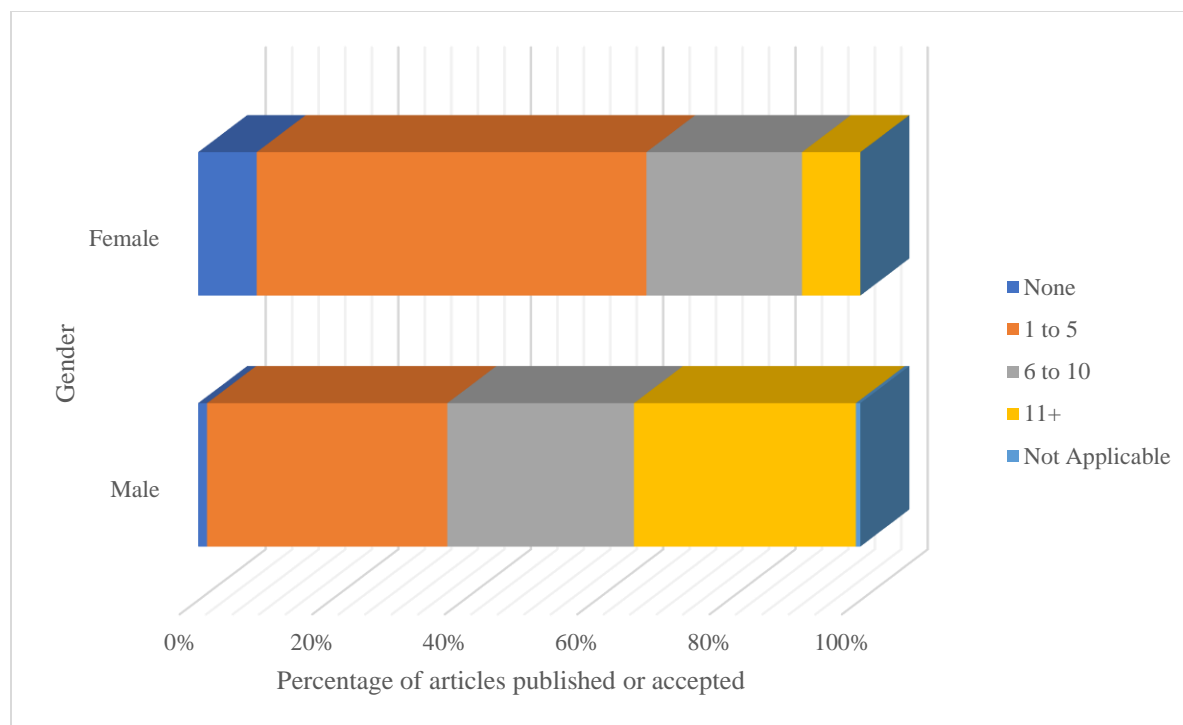


Figure 7.8b Gender versus articles published or accepted (including co-authored)

Figure 7.8b shows that when comparing the percentage outputs that each value contributes to the total, female researchers were almost equally productive for 6–10 articles published or accepted and more productive in 1–5 articles published or accepted. The males however, were more productive for 11+ articles published or accepted. Table 7.6 below gives the outputs by gender for research reports (contracts and/or consultation research).

Table 7.6 Cross-tabulation for gender versus research reports

Gender	Number of research reports (contracts and/or consultation research)					Total
	None	1–5	6–10	11+	Not applicable	
Female	19	10	4	0	1	42
	30.6%	13.7%	20.0%	0.0%	5.6%	20.8%
Male	43	63	16	10	17	160
	69.4%	86.3%	80.0%	100.0%	94.4%	79.2%
	62	73	20	10	18	202
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

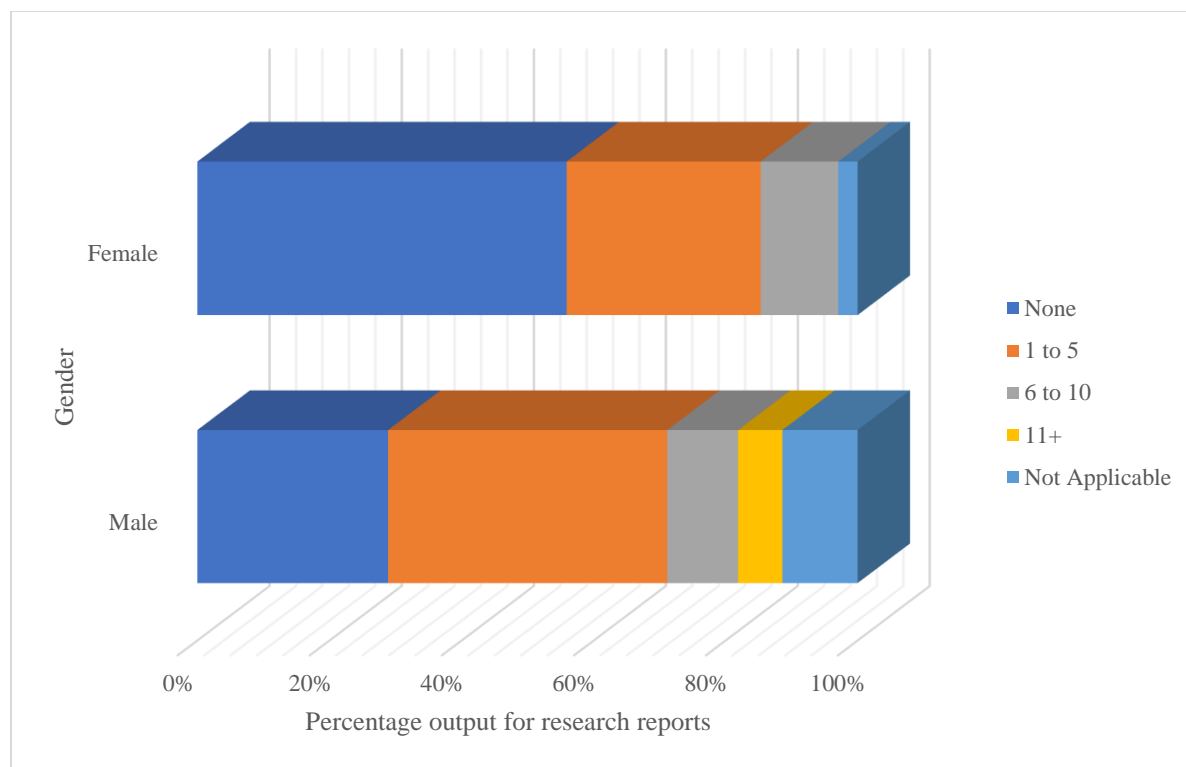


Figure 7.9 Gender versus research reports

Figure 7.9 above also gives an indication that female researchers, although productive in research reports, fell slightly below their male counterparts. It can be observed that male researchers had a higher research output compared to female researchers. However, in the case of 1–5 published articles, 1–5 research reports and 6–10 research reports, 27.0%, 13.7% and 20.0% of the female scores compared with 73.0%, 86.3% and 80.0% of the male scores, which provided a ratio of 1:5 against the background that the female to male ratio of staff in the university was about 1:5 at the time of this research shows that females are equally productive. By implication, we can conclude that female academic staff are as productive or research active as their male counterparts, although generally speaking male researchers seem to be slightly ahead.

7.3.6 Age and research output

Of the 202 valid responses, nine did not provide their year of birth. From the 193 who provided their year of birth, the ages were computed and age brackets created. The descriptive statistics of the age of respondents are given in Table 7.7 below:

Table 7.7 Descriptive statistics for age distribution of respondents

Minimum age of respondents	25
Maximum age of respondents	69
Mean	48
Median	48
Mode	57
Standard deviation	10

Until recently, the average age of staff in the university was above 50 years (QAPU, 2017). The average age of 48 from the survey responses gives a marginal improvement in the quest to have a relatively younger academic staff at KNUST. The age distribution is symmetric since the mean is equal to the median therefore the skewness is zero (Table 7.7). The minimum age of respondents was 25 years and the maximum, 69 years, with a standard deviation (SD) of 10.

Exploring further how age correlates with research productivity, we examined the ages of respondents versus research output over the last three years, using age brackets of 5-year increments. Figure 7.10 gives the distribution and frequencies while Figures 7.11a and 7.11b give the age brackets versus research outputs, specifically for articles published or accepted (including co-authored), with a significant chi-square value of 0. The age group with the highest frequency was 41–45. Although the majority of the respondents were 57 years old, from the cross-tabulations of age bracket versus research output, the age group with the highest research output was 41–45 years. This implies that the productive workforce of the university, as far as research output is concerned, was between the ages of 41 and 45. The university needs to examine this situation critically and channel efforts to encourage the productive workforce who happens to be between the ages of 41 and 45 while making efforts to encourage those in the other age brackets. These should be assigned mentors and/or supervisors and be put into research teams with more senior and experienced academics who have opportunities for funding.

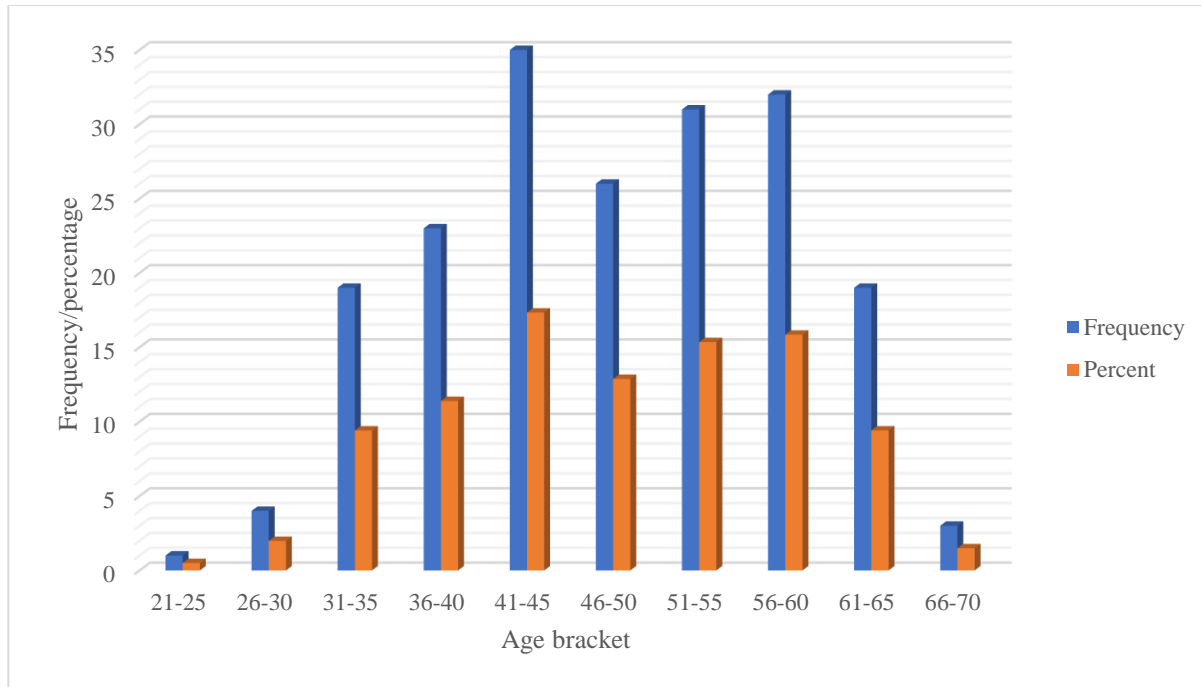


Figure 7.10 Number of respondents by age

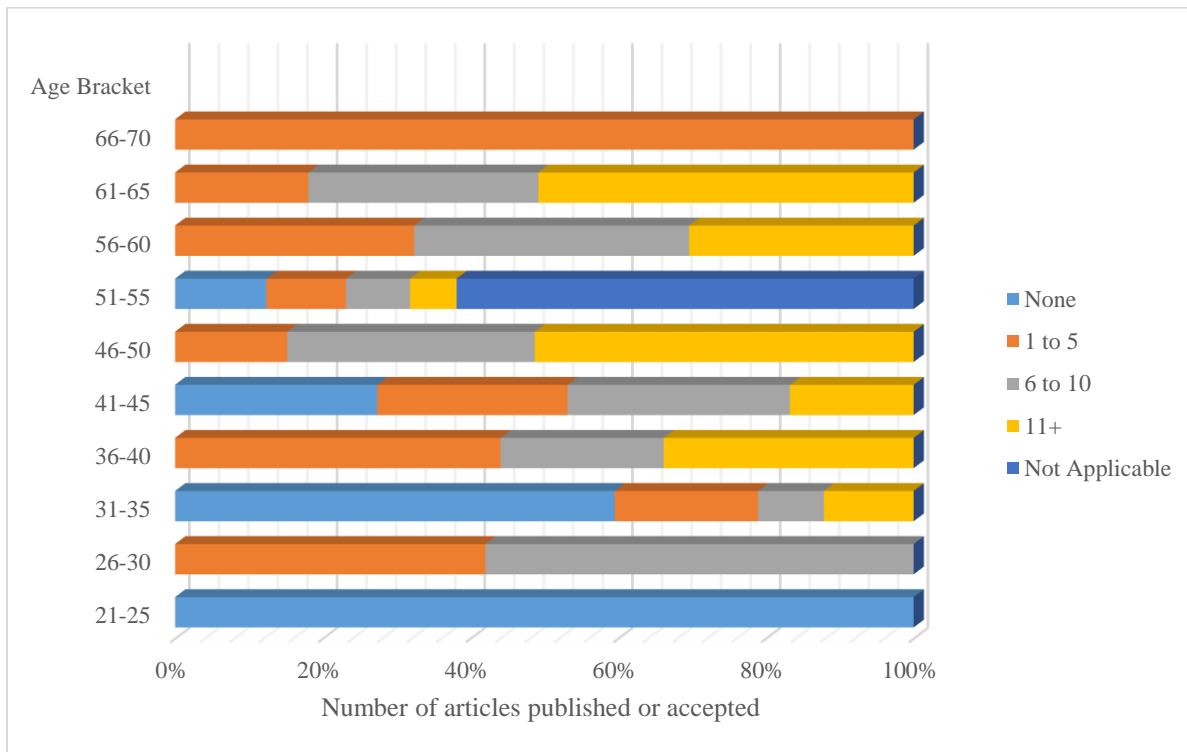


Figure 7.11a Age bracket and research output in terms of articles published or accepted (including co-authored)

Figure 7.11a above and Figure 7.11b below give the overall outlook for the distribution of age bracket and research output in terms of articles published or accepted.

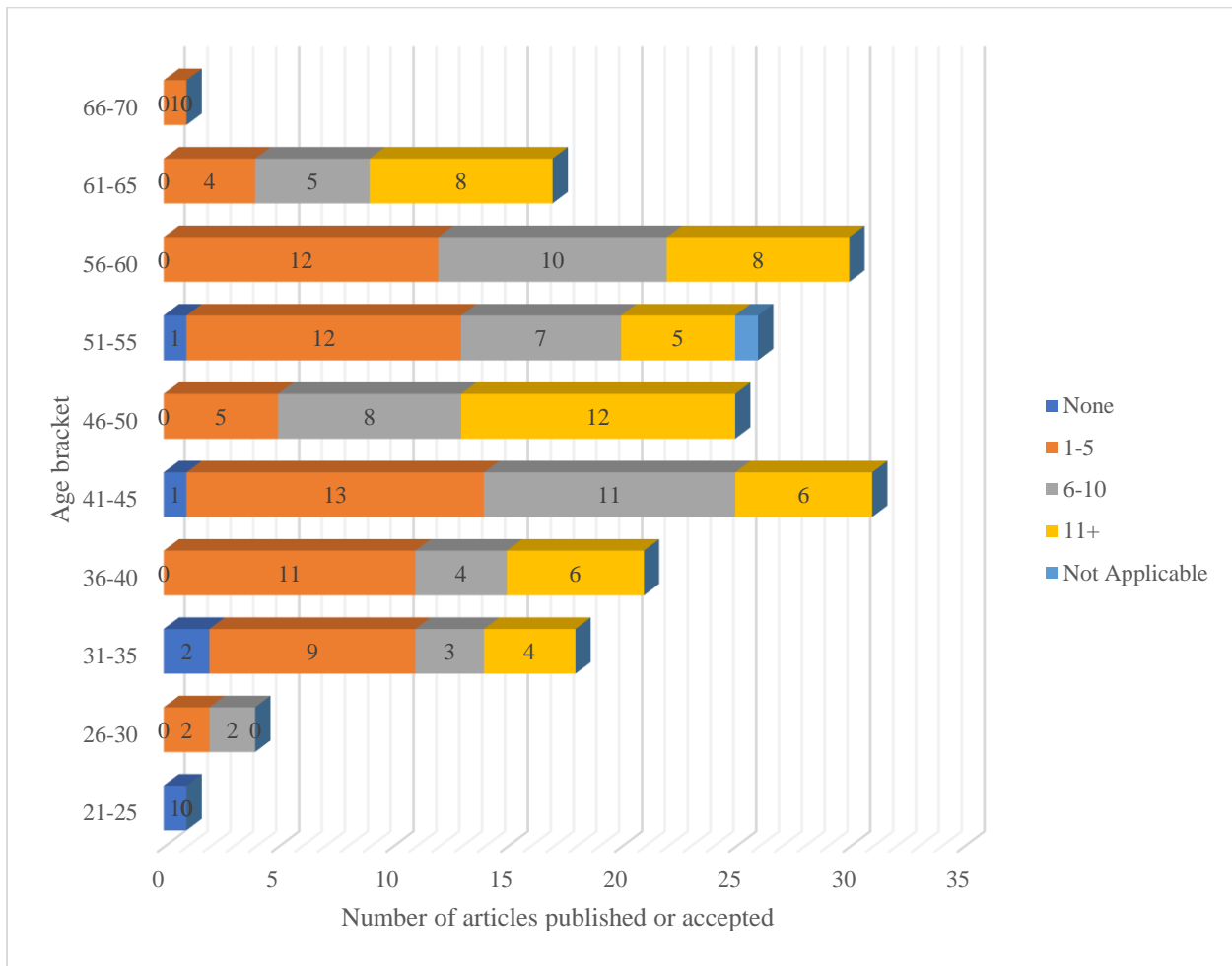


Figure 7.11b Age bracket and research output in terms of articles published or accepted (including co-authored)

Again, from Figure 7.11a above, for 1–5 articles published or accepted, the highest output came from the age bracket 41–45. The same goes for 6–10 but for 11+ articles published or accepted the highest output came from the age bracket 46–50.

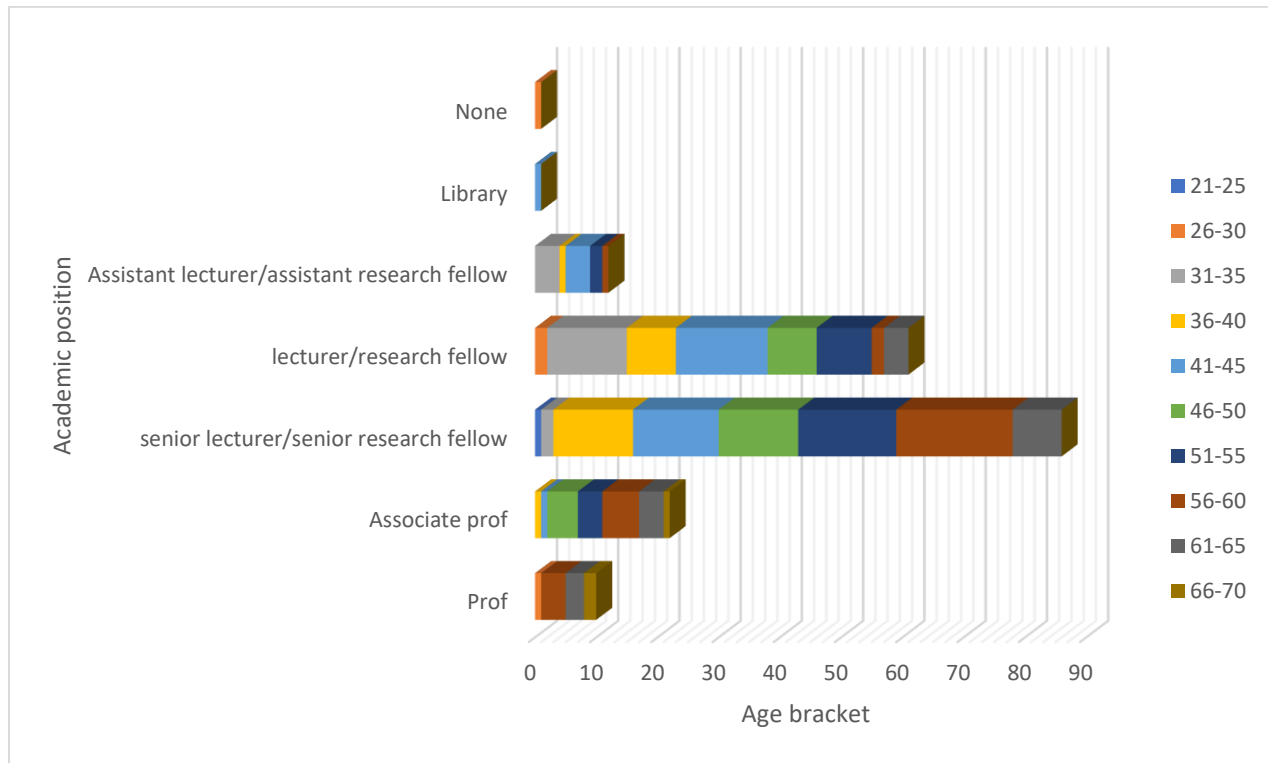


Figure 7.12 Age versus academic position

It is interesting to note that a cross-tabulation of age versus academic position indicates that, in the current study, most professors, associate professors and senior lecturers or senior research fellows were between the ages of 56 and 60 as shown in Figure 7.12 above. A smaller number of associate professors and senior lecturers or senior research fellows were in the age group of 46–50. This is the age bracket with the highest production rate as far articles published or accepted is concerned (see Figure 7.11a). Most senior academics are in the age bracket 56–60 and may retire if not already retired at the mandatory retirement age of 60 years. It is a good sign, however, that the most productive age group is 46–50. Since experience is a function of productivity, the expertise of the most experienced staff ought to be tapped for training and mentoring, promotion of knowledge and service to the community.

7.3.7 Departments or faculties and research output

This subsection reports on research outputs from the various departments and faculties. There were responses from 67 departments and from 22 of the 23 faculties, schools or institutes of KNUST across the six colleges of the university. This afforded us the grounds on which to examine the productivity levels of the various departments and faculties and for that matter, the different fields of specialisation. It has been observed from the literature that different fields of study have different modes of engagement with implications for RU and utilisation (Mouton, 2012) and this will be discussed in the next chapter. This sub-section however, concentrates on the research output of the various faculties. The distribution of responses by departments is given in Figure 7.13 below.

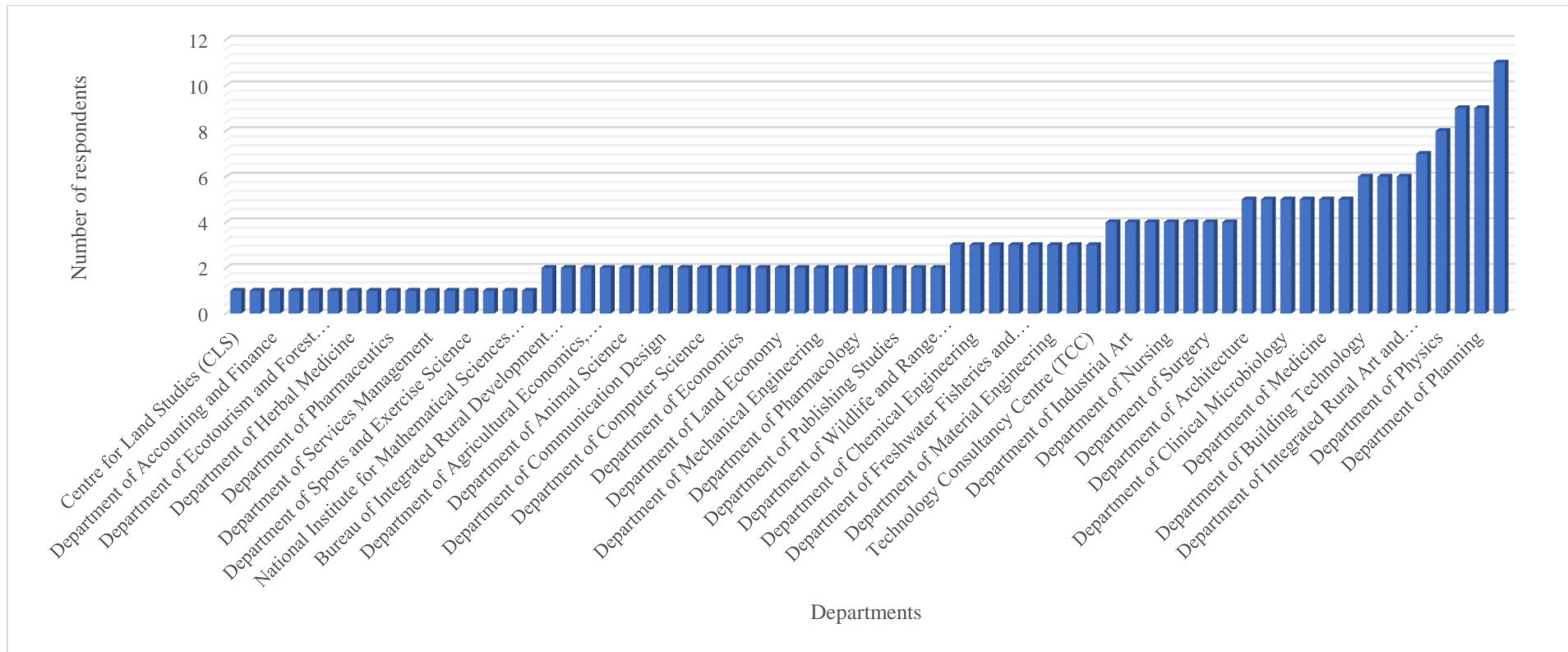


Figure 7.13: Responses by departments

The distribution of responses by faculties, schools or institutes of KNUST is as shown in the Figure 7.14 below:

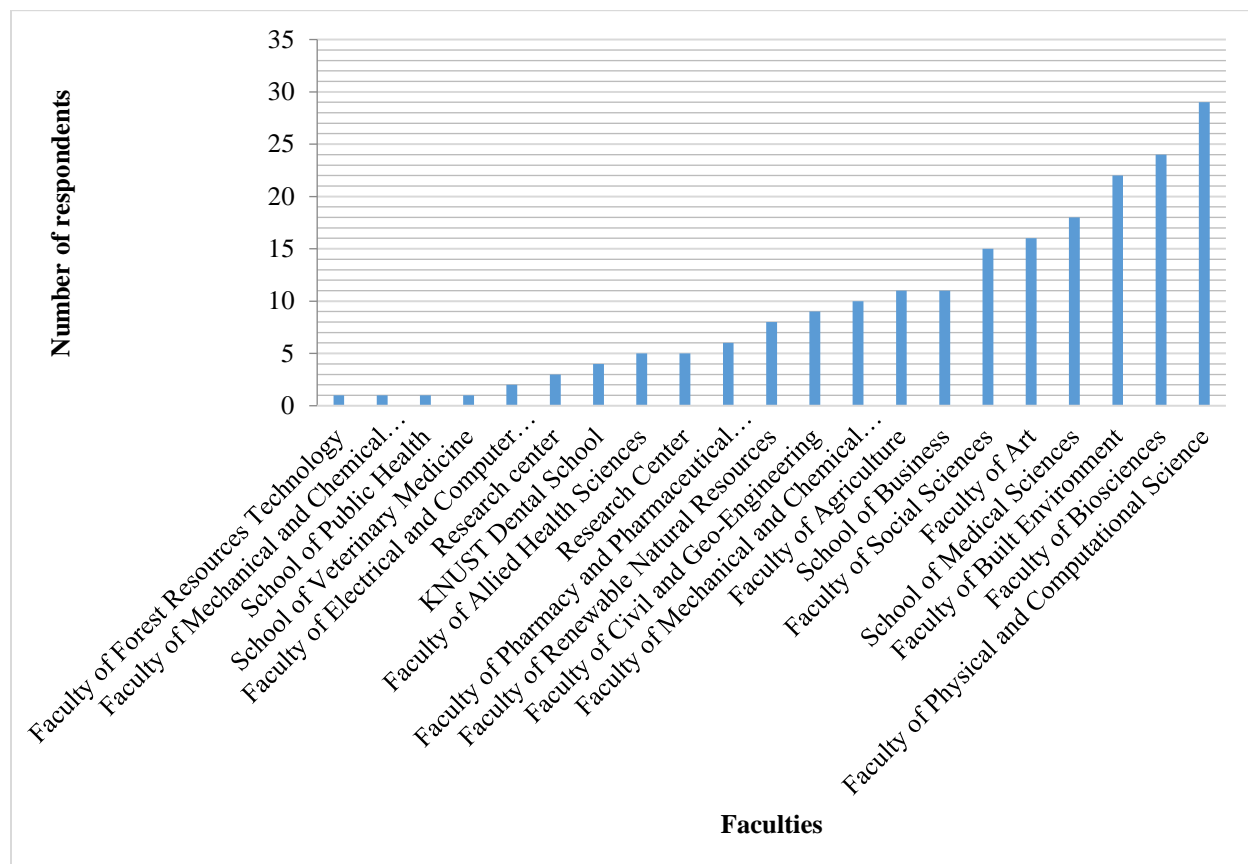


Figure 7.14 Responses by faculties

Research output for individual researchers in faculties, schools or research institutes over the last three years (i.e. 2014-2017) differed significantly from each other in terms of numbers and areas of output. For instance, for 1–5 articles published or accepted (including co-authored), the researchers in the Faculty of Mechanical and Chemical Engineering and the research centres had the highest score of 60%, followed by researchers in the School of Medical Sciences (SMS) with 55%. For 6–10 articles published or accepted, researchers in the research centres had the highest output of 66.7% followed by those of the Faculty of Pharmacy and Pharmaceutical Sciences with 50% and the Faculty of Allied Health Sciences with 40%, as illustrated in Figure 7.15 below. The chi-square value, which was not significant, for faculties versus articles published or accepted was 0.075.

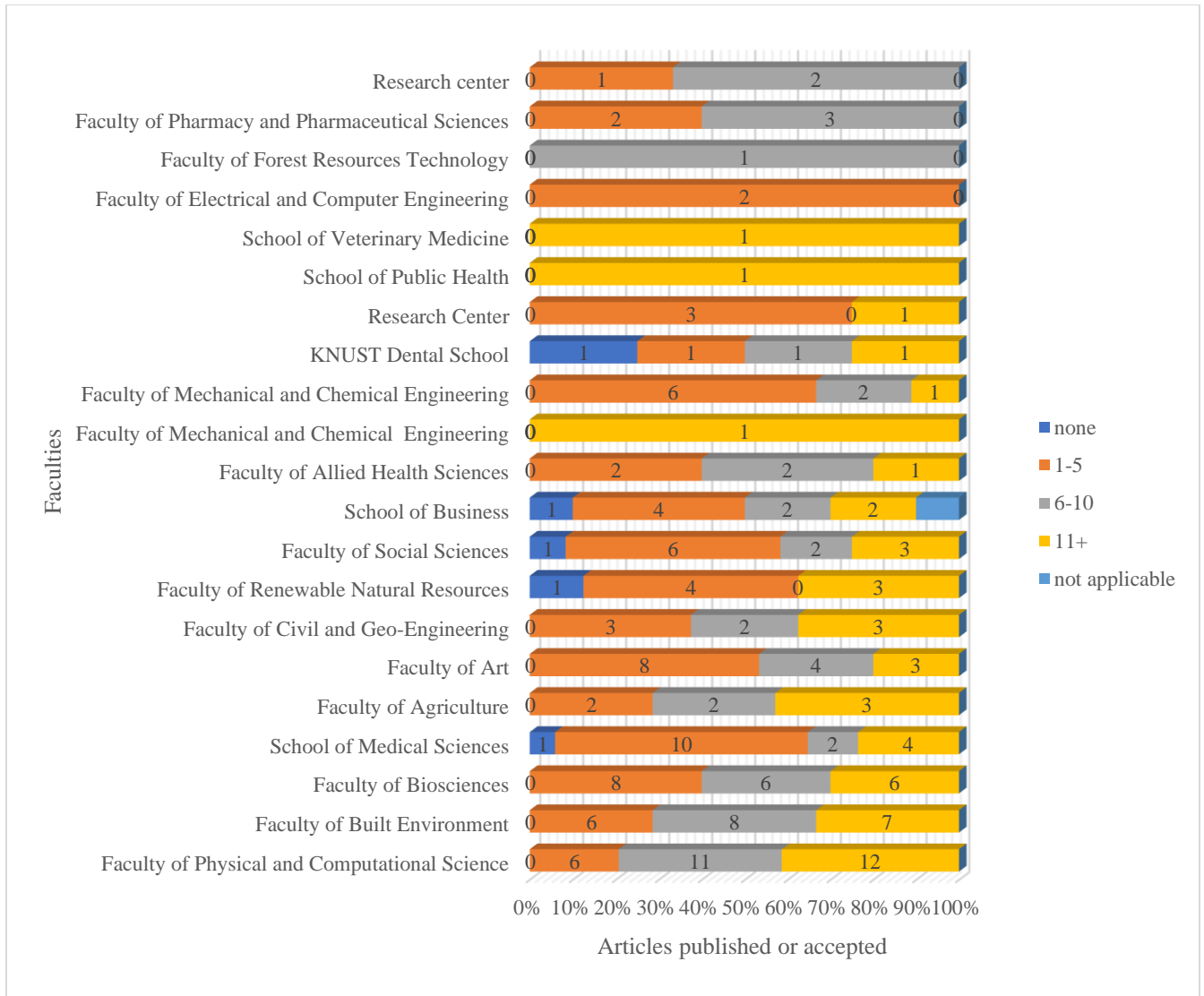


Figure 7.15 Researchers by faculties versus research output (articles published or accepted (including co-authored))

Figure 7.15 above indicates that for 1–5 articles published or accepted, the SMS had the highest score, followed by the Faculty of Biosciences and the Faculty of Art in that order.

Figure 7.15 above illustrates that for 6-10 and 11+ articles published or accepted, researchers from the Faculty of Physical and Computational Science were the most productive, followed by researchers from the Faculty of Built Environment and the Faculty of Biosciences in that order. This result gives an indication of which faculty members need more research support and continuous professional development or any other means to bring their research production levels up to standard.

The outlook of the performance in terms of research output for articles published or accepted of researchers by colleges is provided in Table 7.8 and Figure 7.16 below.

Table 7.8 Colleges versus research output (articles published or accepted)

College	Number of research outputs (articles published or accepted)				
	None	1-5	6-10	11+	Not applicable
CABE	13	16	5	2	1
	21.0%	21.9%	25.0%	20.0%	5.6%
CANR	3	9	3	3	0
	4.8%	12.3%	15.0%	30.0%	0.0%
CHS	16	10	2	1	5
	25.8%	13.7%	10.0%	10.0%	27.8%
CHSS	11	7	0	0	4
	17.7%	9.6%	0.0%	0.0%	22.2%
COE	5	12	3	0	3
	8.1%	16.4%	15.0%	0.0%	16.7%
COS	14	19	7	4	5
	22.6%	26.0%	35.0%	40.0%	27.8%

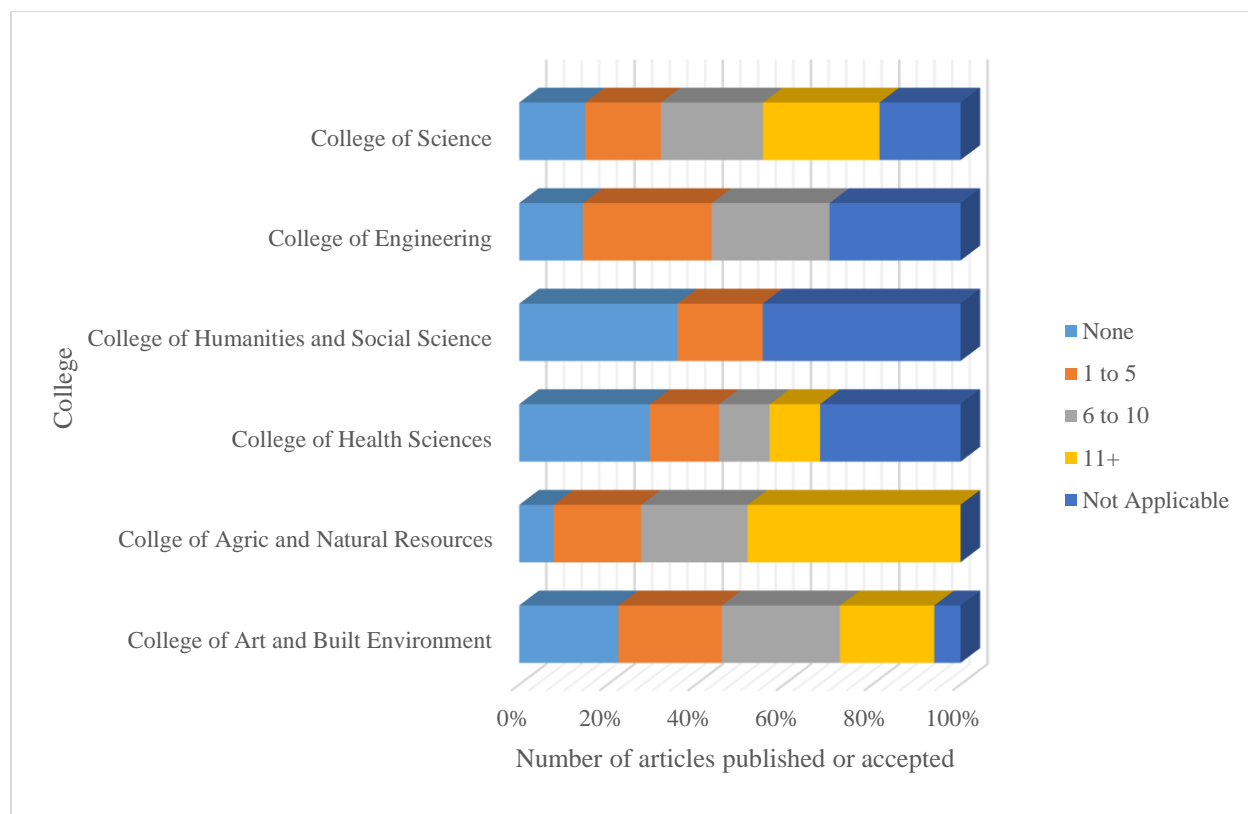


Figure 7.16 Researchers by colleges versus research output (articles published or accepted)

Figure 7.16 above shows that for 6–10 and 11+ articles published or accepted, the COS had the highest with 35% and 40% outputs respectively, followed by the CANR and CABE with 30% and 20% respectively for 11+ articles published or accepted. The Faculty of Physical and Computational Science and the Faculty of Biosciences both belong to the COS while the Faculty of Built Environment belongs to the CABE. Figure 7.16 confirms the outcomes illustrated by Figure 7.15.

Table 7.9 and Figure 7.17 reflect performance in research output for conference papers by researchers in the colleges and published in proceedings. The cross-tabulation gave an insignificant chi-square value of 0.478. However, trends can be observed for the strengths in productivity for different colleges. The COS had the highest level of production of 28.7% for 1-5 and 28.0% for 6-10 outputs, followed by the CHS and the CABE in that order with 18.8% and 16.0% for CHS, and 16.8% and 20.0% for CABE in respect of 1-5 and 6-10 outputs. For 11+ conference papers the

CABE and CHS topped with 27.8% followed by the COS and COE with 11.1% each. This trend is similar to that of research output for articles published or accepted (including co-authored).

Table 7.9 Colleges versus research output (conference papers published in proceedings)

College	Number of research output (conference papers published in proceedings)				
	None	1–5	6–10	11+	Not applicable
CABE	10	17	5	5	0
	28.6%	16.8%	20.0%	27.8%	0.0%
CANR	4	7	3	4	0
	11.4%	6.9%	12.0%	22.2%	0.0%
CHS	6	19	4	5	0
	17.1%	18.8%	16.0%	27.8%	0.0%
CHSS	2	17	3	0	0
	5.7%	16.8%	12.0%	0.0%	0.0%
COE	5	12	3	2	1
	14.3%	11.9%	12.0%	11.1%	25.0%
COS	8	29	7	2	3
	22.9%	28.7%	28.0%	11.1%	75.0%

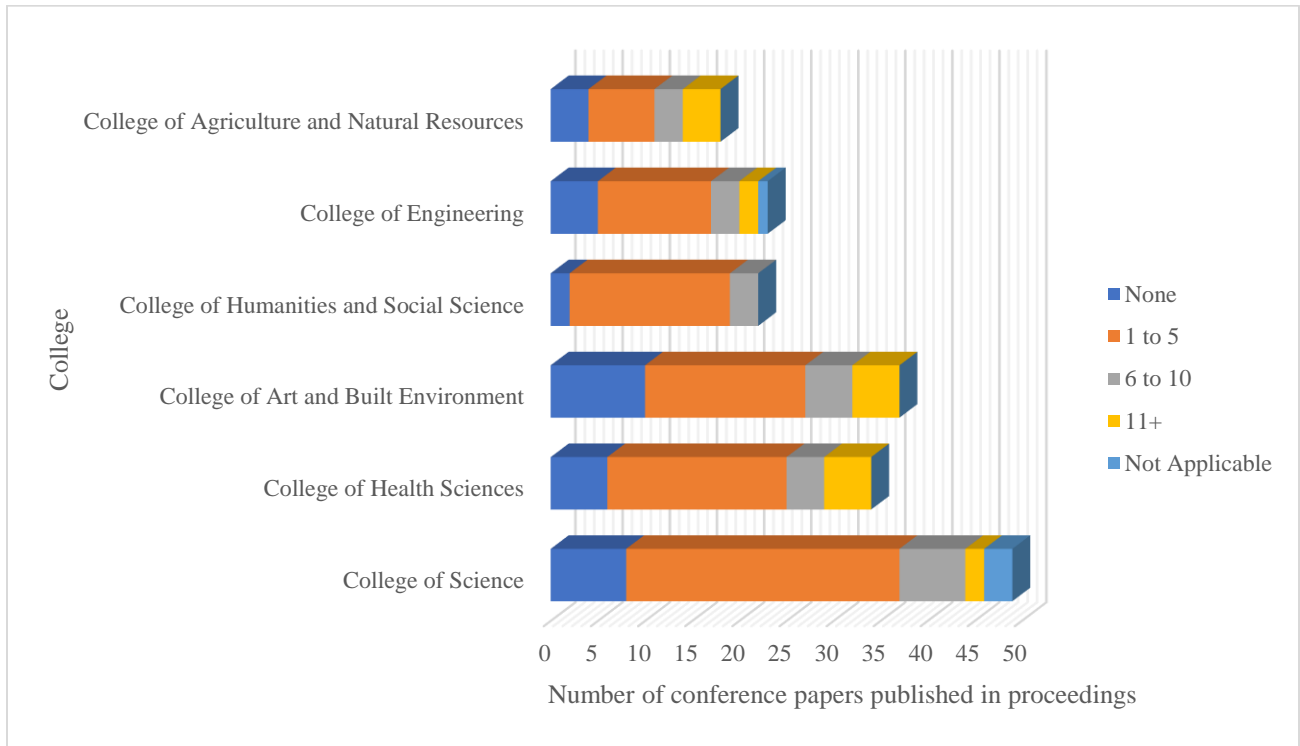


Figure 7.17 Colleges versus research output (conference papers published in proceedings)

Figure 7.17 above shows that for 1–5 research outputs, the COS had the highest score of approximately 29% followed by the CHS and the CABA with approximately 19% and 17% in that order. However, for 6–10, outputs the CHS and the CABA swapped positions while the COS maintained its lead as illustrated in Figure 7.17.

