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OFFICE OF THE DEPUTY VICE CHANCELLOR, RESEARCH

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
AMCOST	African Ministerial Council on Science and Technology
ART	Antiretroviral Therapy
ARV	Antiretroviral
ASTII	African Science, Technology and Innovation Indicator
CoAF	College of Agricultural Sciences and Fisheries Technology
CoET	College of Engineering and Technology
CoICT	College of Information, Communication and Technology
CoNAS	College of Natural and Allied Sciences
COSTECH	Commission for Science and Technology
EAC	East African Community
EU	European Union
GDP	Gross Domestic Product
GDP	Gross Domestic Product
HEI	Higher Education Institutions
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
IK	Indigenous Knowledge
LTPP	Long-Term Perspective Plan
MDG	Millennium Development Goals
MKUKUTA	Mkakati wa Kukuza Uchumina Kupunguza Umaskini Tanzania
MKUZA	Mkakati wa Kuondoa Umasikini Zanzibar
MUCE	Mkwawa University College of Education
NEPAD	New Partnership for Africa's Development
NGO	Non-Government Organization
NSGRP	National Strategy for Growth and Reduction Poverty
OECD	Organization for Economic Cooperation and Development
R & D	Research and Development
RCE	Research Centres of Excellence
RGZ	Revolutionary Government of Zanzibar
S & T	Science and Technology
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SDGs	Sustainable Development
SIDP	Sustainable Industrial Development Policy
SJMC	School of Journalism and Mass Communication

SME(s)	Small and Medium Enterprise(s)
SoED	School of Education
SRA	Strategic Research Agendas
STISA	Science, Technology, and Innovation Strategy for Africa
TB	Tuberculosis
THRIP	Technology and Human Resources for Industry Programme
UDSM	University of Dar es Salaam
UDSoL	University of Dar es Salaam School of Law
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
URT	United Republic of Tanzania
URT	United Republic of Tanzania
WHO	World Health Organisation

NB: A number of abbreviations and acronyms have been contextualised or else explained at relevant places within the text

FOREWORD

This research agenda will provide an enabling environment and resources for research and knowledge production that promotes strategic development of priority research areas, through promotion of multidisciplinary research teams, human capital development, provision of research infrastructure and relevant research support, in pursuit of Tanzania's transition to a industrial economy.

This document will be a management-guiding tool to ensure selection and articulation of identified research needs and priorities in order to enable the University make informed management choices and decisions in terms of allocation of resources that would produce the results desired by stakeholders.

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1.0 INTRODUCTION

1.1 Background

Research plays a very crucial role in the socio-economic development of any nation. At societal level, research is necessary as an entry point into the cherished tradition of seeking knowledge to satisfy human material needs and the endless quest for knowledge. Research aims at complementing efforts of a country towards creating, disseminating and sharing existing and new knowledge and utilizing products, processes and services. The major goal of research is to serve as an instrument of change to improve people's living standards by stimulating growth and increasing productivity in critical sectors of the economy. It can lead to spin-off of new firms, creation of more competitive products and services in a country for the world markets, improvement of people's quality of life thereby increasing life expectancy, food productivity and security and shelter, among many other benefits. At the level of enterprises, research can bring about product innovations, product improvement, enhanced service efficiency, effectiveness and improved performance in the market place.

Despite such benefits of research activity to a nation's development as well as to public efforts to establish a number of R&D institutions, most of existing research activities in the country are those that are carried out in isolation, with most of them failing to address national priority areas and, as such, still following the priorities that were set by COSTECH back in 1998(COSTECH Report, 1998). It should be noted that research areas as are often formulated in isolation from priorities of different sectoral ministries and hence fail to address the national development concerns. Similarly, at UDSM, research agendas were developed by faculties in 2004 with a view to coming up with a multi-disciplinary research approach at a University level 2005–2010 (UDSM Draft Research Agenda, 2006)so as to enable researchers to address prioritized societal problems. Although an ultimate Research Agenda formulation was completed, the same could not be implemented for no clear reason, although this coincided with change in university management and university restructuring.

The research portfolio of UDSM has grown exponentially following the establishment of new Colleges and Schools since 2007.This requires re-formulation of the Research Agenda that would help to redirect research focus and performance within a clear University framework as well as within national priorities. In this regard, this research agenda will act as a management-guiding tool to ensure selection and articulation of identified research needs and priorities in order to enable the University make informed management choices and decisions in terms of allocation of resources that would produce the results desired by stakeholders. This research agenda is also aimed at formation of research teams that could be funded centrally in pursuit of nationally identified solutions.