In terms of conference papers published in proceedings, for 11+ research outputs, the CABA and the CHS obtained the highest scores, followed by the CANR.

The performances by faculties and colleges in other research output areas, such as book chapters, books, official public documents, articles in journals and popular journals, research reports, computer programs, patents and creative art works, all gave varied performance levels for the different faculties and colleges. Some faculties or colleges showed dominance in specific areas, as discussed above for articles published or accepted and conference papers published in proceedings, while slacking in other areas. It is not surprising that the Faculty of Art had the highest score in terms of percentages, in creative art works while the Faculty of Electrical and Computer Engineering led in the production of computer programs. These are directly related to their core business as well as their areas of specialisation. The above result gives an indication of the areas of focus of the various faculties in terms of research output, and also confirms the fact that different faculties have different focuses. This reiterates the need to have tailor-made strategies and incentives for RU for the different areas of study.

7.3.8 Position and research output

This sub-section examines the relationship between position and research output. In order to determine research productivity levels by position, a cross-tabulation of position versus research output was carried out. The research outputs with significant chi-square values of 0.013 and 0.001 were those of articles published or accepted (including co-authored) and computer programs respectively. The Pearson chi-square values gave us a level of significance, which implies that there was an even distribution of articles published and computer programs within the group of official positions in articles published and computer programs over the three-year period (2015-2017). Table 7.10 presents the responses for articles published or accepted generated from the SPSS dataset. Figure 7.18 below illustrates the production levels for articles published or accepted (including co-authored) and those of computer programs.

Table 7.10 Position and research output (articles published or accepted)

Academic position	Number of research outputs (articles published or accepted)				
	None	1–5	6–10	11+	Not applicable
Professor	0	3	2	5	0
	0.0%	4.1%	4.0%	9.4%	0.0%
Associate professor	0	3	6	11	0
	0.0%	4.1%	12.0%	20.8%	0.0%
Senior lecturer, senior research fellow	1	29	23	30	0
	20.0%	39.2%	46.0%	56.6%	0.0%
Lecturer, research fellow	4	28	17	7	1
	80.0%	37.8%	34.0%	13.2%	100.0%
Assistant lecturer, assistant research fellow	0	10	2	0	0
	0.0%	13.5%	4.0%	0.0%	0.0%
Library	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%

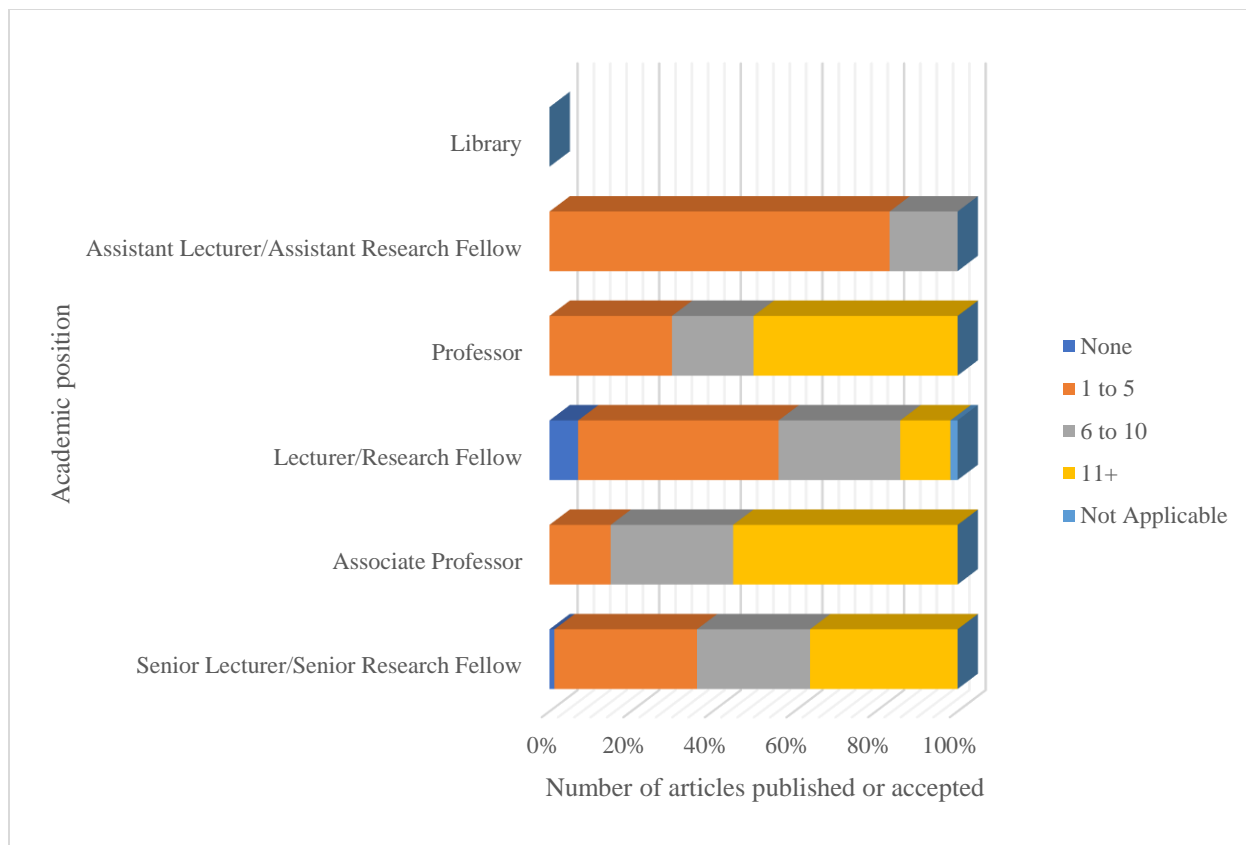


Figure 7.18 Position versus research output (articles published or accepted)

Figure 7.18 above gives the overall outlook for 1–5, 6–10, 11+ research outputs for articles published or accepted by academic positions. These were analysed by comparing the percentage that each position contributes to the total. For 1–5 articles published or accepted, senior lecturers and equivalents obtained the highest score, indicating highest research output, making them the most productive in this category as illustrated in Figure 7.18 above. For production levels of 6–10, again, senior lecturers and equivalents were the most productive. For production levels exceeding 11 articles published or accepted, senior lecturers and associate professors were the most productive. It can be concluded that as far research output for articles published or accepted is concerned senior lecturers and associate professors were the most productive, while the more junior researchers were less productive. This researcher can infer that there is a direct correlation between research output and experience.

The next sub-section reports on the correlation between research output and academic qualification.

7.3.9 Qualification and research output

This sub-section reports on the correlation between qualification and research output.

Similar to the results on position against research output, the qualifications of the respondents had a direct bearing on research productivity. From a cross-tabulation of qualification versus research outputs using SPSS, the research output with the most significant chi-square value is that of articles published or accepted. Figure 7.19 below illustrates the effect of qualification on research output, specifically for articles published or accepted (including co-authored). The Pearson chi-square value for the distribution was 0.001.

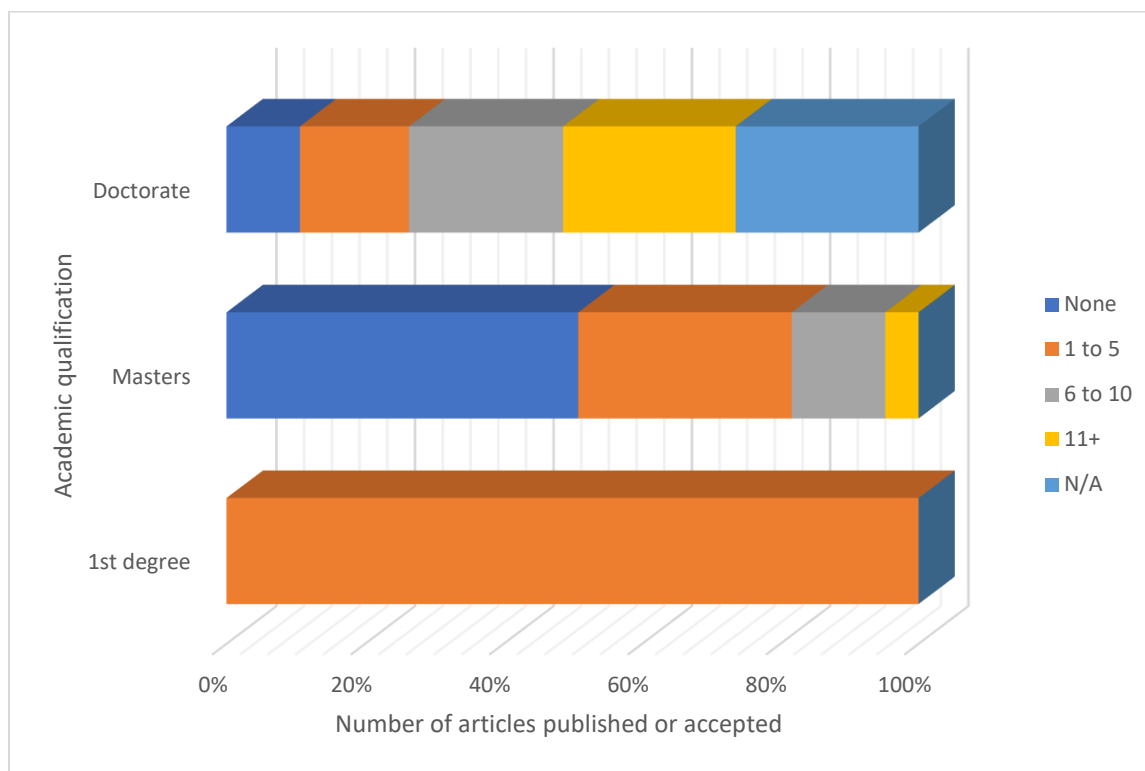


Figure 7.19 Qualification versus articles published or accepted (including co-authored)

As shown in Figure 7.19 above, for 1–5, 6–10 and 11+ articles published or accepted, the most productive were the holders of doctorates. In terms of percentage contribution to the total output, holders of doctorates produced the highest output for 1-5, 6–10 and 11+ articles published or accepted, as shown in Figure 7.19.

This was confirmed and validated from the interview responses where most respondents who held doctorates, indicated that they produced most of their research outputs during their PhD studies or

from their PhD thesis. The same trend is observed for presentations at conferences and articles in popular journals with significant Pearson chi-square values of 0.017 and 0.009 respectively. We observed the same trend again, where holders of doctorates dominate all the counts, i.e. 1–5, 6–10 and 11+ presentations at conferences and published articles in popular journals. We can conclude that holders of doctorates are the most research active in terms of the above research outputs. By implication, there is a possibility that the university could increase its research output through graduate training.

7.4 Research development focus and impact

This sub-section reflects the impact of research produced by researchers, what the focal areas are, and how successful researchers have been with the uptake of the knowledge produced. This provides additional information towards answering the research question, which sought to determine the research focus of researchers at KNUST and how that contributes to local and national development. Most importantly, this current study considers the specifics of how successful researchers have been in their different fields of study in terms of knowledge production and dissemination activities. To this effect, respondents were asked to rate the extent to which they believe that they had been successful with their research in addressing specific issues. The details are discussed in the sub-sections below.

7.4.1 Rate of success in research impact

This sub-section considers the extent to which researchers have been successful as far as their research is concerned. Table 7.11 below summarises the outcomes for the extent to which researchers had been successful in terms of research output. Figure 7.20 below illustrates the extent to which researchers had been successful in terms of the impact of their research with respect to advancing knowledge, solving theoretical problems, and solving immediate technical or applied problems.

Table 7.11 Rate of success with respect to research output

Research outputs	Extent of success					
	Highly successful	Successful to some extent	Not successful at all	Not applicable	Skipped	Valid total
Advancement of knowledge	119 58.9%	60 29.7%	3 1.5%	1 0.5%	19 9.4%	183 90.6%
Solving of theoretical problems	46 22.8%	95 47.0%	8 4.0%	34 16.8%	19 9.4%	183 90.6%
Solving of immediate technical/ applied problems	48 23.8%	96 47.5%	8 4.0%	31 15.3%	19 9.4%	183 90.6%
Solving of environmental or social problems	44 21.3%	87 43.1%	8 4.0%	44 21.8%	19 9.4%	183 90.6%
Development of skills and competencies	74 36.6%	84 41.6%	6 3.0%	19 9.4%	19 9.4%	183 90.6%
Change in behaviour, attitudes or values	35 17.3%	91 45.0%	15 7.4%	42 20.8%	19 9.4%	183 90.6%
Influence on policy- or decision-makers	26 12.9%	92 45.5%	33 16.3%	32 15.8%	19 9.4%	183 90.6%
Influence on practice	55 27.2%	95 47.0%	8 4.0%	25 12.4%	19 9.4%	183 90.6%
Stimulation of discussion or debate	45 22.3%	94 46.5%	17 8.4%	27 13.4%	19 9.4%	183 90.6%
Other	3 1.5%	0 0%	0 0%	0 0%	199 98.5%	3 1.5%

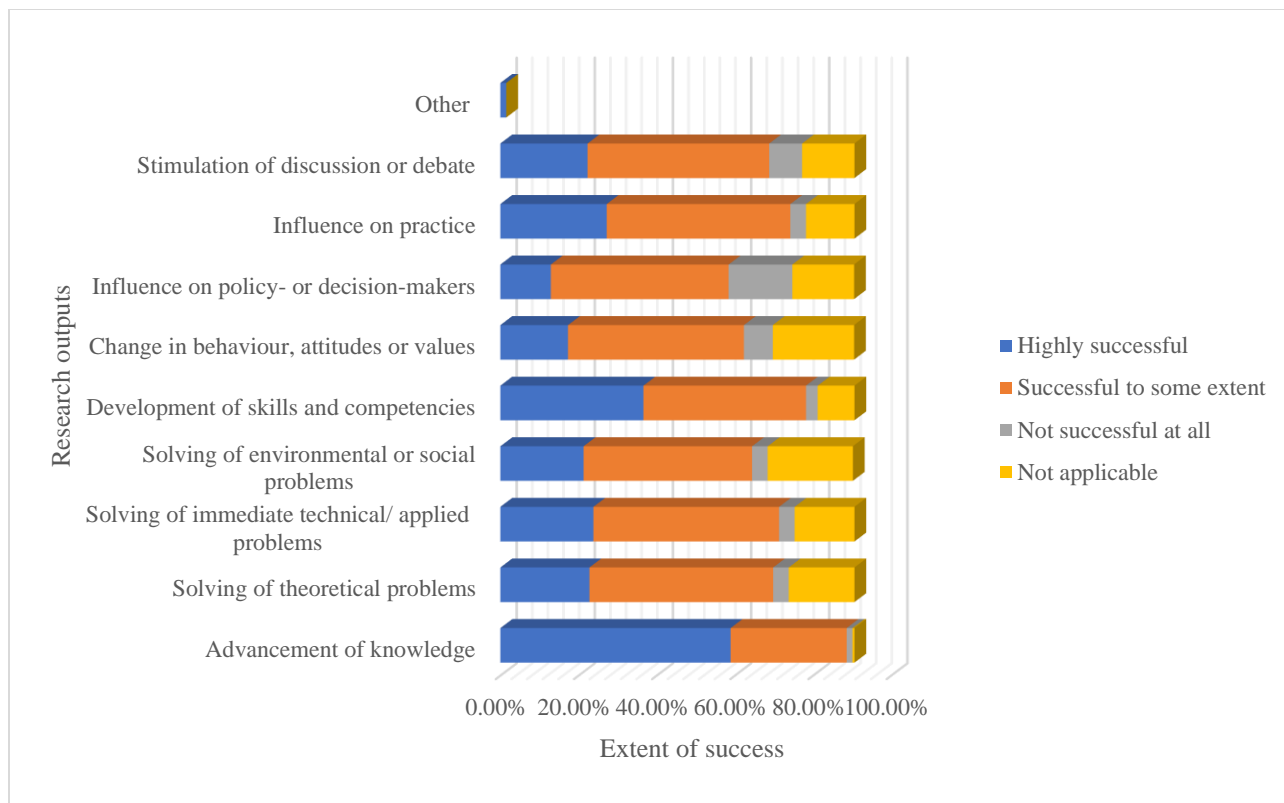


Figure 7.20 Extent of success with research output (N=202)

Figure 7.20 above clearly shows that researchers at KNUST have been highly successful in advancement of knowledge, followed by development of skills and competences, influence on practice, and solving immediate technical or applied problems. This means that most of the respondents aimed at advancing or promoting knowledge through their research. This may be due to the university criterion, which requires promotion of knowledge and, for that matter, publication as a means to career advancement. We can infer that the main motivation for research may not be directed towards local or national development. The above responses confirm that researchers at KNUST mainly aim at publication in refereed journals, and that the majority will go for advancement of knowledge. These areas of success are channels for RU and utilisation, and therefore university management could consider policies along these lines.

Ideally, emphasis is needed in areas that aim at addressing local and national problems rather than research being inclined toward publication. Solving immediate technical/applied problems and influence on practice as well as solving environmental and social problems are areas that need greater attention. The interview report confirms that there have been a few successful attempts at

addressing local and national development problems through research. These responses gave an indication about the research focus areas as far as research output is concerned. The motivation for this ought to be investigated further, although one may assume that research is carried out mainly for promotion purposes.

In order to redirect the research agenda towards solving specific local and national problems, the university needs to reconsider its policy direction as far as promotion of knowledge is concerned. As indicated by some interviewees, there are some actions that they believe the university could take to ensure research is used by government for national development. These actions include:

Dissemination workshop as indicated earlier (Respondent, R9)

Organising a programme where we are showcasing our research to industry (Respondent, R9).

Invite key stakeholders and then bring them into an exhibition [Respondent, R3).

In KNUST we have centres. We have energy centre, water centre, BIRD, TCC and in Planning we have another centre, so we have a day where we are inviting industry to see the research findings that we have and proposed solutions that we have for these ones (Respondent, R15).

What will cause government to use knowledge is the availability [Respondent, R15).

Government awareness of the existence of that knowledge and suitability of that knowledge to address whatever the challenge is (Respondent R16).

Whether it is cutting edge enough to address the challenges (R2).

Research should tackle more national issues (Respondent, R8).

There are several local and national areas of need and therefore public institutions must join in the campaign for national development. Research plays a key role in national development and therefore our strategic RU framework (See sub-section 3.5) aims at defining appropriate pathways in order to redirect the focus of researchers towards uptake and utilisation of research. The next sub-section reflects on the specific areas where attention is given at faculty level.

7.4.2 Research success of different faculties

As a follow-up to the discussion in section 7.4.1, this sub-section considers the focal research areas where the different faculties have been very successful and successful to some extent in their research. As discussed in general above, individual researchers have their own focal areas, specialisations and aims for doing research. We now go into the specifics of what the focal areas of the various faculties are, and how successful they have been with their outputs. A cross-tabulation of the expected impact of research against faculties gives an observation similar to that

made in section 7.4.1, that the research focus of the faculties of the university is geared towards advancement of knowledge and solving theoretical problems. Researchers pay little attention to solving environmental and social problems, influencing policy and practice. These areas are considered essential for local and national development, and therefore measures need to be put in place to redirect attention there.

Figures 7.21 to 7.23 illustrate the extent to which various faculties have been highly successful and successful to some extent with their research. A cross-tabulation of faculties against the rate of success in research was carried using the SPSS dataset. Although the chi-square values were not significant, a few have been selected for the purposes of analysis of how successful faculties have been in their research process and in which areas.

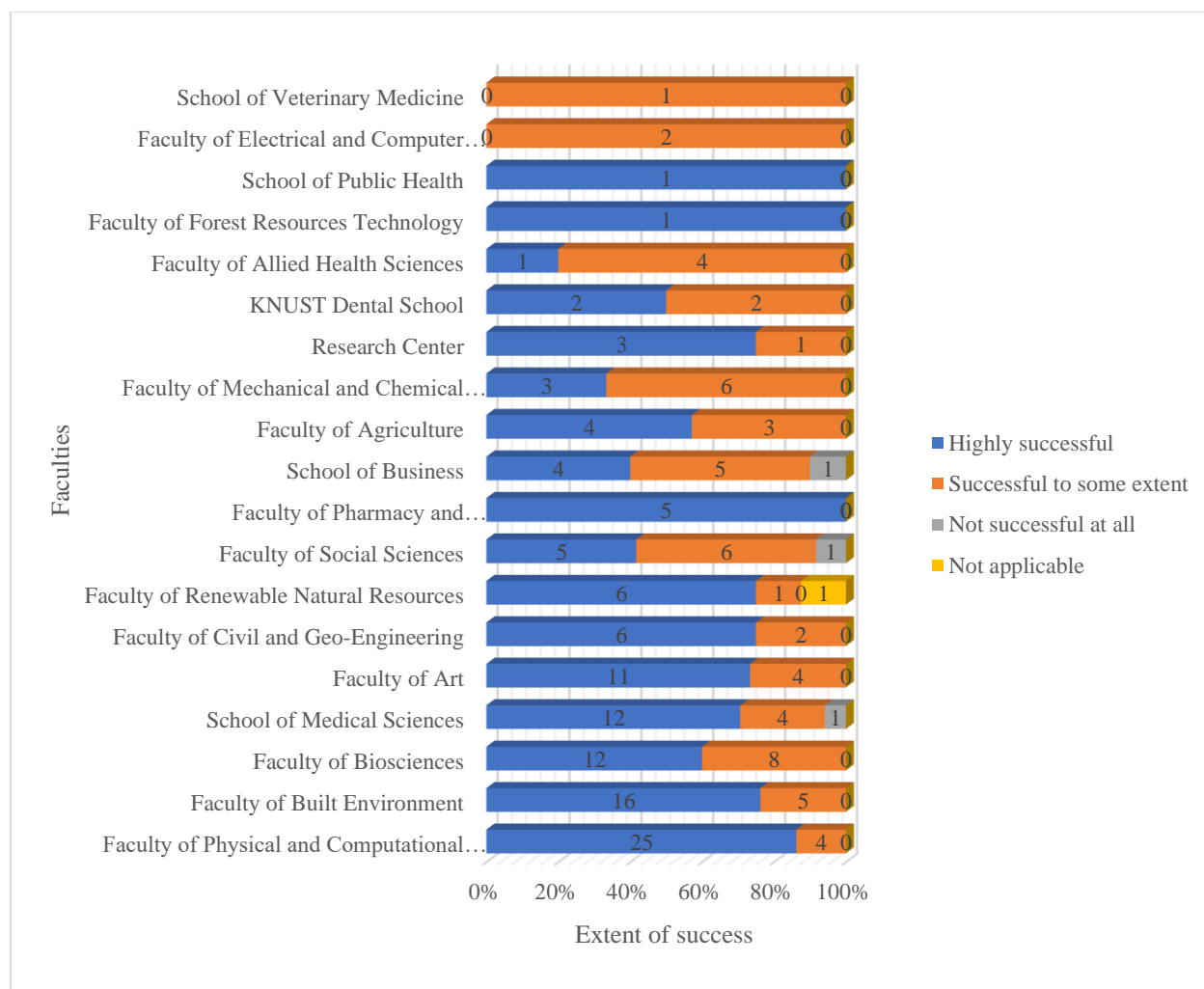


Figure 7.21 Faculties and extent of success with respect to advancement of knowledge (p-value=0.155)

In Figure 7.21 above, we notice that in terms advancement of knowledge, the Faculty of Physical and Computational Science and the Faculty of Built Environment were the top two that were highly successful with advancement of knowledge. The main focus of these faculties is therefore advancement of knowledge as already proved in other sections (see sub-section 7.4.1). It could well be that researchers in these faculties undertake more of basic research rather than applied or developmental research.

Figure 7.22 below provides an illustration of how successful faculties have been as far as solving immediate technical and applied problems is concerned. The Faculty of Art, Faculty of Biosciences and the Faculty of Built Environment in that order were highly successful. By their very nature and establishment, researchers in these faculties are most likely to engage in applied or developmental research which leads to solving practical problems. The impact of their research can therefore be seen in the area of solving theoretical or applied problems.

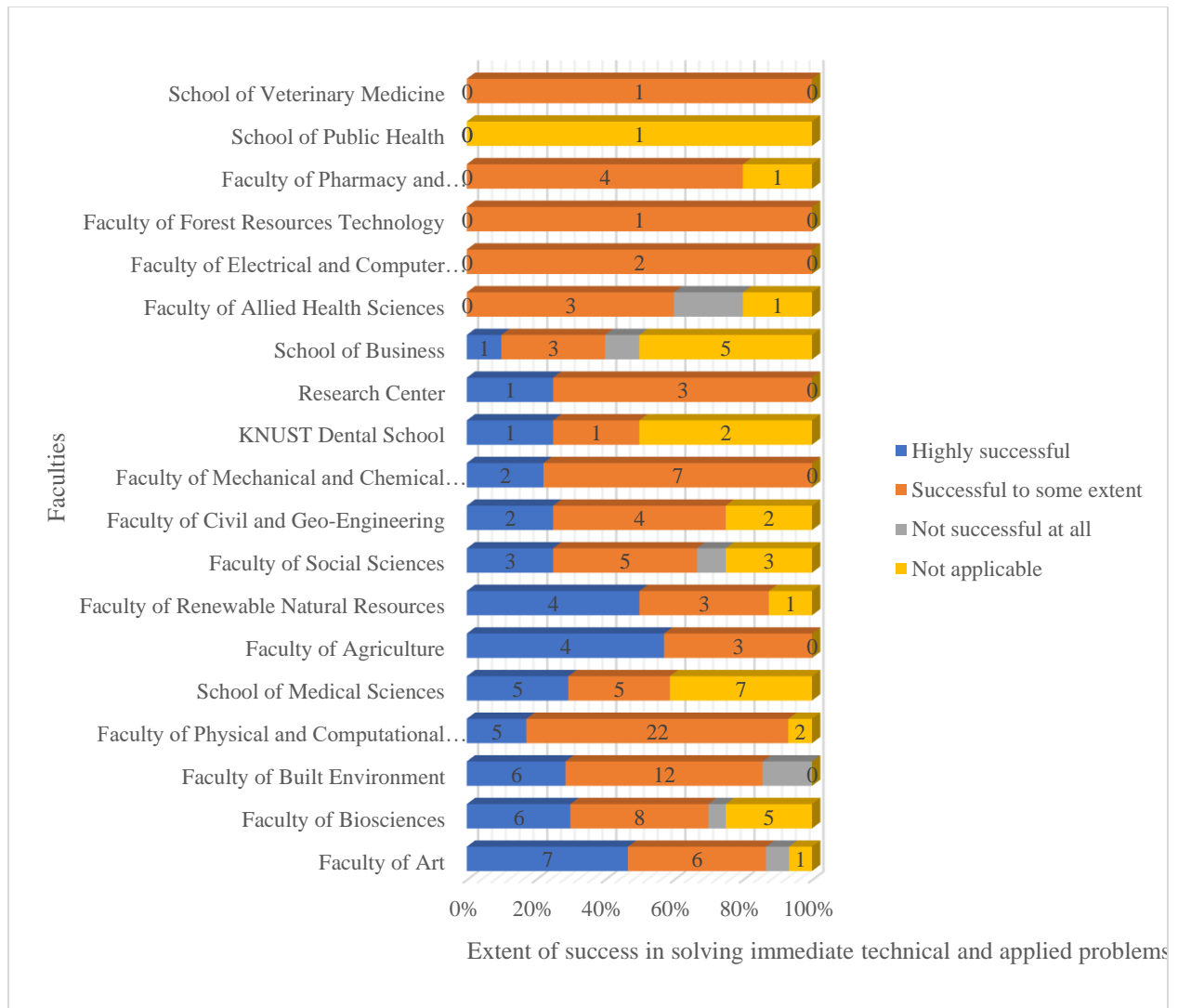


Figure 7.22 Faculties and extent of success with respect to solving immediate technical and applied problems (p-value=0.083)

Solving environmental and social problems have a direct influence as far as RU is concerned. As indicated by some researchers during the interviews:

[F]or me, when the people are using what you have come out with, then that is the biggest success that one would be looking at (Respondent, R17).

In addition to the research output we gained as researchers, it was absolutely refreshing to see these women find jobs to be able to support their families as well as, improve on their own living conditions (Respondent, R11)

Figure 7.23 below indicates that as far as solving environmental problems is concerned, the Faculty of Built Environment, the Faculty of Physical and Computational Sciences, the Faculty of Biosciences and the School of Medical Sciences in that order, were highly successful.

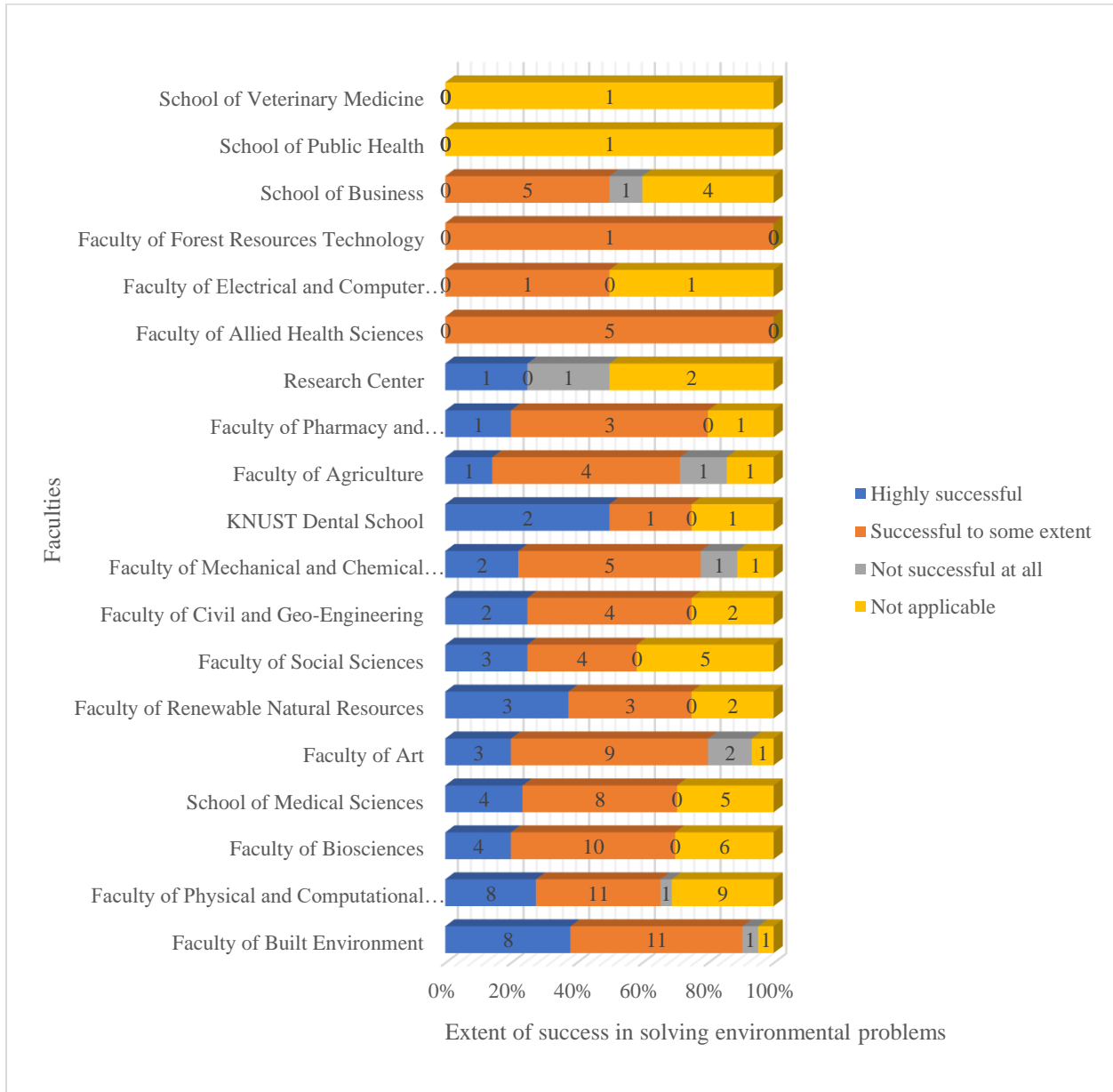


Figure 7.23 Faculties and extent of success with respect to solving environmental and social problems (p-value=0.62)

7.4.3 Overall research success of faculties

This sub-section provides a picture of the overall success of the various faculties and the areas where they appear to be successful. A cross-tabulation of faculties versus areas of focus where faculties had been highly successful, was carried out. Table 7.12 below provides the summary, while Figure 7.24 gives an illustration of the problems next to each other and the extent of success of each faculty.

Table 7.12 Overall research success of faculties

Faculty	Overall research success with outputs									
	Advancement of knowledge	Solving theoretical problems	Solving immediate technical or applied problems	Solving environmental problems	Development of skills and competence	Change of behaviour, attitudes and values	Influencing policy	Influencing practice	Stimulation of discussion	Other
Faculty of Agriculture	4	1	4	1	3	2	1	3	0	0
	3.4%	2.2%	8.3%	2.3%	4.1%	5.7%	3.8%	5.5%	0.0%	0.0%
Faculty of Allied Health Sciences	1	0	0	0	0	0	0	1	1	0
	.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	2.2%	0.0%
Faculty of Art	11	4	7	3	9	4	2	5	2	0
	9.2%	8.7%	14.6%	6.8%	12.2%	11.4%	7.7%	9.1%	4.4%	0.0%
Faculty of Biosciences	12	4	6	4	8	4	0	5	4	0
	10.1%	8.7%	12.5%	9.1%	10.8%	11.4%	0.0%	9.1%	8.9%	0.0%
Faculty of Built Environment	16	6	6	8	13	6	5	7	7	0
	13.4%	13.0%	12.5%	18.2%	17.6%	17.1%	19.2%	12.7%	15.6%	0.0%
Faculty of Civil and Geo-Engineering	6	2	2	2	3	0	1	2	2	0
	5.0%	4.3%	4.2%	4.5%	4.1%	0.0%	3.8%	3.6%	4.4%	0.0%
Faculty of Electrical and	0	0	0	0	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Computer Engineering										
Faculty of Forest Resources Technology	1	1	0	0	1	0	0	0	0	0
	.8%	2.2%	0.0%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Faculty of Mechanical and Chemical Engineering	0	0	1	0	0	0	0	0	1	0
	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%
Faculty of Mechanical and Chemical Engineering	3	1	2	2	1	1	1	1	1	0
	2.5%	2.2%	4.2%	4.5%	1.4%	2.9%	3.8%	1.8%	2.2%	0.0%
Faculty of Pharmacy and Pharmaceutical Sciences	5	0	0	1	4	1	0	2	0	0
	4.2%	0.0%	0.0%	2.3%	5.4%	2.9%	0.0%	3.6%	0.0%	0.0%
Faculty of Physical and Computational Science	25	13	5	8	15	6	2	8	7	0
	21.0%	28.3%	10.4%	18.2%	20.3%	17.1%	7.7%	14.5%	15.6%	0.0%
Faculty of Renewable Natural Resources	6	4	4	3	0	0	0	2	2	0
	5.0%	8.7%	8.3%	6.8%	0.0%	0.0%	0.0%	3.6%	4.4%	0.0%
Faculty of Social Sciences	5	2	3	3	2	2	3	2	4	0
	4.2%	4.3%	6.3%	6.8%	2.7%	5.7%	11.5%	3.6%	8.9%	0.0%
KNUST Dental School	2	2	1	2	2	1	1	2	1	0
	1.7%	4.3%	2.1%	4.5%	2.7%	2.9%	3.8%	3.6%	2.2%	0.0%

Research centre	2	2	0	2	1	1	1	2	2	0
	1.7%	4.3%	0.0%	4.5%	1.4%	2.9%	3.8%	3.6%	4.4%	0.0%
School of Business	4	1	1	0	2	1	3	2	1	1
	3.4%	2.2%	2.1%	0.0%	2.7%	2.9%	11.5%	3.6%	2.2%	100.0%
SMS	12	3	5	4	8	4	6	9	8	0
	10.1%	6.5%	10.4%	9.1%	10.8%	11.4%	23.1%	16.4%	17.8%	0.0%
School of Public Health	1	0	0	0	0	0	0	1	1	0
	.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	2.2%	0.0%
School of Veterinary Medicine	0	0	0	0	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

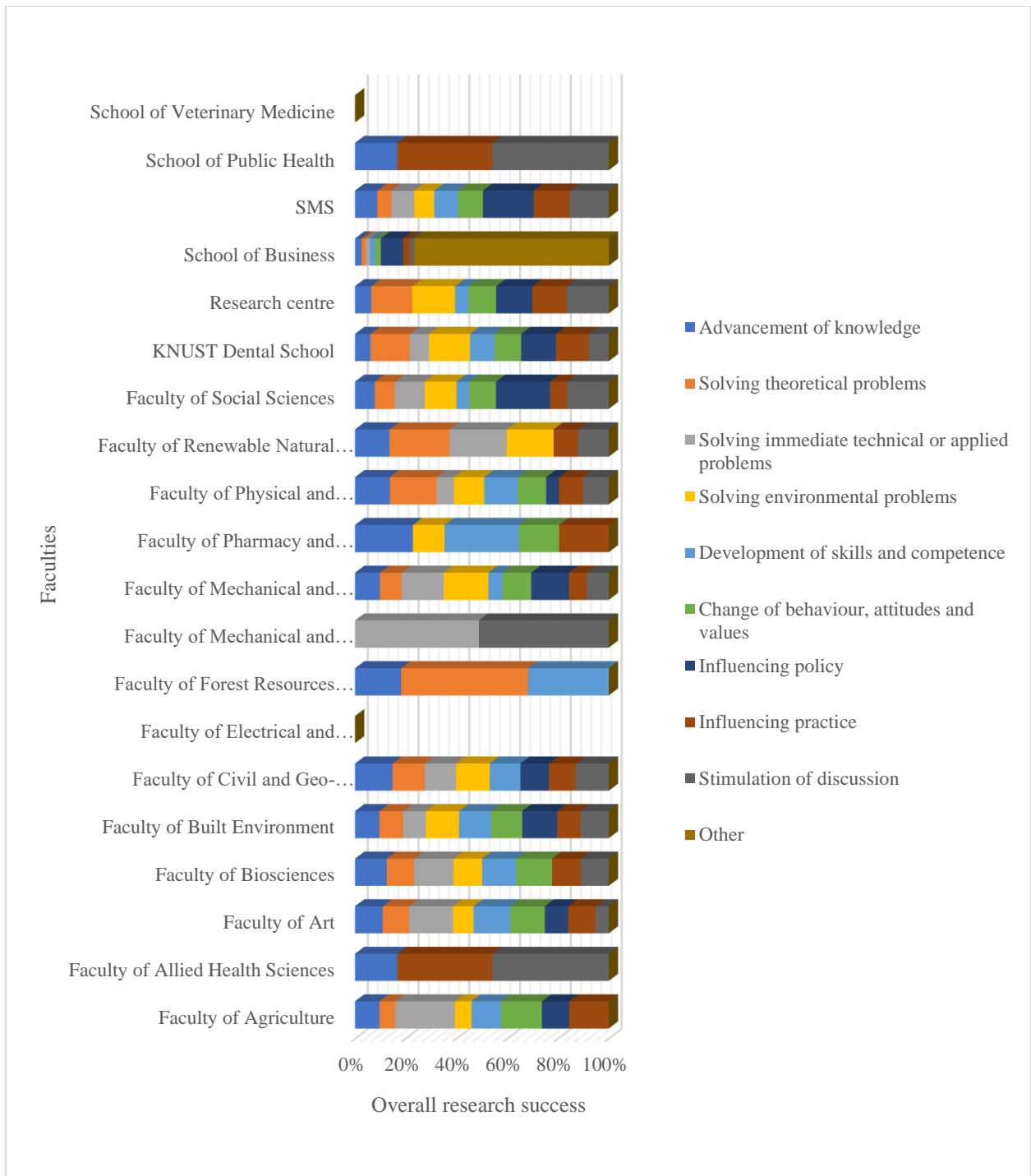


Figure 7.24 Overall research success by faculties

As illustrated in Figure 7.24 above, overall, most faculties and for that matter colleges mainly focus on advancement of knowledge as far as their research is concerned. We can conclude however that, researchers in different faculties focus on different things due to the nature of their establishment, approaches and activities. This can be deduced from the analysis in Figure 7.24 above which shows that when it comes to solving environmental problems the Faculty of Physical and Computational Sciences and the Faculty of Built Environment are the topmost performers. The SMS focuses on influencing policy and practices. The research success of these faculties therefore depends on the nature of their approaches and nature of their activities.

7.4.4 Conclusion

The expected areas of research impact as confirmed by respondents were solving environmental and social problems, influencing policy, influencing practice and solving immediate and technical problems. However, the extent to which researchers had been successful in these areas provided results below expectation compared to advancement of knowledge and solving theoretical problems, which seemed to be the main focus of researchers. It is worth noting that only 9 out of the 22 faculties seemed to be very active in terms of research activities with the potential to bring about some social change. From the interview report, however, there are a few examples of research impact. The following are some quotations from interviewees regarding research use at national level:

MoFA [the Ministry of Food and Agriculture] is implementing a flagship programme, Planting for Food and Jobs, which commits them to employing 2 000 more extension officers in 2018 to provide dedicated extension services across the country. The ministry has recently launched the E-Agriculture portal to bridge the gap between agricultural extension officers and farmers in Ghana online by providing, among other things, articles, videos, handbooks, and flyers (Respondent, R10)

And another aspect too has to do with the formulation of soilless media so that we don't always go removing topsoil in other to pot plants, because its' not an environmentally friendly practice and that one we came up with some good mixes and we even named the best of the mix we named it as AgSSIP [Agricultural Services Sub-Sector Investment Programme] mix (Respondent, R10)

Another one was the EU that wanted to give support for water and sanitation around the country and they contracted us to do the research. We did it and then we even came up with a

training manual and they used it and they have since been using it for their training of district assemblies” [Respondent, R2).

In conclusion, it can be confirmed that, although there are several areas where the university can play a role in local and national development, the research agenda and focus of researchers at KNUST and in faculties and colleges are towards advancement of knowledge and solving theoretical problems. There are, however, a few examples of research that have led to solving environmental problems, solving immediate technical/applied problems and influenced national policy and practice (KNUST Research Report, 2015, 2016). A policy shift is necessary to correct this if the university is to make an appreciable impact on society and help solve social and national problems.

The next chapter considers how researchers engage with various stakeholders and how these mechanisms and channels of engagement influence their research and dissemination activities, including uptake and related challenges.

CHAPTER 8 – CHANNELS AND MECHANISMS OF STAKEHOLDER ENGAGEMENT

8.1 Introduction

This chapter further discusses the findings from the survey and incorporates information from the report of the interviews. Essentially, the survey looked at research activities in relation to communities outside the university, the private sector, government, researchers and scientists from other universities and research institutions, and, NGOs. The main questions, aimed at addressing the research questions, centred on how researchers involve stakeholders in their research activities, the channels and mechanisms of engagement and their importance, and finally the individual or institutional barriers experienced with research utilisation. The chapter thus aims at answering the broad questions listed below.

- With which kind of stakeholders do researchers at KNUST engage, and what are the mechanisms or modes of engagement with these stakeholders?
- How beneficial are the engagements with various stakeholders and to what extent are these stakeholders involved in the research process?
- What are the most common barriers to research uptake?

8.2 Stakeholders mostly engaged by researchers

This section examines who the key stakeholders of researchers are and how often the researchers directly engage the stakeholders in the research process. Respondents were restricted to the top three stakeholders or fewer. The responses per each stakeholder group are given in Table 8.1 below.

Table 8.1 Stakeholders mostly engaged with

Stakeholders	Extent of engagements						
	Every Month	3–4 times a year	Annually	Rarely	Never	Skipped (did not answer)	Valid total
Communities (outside the university)	9 4.5%	45 22.3%	29 14.4%	27 13.4%	7 3.5%	85 42.1%	117 57.9%
Private sector (industry, large firms, SMMEs)	9 4.5%	25 12.5%	25 12.5%	21 10.4%	9 4.5%	111 55.0%	91 45%
Government (MDAs) and parastatals	3 1.5%	22 10.9%	22 10.9%	18 8.9%	9 4.5%	127 62.9%	75 37.1%
Scientists and researchers (in other universities and institutes)	30 14.9%	55 27.2%	41 20.3%	9 4.5%	1 0.5%	66 32.7%	136 67.3%
NGOs (e.g. charities, funders)	2 1.0%	6 3.0%	13 6.4%	10 5.0%	3 1.5%	168 83.2%	34 16.8%

Responses under ‘Skipped’ are those who did not answer that category of question whereas responses under ‘Never’ shows that the question was answered indicating that respondents never actually engaged with the stakeholders. The responses under ‘skipped’ were therefore not used in the analysis but those under ‘Never’ formed part of the response categories used in the analysis. This is so for all tables where ‘Skipped’ and ‘Never’ appeared.

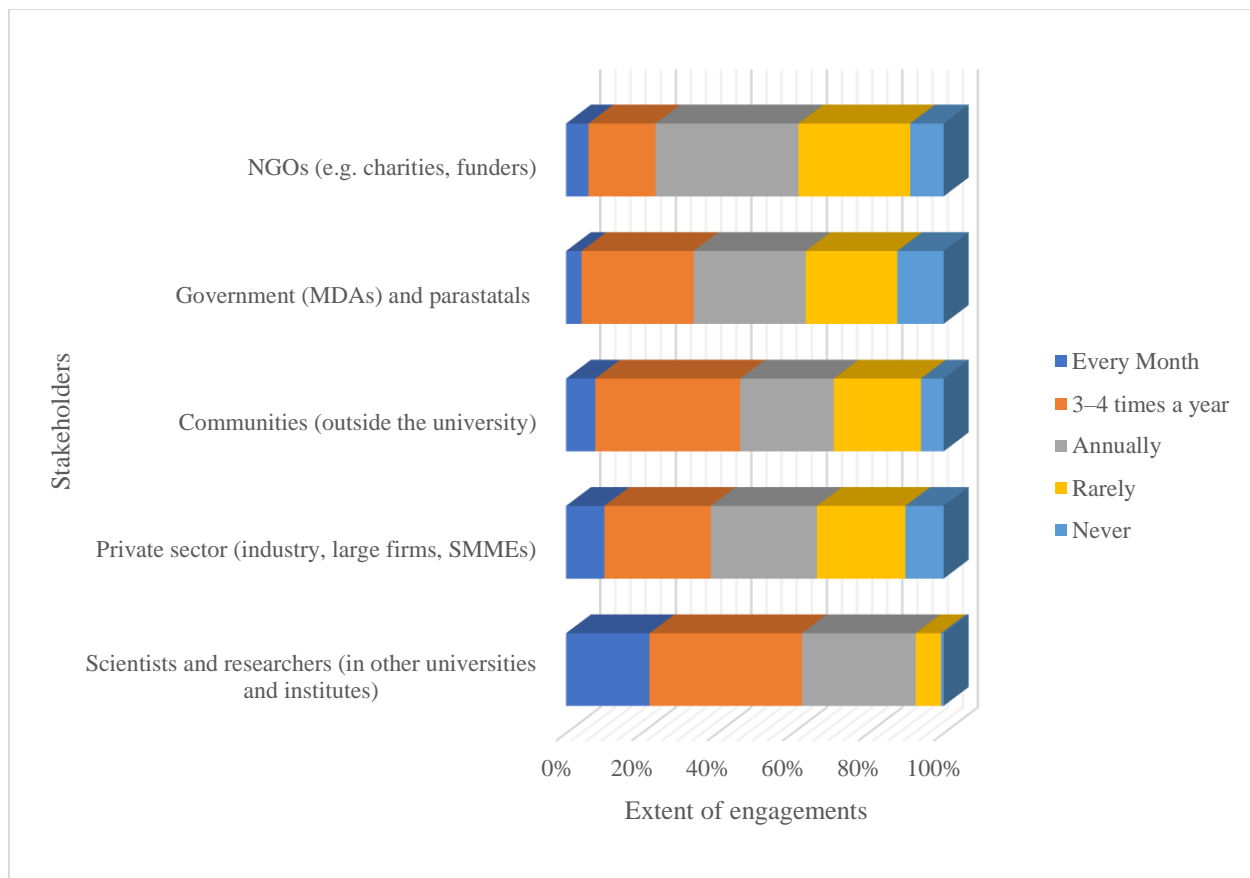


Figure 8.1 Stakeholders mostly engaged by researchers

As illustrated in Figure 8.1 above, on a monthly basis, researchers engage mostly with scientists and researchers from other universities and institutes. For three to four engagements in a year, the highest percentage of engagement is still with scientists and researchers from other universities and institutes, followed by engagements with communities outside the university. On an annual basis however, communities are the most engaged followed by the private sectors as shown in Figure 8.1.

Despite the low levels of engagement, there is every indication that researchers engage mostly with scientists and researchers from other universities and institutes, followed by communities outside the university, the private sector (industry, large firms, SMMEs), government (MDAs) and parastatals, with the least engaged being NGOs. There is an indication of a stronger collaboration between researchers of KNUST and colleagues from sister institutions. It can also be confirmed from the interviews that there is a strong collaboration between respondents and researchers from other universities and institutes. Secondly, respondents seem to do some work with communities

and the private sector. A few of the experienced senior lecturers and professors are the ones who mostly engage with government, presumably as these interactions often require professional and academic standing by the individual. Engagement with NGOs happens the least. The sections that follow discuss in more detail the extent of engagement with these stakeholders generally, and by academic position and faculties, the benefits of engagement, the extent of involvement in the research process and the most common reasons why stakeholders do not use research findings that could be beneficial to them.

8.3 Engagement with communities

This section discusses the following:

- how researchers typically engage with communities through specific engagement mechanisms, which academic position and faculties engage most;
- how beneficial they perceive stated potential benefits of community engagement to their own research engagement activities;
- the extent to which they involve communities at various stages in their research process; and finally
- what in their opinion were the most common reasons why communities do not make use of research findings that could be beneficial to them.

The summary of the survey responses and discussions are provided in the sub-sections below.

8.3.1 Typical engagement with communities

The literature outlines various mechanisms and channels of engagement with stakeholders. According to some authors research is disseminated to stakeholders or audiences through, for example, social media, exhibitions, research fairs, conferences, workshops, publications in refereed journals, public forums, curriculum development, community-based research, community-based networks and adopting communities for research (Becheikh & Ziam, 2010; Cherney et al., 2012; Hood, 2002). This sub-section examines, from the survey and subsequent interviews, how often researchers typically engage with communities around the university, what the mechanisms and channels of engagement are and which academic position and faculties engage most. Table 8.2 below provides the details of the frequency of engagement and the mechanisms of engagement with communities. Those who did not respond to the questions are captured under 'skipped' and these are not included in the illustrations.

Table 8.2 Mechanisms of engagements with communities

Mechanisms of engagement	Extent of engagement						
	Every month	3 or 4 times a year	Annually	Rarely	Never	Skipped (did not answer)	Valid total
Organising exhibitions in the communities	2 1.0%	8 4.0%	21 10.4%	30 14.9%	24 11.9%	117 57.9%	85 42.1%
Conducting research in the communities	4 2.0%	33 16.3%	39 19.3%	16 7.9%	2 1.0%	108 53.5%	94 46.5%
Using community sites for teaching and learning	2 1.0%	27 13.4%	30 14.9%	23 11.4%	9 4.5%	111 55.0%	91 45.0%
Forming community-based networks for learning	1 0.5%	13 6.4%	22 10.9%	30 14.9%	21 10.4%	114 56.4%	88 43.6%
Drawing on community advisors for support, strategy and advice	1 0.5%	16 7.9%	31 15.3%	27 13.4%	12 5.9%	115 56.9%	87 43.1%
Performing research-related drama, concerts or theatre in communities	0 0%	2 1.0%	7 3.5%	15 7.4%	62 30.7%	116 57.4%	86 42.6%
Using social media to reach out to communities	5 2.5%	10 5.0%	14 6.9%	21 10.4%	37 18.3%	115 56.9%	87 43.1%
Other	0 0%	0 0%	0 0%	4 2.0%	0 0%	198 98.0%	4 2.0%

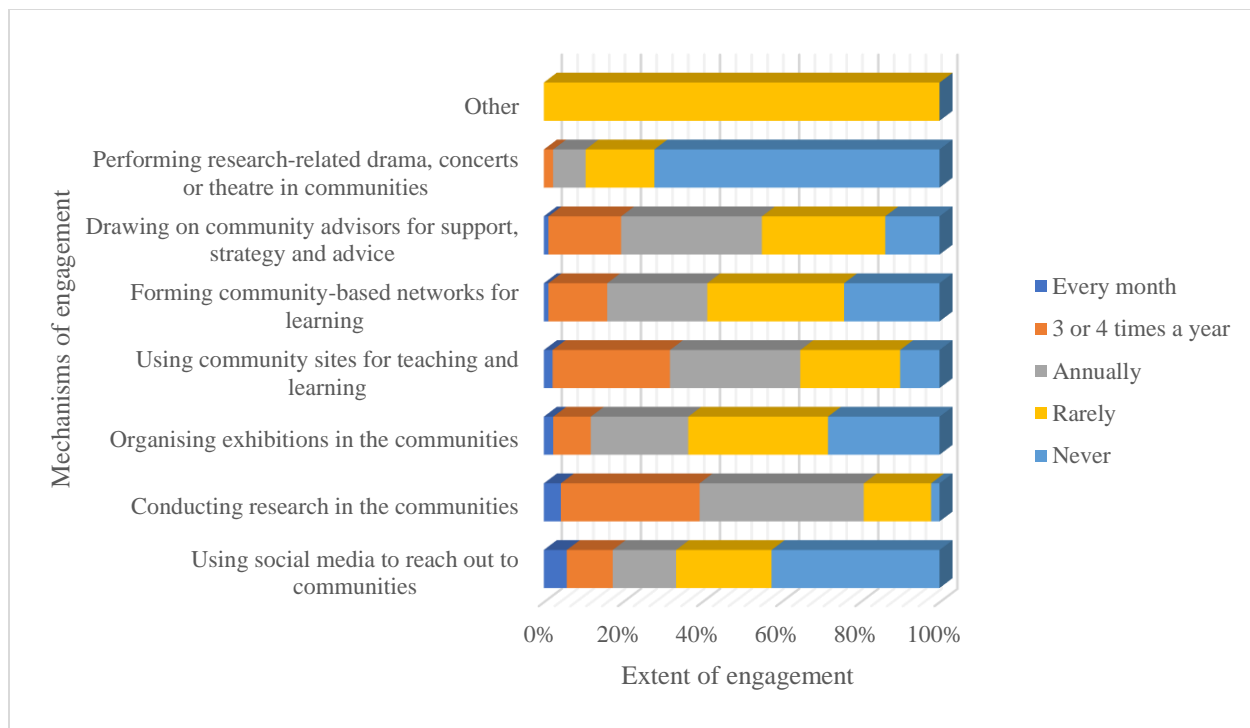


Figure 8.2 Mechanisms of engagement with communities (ordered for monthly engagement)
N=202

Figure 8.2 above shows that on a monthly basis, researchers mostly engage communities using social media, conducting research in communities and organising exhibitions in the communities in that order. These are typical engagement mechanisms adopted to reach communities of need with research and therefore the university can take advantage of that to enhance its community impact programmes.

Figure 8.2 again illustrates that, for three or four times a year, researchers mostly engage communities by conducting research in the communities, using community sites for teaching and learning and drawing on community advisors for support, strategy and advice in that order. The annual trends also involve these same three mechanisms. The university can enhance its social impact programmes in addressing community-based problems by using these mechanisms of engagement with which researchers are already familiar. The faculties and academic positions that mostly engage with communities, as discussed in sub-sections 8.3.1.1 and 8.3.1.2 below, should be encouraged to engage communities through these mechanisms.

It can be concluded that the three most frequently adopted mechanisms of engagement by researchers with communities outside the university are: using social media reach communities,

conducting research in the communities and organising exhibitions in communities as illustrated in Figure 8.2 above.

Monthly engagements through the listed mechanisms are on the low side. The highest frequency of engagement, that is 39%, is through conducting research in the communities on an annual basis followed by using community sites for teaching and learning with 30% as shown in Figure 8.2 above. There is the need to work towards increasing the frequency of engagements, especially for those mechanisms used less frequently.

Despite the low level of engagement by researchers with communities around the university, there is a possibility that these engagements can be enhanced if given the needed impetus. The university can explore ways to enhance its community engagement by addressing the challenges that researchers have with the dissemination of research. As indicated by one respondent, some of the communities they work with in the metropolis are difficult to reach and therefore logistics can be a challenge. The most common barriers that need to be addressed are discussed in 8.3.4.

8.3.1.1 Academic position and extent of engagement with communities outside the university

In order to ascertain the level of engagement with communities for the various academic positions a cross-tabulation of position versus communities was carried to establish who engages most frequently. The figure below illustrates the extent of engagement of different academic positions with communities outside the university.

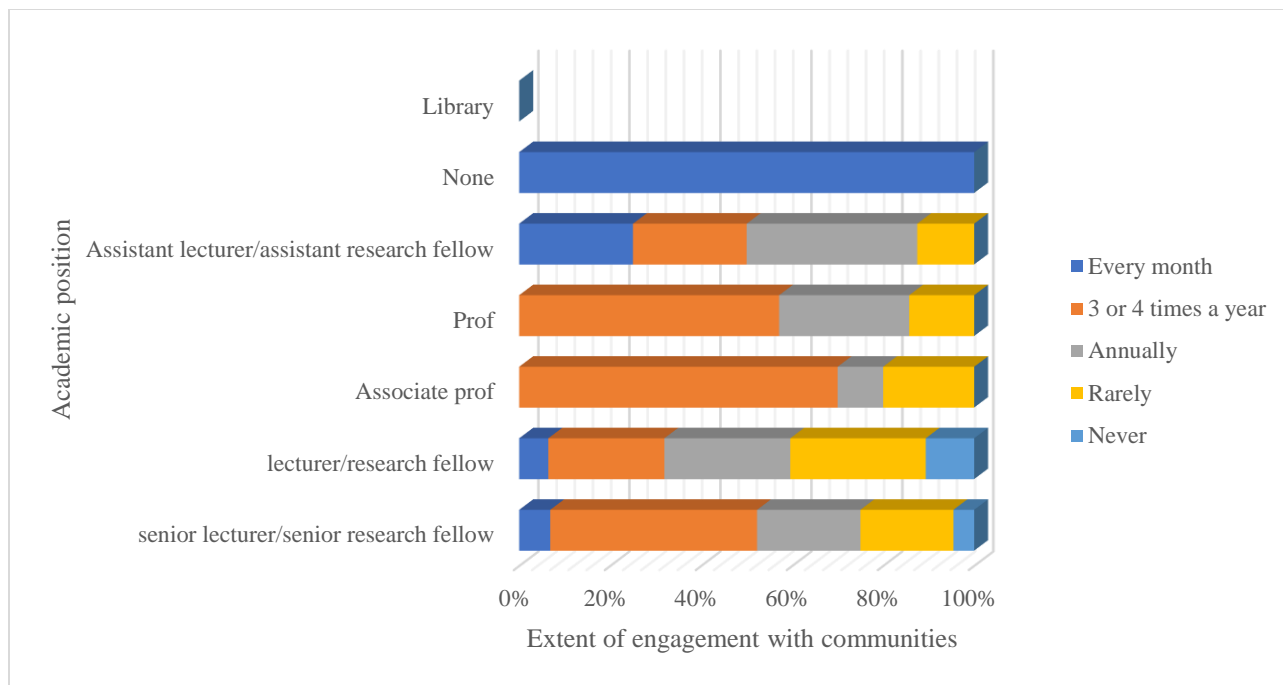


Figure 8.3 Position versus engagement with communities outside the university

From Figure 8.3 above, it can be observed that on a monthly basis, senior lecturers/senior research fellows and lecturers engage most with communities outside the university. For three or four times a year, the same category in addition to associate professors and professors in that order engage most frequently with communities outside the university. The frequency of engagement does not however, directly imply that there is a better engagement since these depend on the nature of the task. These engagements could however, be presumed to be purposeful and thus the more the engagements the more likely these objectives are achieved. This author's intention was to look at engagement practices that lead to research outputs and their subsequent application to solve problems. These scenarios, arising as a result of analysing the data by comparing the percentage that each position contributes to the total, have a potential for RU. The analysis shows that, as far engagement with communities outside the university is concerned, senior lecturers and equivalents engaged most in terms of percentages.

8.3.1.2 Faculties and extent of engagement with communities outside the university

This sub-section provides the outlook on the extent of stakeholder engagement of individual researchers by faculties. This takes care of the specialisation and their level of engagement with

different stakeholders. Figure 8.4 below provides an illustration of the breakdown of responses by various faculties to start with.

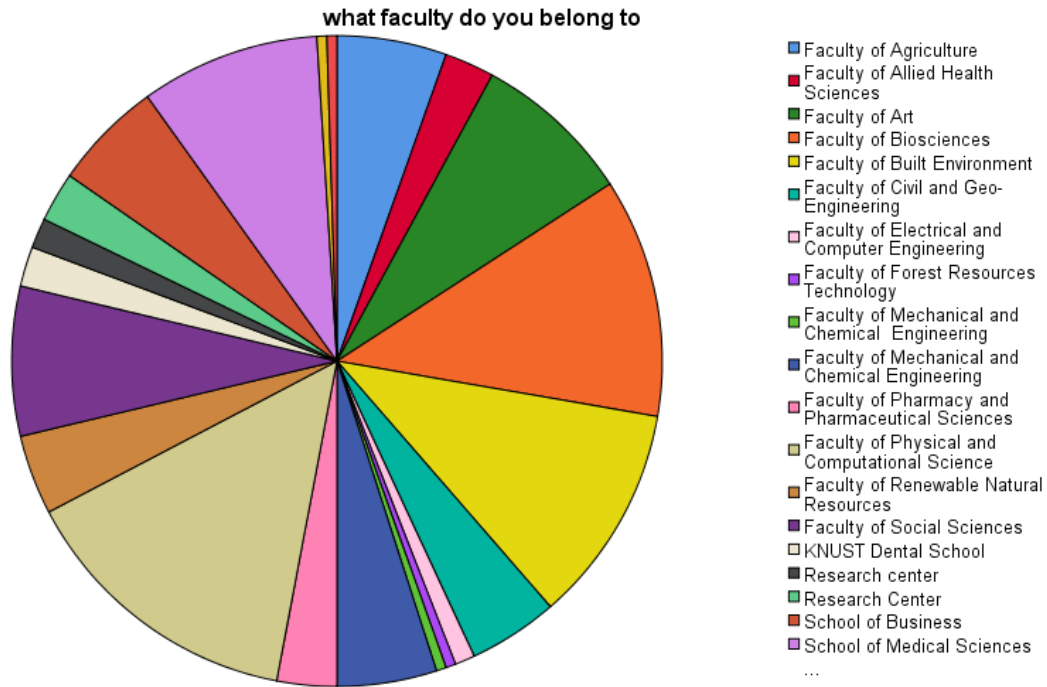


Figure 8.4 Breakdown of the number of respondents by faculties

Since the distribution of responses varied from faculty to faculty, Figures 8.5 provides analysis per percentage contribution of researchers in each faculty to the extent of engagement with communities outside the university.

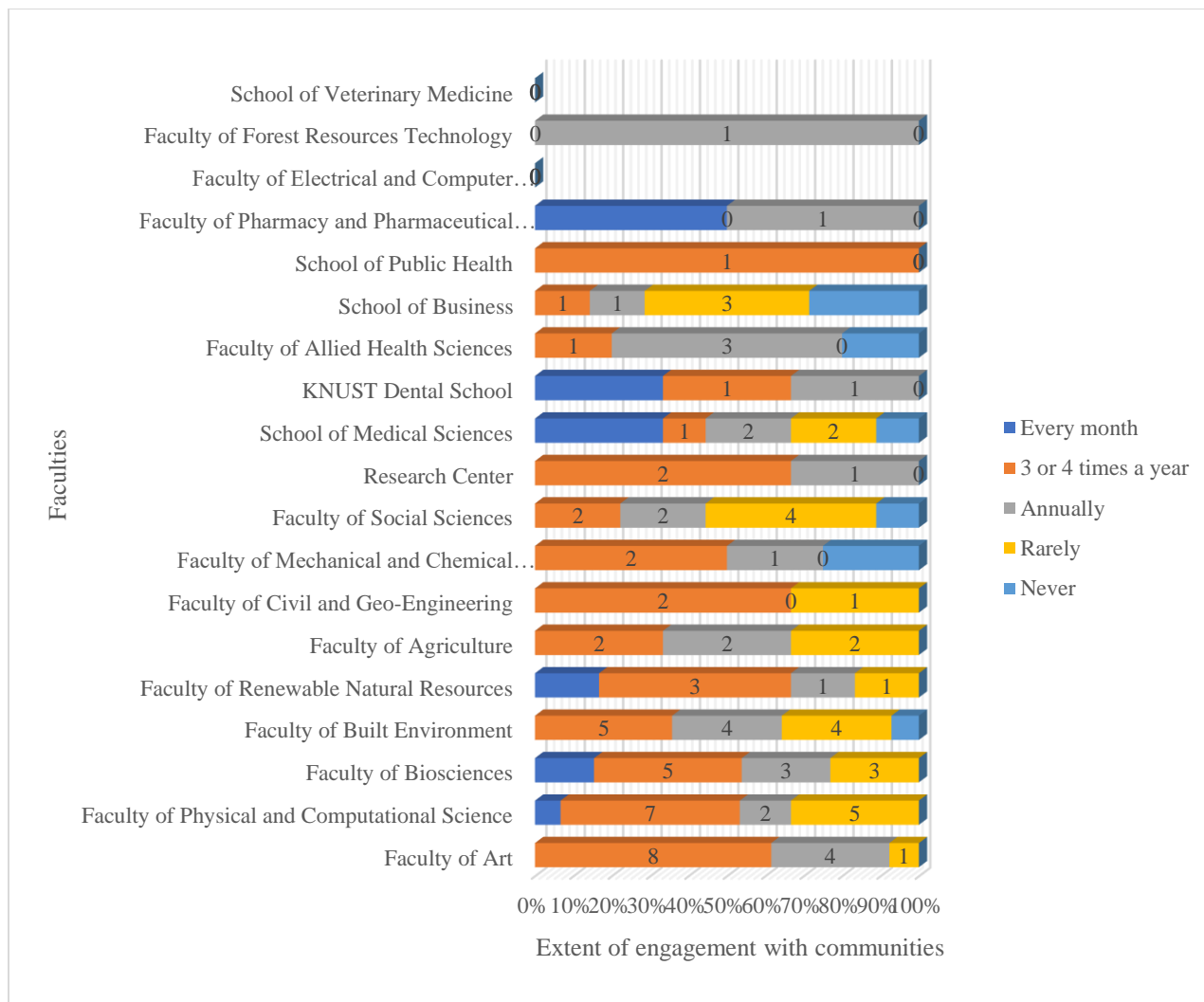


Figure 8.5 Faculties and engagement with communities outside the university

From Figure 8.5 above, it can be observed that on a monthly basis, the SMS followed by the Faculty of Biosciences engaged the most with communities outside the university. This is most probably due to the number of community outreach programmes taking place at SMS and also access to funding opportunities as discussed in Chapter 4. Taking place three or four times a year, as far as engagement with communities is concerned, the Faculty of Art followed by the Faculty of Physical and Computational Sciences engaged the most. Trends for annual engagements indicated that the Faculty of Art, the Faculty of Built Environment and the Faculty of Allied Health Sciences engaged most, as shown in Figure 8.5 above. As could be observed throughout the subsections that follow, as far as engagement with stakeholders is concerned, some faculties are stronger in certain areas than others. The activities of the faculties concerned, their nature and their

set up contribute to the extent of engagement with the different stakeholders. The Faculty of Art and the Faculty of Physical and Computational Sciences have many outreach programmes such as art exhibitions and computer literacy schools, thereby making them more prominent in the immediate communities around the university.

The faculties that excel in community engagement, namely the School of Medical Sciences and the Faculty of Biosciences ought to be encouraged and incentivised to do more while those lagging behind are given the needed human and financial resources. The next sub-section looks at the perceived benefits of engagements with communities.

8.3.2 Benefits of engagements with communities

There are a number of potential benefits of research outlined in the literature. These include opportunities for further research, funding, collaboration, innovations, transferring research to practice, influencing decisions and choices (Bozeman, 2000; Cherney et al., 2012; Jacobson, 2007; Sudsawad, 2007). This sub-section examines the experiences and perceptions of researchers with some of these benefits in their engagement with communities around the university. Generally, researchers agree that conducting and disseminating research has some benefits. Table 8.3 below gives the specific responses as to how beneficial researchers perceive the potential benefits of community engagement is for their own research engagement activities.

Table 8.3 Benefits of engagement with communities

Benefits of engagement	Extent of benefits of engagement						
	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	N/A	Skipped (did not answer)	Valid total
Your research in communities opens opportunities for more research	74 36.6%	11 5.4%	6 3.0%	1 0.5%	2 1.0%	108 53.5%	94 46.5%
Your research influences decisions and/or choices by communities	37 18.3%	41 20.3%	8 4.0%	0 0%	5 2.5%	111 55.0%	91 45.0%
Opens avenues for collaboration with communities	48 23.8%	27 13.4%	10 5.0%	3 1.5%	3 1.5%	111 55.0%	91 45.0%
Solving community-based problems	50 24.8%	32 15.8%	6 3.0%	0 0%	3 1.5%	111 55.0%	91 45.0%
Opportunities to develop innovations	42 20.8%	32 15.8%	12 5.9%	0 0%	5 2.5%	111 55.0%	91 45.0%
To transfer research to practice	55 27.2%	23 11.4%	9 4.5%	1 0.5%	4 2.0%	110 54.5%	92 45.5%
To meet formal requirements of a study	42 20.8%	31 15.3%	7 3.5%	3 1.5%	6 3.0%	113 55.9%	89 44.1%
Others: Real life	1					201 99.5%	1 0.5%
Good feeling						201 99.5%	1 0.5%
Just researching	1					201 99.5%	1 0.5%
	1					201 99.5%	1 0.5%

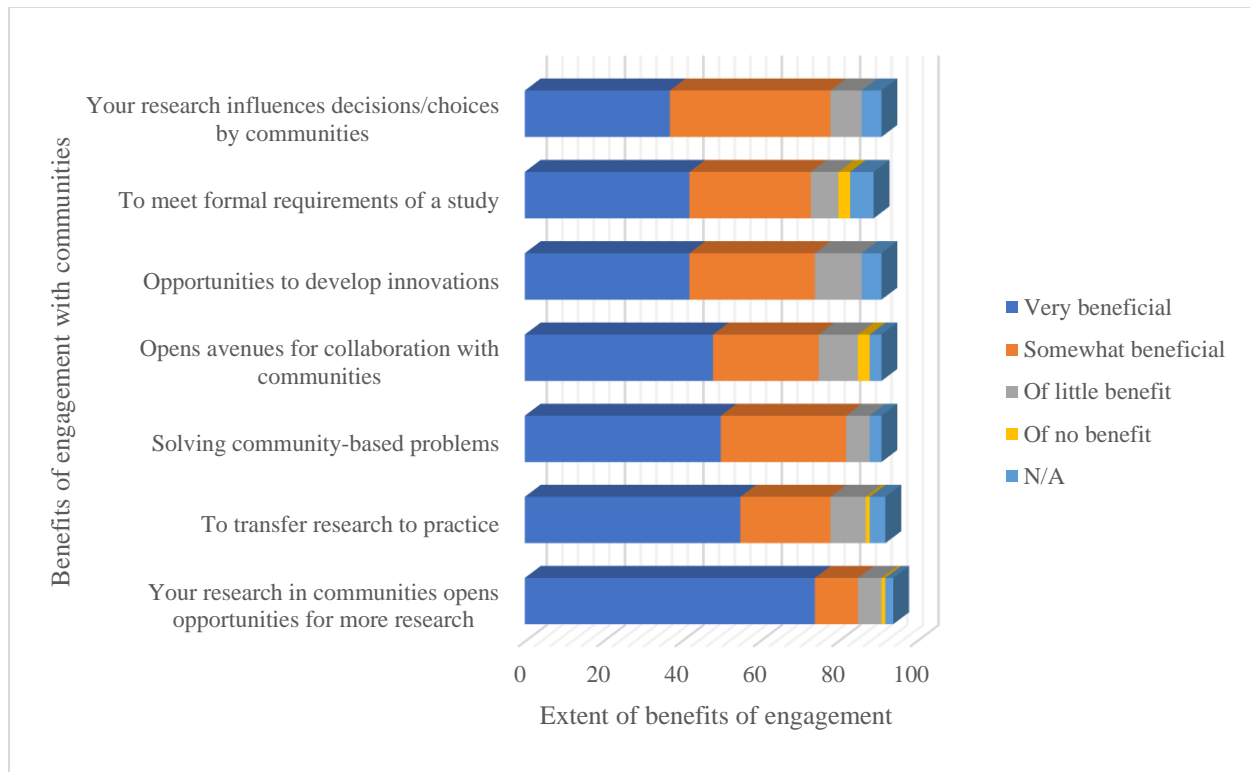


Figure 8.6 Frequencies of benefits of engagement with communities

The frequencies from Figure 8.6 above indicate researchers' perception of the benefits of engagement with communities. The top three benefits are:

- your research in communities opens opportunities for more research;
- to transfer research to practice; and
- solving community-based problems.

Figure 8.6b below provides the analysis for percentage contributions for the various mechanisms of engagement.

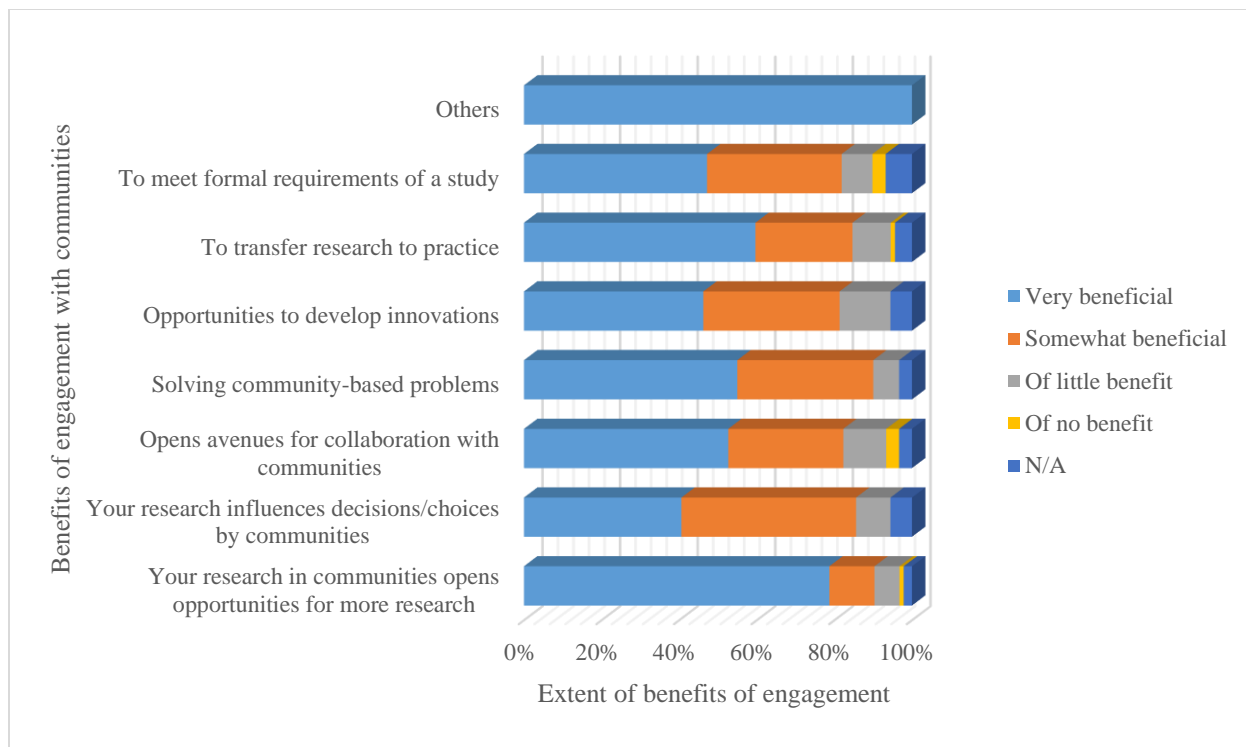


Figure 8.6b Benefits of engagement with communities

The above responses on the benefits of engagement with communities, though very low, still give some indication as to the perception of researchers regarding the benefits of engagement with communities. The highest percentage, 36.6%, of researchers indicated as very beneficial the fact that their research in communities opens opportunities for more research, while those in second place with 27.2%, are of the opinion that their research affords them the opportunity to transfer research into practice. These outcomes of potential perceived benefits of doing research are illustrated in Figure 8.6b above. Apart from research opening opportunities for more research which goes directly to the benefit of the researcher, that of transferring research to practice and solving community-based problems have direct implications for research uptake and utilisation. Once researchers see and experience the benefits of doing research in the communities, they are motivated to conduct research not only for publication in journals, but also for practical application and use. According to some respondents, other reasons for engaging in research are good feelings and just research for its own sake. In order to make more impact with community engagement researchers ought to involve potential users of research in the research process. The next subsection examines the extent of involving communities in the research process and the implications.

8.3.3 Stages of involvement of communities in research

Stakeholder participation in the research process has been argued to be key to acceptance and adoption of research, and therefore uptake and utilisation. Researchers are therefore expected to involve their stakeholders and potential users in their research process at appropriate stages. The stages include the research proposal or development stage, data collection and analysis stage during the research process, during the research report drafting stage, during the final report and dissemination stage and at all stages of the research process (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole & Whitmarsh, 2008). Respondents were required to indicate the extent to which they involve communities in their research process at some specific stages. The outcomes are as indicated in Table 8.4 and illustrated in Figure 8.7 below.

Table 8.4 Stages of involving communities in research

Stages of involvement in research	Extent of involvement						Valid total
	Always	Usually	Sometimes	Rarely	Never	Skipped (did not answer)	
At the research formulation stage	22 10.9%	22 10.9%	25 12.4%	17 8.4%	4 2.0%	112 55.4%	90 44.6%
At the research proposal stage	18 8.9%	19 9.4%	31 15.3%	12 5.9%	8 4.0%	114 56.4%	88 43.6%
During the report writing stage	11 5.4%	13 6.4%	28 13.9%	25 12.4%	11 5.4%	114 56.4%	88 43.6%
Throughout the entire research process	15 7.4%	20 9.9%	29 14.4%	18 8.9%	8 4.0%	112 55.4%	90 44.6%

Figure 8.7 below shows the distribution of the stages at which researchers involve communities in their research process. It can be observed that researchers always involve communities first of all at the research formulation stage. The second preference is at the research proposal stage, third, throughout the entire research process and finally during the report writing stage. Figure 8.7 below gives the percentage distribution for the various stages of involvement.

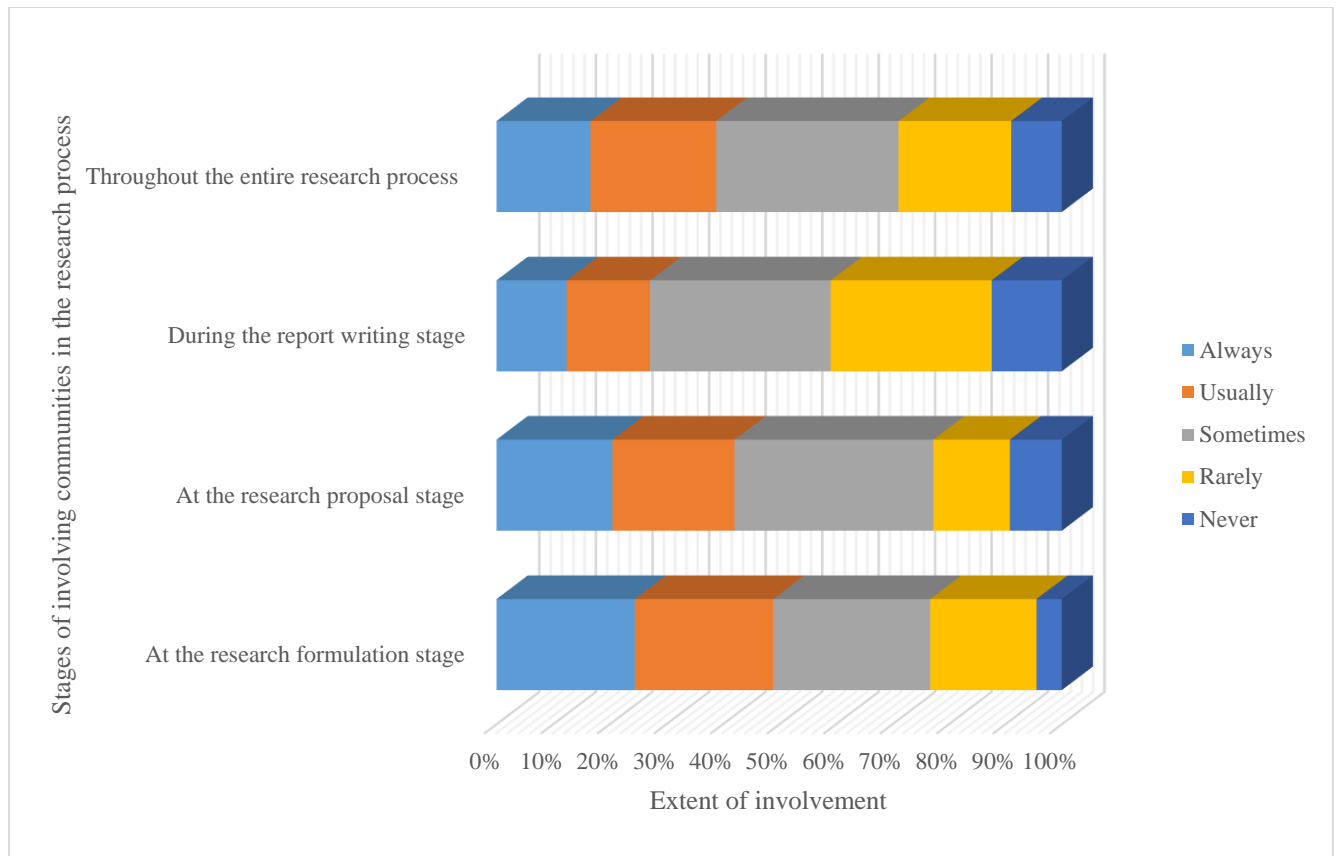


Figure 8.7 Stages of involving communities in the research process

As shown in Figure 8.7 above, respondents indicated that they always involve communities in their research at the formulation and the research proposal stages, in that order. There is also an indication that researchers usually involve communities in the research process at the research formulation stage, throughout the research process and during research proposal stage, in that order. As a channel to effective stakeholder engagement researchers must, as much as possible, link up with their stakeholders at critical points in the research process. Researchers who in one way or the other involved their stakeholders in the research process have had a better chance with research use. As stated by one researcher during the interviews:

[W]e engaged these stakeholders, I mean the community members, so that they tell us their needs, we incorporate it into our research, then when we get our results we go back and share with them, so it becomes a whole cycle. (Respondent R3)

This emphasises the need to consult with stakeholders at one point or the other because they also have useful ideas to improve the quality of the research. The next sub-section outlines some of the reasons why communities do not use research findings.