The formulation of this Research Agenda is therefore closely linked to the Tanzanian Development Vision 2025 (URT, 2000); National Strategies for Growth and Reduction of Poverty - NSRGP - MKUKUTA(URT, 2005); Zanzibar Strategy for Growth and Reduction of Poverty-ZSGRP-MKUZA (RGZ, 2007); Draft National Research Agenda (COSTECH, 2014); the University's Corporate Strategic Plan 2014-2023 (UDSM, 2015a) which seeks to operationalize the University's Vision 2061 (UDSM, 2014); the University's Five-Year Strategic Plan, 2014/15 to 2018/19 (UDSM, 2015b), UDSM Research Policy and Operational Procedures(UDSM, 2008) and theTanzanian Government's Long-Term Perspective Plan(LTPP) 2011/12–2025/26 (URT, 2012). Also, the research agenda is aligned with regional and global development directions includingthe new 2030 agenda for Sustainable

Development Goals (SDGs) of the United Nations (UN, 2015) which are aimed at shaping development goals and objectives of individual societies and international community in general.

1.2 Rationale for Research Agenda

The national development needs ought to be harmonized and prioritized at societal level so that national research teams at higher-learning and R&D institutions, such as UDSM, are formed and funded centrally for an efficient and effective pursuit of nationally perceived solutions. Most research activities at UDSM and in the country as a whole are apparently driven by research programmes funded from a diversity of sources, external or local, and, as such, they do not necessarily or adequately address the country's development agenda. .

Funding is one of the critical conditions for successful and effective research activities. However, some of research undertakings are highly costly requiring heavy investment for longer time periods before their impacts can be felt or appreciated by the society. In order to be able to address issues of national priority, allocation of adequate funds for research from internal sources is extremely important. At the moment, and indeed for a long time, research funding available at the national level amounts only to about 0.24% of GDP. This is even much lower than the 1% of GDP proposed in the 1996 National Science and Technology policy and for SADC countries (COSTECH, 2005; NEPAD, 2010). This figure is far below those of South Africa and the United States of America, which are 0.81% and 2.76%, respectively (Osama, 2007). Thus, a funding level that is adequate for research is necessary in order to take on board and push forward national priority areas with equal vigour and consistency.

Currently, at the University there is an inadequate human resource capacity base in most fields in terms of both quality and quantity for effective participation in the national research activities. According to NEPAD (2010), the number of researchers in Tanzania in 2009 was 50 per million populations as compared to Kenya and South Africa which had 100 and 800 per million populations, respectively. Given such a low number of researchers in Tanzania, it will be difficult to acquire tangible research results aimed at creating a quantum leap in new products, processes and services. With a research agenda in place, it is possible to have collaboration in research that brings together a critical mass of experts that is unlikely to be found in a single individual (Burnett and Ewald, 1994). It should be noted that most of the societal problems require more than one skill to be able to realistically address societal challenges in a comprehensive manner (URT, 2012b).

It is also well known that a good and meaningful research undertaking in the natural sciences and engineering requires a considerable amount of infrastructure (laboratories, workshops, power supply) and capital outlay for equipment and materials. In a poor resourced country like Tanzania where local funding organizations are virtually few, research institutions must of necessity rely on what government and external donor organizations can provide. Under such conditions, collaboration in research within a well-stipulated research agenda is not only imperative and logical but also the only way in which institutional and personal ambitions can be fully expressed and fulfilled. This would in turn facilitate the establishment of research groups around the Research Agenda, which should form the nuclei of Research Centres of Excellence (RCE).

Furthermore, given the fact that human, infrastructure and financial resources at UDSM are inadequate to cover the whole range of the scientific enterprise, there is a need to prioritize research activities without jeopardizing the University's other core mission activities of teaching and provision of public services. Thus, with research agenda in place, it will be possible to facilitate researchers to address national issues that cover a lot of ground in terms of breadth and depth with the available or meagre funding provided. It should be noted that multi-disciplinary research is considered to be more efficient and speedier in delivering results and it covers a lot of breadth and depth. It is important also to note that most development partners prefer funding multi-disciplinary research rather than individual single-discipline-based research. Formulation of a national research agenda is therefore crucial in ensuring prioritized research of societal value. It is also crucial in and for forming of multi-disciplinary research teams that can be funded centrally in the pursuit of nationally perceived solutions.

3.0 RESEARCH AGENDA BY CLUSTERS

Chapter three summarises seven structured research needs and priorities that have been identified by researchers within the University that are likely to address societal challenges in a comprehensive manner. These clusters point out areas of relevance, priority and multi-disciplinary advantage for articulation towards future ‘targeted’ purposes in investigation and innovation. The outcome of research from these clusters will enable the university and the country at large to play its rightful role in the international arena.

3.1 Cluster 1: Science, Technology and Innovation (STI), ICT and Industrial Development

Science, technology and innovation (STI) play a vital role in sustainable development of any society. Experience indicates that no country has attained any breakthrough in its socio-economic development and growth without developing a minimum science, technology and innovation base. STI are powerful tools in combating poverty, through their contribution to increased productivity and competitiveness, sustained economic growth, and creation of employment opportunities (URT, 2012b).