8.3.4 Reasons why communities do not use research findings

This sub-section looks at individual and institutional barriers that are associated with research uptake and utilisation at the community level. As discussed in the literature, there are information-related barriers, organisational structure and process barriers, organisational culture, individual and interaction barriers associated with the use of research (Humphries, 2014; Oliver et al., 2014; Sedlacko, et al., 2013). Respondents were asked to indicate the most common reasons why communities do not use research results which could be beneficial to them. The outcomes, ranked 1–3 from highest down are as given in Table 8.5 and illustrated in Figure 8.8 below. Reason 1 represents what respondents considered the foremost and most important common reasons for non-use of research followed by Reason 2 and Reason 3 in order of priority.

Table 8.5 Most common reasons for non-use of research by communities

Most common reasons for non-use of research findings	Level of importance of reason for non-use of research findings				
	Reason 1	Reason 2	Reason 3	Skipped	Valid total
Financial constraints on the part of researchers to disseminate research findings to communities	49 24.3%	4 2.0%	2 1.0%	147 72.8%	55 27.2%
Financial constraints on the part of communities to implement research findings	16 7.9%	26 12.9%	3 1.5%	157 77.7%	45 22.3%
Lack of human resource capacity in researchers to support and disseminate research	9 4.5%	15 7.4%	8 4.0%	170 84.2%	32 15.8%
Lack of motivation by communities to use research findings	3 1.5%	8 4.0%	12 5.9%	179 88.6%	23 11.4%
Communities' resistance to change	2 1.0%	9 4.5%	9 4.5%	182 90.1%	20 9.9%
Lack of understanding of research benefits by communities	2 1.0%	6 3.0%	12 5.9%	182 90.1%	20 9.9%
Misunderstanding and wrong perceptions of research results by communities	1 0.5%	3 1.5%	7 3.5%	191 94.6%	11 5.4%
Research findings not being relevant to communities	1 0.5%	3 1.5%	4 2.0%	194 96.0%	8 4.0%
Lack of confidence in the research findings by communities	0 0%	0 0%	4 2.0%	198 98.0%	4 2.0%
Lack of contact between researcher and users of the findings in communities	6 3.0%	4 2.0%	11 5.4%	181 89.6%	21 10.4%
Lack of time to implement research findings	0 0%	2 33.3%	4 66.7%	196 97.1%	6 2.9%

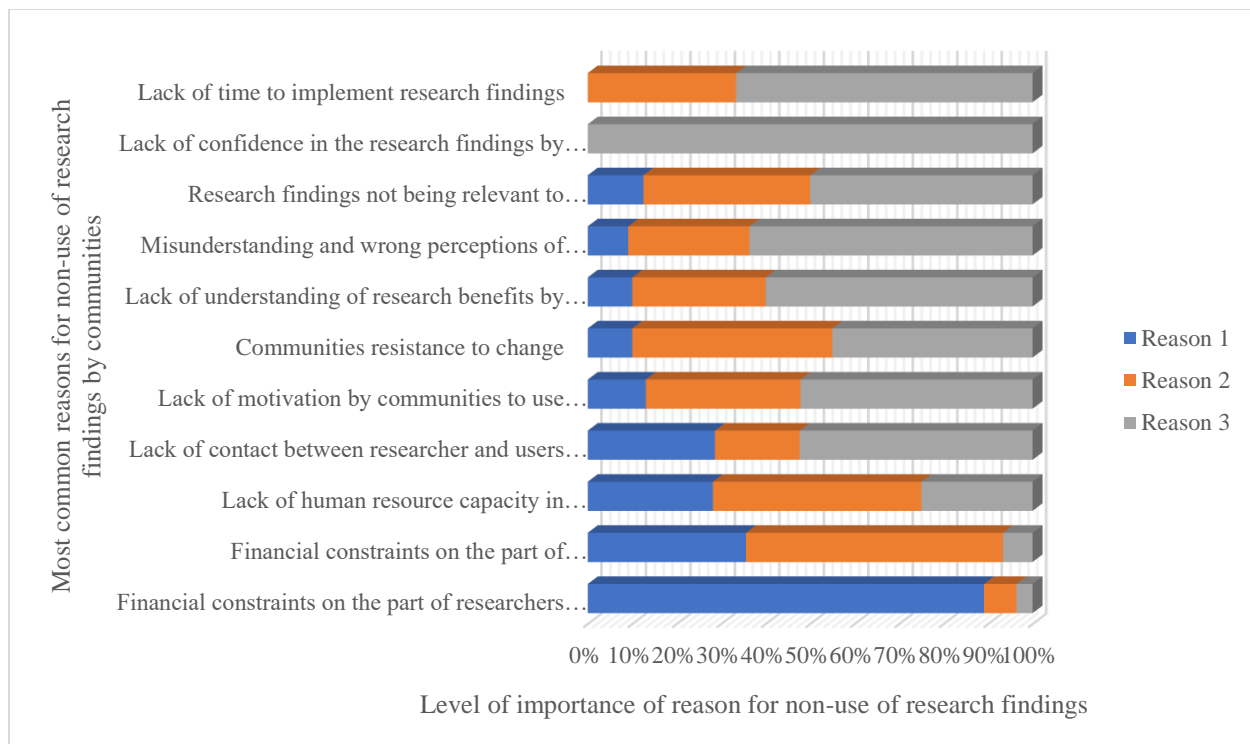


Figure 8.8 Most common reasons why communities do not use research findings

From Figures 8.8 above, the first most common reason why communities do not use research findings indicated by researchers was that of financial constraints on the part of researchers to disseminate research findings to communities. This conforms with the literature and was also confirmed during the interviews. Researchers need funding to disseminate research, findings without which researchers will not be able to bring their findings to the doorsteps of stakeholders. The second most common reason why communities do not use research findings is financial constraints on the part of communities to implement research findings. It implies that even if research findings are made available to communities, lack of funding on the part of communities to implement the findings will be a barrier to the use of the research findings. The third most common barrier to research use by communities is lack of human resource capacity from researchers to support and disseminate research. One way around this barrier is to enhance the level of stakeholder involvement for the necessary confidence and acceptance. This is corroborated by one respondent who said communities do not use research because of “low community involvement in the research”. Please note, in this section, all direct quotations by respondents are provided verbatim and unedited.

Another indicated, “communities prefer money to research”, in which case they will like to resolve issues themselves if funding is made available to them. These barriers are not peculiar only to communities around the university as discussed in other sections.

8.4 Engagement with private sector

Along the same lines as the previous sections, the sub-sections that follow discuss engagement with the private sector under the following sub-themes:

- how researchers typically engage with the private sector via some specific mechanisms, which faculties and academic positions engage most;
- the benefits of engagement, the stages at which researchers involve the private sector in their research process; and
- the most common reasons why the private sector does not use research results, which could be beneficial to them.

8.4.1 Typical engagement with private sector

In order to determine how researchers engage with the private sector some specific engagement mechanisms were provided for which researchers were to indicate how they typically engage through those means. Table 8.6 and Figure 8.9 below provide the outcomes to the question “How do you typically engage with the private sector via the following engagement mechanisms?”

Table 8.6 Engagements with private sector

Mechanisms of engagement	Extent of engagement						Valid total
	Every month	3 or 4 times a year	Annually	Rarely	Never	Skipped (did not answer)	
Developing research proposals for or with private sector	1 0.5%	14 6.9%	23 11.4%	15 7.4%	6 3.0%	143 70.8%	59 29.2%
Organising workshops or seminars with or for private sector	0 0%	18 8.9%	21 10.4%	14 6.9%	7 3.5%	142 70.3%	60 29.7%
Organising conferences for or with the private sector	0 0%	8 4.0%	17 8.4%	20 9.9%	12 5.9%	145 71.8%	57 28.2%

Attending conferences organised by the private sector	0 0%	13 6.4%	20 9.9%	17 8.4%	7 3.5%	145 71.8%	57 28.2%
Serving on advisory boards of the private sector	4 2.0%	10 5.0%	14 6.9%	14 6.9%	16 7.9%	144 71.3%	58 28.7%
Private sector staff serving on advisory boards and/or committees of university	0 0%	5 2.5%	7 3.5%	19 9.4%	23 11.4%	148 73.3%	54 26.7%
Conducting commissioned research for the private sector	0 0%	9 4.5	12 5.9%	23 11.4%	12 5.9%	146 72.3%	56 27.3%
Conducting joint research with the private sector	0 0%	8 4.0%	16 7.9%	20 9.9%	14 6.9%	144 71.3%	58 28.7%
Providing consultancy services for the private sector	4 2.0%	14 6.9%	22 10.9%	14 6.9%	4 2.0%	144 71.3%	58 28.7%
Journal publications co-authored with the private sector	1 0.5%	3 1.5%	6 3.0%	24 11.9%	23 11.4%	145 71.8%	57 28.2%
Technical reports and policy briefs jointly written with the private sector	0 0%	5 2.5%	10 5.0%	18 8.9%	25 12.4%	144 71.3%	58 28.7%
Books and book chapters co-authored with the private sector	0 0%	3 1.5%	1 0.5%	16 7.9%	34 16.8%	148 73.3%	54 26.7%
Engaging in social media discussion for or with the private sector	7 3.5%	4 2.0%	7 3.5%	17 8.4%	24 11.9%	143 70.8%	59 29.2%

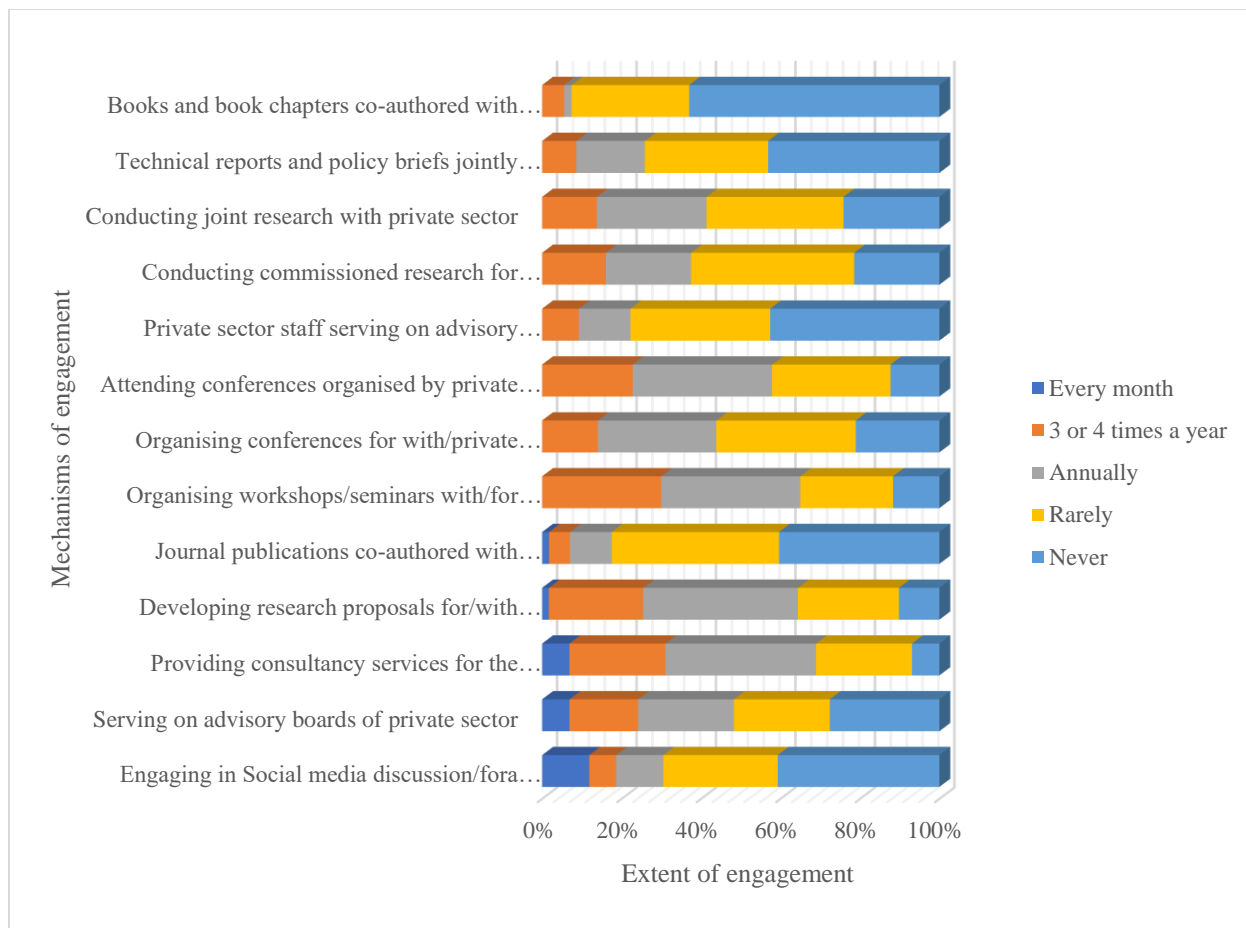


Figure 8.9 Mechanisms of engagement with the private sector

Figure 8.9 indicates that on a monthly basis, the highest percentage of researchers indicated that they engage in social media discussions for and with the private sector. This is a modern trend which has been found useful in recent times. The second in line is serving on private sector advisory boards, as well as providing consultancy services for them. This is high-level engagement which requires the services of experienced and high-ranking researchers as discussed in sub-section 8.4.1.1 below.

Figure 8.9 also indicates that for three or four times a year the mechanisms of engagement are organising workshops and/or seminars with or for the private sector, providing consultancy services for the private sector and developing research proposals for or with the private sector, in that order. Annual engagements ranking of the top three mechanisms are also shown in Figure 8.9 above.

These mechanisms of engagement with the private sector, namely developing research proposals and providing consultancy services for the private sector, have the potential of bringing financial rewards to the researcher in addition to opportunities of getting articles published in journals. The next sub-section discusses which academic positions engage the most with the private sector.

8.4.1.1 Academic position and extent of engagement with the private sector

Figure 8.10 below provides an illustration of the extent of engagement of individual researchers by academic position with the private sector.

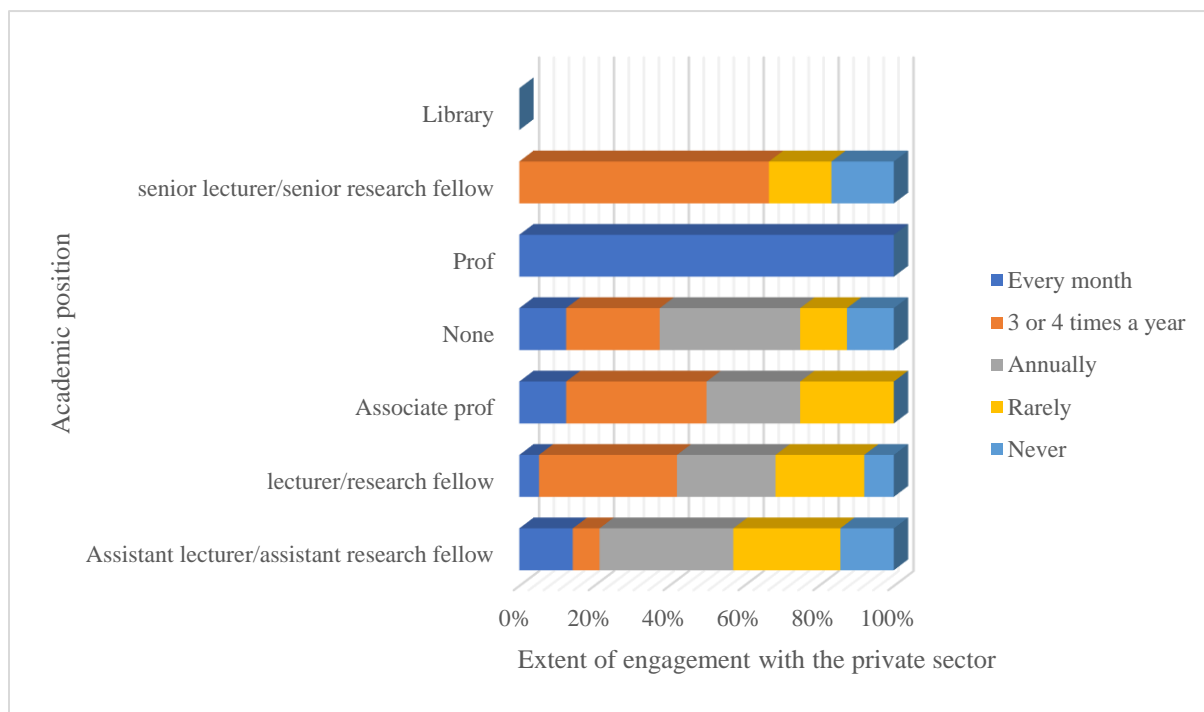


Figure 8.10 Position and engagement with private sector (including industry)

On a monthly basis, assistant lecturers/assistant researcher fellows and lecturers/research fellows in that order engaged the most with the private sector as shown in Figure 8.10 above, giving an indication that the more senior researchers engage the private sector more frequently. For 3–4 times a year, lecturers, senior lecturers and associate professors engaged most. Here, there are indications of engagement with stakeholders involving the most senior and experienced researchers as well as those of the junior ranks. The next sub-section examines the extent of engagement by faculties.

8.4.1.2 Faculties and extent of engagement with the private sector

The extent of engagement of the various faculties with the private sector are illustrated in Figure 8.11 below.

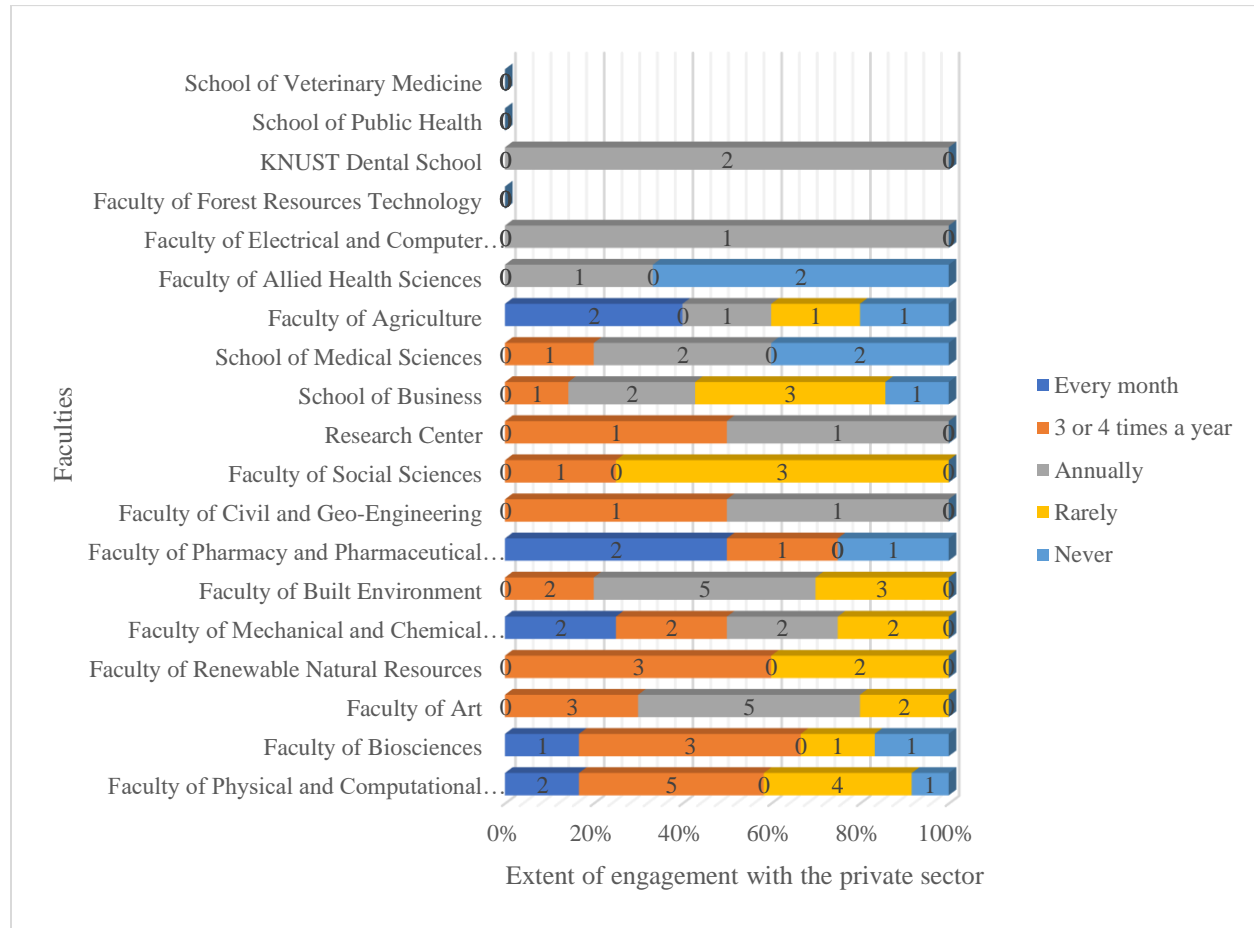


Figure 8.11 Faculties and extent of Engagement with the private sector

Figure 8.11 above shows that on a monthly basis, the Faculty of Pharmacy and Pharmaceutical Sciences, the Faculty of Agriculture, the Faculty of Mechanical and Chemical Engineering and the Faculty of Physical and Computational Sciences in that order, engaged most with the private sector. These four faculties belong to the College of Health Sciences, College of Agriculture and Natural Resources and the College of Engineering and the College of Science, respectively. This implies that the research activities of these four faculties or colleges are such that they favour engagements with the private sector. These research activities give these faculties or colleges a relative advantage over the others and thus there is the need to identify what exactly gives them this edge over the others. The activities of other faculties or colleges could then be tailored to

enhance their engagements with stakeholders. The Faculty of Physical and Computational Sciences, the Faculty of Biosciences and the of the Faculty of Art engaged the most with the private sector three or four times a year. Here again, the dominant colleges include the College of Science, whose set up and research activities favour engagement with the private sector.

The implication for policy development is that faculties or colleges should operate along the lines of their strengths while those not doing well, are either merged with the stronger ones or resourced to boost their performance.

The next sub-section examines the perceptions of researchers as far as benefits of engagement with the private sector are concerned.

8.4.2 Benefits of engagement with the private sector

Along the lines of the literature, this sub-section examines the perceived benefits and experiences of researchers with engaging the private sector. Table 8.7 below provides feedback from the survey on how beneficial researchers perceive the potential benefits of engaging the private sector to be to their own research engagement activities. This is illustrated in Figure 8.12.

Table 8.7 Benefits of engagement with private sector

Benefits of engagement	Extent of benefits of engagement						
	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	N/A	Skipped (did not answer)	Valid total
Your research opens opportunities for more research	42 20.8%	13 6.4%	3 1.5%	0 0%	1 0.5%	143 70.8%	59 29.2%
Your research influences decisions by the private sector	31 15.3%	23 11.4%	4 2.0%	0 0%	1 0.5%	143 70.8%	59 29.2%
Opens avenues for collaboration	35 17.3%	19 9.4%	1 0.5%	1 0.5%	3 1.5%	143 70.8%	59 29.2%
Provides opportunities for funding	20 9.9%	25 12.4%	9 4.5%	1 0.5%	4 2.0%	143 70.8%	59 29.2%
Solving private sector-related problems	32 15.8%	21 10.4%	4 2.0%	0 0%	2 1.0%	143 70.8%	59 29.2%
Opportunities to develop innovations	28 13.9%	22 10.9%	6 3.0%	2 1.0%	1 0.5%	143 70.8%	59 29.2%
To transfer research to practice	36 17.8%	17 8.4%	4 2.0%	0 0%	2 1.0%	143 70.8%	59 29.2%
To meet formal requirements of a study	18 8.9%	20 9.9%	10 5.0%	2 1.0%	8 4.0%	143 70.8%	59 29.2%

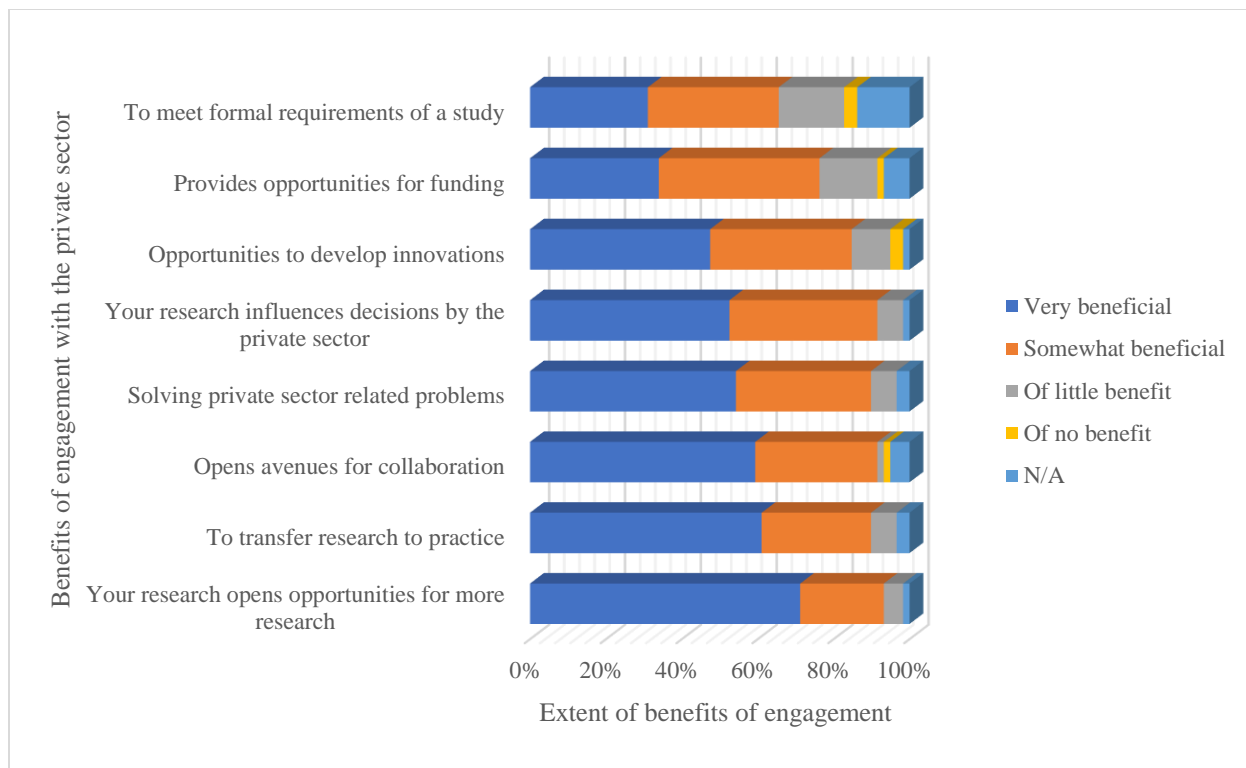


Figure 8.12 Perceived benefits of engagement with the private sector

The majority of those who engage with the private sector perceive as very beneficial the fact that their research opens opportunities for more research, as illustrated in Figure 8.12 above. Others also consider it as very beneficial that their engagement leads to transference of research into practice while others consider it very beneficial that their research opens avenues for collaboration. A lesser number of researchers consider it somewhat beneficial that their research opens opportunities for funding, influences decisions by the private sector and also provides opportunities to develop innovations. Researchers should be made aware of these potential benefits so that they can take advantage of available opportunities to promote their research.

Despite the low percentages recorded, these findings conform to the benefits of engagement outlined by Bozeman (2000), Jacobson (2007), Sudsawad (2007) and Cherney et al. (2012).

8.4.3 Stages of involvement with the private sector

As discussed earlier in Chapter 5 the stages at which stakeholders participate in the research process is key to the adoption and use of research (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole & Whitmarsh, 2008). This sub-section discusses the outcomes of the extent to which

researchers involve the private sector in their research process at each of the listed stages. Table 8.8 and Figure 8.13 provide the feedback and analysis.

Table 8.8 Stages of involving private sector in research

Stages of involvement in the research process	Extent of involvement						Valid total
	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5	Skipped (did not answer)	
At the research formulation stage	11 5.4%	15 7.4%	21 10.4%	9 4.5%	2 1.0%	144 71.3%	58 28.7%
At the research proposal stage	12 5.9%	11 5.4%	21 10.4%	11 5.4%	3 1.5%	144 71.3%	58 28.7%
During the report writing stage	5 2.5%	14 6.9%	15 7.4%	18 8.9%	6 3.0%	144 71.3%	58 28.7%
Throughout the entire research process	6 3.0%	8 4.0%	23 11.4%	18 8.9%	4 2.0%	143 70.8%	59 28.7%

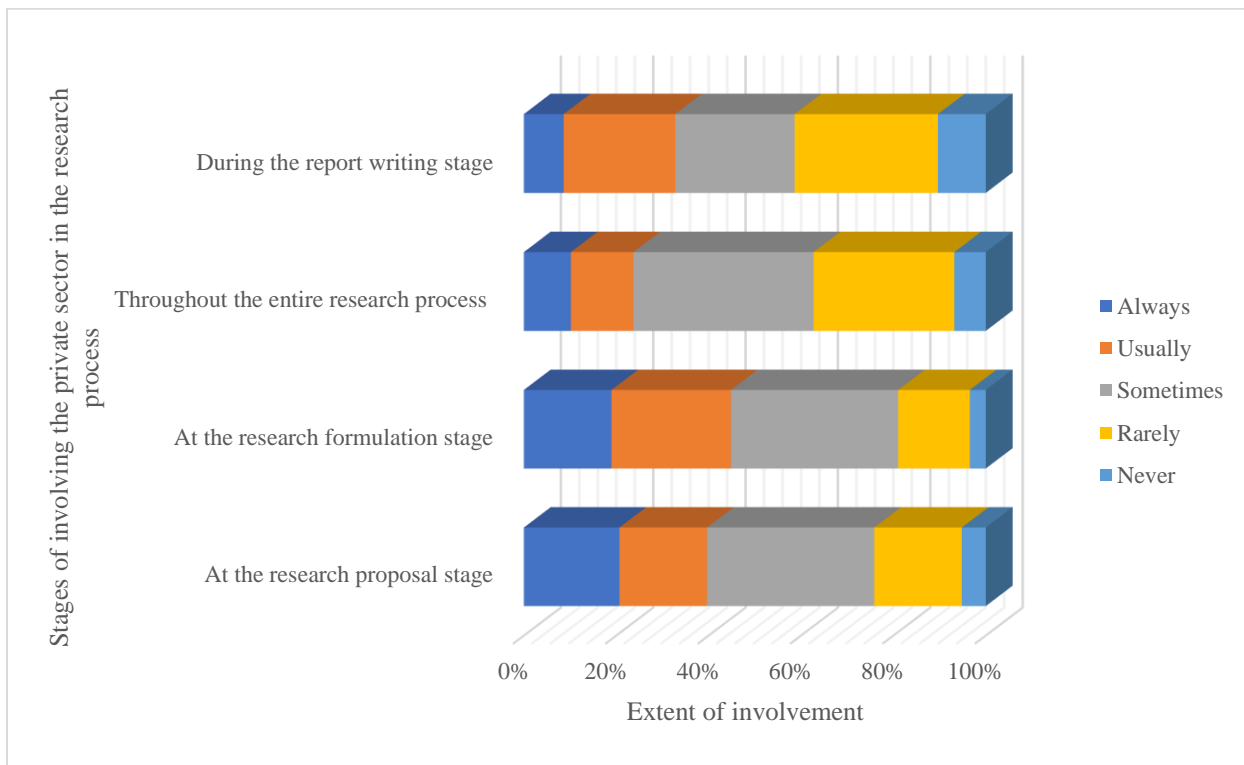


Figure 8.13 Stages of involving the private sector in the research process

Figure 8.13 above indicates that researchers involve the private sector more at the research proposal stage, research formulation stage, throughout the entire research process, in that order. Figure 8.13 also, indicates that researchers usually involve the private sector first and foremost at the research formulation stage, ahead of the report writing stage and before the research proposal stage.

It is worth noting that researchers at least see the need to involve their stakeholders, and in this case, the private sector, in the research process at one point or the other. As confirmed by some respondents during the interviews, involving the eventual users of research findings in the research process makes it easier for adoption and it builds confidence in the research findings. Involving the eventual users of research findings in the research process is therefore one of the pathways to research uptake and utilisation. There are however, some barriers to the uptake and utilisation process and this is discussed in the next sub-section.

8.4.4 Reasons why the private sector does not use research findings

As discussed in previous chapters a number of barriers, both individual and institutional, have been associated with the dissemination and uptake of research. In engaging with the private sector researchers gave indications of the most common reasons why the private sector does not use research which could be beneficial to them. This sub-section examines these barriers and their implications for research use. Table 8.9 and Figure 8.14 below give the responses (1–3, ranking from the highest to the lowest)

Table 8.9 The most common reasons why the private sector does not use research findings

Most common reasons for non-use of research findings	Level of importance of reason for non-use of research findings				
	Reason 1	Reason 2	Reason 3	Skipped (did not answer)	Valid total
Financial constraints to implement research findings	20 9.9%	4 2.0%	2 1.0%	176 87.1%	26 12.9%
Lack of human resource capacity in researchers to disseminate research from the university to the private sector	5 2.5%	10 5.0%	9 4.5%	178 88.0%	22 12.0%
Lack of personal motivation by researchers to disseminate research from the university to the private sector	10 5.0%	11 5.4%	5 2.5%	176 87.1%	26 12.9%
Private sector resistance to change	3 1.5%	7 3.5%	4 2.0%	188 93.0%	14 7.0%
Lack of understanding of research benefits by private sector players	2 1.0%	3 1.5%	5 2.5%	192 95.0%	10 5.0%
Misunderstanding and wrong perceptions of research results by the private sector	3 1.5%	9 4.5%	7 3.5%	183 90.5%	19 9.5%
Research not being relevant to the private sector	3 1.5%	3 1.5%	5 2.5%	191 94.5%	11 5.5%
Lack of confidence by the private sector in the research findings	2 1.0%	2 1.0%	7 3.5%	191 94.5%	11 5.5%
Lack of contact between researcher and users of findings within the private sector	6 3.0%	2 1.0%	7 3.5%	187 92.5%	15 7.5%
Lack of time by researchers to disseminate research findings	1 0.5%	1 0.5%	2 1.0%	198 98.0%	4 2.0%

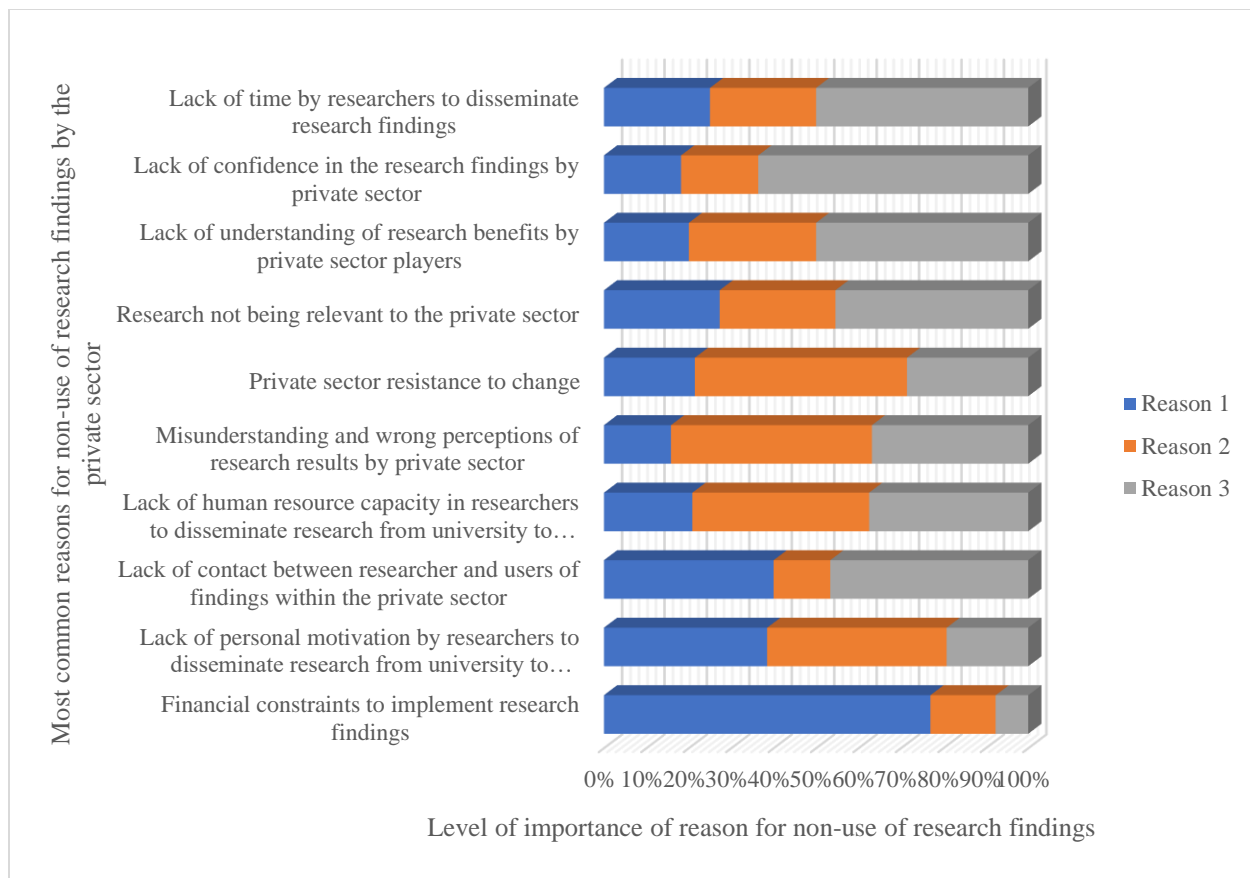


Figure 8.14 Most common reasons why the private sector does not use research findings

The first most common reason for the non-use of research findings by the private sector is that of financial constraints to implement research findings, according to the number of responses as illustrated in Figure 8.14 above. The second and third most common reasons, in the first level of reasons, are the lack of personal motivation by researchers to disseminate research findings and the lack of contact between researchers and users of research findings within the private sector respectively. These findings bring to the fore areas of lack that researchers and the institution need to consider and address.

These reasons for the non-use of research findings as identified will inform the university (KNUST) on the appropriate measures to resolve them. Another constraint, explained by some researchers during the interviews is that some private sector organisations seem to be entrenched in their own ways of doing things, which is the reason that they are not open to change, and resist any external attempts to introduce new ideas.

In order to build confidence in research findings, it was suggested that researchers look at the extent of involvement of the private sector in the research process. As suggested by some respondents, stakeholder involvement, most especially at the research formulation stage, gives a higher probability of acceptance and use of the research findings. Some ‘other’ reasons given by respondents for which the private sector does not use research findings are:

- research not in language private sector understands (Respondent R17);
- private sector not seeing researchers as hands-on consultants ((Respondent R17) and
- culture of receiving free research findings for implementation (Respondent R17).

These are issues that can be addressed by researchers in consultation with all other stakeholders.

8.5 Engagements with governments and parastatals

This section discusses the mechanisms of engagement with governments and parastatals, including MDAs. The sub-sections that follow discuss how researchers typically engage with government, faculties and academic positions that engage the most, the benefits of engagement, stages at which researchers involve government in the research process and the perception of researchers of the most common potential barriers to the use of research findings by government and parastatals. As expounded in the literature and discussed in Chapter 5, the options for the four sub-sections are adapted from the same authors with an expansion in the number of reasons why stakeholders do not use research. The additional reasons included are inadequate skills and experience of policymakers in research literacy, a lack of formal training in research management and a lack of interactions between decision makers and researchers (Humphries, 2014; Oliver et al., 2014; Sedlacko et al., 2013).

8.5.1 Typical engagement with governments and parastatals

This sub-section discusses the engagement mechanisms adopted by researchers in their engagement with government and parastatals and how often it happens. Also, this author looks at extent of engagement by academic positions and faculties. Table 8.10 below gives the respective responses from the survey.

Table 8.10 Engagement with governments and parastatals

Mechanisms of engagement	Extent of engagement						
	Every month	3 or 4 times a year	Annually	Rarely	Never	Skipped (did not answer)	Valid total
Developing research proposals with or for government and parastatals	2 1.0%	9 4.5%	16 7.9%	23 11.4%	3 1.5%	149 73.8%	53 26.2%
Organising workshops with or for government and parastatals	0 0%	14 6.9%	22 10.9%	12 5.9%	6 3.0%	148 73.3%	54 26.7%
Organising conferences with or for government and parastatals	1 2.0%	5 2.5%	21 10.4%	19 9.4%	4 2.0%	152 75.2%	50 24.8%
Serving on advisory boards of government and parastatals	3 5.8%	8 4.0%	10 5.0%	17 8.4%	14 6.9%	150 74.3%	52 25.7%
Conducting commissioned research for government and parastatals	0 0%	6 3.0%	13 6.4%	16 7.9%	15 7.4%	152 75.2%	50 24.8%
Research collaboration with government and parastatals	0 0%	7 3.5%	15 7.4%	22 10.9%	8 4.0%	150 74.3%	52 25.7%
Providing consultancy services for government and parastatals	3 1.5%	8 4.0%	16 7.9%	15 7.4%	10 5.0%	150 74.3%	52 25.7%
Journal publications co-authored with government and parastatals	0 0%	2 1.0%	8 4.0%	26 12.9%	16 7.9%	150 74.3%	52 25.7%
Technical reports and policy briefs jointly written with government and parastatals	0 0%	3 1.5%	11 5.4%	27 13.4%	11 5.4%	150 74.3%	50 25.7%
Books and book chapters co-authored with government and parastatals	0 0%	0 0%	3 1.5%	24 11.9%	25 12.4%	150 74.3%	50 25.7%

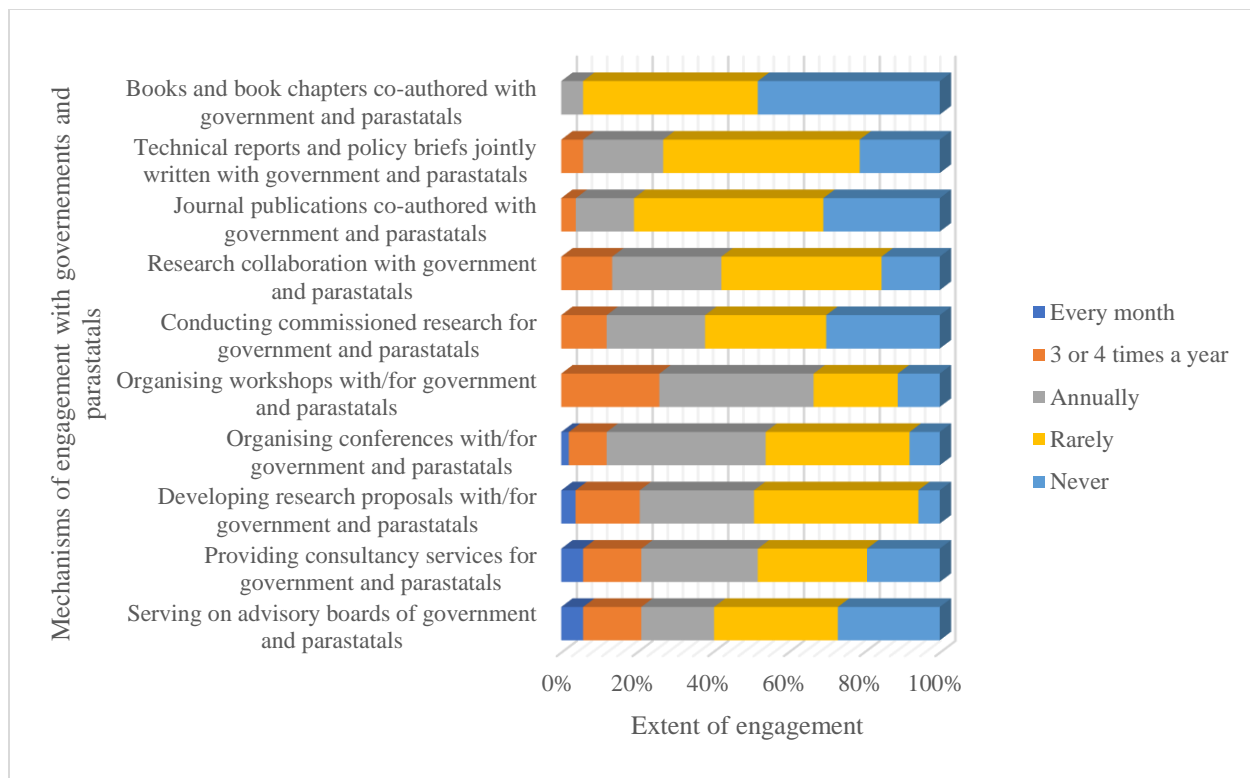


Figure 8.15 Mechanisms of engagement with governments (MDAs) and parastatals

On a monthly basis only 3% of respondents being the highest, indicated that they typically engage government and parastatals by serving on advisory boards of government and parastatals as well as providing consultancy services for governments and parastatals. Here again, this is high-level engagement that involves experienced lecturers and professors. All other monthly engagements with governments on a monthly basis fall below 3 as illustrated in Figure 8.15 above.

For three or four engagements in a year the highest percentage has to do with organising workshops with or for government and parastatals, followed by developing research proposals, serving on advisory boards of government and parastatals and providing consultancy services as illustrated in Figure 8.15 above. On an annual basis, the highest percentage out of 202 respondents said they engage annually with governments and parastatals also by organising workshops with or for government and parastatals.

It can clearly be seen where the attention of researchers lies in terms of the mechanisms and channels of engagement with government and parastatals. These are mainly serving on advisory boards, organising workshops and conferences with or for and providing consultancy services for government and parastatals.

8.5.1.1 Academic position and the extent of engagement with governments and parastatals

Figure 8.16 below provides an illustration of the analysis for the extent to which different academic positions engage with governments and parastatals.

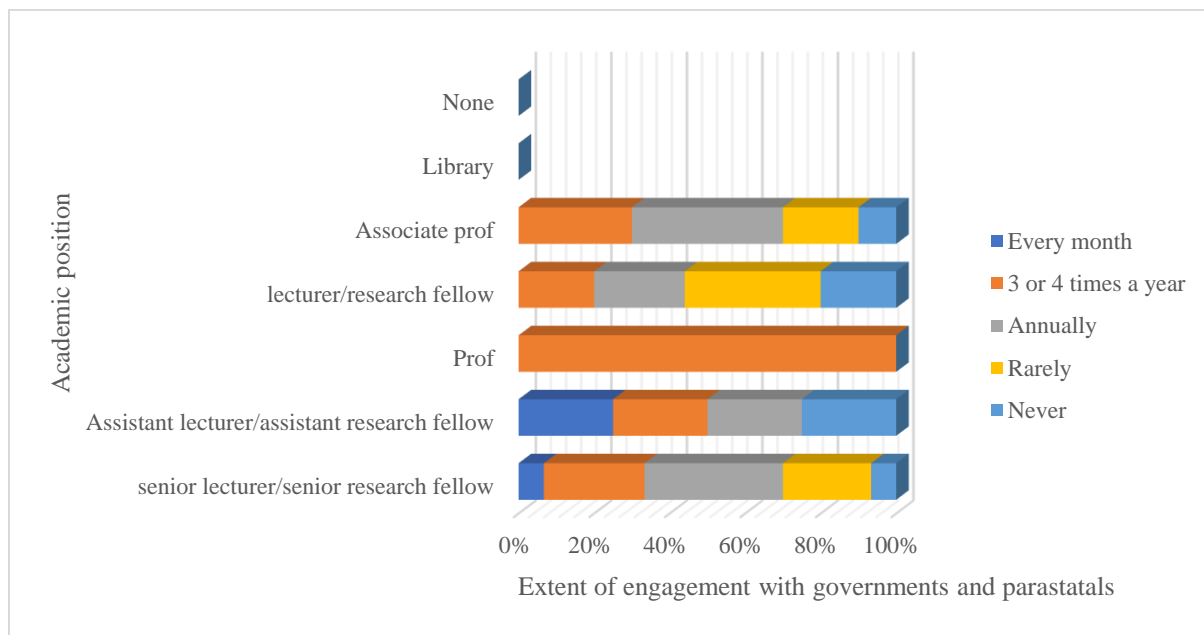


Figure 8.16 Position and extent of engagement with governments (MDAs) and parastatals

Figure 8.16 above presents the results of the analysis for engagement with governments and parastatals in terms of percentage contribution to the total. From the responses and as illustrated, senior lecturers or senior research fellows and assistant lecturers or assistant research fellows in that order engaged most on a monthly basis at the time of this research. For three or four times a year, senior lecturers, professors and lecturers in that order engaged most frequently with governments and parastatals. On an annual basis, senior lecturers, lecturers and associate professors engaged the most. The frequency of engagement is however not an indication of better engagement but determined by the nature of the task at hand. As far as engagement with government is concerned, almost all positions are involved in some level of engagement at one

point or the other. The extent of engagement of individual researchers within the faculties is discussed in the next sub-section.

8.5.1.2 Faculties and extent of engagement with governments (MDAs) and parastatals

Figure 8.17 below provides the analysis for the extent to which individual researchers within faculties engage with governments and parastatals.

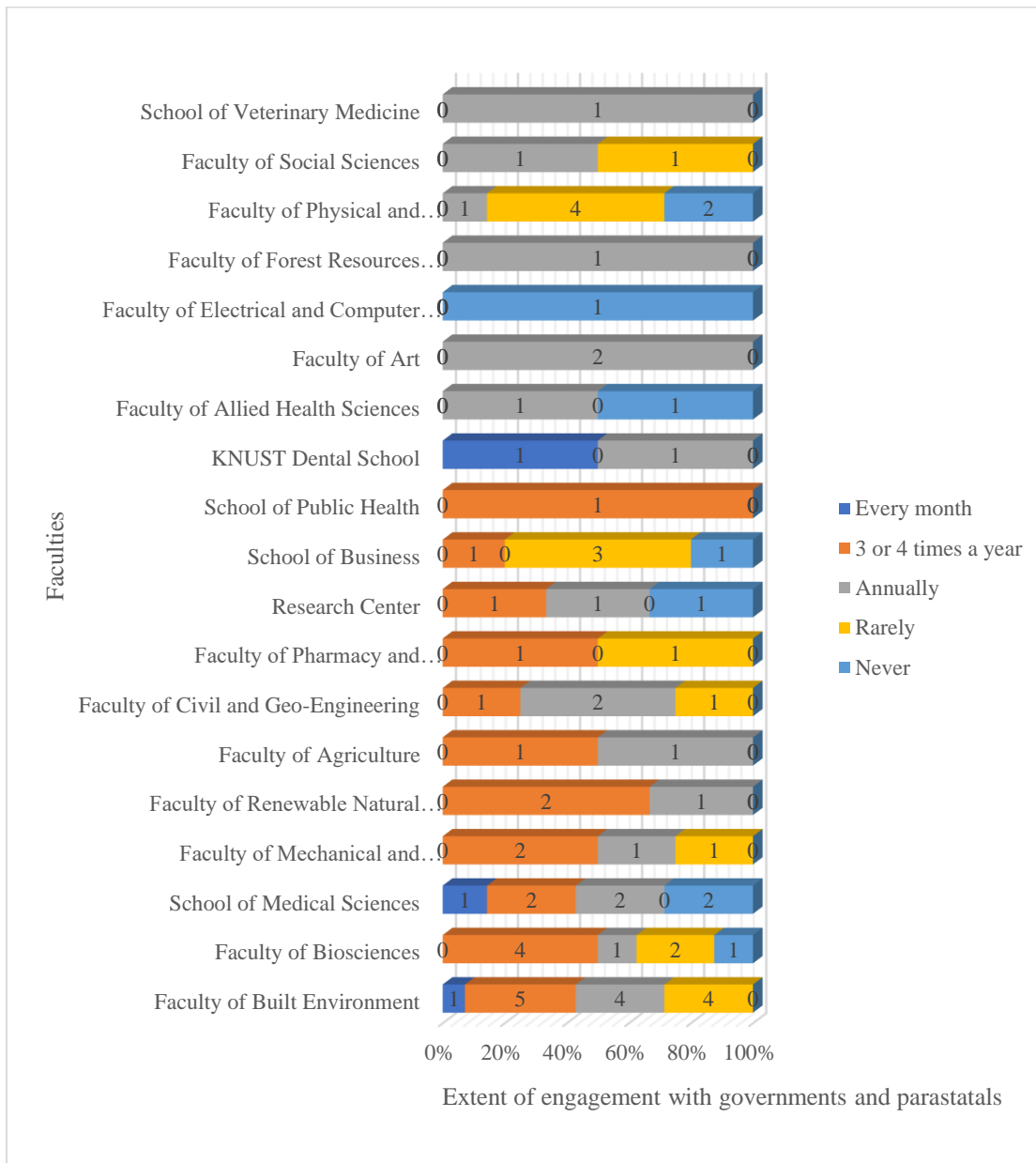


Figure 8.17 Faculties and extent of engagement with governments (MDAs) and parastatals

Figure 8.17 above shows that, on a monthly basis, the KNUST Dental School engaged most with governments and parastatals. In second and third place are the SMS and the Faculty of Built Environment. The Faculty of Built Environment and the Faculty of Biosciences, in that order, engaged with governments and parastatals three or four times a year. The performance of other faculties is as indicated in Figure 8.17 above. Active engagement with governments and parastatals is a good channel for RU. It also provides opportunities for further funding as indicated by some researchers. The university should therefore consider the use of this channel and initiate policies that would foster a good relationship between the faculties, governments and parastatals.

The faculties that engage most with government and parastatals, namely the KNUST Dental School, School of Medical Sciences and the Faculty of Built Environment, , most likely adopt these mechanisms in their engagements. These are the strengths of the faculties concerned and constitute focal areas for policy direction and resource allocation.

8.5.2 Benefits of engagement with governments and parastatals

This sub-section reflects the potential benefits of engagement with government and parastatals. Table 8.11 and Figures 8.18 below highlight the findings from the survey and analysis with regard to the benefits of engagement with government and parastatals. On the benefits of engagement with government and parastatals the highest percentage of the respondents indicated as very beneficial the fact that their research opens opportunities for further research. As seen earlier, researchers will take advantage of every opportunity that has the potential of bringing in funding, and so it is not surprising that this mechanism of engagement is their topmost priority. Some (such as Respondent R8 and Respondent R15) were of the opinion that their engagement has been very beneficial in that their research is used by government and parastatals. This is a good sign of research uptake and utilisation as far as addressing national issues are concerned. Furthermore, others perceived their research as very beneficial “[i]nfluencing policy and decisions of government and parastatals” and that it “[p]rovides opportunities for funding” as illustrated in Figure 8.18 below. Again, the issue of funding opportunities as a potential benefit to research has been highlighted every now and then by researchers.

Table 8.11 Benefits of engagement with governments and parastatals

Benefits of engagement	Extent of benefits of engagement						
	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	N/A	Skipped (did not answer)	Valid total
Your research is used by government and parastatals	26 12.9%	17 8.4%	5 2.5%	1 0.5%	3 1.5%	150 74.3%	52 25.7%
Your research opens opportunities for further research	31 15.4%	15 7.4%	5 2.5%	0 0%	1 0.5%	150 74.3%	52 25.7%
Influencing policy and decisions of government and parastatals	25 12.4%	15 7.4%	10 5.0%	0 0%	2 1.0%	150 74.3%	52 25.7%
Opens avenues for collaboration	24 11.9%	21 10.4%	4 2.0%	1 0.5%	2 1.0%	150 74.3%	52 25.7%
Provides opportunities for funding	25 12.4%	14 6.9%	8 3.9%	2 1.0%	3 1.5%	150 74.3%	52 25.7%
Solving governmental or parastatal problems	20 9.9%	16 7.9%	9 4.5%	1 0.5%	3 1.5%	153 75.7%	49 24.3%
Opportunities to develop innovations	15 7.4%	22 10.9%	7 3.5%	3 1.5%	3 1.5%	152 75.3%	50 24.7%
To transfer research to practice	23 11.4%	16 7.9%	6 3.0%	3 1.5%	2 1.0%	152 75.3%	50 24.7%
To meet formal requirements of a study agreement	13 6.4%	15 7.4%	8 4.0%	3 1.5%	9 4.5%	154 76.2%	48 23.8%
Other	2 1%					200 99.0%	2 1%

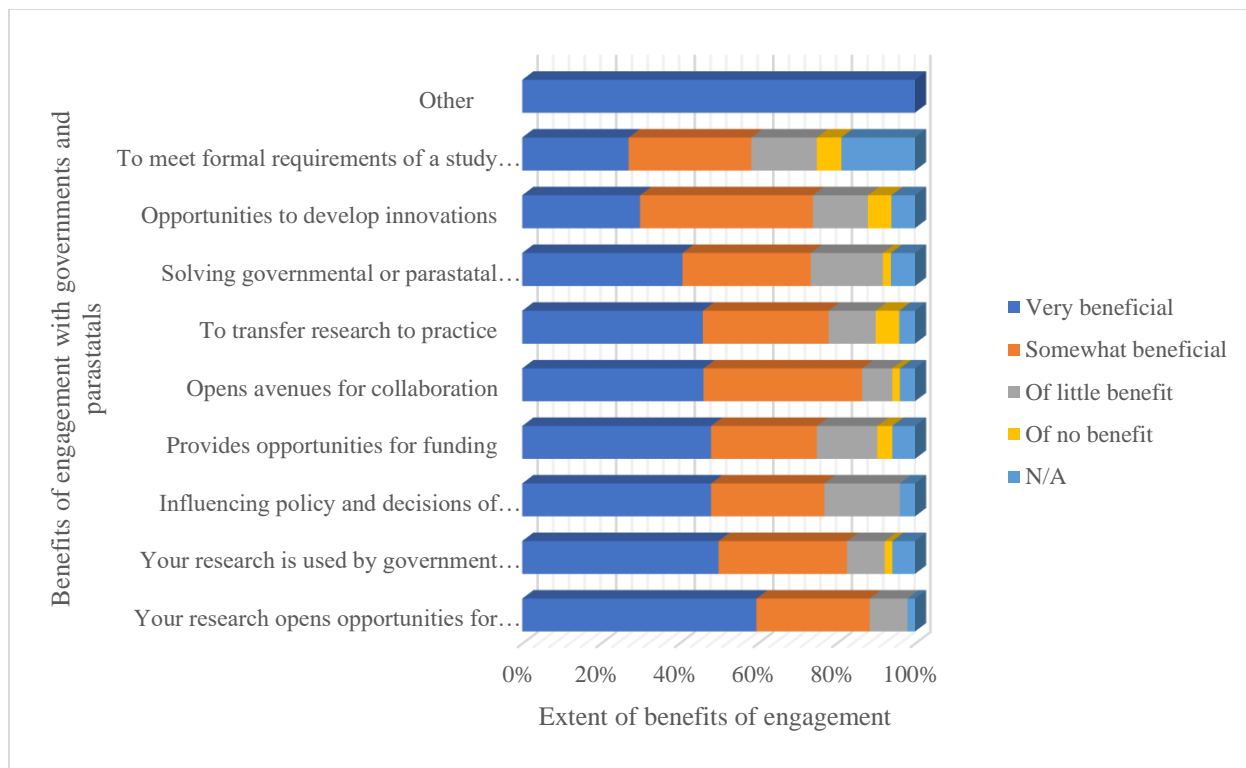


Figure 8.18 Perceived benefits of engagement with governments (MDAs) and parastatals

Some researchers consider it somewhat beneficial that their research provides opportunities to develop innovations, opens avenues for collaboration, etc. as shown in Figure 8.18 above. These are also important channels to explore to promote research. The ultimate goal of this study was to propose a framework that will lead to the institutionalisation of research uptake. For this reason, clear-cut pathways to research uptake are outlined as inferences from the survey and interviews to promote the use of research findings.

8.5.3 Stages of involvement of governments and parastatals

This sub-section discusses the stages at which researchers involve governments and parastatals in their research process. As discussed in Chapter 5, various authors have outlined stages where researchers could involve their stakeholders for the needed buy-in and subsequent use of the research. These stages include: the research proposal or development stage, data collection and analysis stage, during the research process, during the research report drafting stage, during the final report and dissemination stage, and at all stages of the research process (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole & Whitmarsh, 2008). Table 8.12 and Figure 8.19 below provide

the summary and analysis of responses of the extent to which researchers involve governments and parastatals in their research process at various stages.

Table 8.12 Stages of involving governments and parastatals in research

Stages of involvement in the research process	Extent of involvement						
	Always	Usually	Sometimes	Rarely	Never	Skipped (did not answer)	Valid total
At the research formulation stage	6 3.0%	11 5.4%	18 8.9%	12 5.9%	5 2.5%	150 74.3%	52 25.7%
At the research proposal stage	5 2.5%	14 6.9%	20 9.9%	8 4.0%	5 2.5%	150 74.3%	52 25.7%
During the report writing stage	3 1.5%	9 4.5%	13 6.4%	16 7.9%	10 5.0%	151 74.8%	51 25.8%
Throughout the entire research process	3 1.5%	5 2.5%	23 11.4%	13 6.4%	8 4.0%	150 74.3%	52 25.7%

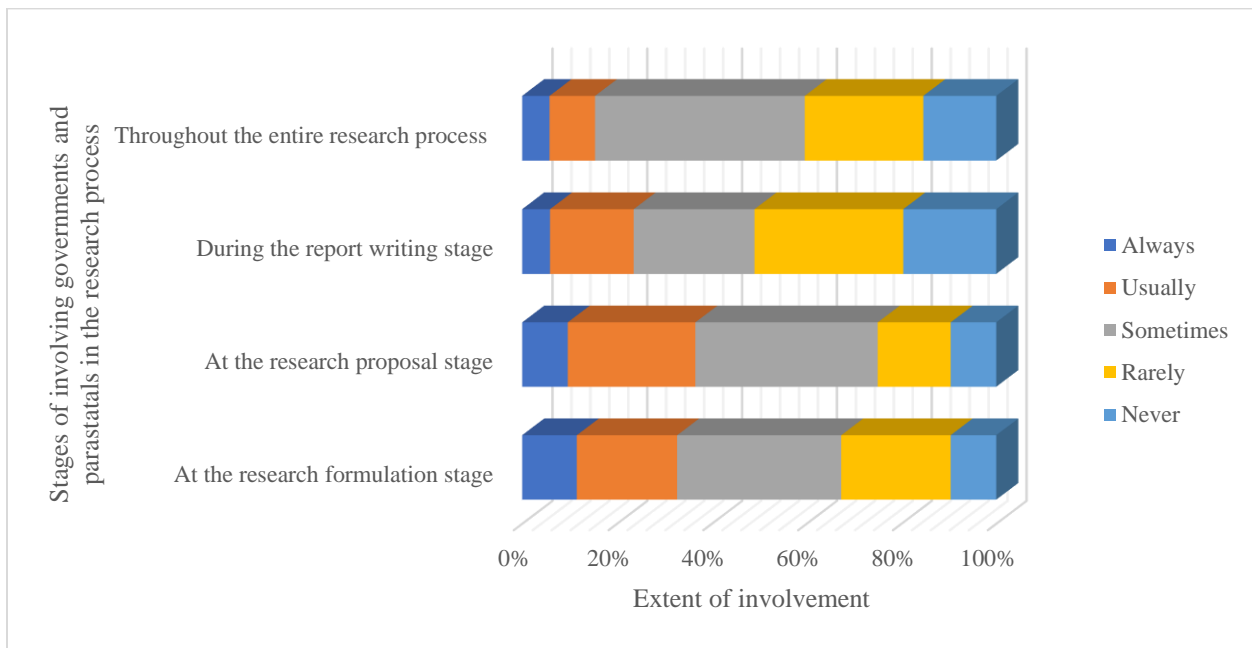


Figure 8.19 Stages of involving government and parastatals in the research process

Figure 8.19 above illustrates the outlook for the stages where researchers mostly involve governments and parastatals in the research process. In order of merit researchers indicated the top three as research formulation stage, research proposal stage and report writing stage. As argued by various authors (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole & Whitmarsh, 2008) these are useful and important ways of getting research into practice since the stakeholders have been part of the process at one point or the other. The same three stages are usually adopted by researchers as illustrated in Figure 8.19 above. The importance of stakeholder involvement cannot be overemphasised, since it leads to an increased likelihood of adoption and use of research findings. During the interviews one respondent indicated that he involves his stakeholders only during the evaluation of the project for feedback. This can be useful for future projects and research activities and can be regarded as a key component of the research cycle. A number of reasons have been attributed to non-use of research findings which could be useful to stakeholders. The next subsection sought to find out the most common reasons why governments and parastatals do not use research findings.

8.5.4 Reasons why governments and parastatals do not use research findings

Table 8.13 below gives the outcomes for the most common reasons (ranked from the highest to the lowest) why governments and parastatals do not use research findings which could be beneficial to them. These are illustrated in Figure 8.20.

Table 8.13 The most common reasons for non-use of research findings by governments and parastatals

Most common reasons for non-use of research findings	Level of importance of reason for non-use of research findings				
	Reason 1	Reason 2	Reason 3	Skipped (did not answer)	Valid total
Decision making culture of government not conducive to make use of research findings	20 9.8%	8 4.0%	5 2.5%	169 83.7%	33 16.3%
Political influence plays a far greater role than evidence to make decisions	12 5.9%	18 8.9%	2 1.0%	170 84.2%	32 15.8%
Research results are not delivered in a timely fashion	0 0%	4 2.0%	5 2.5%	193 95.5%	9 4.5%
There exists financial constraints to implement research findings	6 3.0%	6 3.0%	6 3.0%	184 91.0%	18 9%
Lack of human resource capacity in researchers to disseminate research	1 0.5%	3 1.5%	3 1.5%	195 96.5%	7 3.5%
Lack of personal motivation by researchers to disseminate research findings	1 0.5%	2 1.0%	5 2.5%	194 96.0%	8 4%
Government and parastatals resisting change	1 0.5%	2 1.0%	7 3.5%	192 95.0%	10 5%
Lack of understanding of research benefits by government and parastatals	1 0.5%	1 0.5%	4 2.0%	196 97.0%	6 3%
Misunderstanding and wrong perceptions of research results by governments	1 0.5%	0 0%	1 0.5%	200 99.0%	2 1%
Research not relevant to government and parastatals	0 0%	0 0%	5 2.5%	197 97.5%	5 2.5%
Lack of confidence in research findings	2 1.0%	3 1.5%	1 0.5%	196 97.0%	6 3%
Lack of contact between researchers and users of findings among government and parastatals	2 1.0%	4 2.0%	5 2.5%	191 94.5%	11 5.5%
Lack of time to disseminate research findings	1 0.5%	0 0%	2 1.0%	199 98.5%	3 1.5%

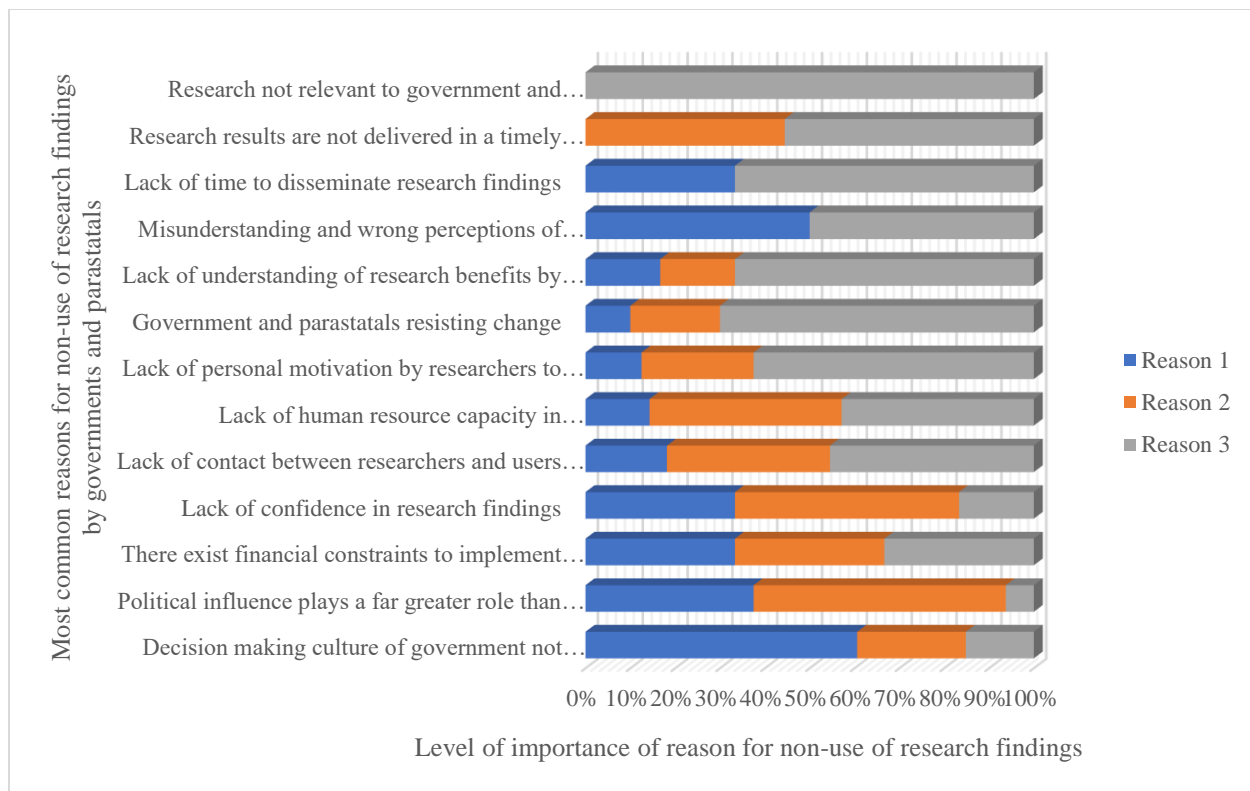


Figure 8.20 Most common reasons why governments (MDAs) and parastatals do not use research findings

In the first category of reasons the first most common reason why governments and parastatals do not use research findings is that “[d]ecision making culture of government is not conducive to make use of research findings”. Still in category 1 (Reason 1), the next most common reason given for non-use of research is that “[p]olitical influence plays a far greater role than evidence to make decisions” and also that of “[f]inancial constraints to implement research”. Though not selected among the three most common reasons for non-use of research by governments and parastatals there were some other reasons worth noting, to the effect that governments have a “culture of not depending on science for decision making” (Respondent 15) and that “they mostly used research they have commissioned with clear terms of reference” (Respondent 15). At the institutional level the channels and mechanisms of engagement with governments and parastatals has to be improved in order to better understand these barriers and thereby devise means to overcome them. Issues about the decision-making culture of government and political influence may not be easy to deal with, but the university could work better through sector ministries to achieve its goals. The

framework proposes ways of facilitating research use by all stakeholders, including government and parastatals, in order to overcome the barriers stated above.

8.6 Engagements with scientists and researchers

This section discusses the responses obtained from researchers with regard to –

- how researchers at KNUST typically engage with scientists and researchers of other universities and institutes via some specified mechanisms of engagement, the faculties and academic positions that engage most;
- the benefits of such engagements;
- the stages at which they involve these stakeholders in their research process; and
- the most common reasons why stakeholders do not use research findings that could be beneficial to them.

The sub-sections that follow examine each of the above in detail.

8.6.1 Typical engagement with scientists and researchers from other universities and institutes

Following on from the foregoing discussions in this chapter this sub-section discusses how often researchers typically engage with scientists and researchers from other universities and institutes via some of the mechanisms and channels outlined in the literature. Table 8.14 and Figure 8.21 below provide the responses and comparisons of frequency of engagements through various mechanisms.

Table 8.14 Engagements with scientists and researchers from other universities and institutes

Mechanisms of engagement	Extent of engagement						
	Every month	3 or 4 times a year	Annually	Rarely	Never	Skipped (did not answer)	Valid total
Developing curriculum in partnership with other scientists and researchers	3.0%	11.2%	14.4%	14.4%	5.0%	52.0%	48%
Organising workshops with or for other scientists and researchers	1.0%	11.9%	21.2%	11.4%	4.0%	50.5%	49.5%
Organising conferences with or for other scientists and researchers	1.0%	9.4%	21.7%	9.9%	5.0%	53.0%	47%
Attending conferences with other scientists and researchers	1.0%	14.9%	27.2%	5.9%	1.0%	50.0%	50%
Serving on advisory boards with other scientists and researchers	3.0%	8.9%	10.9%	13.4%	9.30%	54.5%	45.5%
Research collaboration with other scientists and researchers	5.9%	18.8%	20.3%	4.0%	0.50%	50.5%	49.5%
Providing consultancy services with or for other scientists and researchers	1.5%	8.9%	14.9%	15.7%	4.5%	54.5%	45.5%
Conducting commissioned research with or for other scientists and researchers	0%	8.9%	10.9%	17.8%	10.9%	51.5%	48.5%
Sharing facilities with other scientists and researchers e.g. laboratories and equipment and research data	3.0%	14.3%	13.4%	10.4%	7.4%	51.5%	48.5%
Joint journal publications with other scientists and researchers	2.0%	17.3%	17.8%	6.9%	3.5%	52.5%	47.5%
Newsletters	1.0%	4.5%	8.4%	12.4%	15.3%	58.4%	41.6%
Technical reports and policy briefs jointly written with other scientists and researchers	1.0%	7.4%	10.9%	15.3%	13.4%	52.0%	48.0%
Books and book chapters co-authored with other scientists and other researchers	0%	2.00%	8.4%	19.8%	17.8%	52.0%	48.0%
Public lectures	1.0%	4.5%	16.2%	13.4%	12.4%	52.5%	47.5%
Social media interaction with other scientists and researchers	7.4%	9.4%	7.4%	9.9%	12.4%	53.5%	46.5%

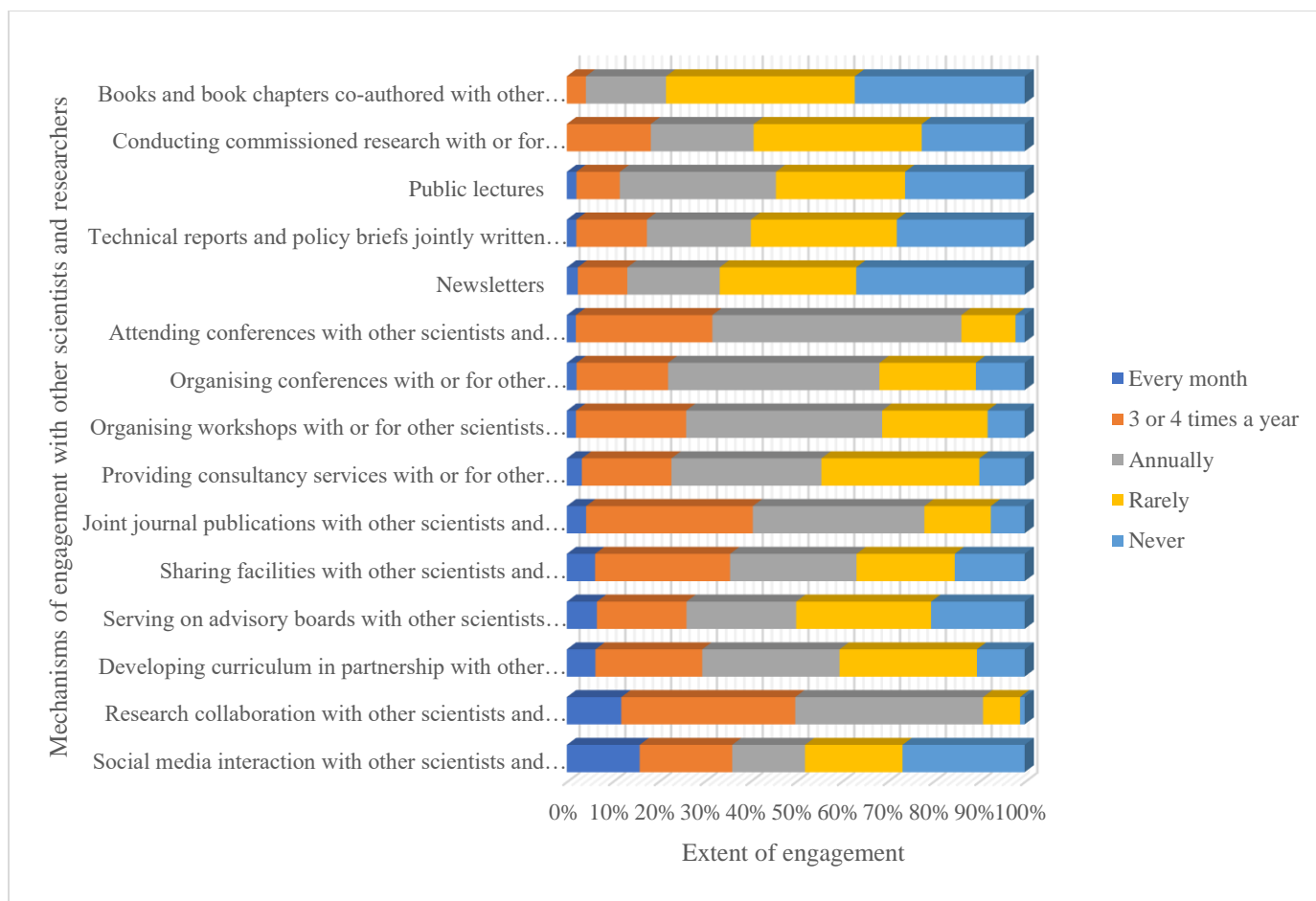


Figure 8.21 Engagement with scientists and researchers from other universities and institutes

On a monthly basis the highest score of 7.4% researchers indicated that they engage with other scientists and researchers through social media interactions. In the opinion of this researcher, this reflects current trends of increase in the use of ICT and social media. Again, WhatsApp platforms are now a common feature for various groups of people and it is therefore not surprising to find its extensive use among researchers. On a monthly basis there is also some level of research collaboration with other scientists and researchers as illustrated in Figure 8.21 above.

The highest percentage of researchers, that is 18.8%, engage through research collaboration with other scientists and researchers three or four times a year, while some others, that is 17.3%, engage in joint journal publication with other scientists and researchers, also three or four times in a year as illustrated in Figure 8.21 above. These are to be expected, as by their schedule and disposition most researchers at KNUST focus on publications in journals.

It can also be observed from Figure 8.21 above that on an annual basis the majority of researchers engage through attending conferences and organising conferences and workshops with or for scientists and researchers from other universities and institutes. Once again, though the engagement takes place only annually, it confirms previous findings (see sub-section 8.3.1, 8.4.1 and 8.5.1) that researchers prefer interactions among peers. These channels of engagement can be harnessed in such a way as to bring together researchers with the aim of propagating the need for emphasis on research uptake and utilisation. Research collaboration, conferences and workshops are some of the preferred mechanisms of engagement through which research uptake can take place and so due consideration is given to these in the framework for research uptake. The extent of engagement by academic position is provided in the next sub-section.

8.6.1.1 Academic position and extent of engagement with scientists and researchers from other universities and institutes

Figure 8.22 below provides the analysis for academic position and the extent of engagement with scientists and researchers from other universities and institutes.

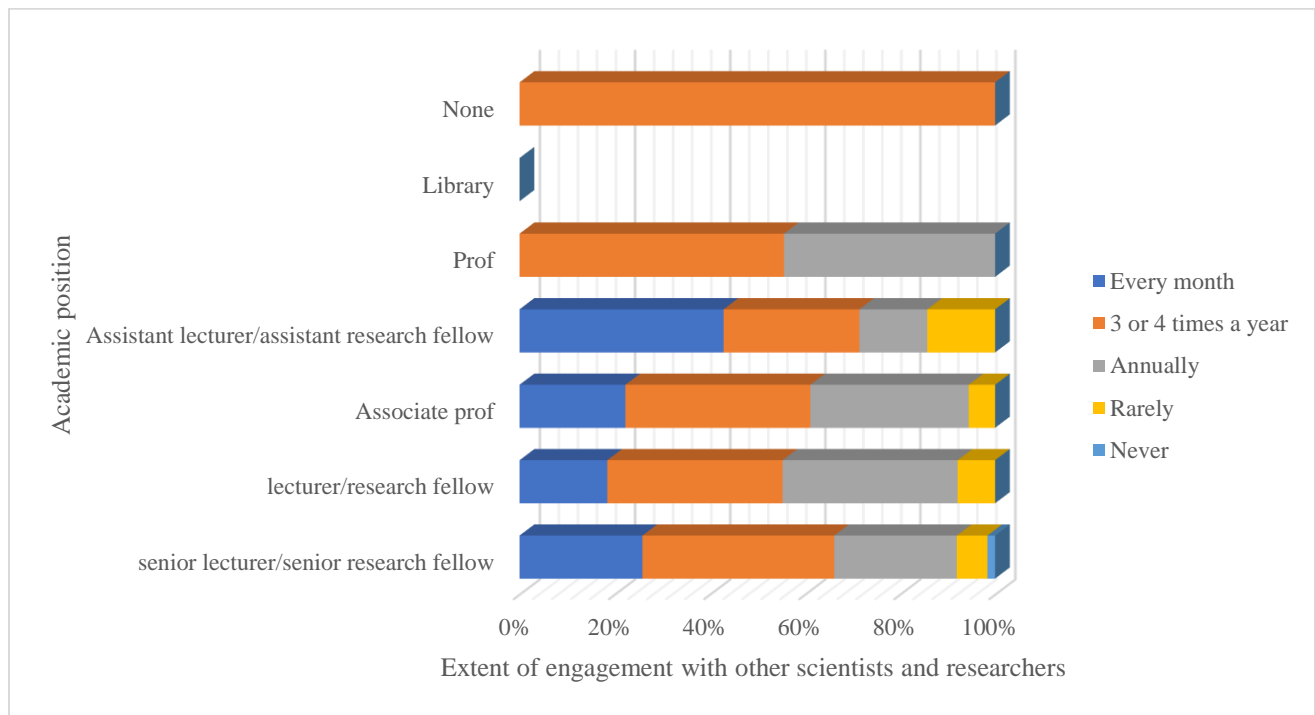


Figure 8.22 Academic position and engagement with scientists and researchers from other universities and institutes

On a monthly basis, senior lecturers and senior research fellows, lecturers and research fellows and associate professors in that order engaged most with scientists and researchers from other universities and HEIs. For three or four times a year, senior lecturers, lecturers and associate professors engaged with scientists and researchers more than the others. The same order is observed for annual engagements. Figure 8.22 above illustrates the engagements with scientists and researchers from other universities and HEIs. Once again, it can be observed that senior lectures and equivalents lecturers and associate professors engaged stakeholders the most. The extent of engagement of individual researchers within the faculties is discussed in the next subsection.

8.6.1.2 Faculties and extent of engagement with scientists and researchers from other universities and institutes

Figure 8.23 below provides the analysis for the extent of engagement by individual researchers at the level of faculties.

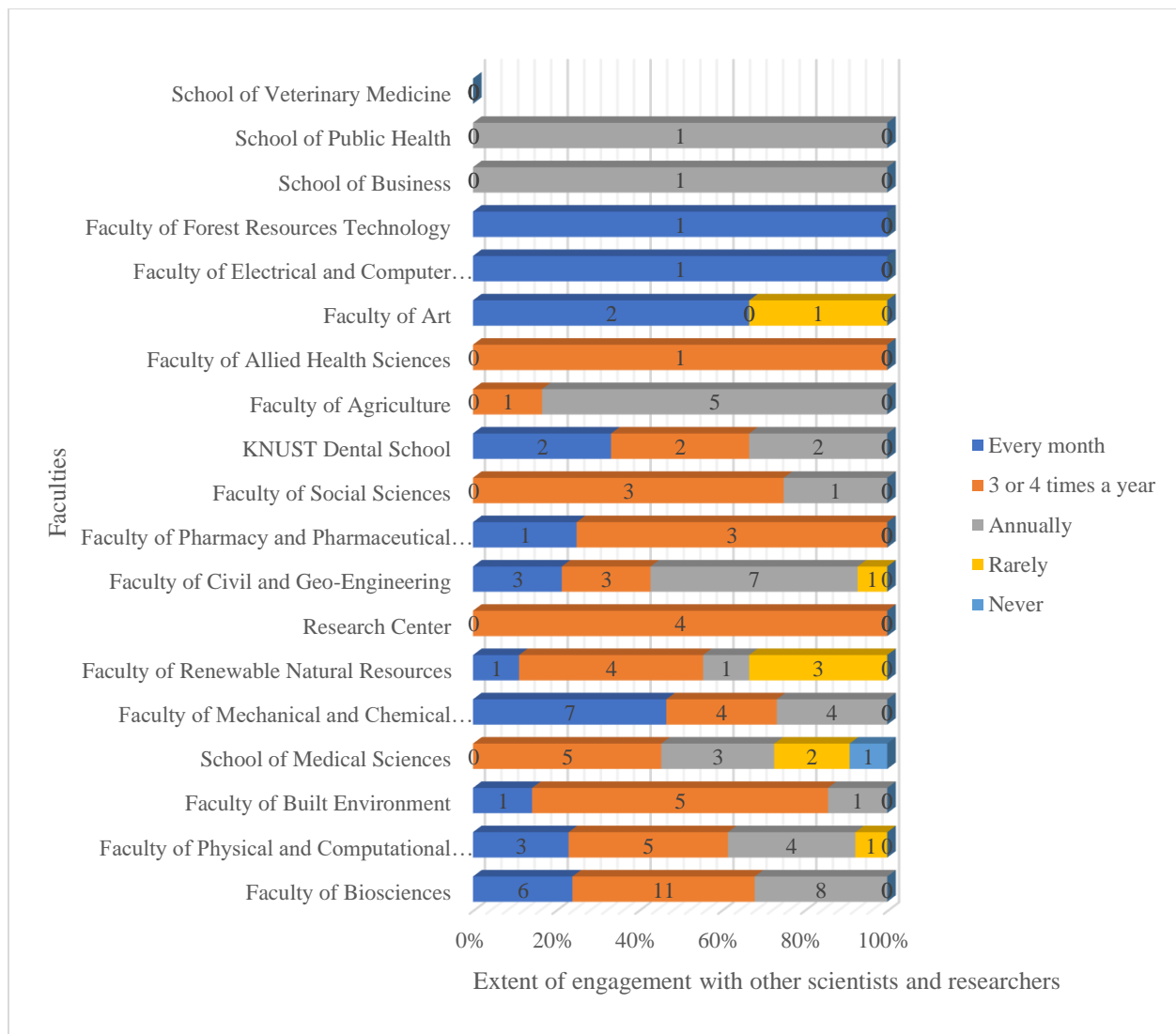


Figure 8.23 Faculties and extent of engagement with scientists and researchers from other universities and institutes

As clearly indicated in Figure 8.23 above, the Faculties of Mechanical and Chemical Engineering, Biosciences and Physical and Computational Sciences, in that order, are the three topmost faculties that engaged with scientists and researchers from other universities and research institutes on a monthly basis. The Faculty of Biosciences, the Faculty of Physical and Computational Sciences and the Faculty of Built Environment however, engaged most, i.e. three or four times a year as shown in the figure. On an annual basis, the Faculty of Biosciences engaged the most. It is worth noting at this point that faculties or schools have their different extents of engagement with stakeholders with some engaging more than others.

8.6.2 Benefits of engagement with scientists and researchers from other universities and institutes

As discussed in the literature there a number of benefits in engaging stakeholders. This sub-section discusses the experiences of researchers and the perceived potential benefits of engagements with scientists and researchers of other universities and institutes. Table 8.15 below gives the percentage responses to the question on how beneficial they perceive potential benefits of engagement with scientists and researchers from other universities and institutes to be to their research engagement activities.

Table 8.15 Benefits of engagement with scientists and researchers from other universities and institutes

Benefits of engagement	Extent of benefits engagement						Valid total
	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	N/A	skipped	
Your research is used by scientists and other researchers	39.1%	9.9%	0.5%	0%	0.5%	50.0%	50%
Your research opens opportunities for further research	38.6%	10.4%	1.0%	0%	0%	50.0%	50%
Your research influences choices and/or decisions by other scientists and researchers	26.7%	20.3%	1.5%	0%	0.5%	51.0%	49%
Opens avenues for collaboration	31.2%	15.3%	1.0%	0%	1.0%	51.5%	48.5%
Solving problems of other scientists and researchers	23.3%	20.2%	3.0%	0%	2.5%	51.0%	49%
Opportunities to develop innovations	21.8%	17.3%	5.9%	2.0%	1.0%	52.0%	48%
To transfer research to practice	26.7%	13.9%	6.9%	1.0%	1.0%	50.5%	49.5%
To meet formal requirements of a study	19.8%	16.4%	5.4%	1.5%	5.4%	51.5%	48.5%

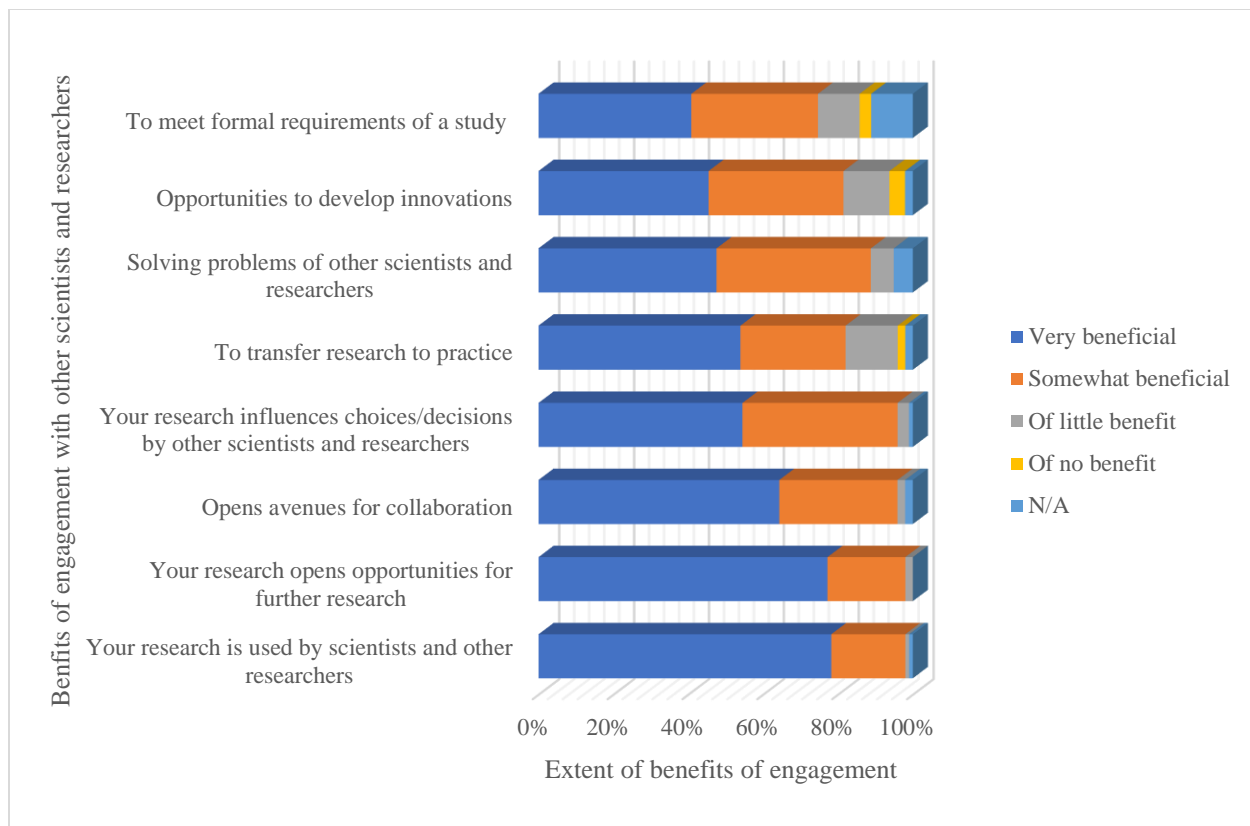


Figure 8.24 Perceived benefits of engagement with scientists and researchers from other universities and institutes

Figure 8.24 above indicates that a majority of researchers perceive as very beneficial the fact that their research is used by other scientists and researchers, that their research opens opportunities for further research and also that their research opens avenues for collaboration. By perceiving research use as being very beneficial, it gives an idea that somehow researchers consider it important and beneficial if their research is used by others. It implies that researchers see the need to work towards the uptake of their research. The current situation however, is that the main focus of researchers at KNUST is towards publications in journals and conference proceedings. To go beyond publications to practical application of research is to provide the right policy framework.

Some researchers also indicated as somewhat beneficial the fact that their research influences choices and/or decisions, solves problems, and opens opportunities to develop innovations as illustrated in Figure 8.24 above.

It is not surprising to have relatively high percentages indicating as very beneficial the fact that their research opens opportunities for further research and opens avenues for collaboration respectively. It is an experience most researchers would love to have since it has the potential of bringing in financial support and also leading to publications in refereed journals. The above findings confirm the assertions by Bozeman (2000), Jacobson (2007), Sudsawad (2007) and Cherney et al. (2012).

8.6.3 Stages of involvement of scientists and researchers from other universities and institutes

This sub-section discusses the stages at which researchers involve scientists and other researchers in their research process. As discussed earlier the level of stakeholder involvement, whether at the inception, during or throughout the research process, has far-reaching consequences for the adoption and use of the research findings (Bozeman, 2000; NCDDR, 1995; Nicholson-Cole & Whitmarsh, 2008). The responses and analysis of the extent to which researchers involve scientists and researchers from other universities and institutes in their research process are given below. Table 8.16 below presents the outcomes for the stages at which researchers at KNUST involve scientists and researchers from other universities and institutes in their research process.

Table 8.16 Stages of involving scientists and other researchers in research process

Stages of involvement	Extent of involvement						Valid total
	Always	Usually	Sometimes	Rarely	Never	Skipped (did not answer)	
At the research formulation stage	12.9%	23.2%	8.4%	4.0%	1.5%	50.0%	50.0%
At the research proposal stage	16.3%	19.3%	9.4%	2.0%	2.5%	50.5%	49.5%
During the report writing stage	14.9%	16.8%	10.9%	5.4%	2.0%	50.0%	50.0%
Throughout the entire research process	14.4%	15.8%	11.4%	7.9%	0.5%	50.0%	50.0%
Other 2	1.0%	0%	0%	0%	0%	99.0%	1.0%

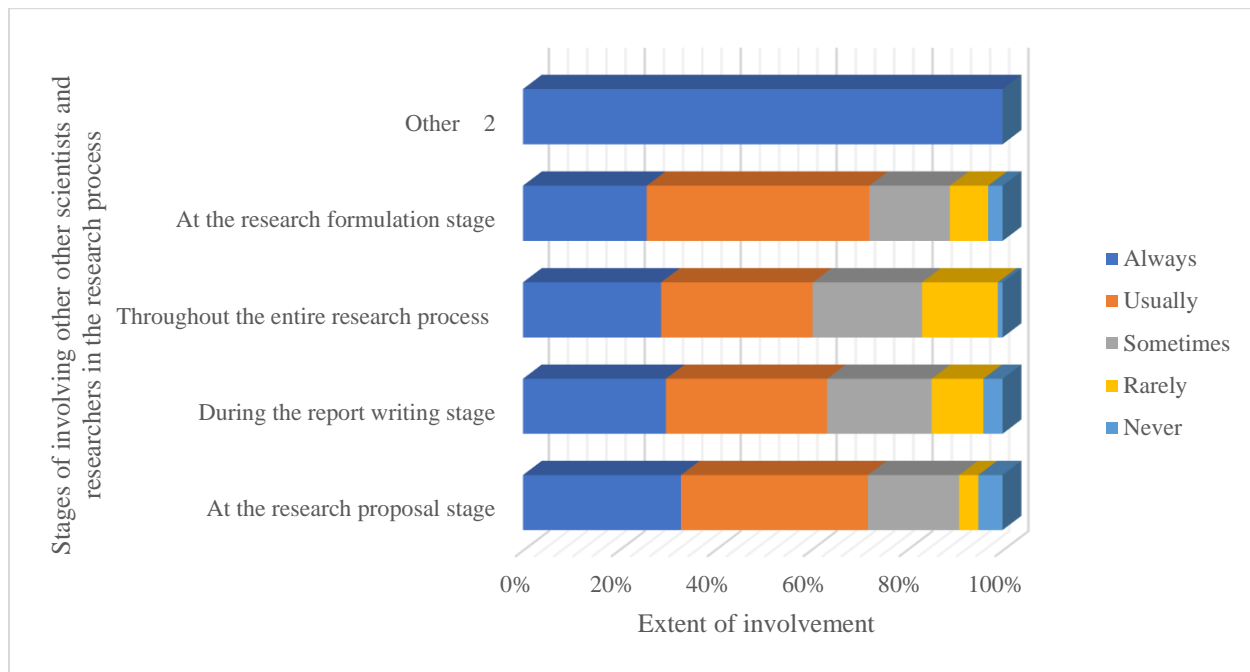


Figure 8.25 Stages of involving scientists and researchers from other universities and institutes in the research process

In Figure 8.25, respondents indicated that they always involve scientists and other researchers at the research proposal stage, during the report writing stage and throughout the entire research process in that order. Researchers also indicated that they usually engage with other scientists and researchers at the research formulation stage, research proposal stage and during the report writing stage as illustrated in Figure 8.25 above.

From all indications, researchers are aware of the need to involve their stakeholders in the research process at the research formulation and research proposal stages. As discussed in Chapter 5, these stages of involvement, including involving stakeholders throughout the research process, are key to the acceptance and use of the research findings by stakeholders. They are therefore necessary pathways to the framework for institutionalising research uptake and utilisation.

8.6.4 Reasons why scientists and researchers do not make use of research findings

This sub-section discusses the most common reasons why scientists and researchers from other universities and institutes do not use research findings that could be beneficial to them. The selected barriers or reasons for non-use of research finding are outlined by Humphries (2014),

Sedlacko et al., (2013), Oliver et al., (2014) and discussed in previous chapters. Table 8.17 and Figure 8.19 below provide the ranking (1–3 from highest down) of the three most common reasons why scientists and researchers of other universities and research institutes do not use research findings that could be beneficial to them.

Table 8.17 The most common reasons for non-use of research findings by scientists and researchers from other universities and institutes.

Most common reasons for non-use of research findings	Level of importance of reason for non-use of research findings				
	Reason 1	Reason 2	Reason 3	Skipped (did not answer)	Valid total
Timely delivery of research results to scientists and researchers	55.3%	21.1%	23.7%	81.2%	18.8%
Research findings not disseminated to scientists and other researchers	48.9%	31.1%	20.0%	77.7%	22.3%
Scientists and researchers not being involved in the research process	27.5%	42.5%	30.0%	80.2%	19.8%
Scientists and researchers resisting change	42.9%	35.7%	21.4%	93.1%	6.9%
Lack of trust in research findings by scientists and researchers	30.4%	21.7%	47.8%	88.6%	11.4%
Misunderstanding and wrong perceptions of research results by scientists and researchers	33.3%	40.0%	26.6%	92.5%	7.5%
Research not being relevant to scientists and researchers	35.0%	20.0%	45.0%	90.1%	9.9%
Lack of confidence in the research findings by scientists and researchers	9.1%	40.9%	50.0%	89.1%	10.9%
Lack of contact between researcher and users of findings among other scientists and researchers	27.5%	45.0%	27.5%	80.2%	19.8%
Lack of time on the part of scientists and researchers to use research findings	30.8%	26.9%	42.3%	87.1%	12.9%

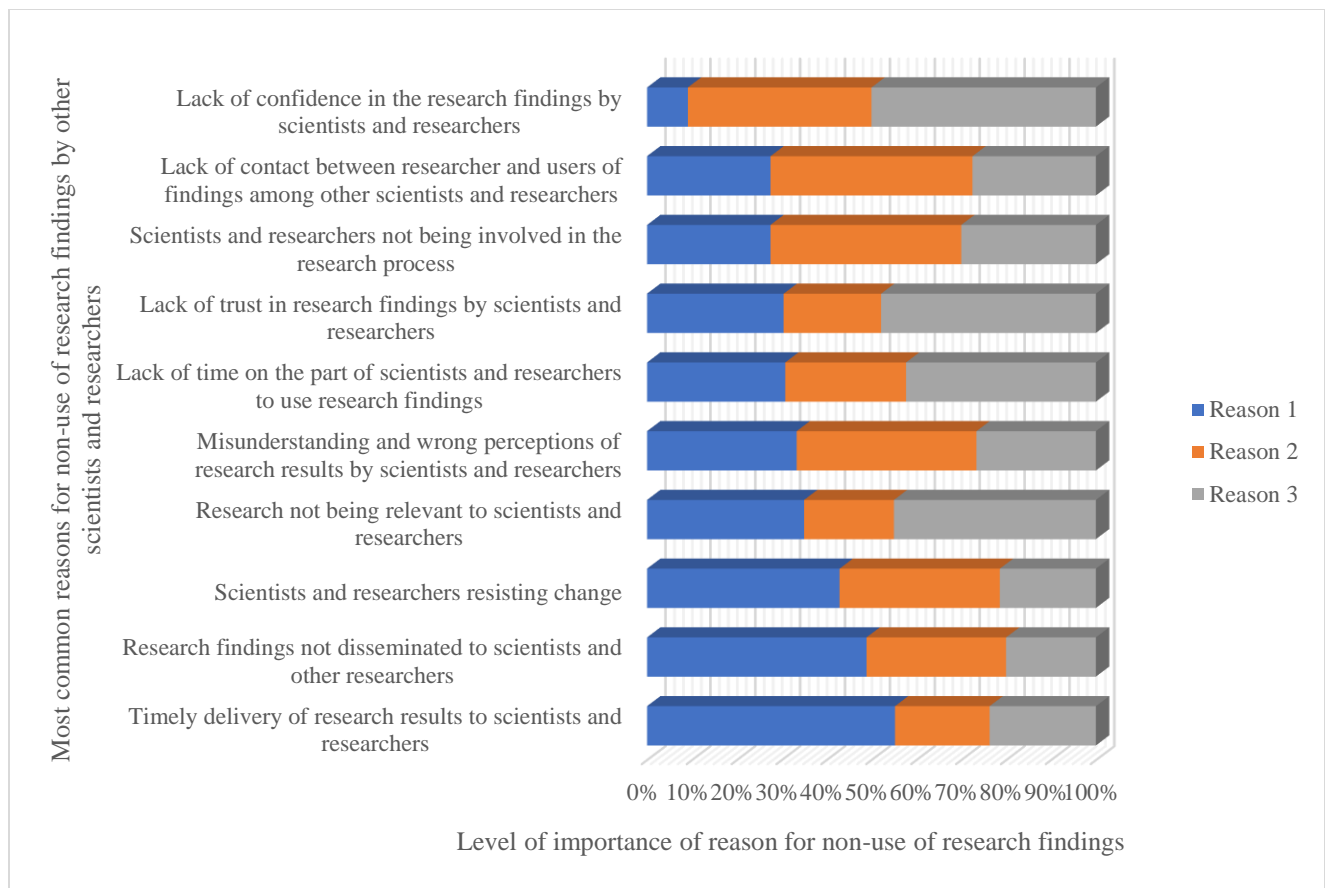


Figure 8.26 Most common reasons why scientists and researchers from other universities and institutes do not use research findings

The first most common reason why scientists and researchers of other universities and institutes do not use research findings is that of timely delivery of research results to scientists and researchers, with a score of 55.3%. 48.9% are of the opinion that research findings are not disseminated to scientists and other researchers, while 42.9% believe that scientists and researchers resisting change is the foremost reason for non-use of research findings as illustrated in Figure 8.26 above. A lack of contact between researchers and users of findings among other scientists and researchers features as one of the common barriers for non-use of research findings. Also specified by one respondent during the interviews is the fact that the lack of funding or insufficient funds contributes to scientists and researchers of other universities and institutes not using research findings. To resolve these challenges is to resolve the problem of research findings not being used. Therefore, putting into place structures to ensure timely delivery of research findings, involving

stakeholders in the research process to build confidence, and sourcing for funding to disseminate research will enhance the process towards uptake and utilisation of research.

8.7 Engagements with non-governmental organisations

The sub-sections below discuss how typically researchers at KNUST engage with non-governmental organisations (NGOs) and which academic positions and faculties engage most, the benefits of the engagements, the stages at which they involve these stakeholders in their research process and what are the most common reasons why these NGOs (including charities and funders) do not use research findings which could be beneficial to them. The details are as discussed and illustrated below.

8.7.1 Typical engagement with non-governmental organisations

This sub-section discusses the mechanisms and channels of engagement adopted by researchers in their engagements with NGOs. The listed mechanisms, discussed in Chapter 5, are as outlined by authors like Becheikh and Ziam (2010), Cherney et al. (2012) and Hood (2002). Table 8.18 and Figure 8.27 below provide the number of responses, respective percentages and analysis of how often researchers typically engage with NGOs via the stated engagement mechanisms.

Table 8.18 Mechanisms of engagements with NGOs

Mechanisms of engagement	Extent of engagement						
	Every month	3 or 4 times a year	Annually	Rarely	Never	Skipped (did not answer)	Valid total
Developing research proposals with or for NGOs	0.5%	2.5%	3.5%	2.0%	1.5%	90.0%	10.0%
Organising workshops or seminars with or for NGOs	0%	3.0%	4.5%	2.5%	0.5%	89.6%	10.4%
Organising conferences with or for NGOs	0%	1.5%	3.5%	4.5%	1.0%	89.6%	10.4%
Attending conferences organised by NGOs	0%	1.5%	5.9%	2.0%	1.0%	89.6%	10.4%
Serving on advisory boards of NGOs	0.5%	1.0%	2.0%	4.0%	2.5%	90.0%	10.0%
NGO staff serving on advisory boards of university	0.5%	0.5%	0%	5.0%	2.5%	91.5%	8.5%
Conducting commissioned research for NGOs	0.5%	0.5%	4.5%	2.0%	2.5%	90.0%	10.0%
Conducting joint research with NGOs	0%	1.0%	2.5%	3.0%	3.0%	90.6%	9.4%
Providing consultancy services for NGOs	0.5%	1.5%	4.5%	2.0%	1.5%	90.0%	10.0%
Joint journal publications with NGOs	0%	1.0%	1.5%	3.5%	4.0%	90.1%	9.9%
Technical reports and policy briefs jointly written with NGOs	0%	1.0%	3.5%	2.0%	3.5%	90.1%	9.9%
Books and book chapters co-authored with NGOs	0%	0.5%	0.5%	3.0%	5.4%	90.6%	9.4%
Engaging NGOs on social media platforms	0%	0%	1.0%	5.0%	4.0%	90.1%	9.9%

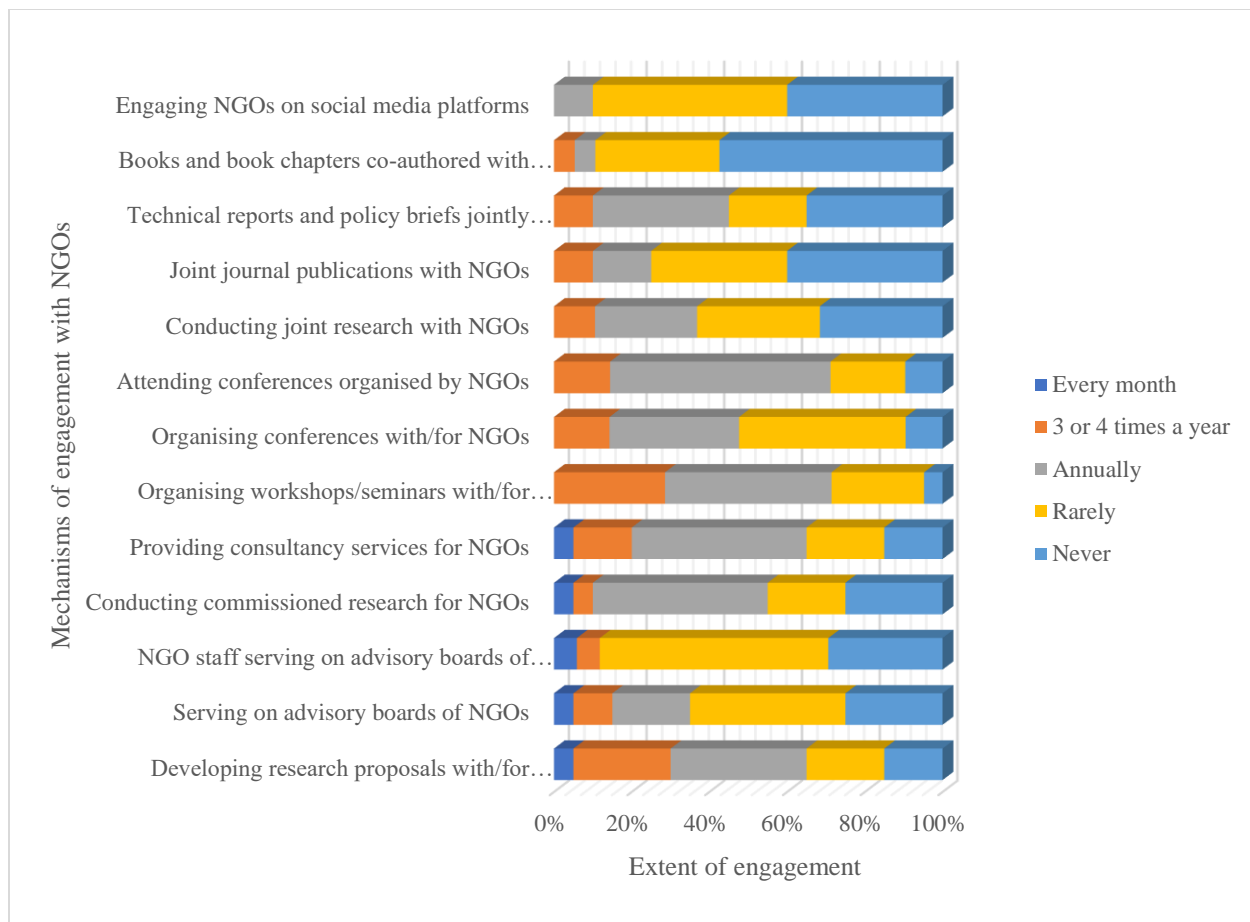


Figure 8.27 Mechanisms of engagement with NGOs

The mechanisms of engagement adopted by those who engage NGOs on a monthly basis are as shown in Figure 8.27 above, from developing research proposals to providing consultancy services for NGOs. The topmost means of engagement is that of NGOs serving on advisory boards of the university. For three or four times a year, the mechanisms of engagement adopted are organising workshops and/or seminars, developing research proposals, providing consultancy services for NGOs, in that order as illustrated above. This author recognises the low levels of responses but that notwithstanding deductions could still be made from these. In reality, this is actually the case with the mechanisms of engaging NGOs as the university has opened up to outside bodies to make input into course development and the running of departments, faculties and colleges.

From Figure.8.27 above, the highest percentage of respondents indicated engaging with NGOs annually by –

- attending conferences organised by NGOs;
- organising workshops and/or seminars with or for NGOs;
- providing consultancy services for NGOs and conducting commissioned research.

All these mechanisms of engagement have the potential of bringing financial gains to the researcher. During the interviews, the issues of funding and funding sources came up repeatedly. It is therefore necessary for researchers to adopt mechanisms of engagements with the potential to bringing in funding for research. The next sub-section provides an analysis of which academic positions engage most with NGOs.

8.7.1.1 Academic position and extent of engagement with NGOs

Figure 8.28 below gives the analysis for the extent to which NGOs are engaged by different academic positions.

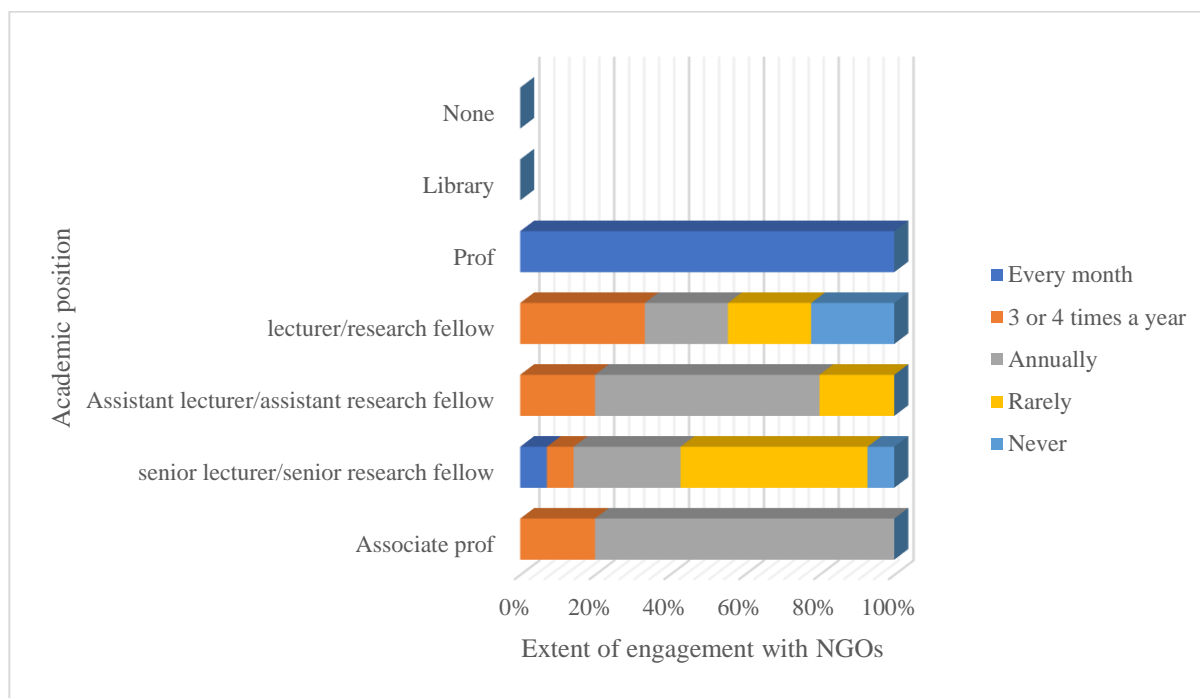


Figure 8.28 Position and engagement with NGOs

As shown in Figure 8.28 above, professors and senior lecturers or senior research fellows engaged most with NGOs on a monthly basis, lecturers engaged most for three or four times a year, while on an annual basis, associate professors, senior lecturers or senior research fellows and assistant lecturers in that order engaged most. It is clear that professors, senior lectures and equivalents

engaged the most with NGOs. The next sub-section examines the extent of engagement of faculties with NGOs.

8.7.1.2 Faculties and extent of engagement with NGOs

Figure 8.29 below provides the analysis for the extent of engagement of individual researchers by faculties with NGOs.

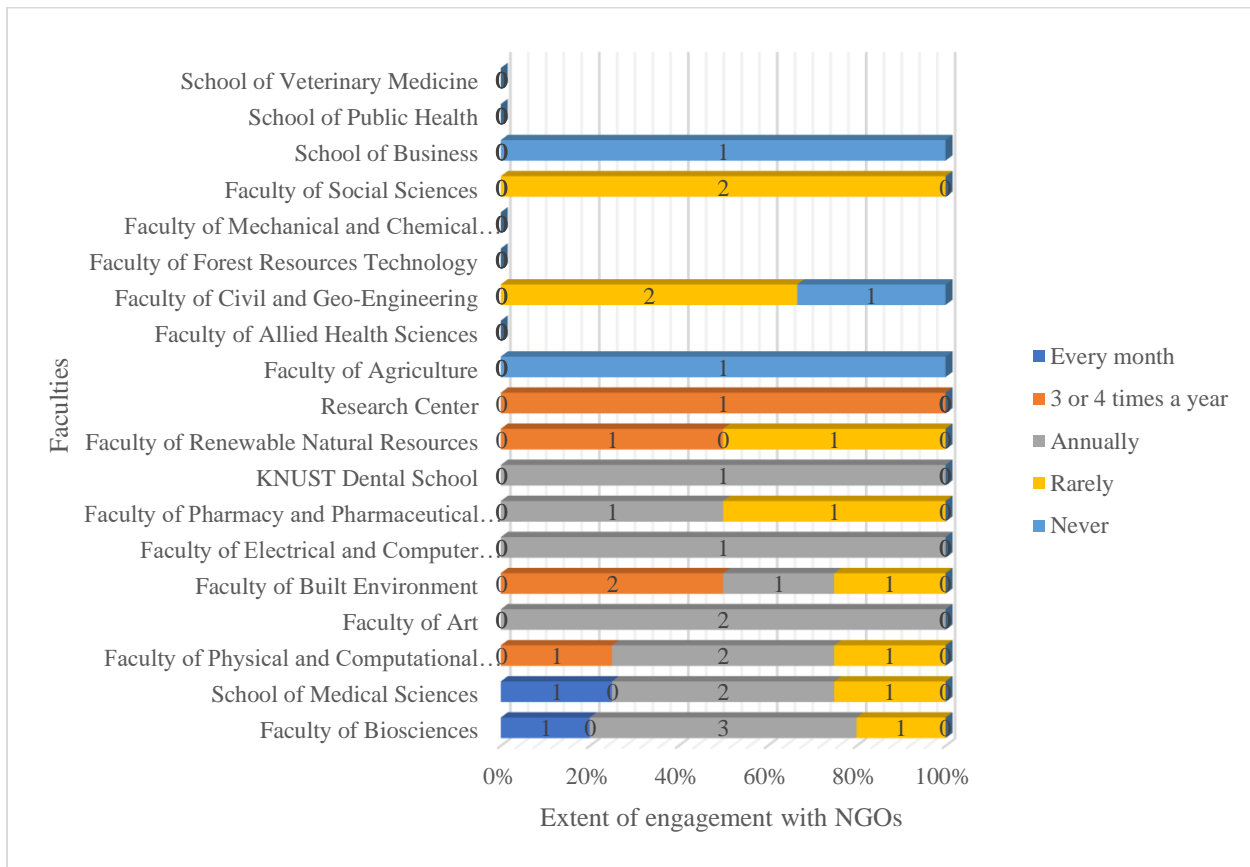


Figure 8.29 Faculties and extent of engagement with NGOs

Despite the low response rates there are still indications of some level of engagement. On a monthly basis, the SMS and the Faculty of Biosciences engaged most with NGOs as shown in Figure 8.29 above. The Faculty of Built Environment, research centres, the Faculty of Renewable Natural Resources, and the Faculty of Physical and Computational Science engaged the most with NGOs, three or four times a year as illustrated above. Once again, the extent of engagement can be attributed to the nature and activities of the faculties.

We can infer that the Faculty of Biosciences (comprising the Departments of Theoretical and Applied Biology Biochemistry, Food Science, Environmental Science, and Optometry and Vision Science), and the School of Medical Sciences engaged the most with NGOs on a monthly basis.. These engagements at the faculty level provide information on the strengths of different faculties or colleges and inform policy as far as outreach is concerned. It also reveals the training needs of each faculty. It is hoped that these faculties will adopt and enhance the above leading mechanisms in their research engagements with NGOs. Other faculties could adopt these mechanisms as well in order to reach out to NGOs with their research.

In concluding this sub-section, it seems that different faculties have different strengths as far engagement with stakeholders is concerned. While excelling in some areas, weaknesses are observed in other areas. Overall, faculties of the Colleges of Health Sciences, Art and Built Environment, Science and Engineering are the ones that engaged the most with NGOs. The above findings can serve as a guide to management of the university in the distribution of resources and in determining the training needs of the faculties. The benefits of the above engagements are discussed in the next sub-section.

8.7.2 Benefits of engagement with NGOs

There are some expected benefits accruing from stakeholder engagement, such as:

- chances that the research will be used;
- research is used to solve problems;
- modification of research;
- opportunities for further research;
- influencing policies and decisions of policymakers;
- opening avenues for collaboration;
- providing opportunities for innovations;
- providing justification for funding as part of fulfilling contract agreement (Bozeman, 2000; Jacobson , 2007; Sudsawad, 2007).

This sub-section presented a discussion on how beneficial researchers perceive the stated potential benefits of engagement with NGOs to be to their own research engagement activities.

Table 8.19 Benefits of engagement with NGOs

Benefits of engagement	Extent of benefits of engagement						
	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	N/A	Skipped (did not answer)	Valid total
Your research is used by NGOs to support programme implementation	57.1%	23.8%	9.5%	0%	9.5%	89.6%	10.4%
Your research opens avenues for further research	52.4%	28.6%	9.5%	0%	9.5%	89.6%	10.4%
Your research influences policies and decisions of NGOs	42.9%	33.3%	14.3%	0%	9.5%	89.6%	10.4%
Opens avenues for collaboration with NGOs	40.0%	35.0%	15.0%	0%	10.0%	90.1%	9.9%
Provides you with opportunities for funding	38.1%	28.6%	19.1%	4.8%	9.5%	89.6%	10.4%
Solving NGO-related problems	50.0%	25.0%	10.0%	5.0%	10.0%	90.1%	9.9%
Opportunities to develop innovations	30.0%	30.0%	25.0%	5.0%	10.0%	90.1%	9.9%
To transfer research to practice	50.0%	25.0%	10.0%	5.0%	10.0%	90.1%	9.9%
To meet formal requirements of a study	20.0%	30.0%	10.0%	10.0%	30.0%	90.1%	9.9%

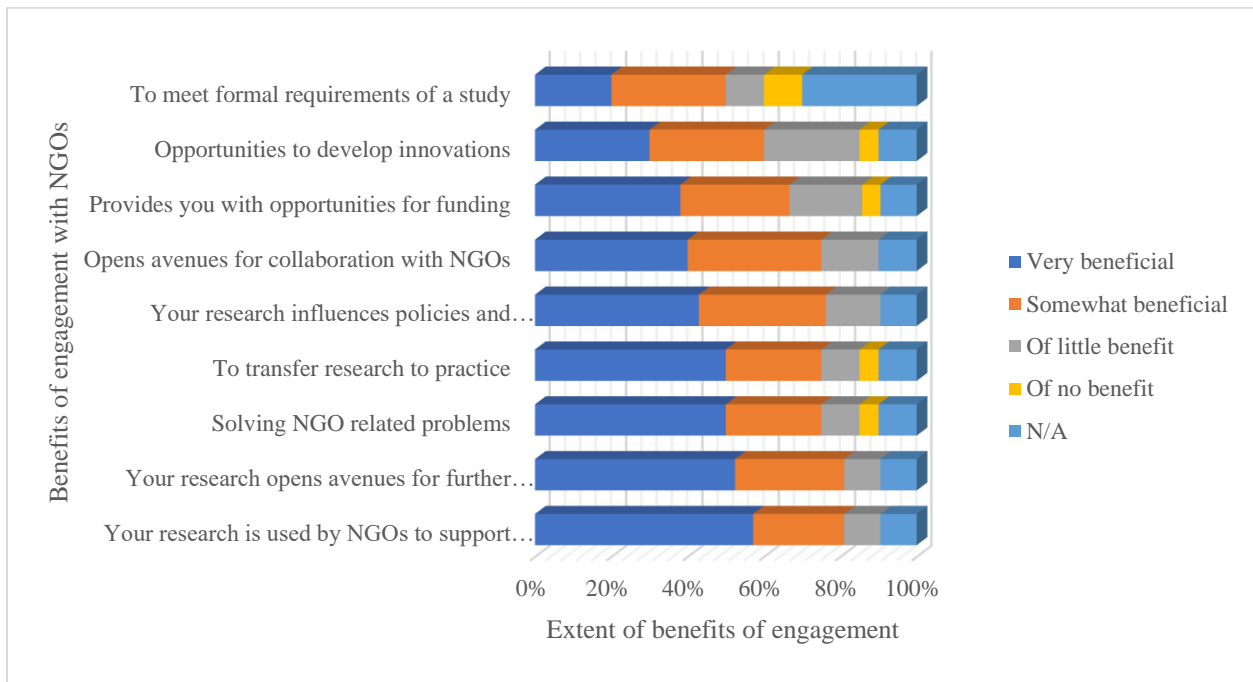


Figure 8.30 Perceived benefits of engagement with NGOs

As shown in Table 8.19 and illustrated in Figure 8.30 above, 57.1% of respondents perceive as very beneficial the fact that their research is used by NGOs to support programme implementation. 52.4% of respondents deem it very beneficial that their research opens avenues for further research, while 50.0% believe that solving NGO-related problems and transferring research to practice are also very beneficial. The figure also provides the analysis for researchers who perceive various engagements with NGOs as being somewhat beneficial. These include avenues for collaboration, influence on policies and decisions and opportunities to develop innovations in that order.

Research use in the above cases is the topmost priority of respondents' engagement with NGOs and this practice needs to be encouraged. Here again, researchers gave indications to the effect that their research opens avenues for further research. Solving NGO-related problems and transferring research into practice with NGOs is a rewarding experience that contributes towards research uptake and utilisation. This practice, confirmed by the interview report, must be encouraged and facilitated among researchers, since it leads to research uptake.

8.7.3 Stages of involvement of NGOs

The involvement of NGOs in the research process has the potential of influencing whether or not research findings will be acceptable to them and subsequently used. As already discussed in the previous sections, the literature spells out key stages of stakeholder involvement in the research process. Table 8.20 and Figure 8.31 below provide the responses and analysis of the extent to which researchers involve NGOs in the research process at the various stages.

Table 8.20 Stages of involving NGOs in research process

Stages of involvement in the research process	Extent of involvement						Valid total
	Always	Usually	Sometimes	Rarely	Never	Skipped (did not answer)	
At the research formulation stage	14.3%	42.9%	19.1%	9.5%	14.3%	89.6%	10.4%
At the research proposal stage	23.8%	38.1%	14.3%	9.5%	14.3%	89.6%	10.4%
During the report writing stage	9.5%	19.1%	23.8%	33.3%	14.3%	89.6%	10.4%
Throughout the entire research process	15.0%	15.0%	25.0%	30.0%	15.0%	90.9%	9.1%

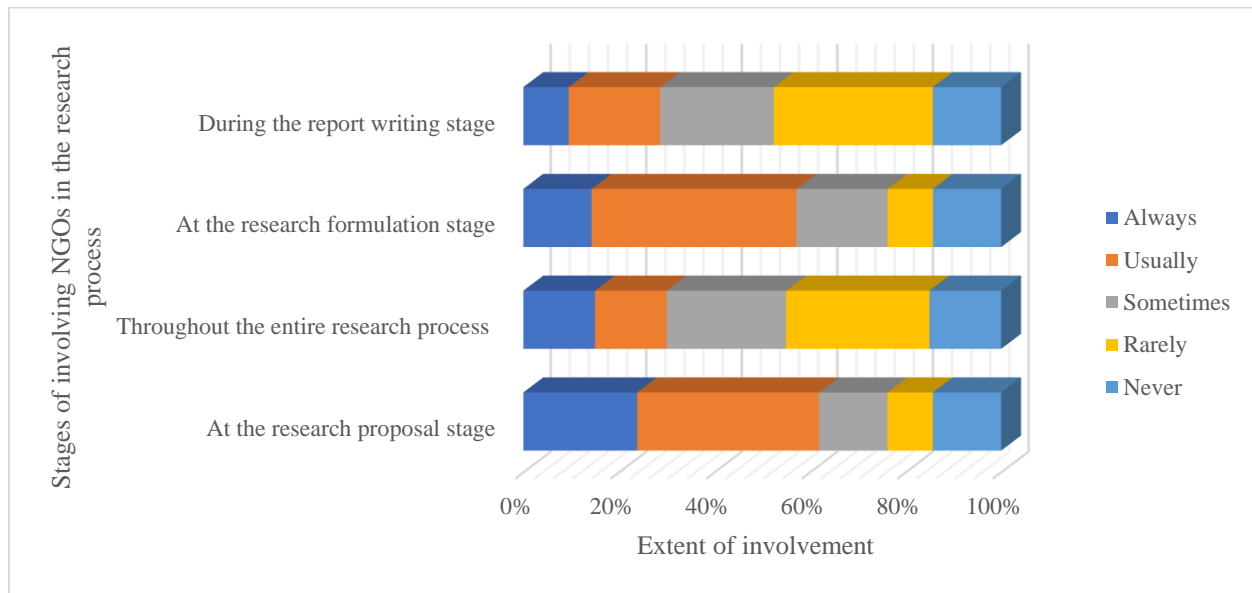


Figure 8.31 Stages of involving NGOs in the research process

As illustrated in Figure 8.31 above, 23.8% of respondents indicated that they always involve NGOs at the research proposal stage of the research process, while 15% always involve NGOs throughout the entire research process, and 14.3% always at the research formulation stage.

The highest score 42.9% of the respondents indicated that they usually engage with NGOs at the research formulation stage, while 38.1% indicated that they usually engage with NGOs at the research proposal stage, and 19.1% at the report writing stage as illustrated above. These are indications of the fact that some researchers are aware of the need for stakeholder involvement in

the research process. As argued by the aforementioned authors stakeholder involvement in the research process plays a very significant part in the adoption and use of the research. The next sub-section discusses the most common reasons why NGOs do not use research findings that could be beneficial to them.

8.7.4 Reasons why NGOs do not use research findings

As discussed earlier on, various reasons have been attributed to the non-use of research findings by stakeholders. This sub-section outlines the most common reasons why NGOs do not use research findings that could be beneficial to them. Table 8.21 and Figure 8.32 below give the ranking (from the highest down) of the responses to the most common reasons why NGOs do not make use of research findings that could be beneficial to them. Once again, Reason 1 represents the first category of most important reasons for which NGOs do not use research findings. Reason 2 is the second category of the most important category of reasons for non-use of research, followed by Reason 3.

Table 8.21 The most common reasons why NGOs do not use research findings

Most common reasons for non-use of research findings	Level of importance or reason for non-use of research findings				
	Reason 1	Reason 2	Reason 3	Skipped (did not answer)	Valid total
Financial constraints on the part of NGOs to implement research findings	81.8%	9.1%	9.1%	94.6%	5.4%
Lack of human resource capacity by NGOs to implement research findings	10.0%	60.0%	30.0%	95.1%	4.9%
Lack of motivation by NGOs to use research	20.0%	60.0%	20.0%	97.5%	2.5%
NGOs resisting change	0%	0%	100%	99.6%	0.4%
Lack of understanding of research benefits	0%	66.7%	33.3%	98.5%	1.5%
Misunderstanding and wrong perceptions of research results by NGOs	40.0%	20.0%	40.0%	97.5%	2.5%
Research not being relevant to NGOs	33.3%	0%	66.7%	98.5%	1.5%
Lack of confidence by NGOs in the research findings	0%	0%	0%	100%	0%
Lack of contact between researcher and users of findings among NGOs	50.0%	20.0%	30.0%	95.1%	4.9%

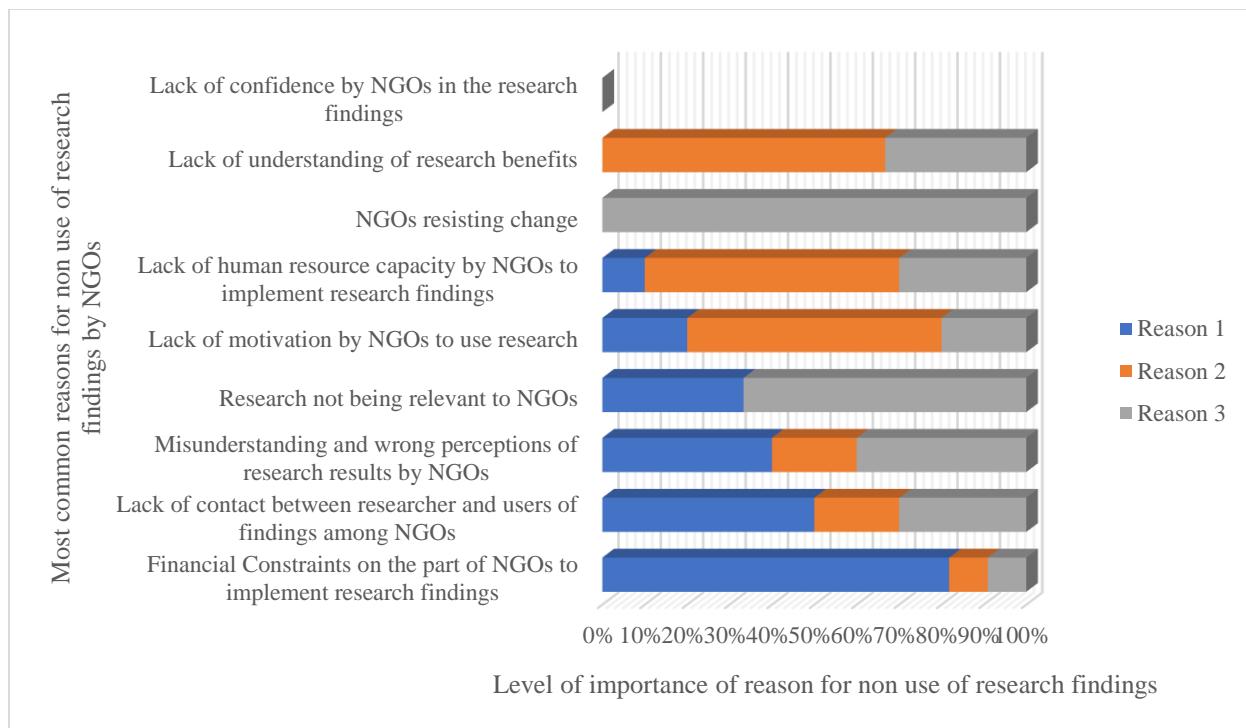


Figure 8.32 Most common reasons why NGOs do not use research findings

As indicated on Table 8.21 above, 81.8% of the respondents indicated that “[f]inancial constraints on the part of NGOs to implement research findings” is the first among the first category of most common reason (Reason 1) why NGOs do not use research findings. Once again, the issue of funding to implement research findings comes up strongly. In the second category of the most common reasons for non-use of research findings (Reason 2), 66.7% were of the opinion that a lack of understanding of research findings contributes to the non-use of research findings by NGOs. In the third category of the most common reasons (Reason 3) is resistance to change by NGOs.

Figure 8.32 above shows that for the first level (Reason 1), financial constraints on the part of NGOs to implement research, a lack of contact between researcher and users of findings among NGOs and misunderstanding and wrong perceptions of research results by NGOs are the three most common reasons why NGOs do not use research findings which could be beneficial to them. These are essential considerations, outlined in the literature (see Humphries, 2014; Oliver et al., 2014; Sedlacko et al., 2013), that hinder the use of research findings.

For the third level, that is Reason 3, all respondents indicated “NGOs resisting change” as their most common reason for non-use of research. This issue was corroborated during the interviews when an interviewee indicated that NGOs are set in their own ways of doing things and –

[T]hey are driven by their own agenda (Respondent R8)

Another interesting reason for non-use of research by NGOs as stated by Respondent R8 was:

NGOs too, one thing we've noticed is that they are NGOs though, but sometimes they have a hidden agenda of making profit than the non-profit organisation that they are supposed to be and so working through them too, there are some kind of double standards that you have to reckon with.

There are corresponding facilitators to research use, as discussed in Chapter 3, that could help to overcome some of the above-mentioned barriers. Building a strong relationship between researchers and policymakers, in this case NGOs, has been suggested as a strong facilitator to research use (Humphries, 2014; Oliver et al., 2014; Sedlacko et al., 2013). In defining our mechanisms and pathways to research uptake these facilitators are taken into consideration.

8.8 Conclusion

The foregoing discussions have centred mainly on the extent of engagement of researchers by position and faculties with various stakeholders, the benefits of engagement, the stages at which researchers involve their stakeholders in the research process and finally the reasons why stakeholders do not use research findings that could be beneficial to them. The focus of the above discussions has been aimed at finding answers to the research questions relating to knowledge production and dissemination activities and their implications for research utilisation, the extent and levels of engagement with the external environment, and, the individual and institutional barriers to research uptake.

It has been observed that as far as engagement with stakeholders is concerned, respondents engaged mostly with scientists and researchers from other universities and institutes. In their research activities there were interactions, collaboration and partnerships with peers and colleagues within and outside the university. Researchers at KNUST also engaged with communities outside the university, government (MDAs) and parastatals, the private sector (including industry) and NGOs on a lesser scale. During the interviews, interviewees mentioned

other stakeholders such as ornamental plant dealers, students, health professionals, individuals and local people.

As far as engagement by academic position is concerned researchers of senior ranks engaged at high levels the most with different stakeholders. Faculties engaged different stakeholders at different levels depending on the activities involved. Appendices 7 and 8 provide a summary of the extent to which different faculties and academic positions engaged with different stakeholders.

The mechanisms and channels of engagement vary from stakeholder to stakeholder, but it was generally observed that respondents mostly engaged through conferences, workshops and seminars, confirming thoughts expressed by Larsen (1980), the NCDDR (1995), Bozeman (2000), Innvaer and Vist (2002), Becheikh and Ziam (2010) and Cherney et al. (2012). Other mechanisms of engagement mentioned during the interviews were writing proposals, organising short courses, networking, industrial internships, journal club presentations, radio programs, intervention research, knowledge sharing, and focus group discussions.

Researchers generally consider it very beneficial if their research provides opportunities for further research, opens avenues for collaboration and funding, their research is used and influences practice. As stated by one interviewee “[y]ou become known to your colleagues, grant bodies as productive and an authority in the subject area. Ultimately, you get more grants.” (Respondent R2) For others the satisfaction that comes with meeting the needs of others are very rewarding as stated by two interviewees.

[F]or me, when the people are using what you have come out with, then that is the biggest success that one would be looking at (Respondent R1).

In addition to the research output we gained as researchers, it was absolutely refreshing to see these women find jobs to be able to support their families as well as improve on their own living conditions (Respondent R10)

Other benefits of doing research given by respondents are gaining credibility and an improvement in their track records.

In order for acceptance, adoption and possible use of research findings respondents largely agreed that stakeholders should be involved in the research process at the research formulation and proposal stages. These are further confirmed from the interviews where there were indications of

research impact due to the extent of involvement of stakeholders in the research process. One interviewee stated:

I think one of the fundamental things that I do in terms of research is to involve my stakeholders from the very beginning (Respondent R6).

According to another interviewee, direct contact with farmers, collaboration with other scientists at all stages and availability of funding proved very useful, confirming propositions from Hood (2002), Becheikh and Ziam (2010).

The most common reason, given by respondents, why stakeholders do not use research findings that could be beneficial to them was attributed to financial constraints both on the part of researchers and stakeholders for dissemination and implementation of research findings. Some other stated reasons for non-use of research, as far as government and policy issues are concerned were:

Government, before, they come into power, have what we call the manifesto, right? They develop a manifesto. I am sure they get people to help them to develop the manifesto but that is a political thing and it is a four-year manifesto. Science and technology goes beyond four years. So they would want to do things within the four years and these are the guys who are not very much science and technology minded. I don't like the issue of party manifestos because they are for four years and there is no continuation with the work. Another government comes and disregards what another government has done, then it does not help the country. (Respondent R16)

[S]ometimes we have not engaged the policymakers as much as we should in order for them to also know the research that has been done, the findings and the need to change policy (Respondent R16).

Table 8.22 below provides a summary of the mechanisms of engagements with different stakeholders, most perceived benefit of engagement, most common stage of involving stakeholders in the research process and the most common reason for non-use of research findings by different stakeholders. These findings as discussed in the previous sections, are directly in agreement with the literature (see Humphries, 2014; Oliver et al., 2014; Sedlacko et al., 2013) and therefore are adopted in the framework for institutionalisation of research uptake and utilisation. The framework which proposes pathways, mechanisms and channels of engagement with stakeholders is ultimately geared towards optimum research uptake.

Table 8.22 Summary of activities with different stakeholders

Stakeholders	Mechanism of engagement	Most common perceived benefit of engagement	Most common stage of involving stakeholders in the research process	Most common reason for non-use of research findings
Communities outside the university	Social media discussions/fora	Research opens opportunities for more research	Research formulation stage	Financial constraints to disseminate research findings
Private sector	Social media discussions/fora	Research opens opportunities for more research	Research proposal stage	Financial constraints to implement research findings
Governments and parastatals	Serving on advisory boards of governments and parastatals	Research opens opportunities for further research	Research formulation stage	Decision making culture of government not conducive to make use of research findings
Scientists and researchers from other universities and institutes	Social media interactions	Research is used by other scientists and researchers	Research proposal stage	Timely delivery of research results
NGOs	NGOs serving on advisory boards of the university	Research is used by NGOs	Research proposal stage	Financial constraints on the part of NGOs to implement research findings

CHAPTER 9 – CONCLUSIONS AND RECOMMENDATIONS

9.1 Introduction

This chapter presents the contribution this study makes to the body of knowledge regarding research uptake and utilisation, and proposes a framework for institutionalising research uptake, in particular, at KNUST. The framework is intended to provide policy direction for KNUST and HE management in general on how research uptake can be integrated into the institutional research cycle and thus institutionalised. It suggests various pathways by which research uptake management can be improved. Additionally, the chapter concludes with some challenges to the study and suggests areas for further studies in the area of research uptake and utilisation in Ghana.

9.2 Proposed framework for research uptake

As discussed in Chapter 2 of the current study, different authors have outlined different frameworks and strategies with implication for research uptake. The current findings, outlined in details below, fall in line with discussions from the literature and covers the university's mission and vision (Lavis & Robertson, 2003); research policy (Lavis & Robertson, 2003); research stakeholders or users (Jacobson et al., 2007; Mitton et al., 2007); capacity building (Andrews, 2012); communicating research or accessibility of research (Andrews, 2012); budgeting for research (Andrews, 2012); and M&E of uptake (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007). More recent works by Ellen et al. (2011) and Grobbelaar & Haber (2014) gave further impetus to earlier research in the field of knowledge utilisation. It is from these elements of the knowledge utilisation literature and the findings from the survey that the current study proposes a model framework for RU.

At the initial stages of the DRUSSA programme KNUST only had a draft research policy to govern its research agenda. Many researchers in the university were not privy to the content of the draft policy. It was then the case that research was conducted for its own sake and purposely for publication in refereed journals with the ultimate aim of career progression or promotion. With time the term research uptake has taken root and the consciousness that research must be sent out to end users has caught on with many researchers. With a strong advocacy for a policy regime as far as research is concerned the KNUST had to come onboard. The university now has an approved research policy which has aspects of RU/RUM incorporated in it. As discussed in Chapter 4 there

has been improvement in the research efforts of the university with the establishment of an office for grants and research which ensures compliance to the prescriptions of the research policy. From the survey and subsequent interviews this author affirms the importance of policy in the RU/RUM process (Lavis & Robertson, 2003). It is with this view that an institutional policy is a key component of the proposed RU framework.

The overarching aim of this study was to propose a research uptake framework to provide the guiding principles to RU for the operations of the university, in particular, the KNUST. The key issue that this author sought to address is how research can be utilised. Various factors have been outlined which have the likelihood to determine the extent to which any research finding can be used. Quite apart from the stated barriers during the survey and subsequent interviews (see sub-section 9.4.2) there are other factors relating to the patterns underlying the research, the nature of the research and the target audience (Ashley, 2009). These other determinants of research success which have the potential of influencing the adoption of research findings have to be taken into consideration. Mitigating actions are therefore necessary to ensure that the barriers to RU are reduced to the barest minimum (Humphries, 2014; Oliver et al., 2014). The proposed research uptake framework therefore gave due recognition to the issue about barriers outlined in sub-section 9.4.2.

The need for monitoring and evaluation of the entire research cycle has been emphasised every now and then by various authors (Eagar et al., 2003; Lavis & Robertson, 2003; Mitton et al., 2007). The current study confirms and reaffirms the need for monitoring and evaluation due to uncertainties that are likely to crop up during the research process. As and when these issues crop up during the research process the necessary adjustments could be made in the form of researcher's or university actions to limit or mitigate the effects of these opposing factors. Sub-section 9.4.3 outlines some university actions necessary to facilitate the RU/RUM process. It is with this view that the proposed framework incorporates monitoring and evaluation as a searchlight for the entire framework.

The RU process and the efforts to transmit research findings to possible users may be compared to components of the diffusion process, namely, "the innovation, the social system through which

the innovation moves, the communication channels of that system, the time it takes for an innovation to spread through the social system, and the adoption of the innovation by the intended recipients” (Ashley, 2009:37). Similarly, for research findings to be used it must go through certain communication channels within and outside of the university. This include stakeholder engagement through dialoguing with the eventual users of the research findings. Also, due cognisance must be given to the social system within which the implementation is expected to take place. The social system may determine the language and the style of communicating the research findings (Andrews, 2012). The language in which the research findings is communicated is very necessary for understanding, appreciation and acceptance of research findings. This brings to the fore the need for capacity building in areas such as science communication, dissemination and negotiation skills.

According to Ashley (2009), the time it takes for an innovation to spread through a social system is another component of the diffusion process. Some research findings will take a longer period for its adoption and implementation while others take shorter periods. The timing and usage depend on several factors such as the nature of the research findings and the context of its application. These factors have the potential to slow down the research and uptake process and therefore must be attended to as part of the university actions to mitigate the barriers and facilitate the research process.

It must be acknowledged that not all research findings will be fully adopted in their entirety. There is the possibility that parts of the research findings could be applicable in different contexts. In some cases, research findings could be used only after some modification has taken place in order to make them suitable for a particular system. This reinforces the need for constant engagement with stakeholders by involving them throughout the research process as determined during the survey. The need for modification of research findings before usage is comparable to the process of adaptation in the diffusion process proposed by Rogers (2003).

The perceived characteristics of the research findings also has an influence on the extent of its adoption or adaption by the eventual users. These characteristics must be such that it offers better alternatives and must be culturally relevant to the users. The research findings must also be compactible to the practices within the context of its application, that is, the social system within

which the research is applied. It is therefore necessary ensure that any research finding intended for a particular audience have a relative advantage over what is already in practice (Ashley, 2009). Once again, with a good monitoring and evaluation system these issues can be detected and addressed. Per the proposed RU framework emphasis is placed on the issue of monitoring and evaluation.

There is the need to emphasise the need for stakeholder involvement as an important factor in the research uptake process. As already argued, the eventual users of research findings cannot be left out of the research process. This was confirmed during the survey and interviews and falls directly in line with the literature (Jacobson et al., 2007; Mitton et al., 2007). As argued by Gabbey and Le May (2004), “successful implementation of research evidence will require a deeper understanding of the processes of collective “sense making” by which knowledge, both explicit and tacit and from whatever source, is negotiated, constructed, and internalised in routine practice” (Gabby & Le May, 2004:1013). Collective sense making calls for active interactive and continuous engagement with stakeholders so as to bring about the adoption or adaption of research findings for application within systems which may already have existing practices. Some stakeholders may be holding on to their own conceptions or misconceptions and practices. Some of these previous knowledges may be in conflict with scientific knowledge arising out of research and thus could be a barrier to receiving new ideas. It is with this view that this author supports the idea of active stakeholder engagement. One other reason for the need for effective stakeholder engagement is about ownership of research findings. Involving stakeholders in the research process at appropriate points makes them feel part of the process and ownership of the findings (Jacobson et al., 2007; Mitton et al., 2007). The mechanisms of engagement observed during the survey and interviews are outlined in sub-section 9.4.1 above. In proposing the RU framework all the above factors were taken into consideration so as to ensure that research is used by communities of need.

From the foregoing discussion this author proposes the framework below. The proposed framework covers the essential focal areas needed for a policy framework for the university, the key features being the following:

- a need for an institutional research policy that fully enforces RU and RUM;
- making research accessible to stakeholders;

- making funding or budget available to support dissemination and uptake;
- ensuring stakeholder engagement and involvement in the research process;
- building capacity and support for faculties; and
- ensuring monitoring and evaluation for feedback and improvement.

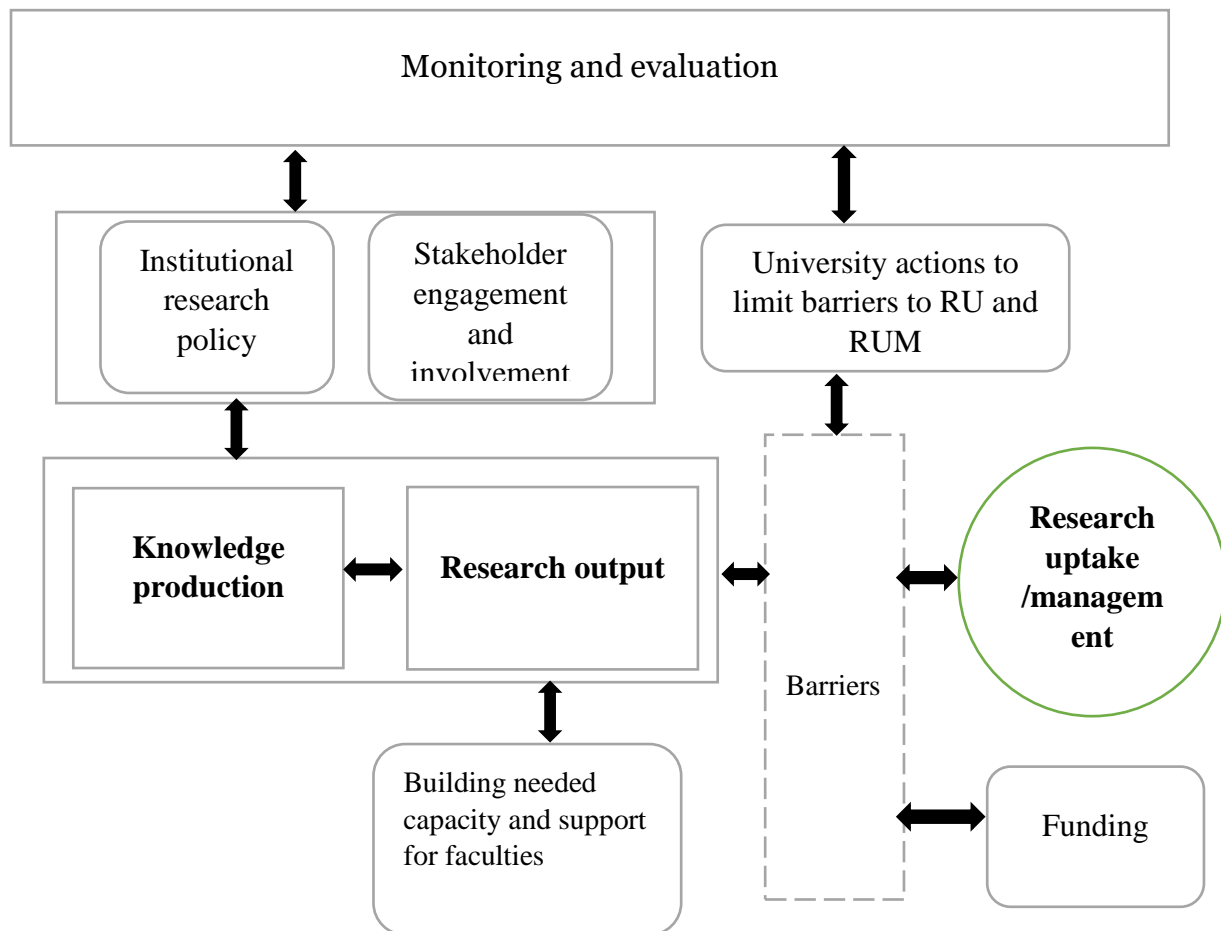


Figure 9.1 Model framework for research uptake

As proposed in the above framework, RU/RUM revolves around institutional policy, stakeholder engagement and specific actions that needed to be taken by the university, as far as KNUST is concerned. As is the case with many initiatives it is expected that there will be barriers to the entire process but there are mitigating factors from the end of the university to ensure availability of funds and other proactive measures as outlined in sub-section 9.3.3 below. These actions, in addition to building the needed capacity and support will facilitate knowledge production and research output which should eventually lead to uptake and utilisation of findings.

9.3 Demographic deductions

This sub-section outlines the various findings and deductions from the responses regarding demographics.

9.3.1 Research outputs

Research outputs over the last three years have been mainly from articles published and presentations at conferences, predominantly to academic audiences.

9.3.2 Gender and research output (articles published)

According to the ratios there is a balance of production levels between male and female researchers. Female academic staff members are as productive or research active as their male counterparts. However, generally speaking, male researchers seem to be slightly more productive than female researchers.

9.3.3 Age and research output

The average age of respondents is 48, which falls within the most productive age group. The age bracket of 46-50 is the most productive in terms of research output.

9.3.4 Age and academic qualification

Most professors and senior lecturers or senior research fellows are in the age bracket of 56–60.

9.4 Towards a framework for research uptake

This section presents findings for the four main thematic areas that contributed to the proposed framework for research uptake, illustrated in Figure 9.1 above. The thematic areas are: stakeholder engagement, mechanisms and channels of engagement, facilitators and barriers to research uptake, and university actions to facilitate research uptake. These thematic areas cover aspects of the capacity areas for policy as outlined in the framework component, which deals with the question of how an organisation can transfer its knowledge to user stakeholders effectively.

9.4.1 Mechanisms and channels of engagement

This sub-section outlines the findings that are related to the forms and focus of interaction and engagement, specifically the channels and mechanisms of stakeholder engagement in line with

stakeholder engagement and involvement suggested in the framework. The findings were as follows:

1. The extent and usage of research findings is dependent on the extent to which stakeholders are engaged. If stakeholders are not involved at some point in the research process, their interest in the research finding is low. Engaging stakeholders from the initiation of the research process therefore makes them part of the process and their input (if valued) leads to acceptance and use of the research findings.
2. In order to engage with various stakeholders there are a number of channels through which this can be done. Researchers adopt the most convenient means to reach out to their stakeholders and the mode of engagement would under normal circumstances depend on the kind of stakeholders involved. Researchers at KNUST mainly engage through presentations at conferences and workshops, predominantly to academic audiences.
3. Researchers of professorial level engage more with stakeholders at policy level and through collaborations, more than senior lecturers or senior research fellows and the junior academics.
4. Researchers have their personal goals for researching issues in their fields of endeavour. The primary goal of researchers at KNUST is not purposely for solving local and national problems, but for personal career enhancement. Most researchers in the university aspire to advance in their careers and since one key criterion for promotion is publication in journals, many aim for that without necessarily considering local and national needs.
5. Researchers at KNUST generally do not prioritise solving environmental and social problems, influencing policy, influencing practice and solving immediate and/or technical problems. Although research is intended to solve problems, including environmental and social problems, researchers at KNUST rarely consider the dissemination and subsequent use of their research in these priority areas. What matters to the researchers is the publication of their findings.

Engagements with other scientists and researchers

6. Researchers mostly engage with scientists and researchers from other universities and institutes by attending conferences and organising workshops with or for other scientists

and researchers. They engage with other stakeholders, but not on the same scale as with other scientists and researchers from other universities and institutes.

7. Researchers consider engagement with other scientists and researchers as very beneficial, because their research is used by the other researchers. This opens opportunities for further research, as well as opening avenues for collaboration which leads to funding opportunities.
8. With regard to the stages at which researchers involve their stakeholders in the research process, researchers usually involve other scientists and researchers in their research process during the research formulation stage. During the design of the research project the researcher and the stakeholder both have a stake in the findings and therefore their level of involvement in the research process is high, beginning mostly from the research formulation stage to the report writing stage.
9. The most common reasons why other scientists and researchers do not use research results are: timely delivery of research results, research findings are not disseminated and resistance to change. A lack of contact between researchers and the users of findings among other scientists and researchers featured as one of the common barriers. A lack of funding or insufficient funds is also a problem.

Engagements with communities outside the university

10. The three most common mechanisms of engagement with communities adopted by researchers at KNUST are: conducting research in communities, drawing on community advisors for support, strategy and advice, and using community sites for teaching and learning.
11. Researchers have the perception that it is very beneficial to engage with communities, because it opens opportunities for more research, transfers research to practice and solves community-based problems. In reality, however, the level of engagement by researchers with communities outside the university is very low.
12. Researchers always involve communities in their research at the research formulation and proposal stages.

13. The most common reasons why communities do not use research findings that could be beneficial to them are financial constraints on the part of researchers to disseminate research findings to communities, financial constraints on the part of communities to implement research findings and a lack of human resource capacity among researchers to support and disseminate research.

Engagements with government and parastatals

14. Researchers hardly engage directly with government and parastatals on a regular basis, though researchers believe that it is very beneficial to engage with these groups for the following reasons: the engagement opens opportunities for further research, their research is used by government and parastatals, their research influences policies and decisions by government and parastatals, and provides opportunities for funding.
15. The few researchers who engage with governments and parastatals do so by serving on advisory boards, organising workshops or conferences with or for these bodies and by providing consultancy services.
16. The three most common reasons why governments and parastatals do not use research findings that could be beneficial to them are that the decision-making culture of government is not conducive to make use of research findings, political influence plays a far greater role than evidence to make decisions, and government and parastatals resisting change.

Engagements with the private sector

17. Researchers engage the private sector, including industry, mainly through the development of proposals with or for the private sector, providing consultancy services and by attending conferences with the private sector.
18. The most often-cited reasons for engagement with the private sector are that it opens up opportunities for more research and thus opportunities for funding, to transfer research into practice and opens avenues for collaboration.
19. Researchers always involve the private sector at the research proposal stage, and to a lesser extent the research formulation stage, or throughout the entire research process. Involving

the private sector throughout the research process makes adoption of findings easier and builds confidence in the research findings.

20. The most common reasons why the private sector does not use research findings have been attributed to financial constraints to implement research findings, a lack of personal motivation by researchers to disseminate research findings and a lack of contact between researchers and users of research findings within the private sector.

Engagements with NGOs

21. NGOs are the group of stakeholders which is the least engaged with by researchers. Researchers engage NGOs annually through conferences organised by the NGOs, conducting commissioned research and providing consultancy services for the NGOs.
22. Researchers perceive as very beneficial their research being used by NGOs to support programme implementation. In addition, their research opens avenues for further research, as well as transferring research to practice.
23. Researchers at KNUST who engage with NGOs usually involve them at the research formulation stage. Stakeholder involvement in the research process is key to research use, because it brings about acceptance and the necessary buy-in.
24. The reasons why NGOs do not use research results that could be beneficial to them are: financial constraints on the part of NGOs to implement research, a lack of contact between researchers and users of findings among NGOs, and misunderstanding and wrong perceptions regarding research results by NGOs.

9.4.2 Facilitators and barriers to research uptake

Listed below are the findings related to barriers and facilitators to research production, dissemination, uptake and utilisation. As illustrated in Figure 9.1 above, the barriers oppose the entire research uptake process. These include institutional and systemic barriers that inhibit the developmental activities of the university. For optimum research uptake the facilitators ought to be enhanced while efforts are made to limit the barriers. The findings so far are as follows;

1. Research findings, when available, must necessarily be supplied to the end users. It was observed that there are research findings available which could be useful to stakeholders,

but these findings are not disseminated to them. The institution and researchers do not have adequate avenues for dissemination.

2. End users of research must understand what the research is about and it must be communicated to them in a language with which they are familiar.
3. Existing links between researchers and the users of research, including policy-makers, are weak. This reinforces the need for stakeholder engagement.
4. The main motivation of researchers at KNUST to do research is career progression or for promotion. Other factors and mechanisms that lead to research uptake can also be linked to the promotion criteria or rewarded in other ways.
5. Researchers hardly consider the uptake of their research as a priority. This calls for the setting of priorities and institutional policies to promote and push for research uptake.
6. Until recently there has been no policy regime in the university that seeks to promote research uptake. A recently promulgated research policy provides that research uptake be given the needed recognition.
7. Academic qualification has a direct bearing on research output. Researchers with terminal degrees, i.e. doctorate degrees, are more research active than those with master's degrees.
8. Female academic staff members are almost equally research active and productive compared to their male counterparts, though the male counterparts seem to be slightly ahead. With equal incentives and resources female academic staff will do equally well.
9. Age and experience of researchers have a direct bearing on research output. This explains why professors, senior lecturers and equivalents are producing more research outputs than the junior ranks. These professors and experienced researchers should be encouraged to team up with the less experienced staff members in research activities.
10. Professors shift their focus from publication in journals to high level engagements with stakeholders, such as consultancies and conference presentations. Qualification and experience lead to better engagement and also have implications for mentoring and training.

11. There are mechanisms and channels of engagement with stakeholders that facilitate research success and impact as discussed in 9.3.1 above.
12. The most common reasons why stakeholders do not use research findings that could be beneficial to them were discussed in 9.3.1 above. Corresponding facilitators, as suggested, are needed to overcome these barriers.
13. For research to be accepted and used by stakeholders they must be involved throughout the research process.

9.4.3 University actions to facilitate research uptake

This sub-section outlines the findings related to internal and external drivers of focus, the nature and level of knowledge production and how the university can relate with stakeholders. These university actions are key to the research uptake and management process as illustrated in the proposed framework in Figure 9.1 above. The possible actions include the following.

1. The university (KNUST) has the potential and can play a key role in local and national development, therefore the university must identify national and local needs for possible attention.
2. The research policy of the university must spell out modalities to link research to the developmental goals of the nation and this must be incentivised.
3. There is adequate research already completed, as well as ongoing, available in the university with the potential to resolve local and national problems. The university must ensure that these research products are publicised in newspapers, through radio programmes, during open days, fairs, symposia, exhibitions, dissemination workshops and conferences, all in a bid to showcase university research to stakeholders.
4. The criterion that requires publication for promotion motivates researchers to focus on advancement of knowledge for career progression, but the university should also recognise the need for dissemination and actions that ensure that research reaches the end user.
5. The university, as a research but teaching institution, should emphasis teaching through research. This can be done by ensuring that lecturers, or researchers especially, conduct research in their areas of specialisation. Research must be in line with the teaching

curriculum, so that in the long run the findings and procedures will benefit the students who are also stakeholders in the knowledge production and utilisation chain.

6. All research conducted in the university must be documented and kept in online repositories and open access journals. For the sake of public consumption research must be documented in a language that can be understood by key stakeholders. The university must consider translating publications, especially of research findings meant for indigenous people, into local languages and with graphics that the local people can read and understand. Communicating scientific research is important and must be done in such a manner that people who are not scientists can understand the key concepts.
7. The university should make funds available for sponsorship to attend conferences, disseminate research and for the procurement of essential laboratory equipment and consumables to facilitate research.
8. KNUST has research centres attached to each of the colleges responsible for research and innovations for the public good. To be able to carry out their mandate, these centres should be well resourced and tasked to link up with industry, government and other stakeholders to address societal challenges in a practical way.
9. The university should set targets for research that addresses local and national problems, with sources for funding and purposefully assign these to specific departments. Government and other beneficiaries should be made aware of this and must get involved in the process in order for them to be aware of the existence of that knowledge and the suitability of that knowledge to address societal challenges.
10. In view of 9 above the university must encourage and reward developmental and applied research which have the potential of influencing practice and solving environmental and social problems.
11. The identified strengths, focus and engagement practices of the different faculties must be strengthened and channelled. The university must put in place measures to build the capacities of faculties that are weak in their delivery of teaching, research and extension of research to communities of need. Continuous professional development must be an issue of policy.

9.4.4 Pathways to research uptake

This sub-section provides pathways for research uptake with an illustration derived from a network of ATLAS.ti. In order for research to be utilised there are various pathways to follow. Many drivers necessary for research uptake and utilisation were identified in the literature and the survey. These drivers facilitate and serve as links for ‘sustained interactivity’ between the producers and users of knowledge (Andrews, 2012; Lavis et al. 2003; Mitton et al. 2007). Along these same lines Jacobson et al., (2003) proposed that, key to the research uptake process is the need for interpersonal links. These links provide for an effective interaction between all the actors in the research production and utilisation process. Figure 9.2 below gives an illustration that identifies some interconnections between the essential pathways and drivers necessary for research uptake and utilisation. The illustration below also covers the essential processes that one needs to go through from knowledge production to knowledge utilisation (Becheikh et al., 2010) including the exchanges between researchers and those who apply research. As far as this current study is concerned, within the research cycle, attention needs to be given to the following drivers of research uptake; research output, stakeholders engaged with, mechanisms of engagement; importance of engagement, beneficiaries of research, research use and impact, channels of dissemination, challenges to RU and university actions to facilitate RU. Figure 9.2 below provides an illustration that establishes the linkages between these actors of the research production and dissemination process.

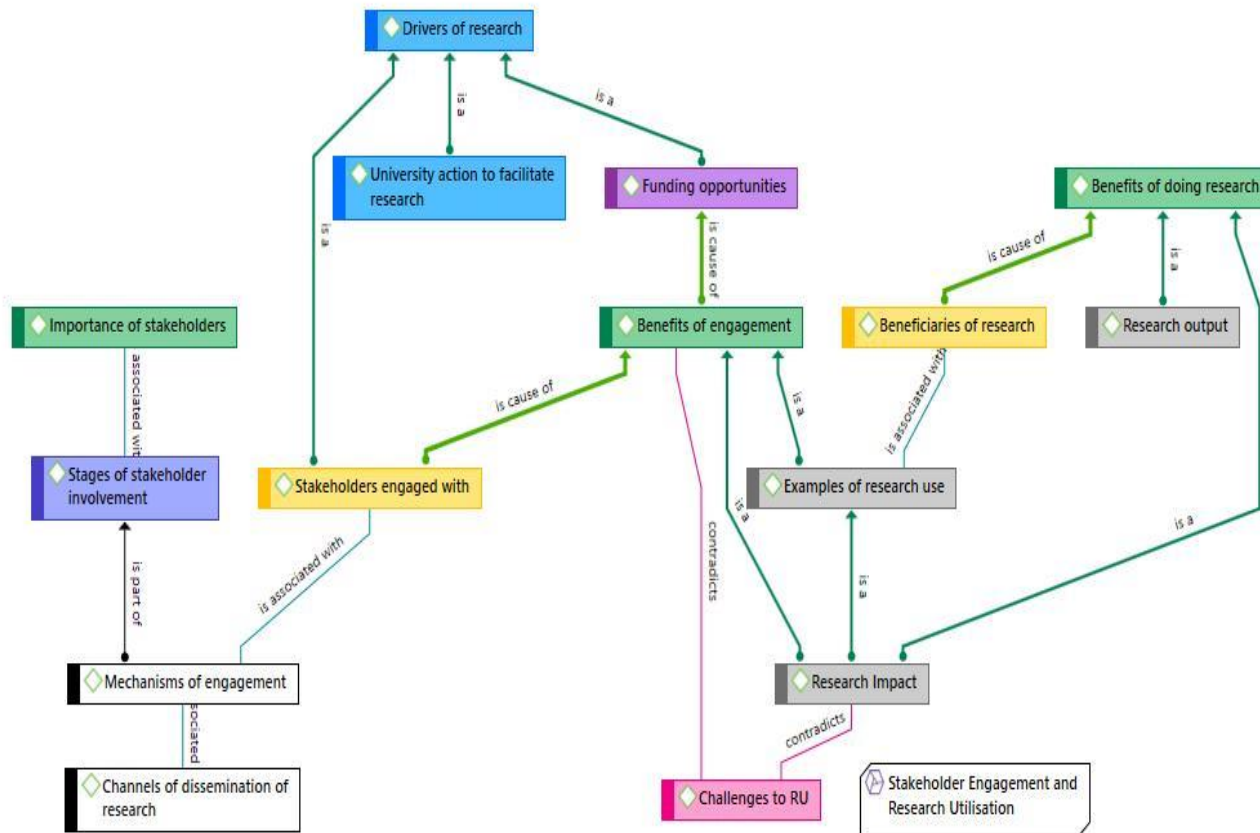


Figure 9.2 Drivers of research uptake

As illustrated in Figure 9.2 above there are facilitators, mechanisms and channels as well as barriers to research uptake. These are interconnected and influence each other as discussed in Chapters 7 and 8 of this study. For example, the various university actions are intended to facilitate research uptake. Also, the importance of stakeholders in the research process has been emphasised. The linkages and their effects on each other were taken into consideration in the proposed framework for research uptake.

9.5 Conclusions of the study

Based on the findings from the study the following conclusions were drawn.

1. Female academic staff members are as productive or research active as their male counterparts, although generally speaking male researchers seem to be slightly ahead.
2. There is an indication of an aging staff complement, and therefore there is the need to put into place measures to attract young staff members. This is an issue that ought to be addressed by management, because of its negative impact on training, promotion of knowledge and service to the community.
3. The performance in terms of research output differs for different fields, reiterating the need to have tailor-made strategies and incentives for research uptake for the different areas of study.
4. Professors or senior lecturers and equivalents are more productive in research output than lecturers, assistant lecturers and equivalents. This has implications for development initiatives and continuous professional development of researchers.
5. Professors turn their attention towards other productive areas such as stakeholder engagement for consultancies, mentoring and supervision of postgraduate students.
6. It can also be deduced that whereas professors engage mainly with government and MDAs, followed by the private sector, associate professors engage almost equally with all stakeholders. Senior lecturers and equivalents focus on engagement with the private sector while lecturers and equivalents engage more with NGOs. Assistant lecturers and equivalents engage mainly with NGOs.
7. There is every indication that researchers at KNUST engage mostly with scientists and researchers from other universities and institutes, followed by communities outside the university, the private sector (industry, large firms, SMMEs), government (MDAs) and parastatals, with the group least engaged being NGOs.

8. The extent and usage of research findings is dependent on the extent to which stakeholders are engaged. Stakeholders' input into the research process is key to the acceptance and adoption of research findings.
9. The most common channel of engagement by researchers at KNUST with stakeholders is through presentations at conferences and the organisation of workshops to predominantly academic audiences.
10. The main barriers to research uptake are financial and capacity constraints to disseminate research, inadequate engagement with stakeholders, and the initial absence of an institutional policy framework to drive university research.
11. The primary goal of researchers at KNUST is publication in refereed journals with the aim of career enhancement. Research is thus largely not for the purpose of addressing societal problems.
12. As far as engagement by academic position is concerned researchers of senior ranks engage at high levels the most with different stakeholders.
13. Faculties engage different stakeholders at different levels depending on the activities involved.

9.6 Recommendations

Listed below are the recommendations made based on the results of the current study.

1. University-wide publicity, dissemination workshops, exhibitions, fairs, and open days are needed to create stakeholder awareness of the existence and availability of research findings.
2. Different stakeholders have different operational procedures and this must be taken into consideration during stakeholder engagement. It is necessary to consider the specific needs of stakeholders so as to adopt the appropriate mechanism of engagement.
3. There is the need for an active continuous interaction between researchers and users of research in order to build the needed confidence and the buy-in for use of research findings. Continuous engagement allows for stakeholder input, refinement of the research and subsequently the adoption and use of the findings.
4. Staff engagement procedures, especially at management level, must consider expertise in research uptake. It has been the case that most researchers and management staff lack capacity in research management, resulting in a lack of attention to research uptake and research uptake management. For those already engaged in the service of the university, retraining in the area of research management is necessary as part of continuous professional development.

5. There must be an emphasis on graduate training in order to produce research that is cutting edge enough for local and national development. The current emphasis on undergraduate recruitment and training has implications for future research output. Although there may be some good undergraduate projects available, graduate training has much to offer in terms of cutting-edge research with the potential to address societal challenges.
6. The university must aim to promote PhD studies as a good channel for research or knowledge generation and dissemination. Graduate training should be designed in such a way that research uptake is made an integral part of the training. Students can be encouraged to undertake projects with stakeholders within the industrial sector, with government agencies, and in communities.
7. There is the need to redefine the roles and responsibilities of researchers to include research dissemination and uptake. Letters appointing staff must categorically state the duties to include research dissemination in addition to teaching and service to communities.
8. The promotion criteria must acknowledge research that has been utilised, more than those which are only published without any significant citation index or impact.
9. There must be policies and incentives that promote a shift towards using research to solve local and national problems.
10. There is the need for a budget line to provide the necessary funds and resources for research dissemination and uptake. The university should consider additional linkages with stakeholders to set up research chairs to bring in the needed funding for research.
11. The Offices of Grants and Research of the university must ensure that research proposals which include dissemination and uptake are accorded more support than those which do not go further than publication in journals.
12. Research findings must be made relevant to communities in need. Stakeholder demand-driven research has greater potential for uptake and utilisation, and therefore communities in need ought to be consulted in any attempt to address their needs.
13. Research uptake management capacity should be built for top level HE managers to oversee offices of grants and research in the university. There must be programmes for continuous professional development to raise the calibre and competence of staff for good research output.

14. Researchers should team up and work with government at senior ministerial level for evidence-informed policymaking. The same principle can be applied to other stakeholders.
15. For stakeholders to accept and adopt research findings they must be involved in the research process at some point in time, especially, during the research formulation and proposal stages.
16. Institutional research centres must be made responsible for research and innovations meant for the public good. To be able to carry out their mandates, these centres should be well resourced and tasked to link up with industry, government and other stakeholders to address societal challenges practically.
17. The university should set targets for research that address local and national problems, find sources for funding and purposely assign these to specific departments according to their strengths. Government and other beneficiaries should be made aware of this and involved in the process in order for them to be aware of the existence of that knowledge and the suitability of that knowledge for addressing societal challenges.
18. Research collaboration, conferences and workshops are the preferred mechanisms of engagement through which research uptake can take place. The university should take advantage of this to ensure that the needed resource support is provided for dissemination and eventual uptake of research findings.

9.7 Challenges to the study

A few limitations encountered during the study are that:

Available literature is not explicit in terms of the research uptake and utilisation strategy for Sub-Saharan African HEIs. Most of the available pieces of literature were on knowledge production and utilisation in foreign contexts.

9.8 Future studies

A study may be necessary to look at the types of research taking place in the university and their impact, the quality of research and the types of journals in which researchers are publishing. Furthermore, there is the need to do a tracer studies of the impact of research conducted by researchers of KNUST. Research impact assessment is necessary for improving the research uptake management system of the university.

There is also the need to investigate researcher's perception and understanding of what constitutes service to community and how these could be given full recognition in the university's scheme of affairs.

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APPENDICES

1. SAMPLE OF SURVEY INSTRUMENT

SURVEY ON STAKEHOLDER ENGAGEMENT, CHANNELS AND MECHANISMS OF ENGAGEMENT FOR RESEARCH UPTAKE

Introduction

Dear Sir/ Madam

We are approaching you in order to solicit your views in our assessment of the extent of stakeholders engagement (involvement in research process) and research dissemination activities at KNUST. Essentially, we are looking at research activities in relation to the following audience:

Local communities outside the university

Private sector (this includes industry/ large firms and small and medium managed enterprises-SMMEs)

Government (ministries, departments and agencies-MDAs) and parastatals

Researchers and Scientists from other universities and research institutes

Non-governmental organisations (NGOs) such as charities and funders.

The survey consists of 20-24 questions (depending on the number of stakeholders you are most frequently involved with) ideally; it should take you no longer than 15minutes to complete the survey. Participation in the survey is voluntary and all information will be treated as highly confidential.

We promise to adhere to ethical standards in analyzing respondents' feedback so as to ensure confidentiality and anonymity. by continuing you agree to these conditions.

Thank you in advance for your time and valuable input!

Section A: Background

Title (please tick): Dr. Mr. Mrs Ms Pro Oth

Name (surname and first names):

Gender: Male Female

Year of birth.....

Department/Division

Position..... (Drop down list: Professor, Associate Professor, Senior lecturer, Senior Research Fellow, Lecturer, Research Fellow, Assistant Lecturer, Assistant Research Fellow)

Highest educational qualification: 1st Degree Masters Doctorate

In what year did you receive your highest degree?.....

At what institution did you obtain your highest degree?.....

Section B: Research Output Profile

Please indicate how many of the following research outputs you have produced over the last three years.

Please tick

	None	1-5	6-10	11+	Not applicable
Articles published/accepted (including co-authored)					
Books (i.e. monographs and edited volumes)					
Book chapters (including co-authored)					
Conference papers published in proceedings					
Presentation at conferences to predominantly academic audiences					
Written input to official public policy documents					

Research reports (contract/consultation research)					
Articles in popular journals/magazines, essays, newspaper articles or other public outreach media					
Patents (applied for and/ or granted)					
Computer programmes (including co- writing)					
Creative/artistic works of art performed or exhibited (e.g. music, sculpture, paintings, theatre, film)					
Other (please specify how many as well)					

As far as **your research** is concerned, please rate the extent to which you believe that the following have been successfully attained where applicable:

	Highly successful 1	Successful to some extent 2	Not successful at all 3	Not applicable 4
Advancement of knowledge				
Solving of theoretical problems				
Solving of immediate technical/ applied problems				
Solving of environmental or social problems				
Development of skills and competences				
Change in behaviour/attitudes/values				
Influence policy/decision- makers				
Influence practice				

Stimulation of discussion/debate				
Others (please specify how successful as well)				

Section C: Engagement with Stakeholders

Please indicate how often you engage directly in **your own research projects** with each of the following stakeholder groups (**NB!** Please **limit** your answer to the **top three or fewer**)

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Communities outside the university					
Private Sector (industry, large firms, SMMEs)					
Government (MDAs) and parastatals					
Scientists and researchers in other universities and institutes					
NGOs (e.g. charities, funders)					

Communities Query

Did you select **COMMUNITIES** as one of your top three choices in **Section C**?

	Yes I did
	No I did not select communities, please this skip section
	I can't remember, please take me back to section C to see my top choices

Section D: Engagement with Communities (your personal experiences with communities of need)**Communities**

How do you typically engage with communities around the university? Please tick in the boxes below how often you engage with these stakeholder groups through these engagement mechanisms.

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Organising exhibitions in the communities					
Conducting research in the communities					
Using community sites for teaching and learning					
Forming community-based networks for learning					
Drawing on community advisors for support, strategy and advice					
Performing research related Drama/concerts/theatre in communities					
Using social media to reach out to communities					
Other (please specify how often as well)					

How beneficial do you perceive the following potential benefits of community engagement to be your own research engagement activities:

	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	Not applicable

	1	2	3	4	5
Your research in communities opens opportunities for more research					
Your research influences decisions/choices by communities					
Opens avenues for collaboration with communities					
Solving community-based problems					
Opportunities to develop innovations					
To transfer research to practice					
To meet formal requirements of a study					
Other (please specify benefit of community engagement and level of benefit to you)					

To what extent do you involve communities in your research process at each of the under listed stages?
Please tick.

	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5
At the research formulation stage					
At the research proposal stage					
During the report writing stage					
Throughout the entire research process					
Other (please specify)					

Based on your experience please rank the **three most common reasons** why communities do not use research findings about their communities (1-3 highest down)

	1	2	3
Financial constraints on the part of researchers to disseminate research findings to communities			

Financial constraints on the part of communities to implement research findings			
Lack of human resource capacity in researchers to support and disseminate research			
Lack of motivation by communities to use research findings			
Communities resistance to change			
Lack of understanding of research benefits by communities			
Misunderstanding and wrong perceptions of research results by communities			
Research findings not being relevant to communities			
Lack of confidence in the research findings by communities			
Lack of contact between researcher and users of the findings in communities			
Lack of time to implement research findings			
Other (please specify)			

Private Sector query

Did you select **PRIVATE SECTOR** in your top three choices in **Section C**?

	Yes I did select PRIVATE SECTOR as one of my choices in Section C
	No I did not select Private Sector as one of my choices in Section C (Please skip this section)
	I can't remember, please take me back to section C to see my top choices

Section E: Engagement with Private sector (this includes industry/ large firms and SMMEs)**PRIVATE SECTOR**

How often do you typically engage with the private sector via the following engagement mechanisms?

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Developing research proposals for/with private sector					
Organising workshops/seminars with/for private sector					
Organising conferences for with/private sector					
Attending conferences organised by private sector					
Serving on advisory boards of private sector					
Private sector staff serving on advisory boards/committees of university					
Conducting commissioned research for private sector					
Conducting joint research with private sector					
Providing consultancy services for the private sector					
Journal publications co-authored with private sector					
Technical reports and policy briefs jointly written with private sector					

Books and book chapters co-authored with private sector					
Engaging in Social media discussion/fora with private sector					
Other (please specify how often as well)					

How beneficial do you perceive the following potentials benefits of private sector engagement to be to your own research engagement activities. Please tick in the boxes below.

	Very beneficial 1	Somewhat beneficial 2	Of little benefit 3	Of no benefit 4	Not applicable 5
Your research opens opportunities for more research					
Your research influences decisions by the private sector					
Opens avenues for collaboration					
Provides opportunities for funding					
Solving private sector related problems					
Opportunities to develop innovations					
To transfer research to practice					
To meet formal requirements of a study					
Other (please specify benefit of private sector engagement and level benefit to you)					

To what extent do you involve the private sector in your research process at each of the under listed stages? Please tick.

	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5

At the research formulation stage					
At the research proposal stage					
During the report writing stage					
Throughout the entire research process					
Other (please specify stage and frequency of involvement)					

Based on your experience, please rank the **three most common reasons** why the private sector does not make use of research findings that could be beneficial to them (1-3 from highest down)

	1	2	3
Financial constraints to implement research findings			
Lack of human resource capacity in researchers to disseminate research from university to private sector			
Lack of personal motivation by researchers to disseminate research from university to private sector			
Private sector resistance to change			
Lack of understanding of research benefits by private sector players			
Misunderstanding and wrong perceptions of research results by private sector			
Research not being relevant to the private sector			
Lack of confidence in the research findings by private sector			
Lack of contact between researcher and users of findings within the private sector			
Lack of time by researchers to disseminate research findings			
Other (please specify)			

Government and Parastatals Query

Did you select **GOVERNMENT AND PARASTATALS** as one of your top three choices in **Section C**?

<input type="checkbox"/>	Yes I DID select Governments and Parastatals as one of my top three choices in Section C
<input type="checkbox"/>	No I did NOT select Governments and Parastatals as one of my top three choices in Section C (Please skip this section)
<input type="checkbox"/>	I can't remember take me back to section C to see my top 3 choices

Section F: Engagement with Governments (ministries, departments and agencies-MDAs) and Parastatals

Government and Parastatals

How do you typically engage with governments (MDAs) and parastatals? Please tick in the boxes below how often you engage with these stakeholder groups through these engagement mechanisms.

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Developing research proposals with/for government and parastatals					
Organising workshops with/for government and parastatals					
Organising conferences with/for government and parastatals					
Serving on advisory boards of government and parastatals					
Conducting commissioned research for government and parastatals					
Research collaboration with government and parastatals					

Providing consultancy services for government and parastatals					
Journal publications co-authored with government and parastatals					
Technical reports and policy briefs jointly written with government and parastatals					
Books and book chapters co-authored with government and parastatals					
Other (please specify)					

How beneficial do you perceive the following potential benefits of government and parastatal engagement to be to **your own research engagement activities**:

	Very beneficial 1	Somewhat beneficial 2	Of little benefit 3	Of no benefit 4	Not applicable 5
Your research is used by government and parastatals					
Your research opens opportunities for further research					
Influencing policy and decisions of government and parastatals					
Opens avenues for collaboration					
Provides opportunities for funding					
Solving governmental or parastatal problems					
Opportunities to develop innovations					
To transfer research to practice					
To meet formal requirements of a study agreement					
Other (please specify)					

To what extent do you involve governments and parastatals in your research process at each of the under listed stages? Please tick.

	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5
At the research formulation stage					
At the research proposal stage					
During the report writing stage					
Throughout the entire research process					
Other (please specify)					

Based on your experience, please rank the **three most common reasons** why governments and parastatals do not make use of research findings that could benefit them (1-3 from highest down)

	1	2	3
Decision making culture of government not conducive to make use of research findings			
Political influence plays a far greater role than evidence to make decisions			
Research results are not delivered in a timely fashion			
There exists financial constraints to implement research findings			
Lack of human resource capacity in researchers to disseminate research			
Lack of personal motivation by researchers to disseminate research findings			
Government and parastatals resisting change			
Lack of understanding of research benefits by government and parastatals			
Misunderstanding and wrong perceptions of research results by governments			
Research not relevant to government and parastatals			
Lack of confidence in research findings			

Lack of contact between researchers and users of findings among government and parastatals			
Lack of time to disseminate research findings			
Other (please specify stage and frequency of involvement)			

Scientist and Researchers Query

Did you select **SCIENTIST AND RESEARCHERS** as one of your top three choices in **Section C**?

<input type="checkbox"/>	Yes I DID select Scientist and Researchers as one of my top three choices in Section C
<input type="checkbox"/>	No I did NOT select Scientist and Researchers as one of my top three choices in Section C (Please skip this section)
<input type="checkbox"/>	I can't remember take me back to section C to see my top 3 choices

Section G: Engagement with Scientists and researchers of other universities and institutes

Scientist and Researchers

How often do you typically engage with scientists and researchers from other universities and institutes via the following engagement mechanisms?

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Developing curriculum in partnership with other scientists and researchers					
Organising workshops with/for other scientists and researchers					
Organising conferences with/for other scientists and researchers					
Attending conferences with other scientists and researchers					

Serving on advisory boards with other scientists and researchers					
Research collaboration with other scientists and researchers					
Providing consultancy services with/for other scientists and researchers					
Conducting commissioned research with/for other scientists and researchers					
Sharing facilities with other scientists and researchers e.g. labs/ equipment and research data					
Joint Journal publications with other scientists and researchers					
Newsletters					
Technical reports and policy briefs jointly written with other scientists and researchers					
Books and book chapters co-authored with other scientists and other researchers					
Public lectures					
Social media interaction with other scientists and researchers					
Other (please specify how often as well)					

How beneficial do you perceive the following potential benefits of engagement with scientists and researchers from other universities and institutes to be to your own research engagement activities:

	Very beneficial	Somewhat beneficial	Of little benefit	Of no benefit	Not applicable
	1	2	3	4	5
Your research is used by scientists and other researchers					
Your research opens opportunities for further research					

Your research influences choices/decisions by other scientists and researchers					
Opens avenues for collaboration					
Solving problems of other scientists and researchers					
Opportunities to develop innovations					
To transfer research to practice					
To meet formal requirements of a study					
Other (please specify benefit of engagement with scientist and researchers from other universities and institutes and level of benefit to you)					

To what extent do you involve other scientists and researchers in your research process at each of the under listed stages? Please tick.

	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5
At the research formulation stage					
At the research proposal stage					
During the report writing stage					
Throughout the entire research process					
Other (please specify stage and frequency of involvement)					

Based on your experience, please rank the **three most common reasons** why scientists and researchers of other universities and institutes do not use research findings that could be beneficial to them. Please rank (1-3 from highest down)

	1	2	3
Timely delivery of research results to scientists and researchers			
Research findings not disseminated to scientists and other researchers			
Scientists and researchers not being involved in the research process			
Scientists and researchers resisting change			
Lack of trust in research findings by scientists and researchers			
Misunderstanding and wrong perceptions of research results by scientists and researchers			
Research not being relevant to scientists and researchers			
Lack of confidence in the research findings by scientists and researchers			
Lack of contact between researcher and users of findings among other scientists and researchers			
Lack of time on the part of scientists and researchers to use research findings			
Other (please specify)			

NGOs query

Did you select **NGOs** as one of your top three choices in **Section C**?

<input type="checkbox"/>	Yes I DID NGOs as one of my top three choices in Section C
<input type="checkbox"/>	No I did NOT select NGOs as one of my top three choices in Section C (Please skip this section)
<input type="checkbox"/>	I can't remember take me back to section C to see my top 3 choices

Section H: Engagement with NGOs (including charities and funders)

Non- Governmental Organisations

How do you typically engage with NGOs? Please tick in the boxes below how often you engage with these stakeholder groups through these engagement mechanisms.

How often do you typically engage with NGOs via the following engagement mechanisms?

	Every month 1	3 or 4 times a year 2	Annually 3	Rarely 4	Never 5
Developing research proposals with/for NGOs					
Organising workshops/seminars with/for NGOs					
Organising conferences with/for NGOs					
Attending conferences organised by NGOs					
Serving on advisory boards of NGOs					
NGO staff serving on advisory boards of university					
Conducting commissioned research for NGOs					
Conducting joint research with NGOs					
Providing consultancy services for NGOs					
Joint journal publications with NGOs					
Technical reports and policy briefs jointly written with NGOs					
Books and book chapters co-authored with NGOs					
Engaging NGOs on social media platforms					
Other (please specify)					

How beneficial do you perceive the following potential benefits of NGO engagement to be to your own research engagement activities:

	Very beneficial 1	Somewhat beneficial 2	Of little benefit 3	Of no benefit 4	Not applicable 5
Your research is used by NGOs to support programme implementation					
Your research opens avenues for further research					
Your research influences policies and decisions of NGOs					
Opens avenues for collaboration with NGOs					
Provides you with opportunities for funding					
Solving NGO related problems					
Opportunities to develop innovations					
To transfer research to practice					
To meet formal requirements of a study					
Other (please specify)					

To what extent do you involve NGOs in your research process at each of the under listed stages? Please tick.

	Always 1	Usually 2	Sometimes 3	Rarely 4	Never 5
At the research formulation stage					
At the research proposal stage					
During the report writing stage					
Throughout the entire research process					
Other (please specify)					

Based on your experience, please rank the **three most common reasons** why NGOs do not use make use of research findings that could be beneficial to them (1-3 from highest down)

	1	2	3
Financial Constraints on the part of NGOs to implement research findings			
Lack of human resource capacity by NGOs to implement research findings			
Lack of motivation by NGOs to use research			
NGOs resisting change			
Lack of understanding of research benefits			
Misunderstanding and wrong perceptions of research results by NGOs			
Research not being relevant to NGOs			
Lack of confidence by NGOs in the research findings			
Lack of contact between researcher and users of findings among NGOs			
Other (please specify)			

Please indicate if you are willing to be contacted for a follow-up interview so as to find out more about your research experiences: Yes No

Thank you very much for the time and effort you have put into completing the survey!

2. PhD Graduates from 2009-2017

Year	Males	Females	Total
2009	13	3	16
2010	46	6	52
2011	42	12	54
2012	30	4	34

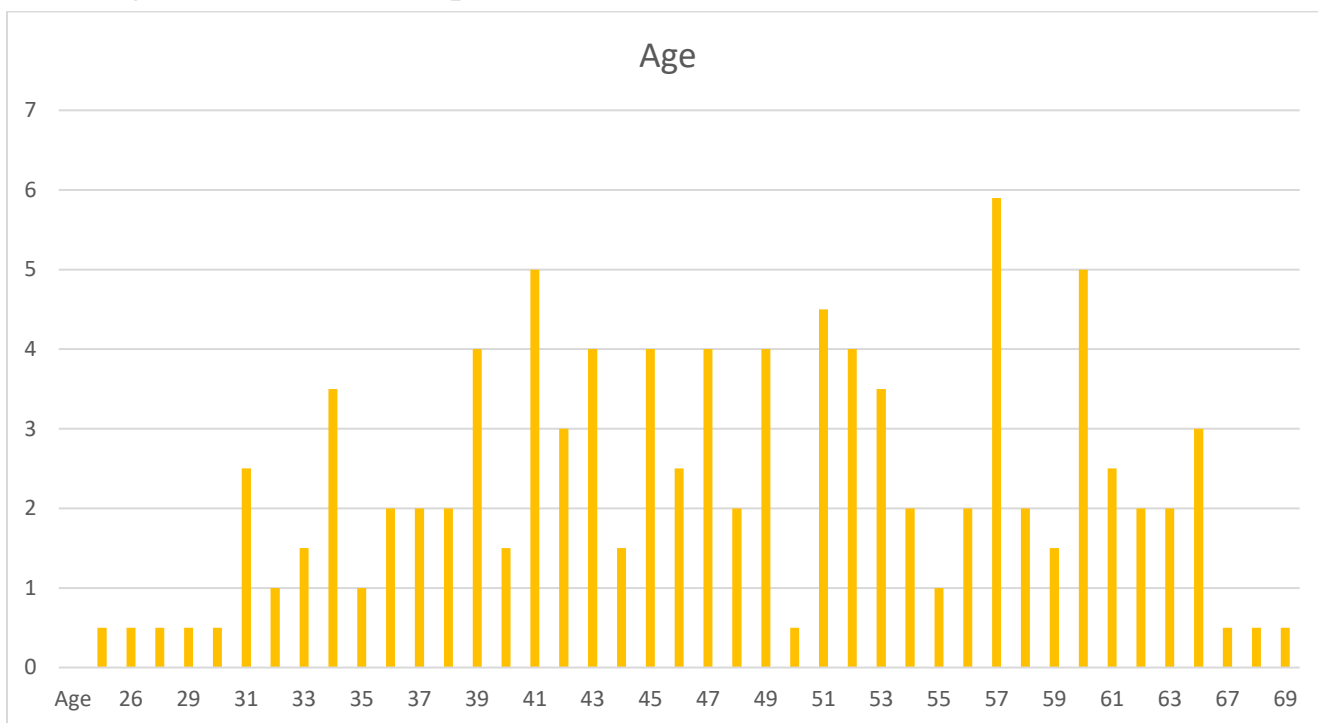
June 2013	19	6	25
November 2013	14	1	15
June 2014	13	1	14
November 2014	20	6	26
June 2015	36	6	42
November 2015	42	7	49
June 2016	39	12	51
November 2016	38	8	46
June 2017	29	10	39
November 2017	34	16	50

3. Responses by Position

Position	Frequency	Percentage
Professor	11	5.4
Associate Professor	24	11.9
Senior Lecturer/Senior Research Fellow	88	43.6
Lecturer/Research fellow	64	31.7

Assistant lecturer/Assistant Research Fellow	13	6.4
Librarian	1	0.5
None	1	0.5
Total	202	100.0

4. Age Distribution of Respondents



5. Faculty versus research output (articles published or accepted)

	None	1-5	6-10	11+	Not Applicable
Faculty of Agriculture	0.0%	2.7%	4.0%	5.7%	0.0%
Faculty of Allied Health Sciences	0.0%	2.7%	4.0%	1.9%	0.0%
Faculty of Art	0.0%	10.8%	8.0%	5.7%	0.0%
Faculty of Biosciences	0.0%	10.8%	12.0%	11.3%	0.0%
Faculty of Built Environment	0.0%	8.1%	16.0%	13.2%	0.0%
Faculty of Civil and Geo-Engineering	0.0%	4.1%	4.0%	5.7%	0.0%

Faculty of Electrical and Computer Engineering	0.0%	2.7%	0.0%	0.0%	0.0%
Faculty of Forest Resources Technology	0.0%	0.0%	2.0%	0.0%	0.0%
Faculty of Mechanical and Chemical Engineering	0.0%	0.0%	0.0%	1.9%	0.0%
Faculty of Mechanical and Chemical Engineering	0.0%	8.1%	4.0%	1.9%	0.0%
Faculty of Pharmacy and Pharmaceutical Sciences	0.0%	2.7%	6.0%	0.0%	0.0%
Faculty of Physical and Computational Science	0.0%	8.1%	22.0%	22.6%	0.0%
Faculty of Renewable Natural Resources	20.0%	5.4%	0.0%	5.7%	0.0%
Faculty of Social Sciences	20.0%	8.1%	4.0%	5.7%	0.0%
KNUST Dental School	20.0%	1.4%	2.0%	1.9%	0.0%
Research center	0.0%	1.4%	4.0%	0.0%	0.0%
Research Center	0.0%	4.1%	0.0%	1.9%	0.0%
School of Business	20.0%	5.4%	4.0%	3.8%	100.0%
School of Medical Sciences	20.0%	13.5%	4.0%	7.5%	0.0%
School of Public Health	0.0%	0.0%	0.0%	1.9%	0.0%
School of Veterinary Medicine	0.0%	0.0%	0.0%	1.9%	0.0%

6. Overall research performance for KNUST 2013-2017

	Overall	2013	2014	2015	2016	2017
Awards Volume (count)	2	0	1	0	0	1
Awards Volume (value)	339413	0	49433	0	0	289980
International Collaboration (%)	62.4%	58.8%	61.6%	65.3%	61.1%	63.2%
Academic-Corporate Collaboration (%)	1.3%	1.1%	1.7%	1.1%	1.3%	1.2%
Scholarly Output	2200	260	344	447	543	606
Scholarly Output (growth %)	133.1%					
Citations	15543	2468	2652	5983	3061	1379
Field-Weighted Citation Impact	1.73	0.86	0.97	2.65	1.92	1.67
Outputs in Top Citation Percentiles (top 10%)	11.6%	8.1%	10.5%	11.6%	10.9%	14.4%
Publications in Top Journal Percentiles (top 10% by CiteScore Percentile)	24.1%	19.7%	25.8%	27.7%	24.3%	22.2%
Citations per Publication	7.1	9.5	7.7	13.4	5.6	2.3
Views	51021	5702	6228	14469	13121	11501
Outputs in Top Views Percentiles (top 10%)	13.1%	13.8%	8.4%	14.1%	14.2%	13.7%
Views per Publication	23.2	21.9	18.1	32.4	24.2	19
Field-Weighted View Impact	1.94	1.04	1.04	2.57	2.13	2.21
Citing-Patents Count (patent office: All Patent Offices)	6	5	1	-	-	-
Patent-Cited Scholarly Output (patent office: All Patent Offices)	4	3	1	0	0	0

Patent-Citations Count (patent office: All Patent Offices)	6	5	1	0	0	0
Patent-Citations per Scholarly Output (patent office: All Patent Offices)	2.7	19.2	2.9	0	0	0
h5-index	35					

Overall Research Performance for KNUST 2013-2017: Source Scopus

7. Summary of cross-tabulation of engagement in terms of position and stakeholders three or four times a year

	Engagements with communities	Engagements with private sector	Engagements with government or MDAs	Engagements with other scientists and researchers	Engagements with NGOs
Professor	4	4	5	5	0
	8.9%	16.0%	22.7%	9.3%	0.0%
Associate professor	7	3	3	7	1
	15.6%	12.0%	13.6%	13.0%	16.7%
Senior lecturer, senior research fellow	20	14	8	25	1
	44.4%	56.0%	36.4%	46.3%	16.7%
Lecturer, research fellow	12	2	5	14	3
	26.7%	8.0%	22.7%	25.9%	50.0%
Assistant lecturer, assistant research fellow	2	2	1	2	1
	4.4%	8.0%	4.5%	3.7%	16.7%
Library	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%
None	0	0	0	1	0
	0.0%	0.0%	0.0%	1.9%	0.0%

8. Summary of overall engagement of faculties with stakeholders three or four times a year

	Communities	Private sector	Govt. & parastatals	Other scientists	NGOs
Faculty of Agriculture	2	0	1	3	0
	4.4%	0.0%	4.5%	5.6%	0.0%
Faculty of Allied Health Sciences	1	0	0	4	0
	2.2%	0.0%	0.0%	7.4%	0.0%
Faculty of Art	8	3	0	5	0
	17.8%	12.0%	0.0%	9.3%	0.0%
Faculty of Biosciences	5	3	4	4	0
	11.1%	12.0%	18.2%	7.4%	0.0%

Faculty of Built Environment	5	2	5	3	2
	11.1%	8.0%	22.7%	5.6%	33.3%
Faculty of Civil and Geo-Engineering	2	1	1	5	0
	4.4%	4.0%	4.5%	9.3%	0.0%
Faculty of Electrical and Computer Engineering	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%
Faculty of Forest Resources Technology	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%
Faculty of Mechanical and Chemical Engineering	0	1	0	0	0
	0.0%	4.0%	0.0%	0.0%	0.0%
Faculty of Mechanical and Chemical Engineering	2	2	2	3	0
	4.4%	8.0%	9.1%	5.6%	0.0%
Faculty of Pharmacy and Pharmaceutical Sciences	0	1	1	3	0
	0.0%	4.0%	4.5%	5.6%	0.0%
Faculty of Physical and Computational Science	7	5	0	11	1
	15.6%	20.0%	0.0%	20.4%	16.7%
Faculty of Renewable Natural Resources	3	3	2	2	1
	6.7%	12.0%	9.1%	3.7%	16.7%
Faculty of Social Sciences	2	1	0	4	0
	4.4%	4.0%	0.0%	7.4%	0.0%
KNUST Dental School	1	0	0	0	0
	2.2%	0.0%	0.0%	0.0%	0.0%
Research centre A	2	0	1	0	1
	4.4%	0.0%	4.5%	0.0%	16.7%
Research Centre B	2	1	1	0	1
	4.4%	4.0%	4.5%	0.0%	16.7%
School of Business	1	1	1	1	0
	2.2%	4.0%	4.5%	1.9%	0.0%
SMS	1	1	2	5	0
	2.2%	4.0%	9.1%	9.3%	0.0%
School of Public Health	1	0	1	1	0
	2.2%	0.0%	4.5%	1.9%	0.0%
School of Veterinary Medicine	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%

B.1 Summary of literature sources for stakeholders engaged with

The table below provides a summary of the literature sources for the kind of stakeholders normally engaged with by researchers.

	Sudsawad (2007)	Grimshaw and Eccles (2012)	DRUSSA (2014,2016)
Communities	√		
Private Sector/informal sector	√	√	√
Government (MDAs), Parastatals, Policy makers	√	√	√
Media Agents			√
Scientists and Researchers		√	
Non-governmental organisations (NGOs)	√		√
Research funders and donors			√

C.1 Summary of channels of engagement with communities

	Hood (2002)	Becheikh and Ziam (2010)	Cherney et al (2012)	DRUSSA (2016)
Involving communities in setting research agenda	√	√		√
Community based exhibitions				
Conducting research in communities	√			
Co-creation of knowledge	√	√		√
Using community sites for learning	√			
Forming community-based networks	√		√	
Drawing on community advisors for support, strategy and advice			√	√
Drama/concert	√			

Social media	√			√
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C.2 Summary of benefits of engagement with communities

	Bozeman (2000)	Jacobson et al. (2003)	Sudsawad (2007)	Cherney et al. (2012)
Chances of research use by communities	√	√	√	√
Solving community-based problems	√	√	√	√
Influencing decisions of community leaders		√	√	√
Creating avenues for further research	√	√	√	
Proving avenues for collaboration with communities		√	√	√
Providing justification for more funding	√		√	
Fulfilling contract agreements			√	

C.3 Summary of stages of involvement of communities in research process

	NCDR (1995)	Bozeman (2000)	Nicholson-Cole and Whitmarsh (2008)	DRUSSA (2014,2016)
Research formulation stage	√	√	√	√
Research proposal stage	√	√	√	√
During data collection and analysis stage	√	√	√	

During all stages of the research process	√	√	√	
During the research report drafting stage	√	√	√	
During the final report stage	√	√	√	
During the research dissemination stage	√	√		√

C.4 Summary of barriers to engagement with communities

The table below provides the sources of the options as discussed in the literature.

	Sedlacko and Pisano (2013)	Humphries (2014)	Oliver and Innvar (2014)
Financial constraints to implement findings	√	√	√
Lack of human resource capacity to support and disseminate research	√	√	√
Lack of expertise in science communication	√	√	√
Misunderstanding and wrong perception of research		√	√
Lack of personal motivation to disseminate research		√	√
Research findings not being relevant to communities		√	√

Resistance to change by communities	√	√	
Lack of understanding of research benefits by communities		√	√

D.1 Summary of channels of engagement with industry

	Larsen (1980)	NCDR (1995)	Bozeman, (2000)	Innvaer and Vist (2002)	Becheikh and Ziam (2010)	Cherney et al. (2012)
Developing research proposals with private sector	√	√	√	√	√	
Organising workshops/seminars for private sector	√			√	√	√
Organising conferences for private sector	√	√	√	√	√	√
Attending conferences organised by private sector	√	√	√	√	√	
Serving on advisory boards of private sector	√	√	√	√	√	√
Private sector staff serving on advisory boards of university	√			√	√	√
Conducting commissioned research	√			√		
Conducting joint research with private sector	√	√	√	√	√	√
Providing consultancy for the private sector	√			√		
Journal publications		√	√		√	
Websites/pages					√	

Newsletters		√	√		√	
Technical reports and policy briefs		√	√			√
Books and book chapters		√	√		√	
Social media		√	√			

D.2 Summary of benefits of engagement with private sector

	Bozeman (2000)	Jacobson et al. (2003)	Sudsawad (2007)	Cherney et al. (2012)
Chances of research use by private sector	√	√	√	√
Opportunities for further research	√	√	√	
Influencing policy, decisions and choices of private sector		√	√	√
Opens avenues for collaboration with private sector	√	√	√	
Opportunities for funding	√		√	
Solving problems in the private sector		√	√	√
Opportunities to develop innovations			√	
To transfer research to practice	√	√	√	√
To justify funding			√	
To satisfy contractual agreement			√	

D.3 Summary of stages of involving private sector in the research process

	NCDR (1995)	Bozeman (2000)	Nicholson- Cole and Whitmarsh (2008)	DRUSSA (2014, 2016)
At the research formulation stage	√	√	√	√
At the research proposal stage	√	√	√	√
During the research process	√	√	√	√
During the research report drafting stage			√	
During the final report stage	√	√	√	√
At all stages of the research process	√	√	√	
During the research dissemination stage	√	√		√

D.4 Summary of barriers to research uptake when engaging with the private sector

	Mitton et al. (2007)	Andrews (2012)	Sedlacko and	Humphries (2014)	Oliver and	Becheikh and Ziam, 2010

			Pisano (2013)		Innvar (2014)	
Limited access to research information/availability			√	√	√	
Timely delivery of research			√	√	√	
Decision making culture			√	√	√	
Political influence on decisions						
Financial Constraints to disseminate research findings		√	√	√	√	
Lack of human resource capacity to disseminate research findings		√	√	√	√	
Lack of personal motivation to disseminate research				√	√	
Resistance to change by private sector			√	√		
Lack of understanding of research findings		√		√	√	
Research not being relevant to the private sector		√		√	√	√
Lack of management support and culture			√	√	√	√
Lack of confidence in the research findings			√	√		
Lack of expertise in Science Communication		√	√	√	√	√
Lack of intermediaries (e.g. knowledge brokers) to take research to users	√					√
Lack of contact between researcher and users	√	√				√
Lack of time to disseminate research findings			√	√	√	√

E.1 Summary of channels of engagement with government and parastatals

	Larsen (1980)	NCDR (1995)	Bozeman, (2000)	Innvaer and Vist (2002)	Becheikh and Ziam (2010)	Cherney et al. (2012)

Developing research proposals with government and parastatals	√	√	√	√	√	
Organising workshops/seminars for government and parastatals	√			√	√	√
Organising conferences for government and parastatals	√	√	√	√	√	√
Attending conferences organised by government and parastatals	√	√	√	√	√	
Serving on advisory boards of government and parastatals	√	√	√	√	√	√
Government and parastatals serving on advisory boards of university	√			√	√	√
Conducting commissioned research	√			√		
Conducting joint research with government and parastatals	√	√	√	√	√	√
Providing consultancy for the government and parastatals	√			√		
Journal publications		√	√		√	
Websites/pages					√	
Newsletters		√	√		√	
Technical reports and policy briefs		√	√			√
Books and book chapters		√	√		√	
Social media		√	√			

E.2 Summary of benefits of engagement with government and parastatals

	Bozeman (2000)	Jacobson et al. (2003)	Sudsawad (2007)	Cherney et al. (2012)
Chances of research use by government and parastatals	√	√	√	√
Opportunities for further research	√	√	√	

Influencing policy and decisions of government and parastatals		√	√	√
Opens avenues for collaboration	√	√	√	√
Opportunities for funding	√		√	
Solving problems		√	√	√
Opportunities to develop innovations			√	
To transfer research to practice	√	√	√	√
To justify funding			√	
To satisfy contractual agreement			√	

E.3 Summary of stages of involving government and parastatals in the research process

	NCDR (1995)	Bozeman (2000)	Nicholson-Cole and Whitmarsh (2008)	DRUSSA (2014, 2016)
At the research formulation stage	√	√	√	√
At the research proposal stage	√	√	√	√
During the research process	√	√	√	√
During the research report drafting stage			√	
During the final report stage	√	√	√	√
At all stages of the research process	√	√	√	
During research dissemination	√	√		√

E.4 Summary of barriers to research uptake when engaging with government and parastatals

	Mitton et al. (2007)	Andrews (2012)	Sedlacko and Pisano (2013)	Humphries (2014)	Oliver and Innvar (2014)	Becheikh and Ziam, 2010
Inadequate skills and experience of policy makers in research literacy			√	√	√	
Limited access to research information/availability			√	√	√	
Timely delivery of research			√	√	√	
Decision making culture of government			√	√	√	
Political influence on decisions			√	√		
Financial Constraints to disseminate research findings		√	√	√	√	

Lack of human resource capacity to disseminate research		√	√	√	√	
Lack of personal motivation to disseminate research				√	√	
Governments and parastatals resisting change			√	√		
Lack of understanding of research findings by government and parastatals		√		√	√	
Research not being relevant to government and parastatals		√		√	√	√
Lack of management support and culture			√	√	√	√
Lack of confidence in the research findings			√	√		
Lack of expertise in Science Communication		√	√	√	√	√
Lack of intermediaries (e.g. knowledge brokers) to take research to users	√					√
Lack of contact/interaction between researcher and users/decision makers	√	√				√
Lack of time to disseminate research findings			√	√	√	√

F.1 Summary of channels of engagement with scientists and researchers from other universities and research institutes

	Larsen (1980)	NCDR (1995)	Bozeman, (2000)	Innvaer and Vist (2002)	Becheikh and Ziam (2010)	Cherney et al. (2012)
Developing research proposals with scientists and researchers from other universities and institutes	√	√	√	√	√	
Organising workshops/seminars for scientists and researchers from other universities and institutes	√			√	√	√

Organising conferences for scientists and researchers from other universities and institutes	√	√	√	√	√	√
Attending conferences organised by scientists and researchers from other universities and institutes	√	√	√	√	√	
Serving on advisory boards of scientists and researchers from other universities and institutes	√	√	√	√	√	√
Scientists and researchers from other universities and institutes serving on advisory boards of university	√			√	√	
Conducting commissioned research	√			√		
Conducting joint research with scientists and researchers from other universities and institutes	√	√	√	√	√	√
Providing consultancy for the scientists and researchers from other universities and institutes	√			√		
Journal publications		√	√		√	
Websites/pages					√	
Newsletters		√	√		√	
Technical reports and policy briefs		√	√			√
Books and book chapters		√	√		√	
Social media		√	√			

F.2 Summary of benefits of engagement with scientists and researchers from other universities and research institutes

	Bozeman (2000)	Jacobson et al. (2003)	Sudsawad (2007)	Cherney et al. (2012)
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Chances of research use by scientists and researchers from other universities and research institutes	√	√	√	√
Opportunities for further research by researchers	√	√	√	
Influencing research focus of scientists and researchers from other universities and research institutes		√	√	
Opens avenues for collaboration with scientists and researchers from other universities and research institutes	√	√	√	√
Opportunities for funding	√		√	
Solving problems of scientists and researchers from other universities and research institutes		√	√	√
Opportunities to develop innovations			√	
To transfer research to practice	√	√	√	√
To justify funding			√	
To satisfy contractual agreement			√	

F.3 Summary of stages of involving scientists and researchers from other universities and research institutes in the research process

	NCDR (1995)	Bozeman (2000)	Nicholson-Cole and Whitmarsh (2008)	DRUSSA (2014, 2016)
At the research formulation stage	√	√	√	√
At the research proposal stage	√	√	√	√
During the research process	√	√	√	√
During the research report drafting stage			√	
During the final report stage	√	√	√	√
At all stages of the research process	√	√	√	
During research dissemination	√	√		√

F.4 Summary of barriers to research uptake as far as scientists and researchers from other universities and research institutes are concerned

	Andrews (2012)	Sedlacko and Pisano (2013)	Humphries (2014)	Oliver and Innvar (2014)	Becheikh and Ziam, 2010
Inadequate skills and experience in research literacy		√	√	√	
Limited access to research information/availability		√	√	√	
Timely delivery of research					

Decision making culture of scientists and researchers of other universities and institutes		√	√	√	
Financial Constraints to disseminate research findings	√	√	√	√	
Lack of human resource capacity to disseminate research	√	√	√	√	
Lack of motivation to disseminate research			√	√	
Scientists and other researchers resisting change		√	√		
Lack of understanding/clarity of research	√		√	√	
Research not being relevant to scientists and researchers from other universities and institutes	√		√	√	√
Lack of management support and culture		√	√	√	√
Lack of confidence in the research		√	√		
Lack of expertise in Science Communication	√	√	√	√	√
Lack of intermediaries (e.g. knowledge brokers) to take research to users					√
Lack of contact between researcher and users	√				√
Lack of time to disseminate research to other scientists and researchers		√	√	√	√