The main goal of this cluster is to enhance contribution of STI to industrial development towards creating wealth and eradicating poverty by providing support towards related research in industrial production, agricultural production and agri-business. Among others the cluster will also deal with examining the interaction of technology, Micro, Small and Medium Enterprise (SMEs) development for the purpose of eradicating poverty in urban and rural areas (URT, 2003a, Kimambo, 2005).

For this case, the focus will however be on how to use improved technology including ICT to enhance productivity gains in SMEs for reduced poverty levels amongst the majority of the population (URT, 2003b). Issues related to indigenous technology, its improvement and use including entrepreneurship skills to enhance productivity and marketing will also be dealt with. Furthermore, research on emerging technologies such as ICT (security/cyber-crime etc), nanotechnologies, material sciences and bioinformatics as well as innovation will be carried out.

3.1.1 Research Areas

The research area themes are as detailed below:

- (i) Commercialization, enterprise development and marketing of agricultural, livestock and fisheries products;
- (ii) Technologies for improved food quality, quantity and storage and reducing postharvest losses;
- (iii) Natural products (pesticides, fertilizers etc.) that are environment-friendly;
- (iv) Creation of off-farm employment opportunities in rural areas;
- (v) Road infrastructure and other forms of communication;
- (vi) New and emerging technologies (ICT, nanotechnologies, material sciences, bioinformatics) and production processes in fields such as, industry, agriculture and agribusiness;
- (vii) Innovations, applications and commercial value-addition advantages; and

- (viii) Earth sciences (physical, chemical and biological processes) that shape the earth's surface and enable future predictions through modelling.

3.1.2 Key Players

Industrialists, engineers, scientists, veterinarians, agriculturists, technologists, lawyers, librarians, journalists and researchers from partner countries.

3.2 Cluster 2: Education, Agriculture, Food Security and Health

There exists a close and cyclic relationship between, educational underachievement and disease, just as a relationship in the positive exists between health, good life, educational attainment and wealth creation. Access to education should aim at all population segments of the society, including marginalized minorities to develop scientific innovative ways of food production and security need. With proper education, farmers will be able to add value to, and market their agricultural products, process and sell agricultural by-products. Farmers will thereby attain greater capacity for wealth creation. Similarly, application of education in agriculture has the potential to increase food production through improved soil fertility and conservation, efficient irrigation and high yield crops with enhanced food value (WHO, 2015).

This will also be able to create a health society. Furthermore, education and research in medicines should assist the country to seek and assess safety and efficacy of newer anti-HIV, anti-malarial and anti-TB drugs as well as vaccines against such diseases.

The purpose of this cluster is therefore to transform people, through education and training and hence access to educational opportunity by individuals and fair distribution of educational opportunities to individuals and communities. The other priority is to transform agriculture, animal husbandry and fishing. Furthermore, this cluster will research on vaccine and medicine for communicable and non-communicable diseases that significantly affect developing countries (UN, 2015). Further to that, there will be need to assess the impact of care and support to patients of HIV/AIDS, Malaria and Tuberculosis; and access to antiretroviral drugs. Also, to assess traditional medicines, anti-malaria and anti-tuberculosis drugs, integrated management of HIV/AIDS and Tuberculosis, and voluntary counselling and testing for HIV (Kitua et al., 1999).

3.2.1 Research Areas

- (i) Educational access and equity;
- (ii) Health intervention / Health care promotion in schools;
- (iii) Modelling for development;
- (iv) Teacher professionalization, professional development and professional efficacy;
- (v) Tanzania Development Vision 2025 and school curricula;
- (vi) Education and training for (in anticipation of) a middle-level national economy;
- (vii) The United Nations SDG No. 4 and implications for higher education curricula for industrialization;
- (viii) Communicable and non-communicable diseases;
- (ix) Biomedical and product safety;
- (x) Increased productivity through technological optimisation in agriculture, livestock, fisheries and marine resources for food security;

- (xi) Food quality, safety and nutrition;
- (xii) Educational management, policy and planning;
- (xiii) The financing of education;
- (xiv) Educational information management systems; and
- (xv) User information seeking behaviour patterns.

3.2.2 Key Players

Key players in this cluster will be educationists, health specialists, agriculturist, librarians, journalists, mathematicians, industrialists, sociologists, medical doctors and scientists.

3.3 Cluster 3: Governance, Industrial Policy and Cleaner Production

Governance is about relations in society; it is about setting rules and regulations for governing society and its environment. Of interest is the interaction that goes on between and among (i) governing actors and those that are governed and (ii) enhancing a productively yet democratically equitable dialogue between the state, market and the community. It is about understanding how problems are solved and opportunities are created, setting-up legitimate institutions and setting standards (norms, values and principles) of how production, processing and distribution of commodities is to be conducted and how environmental and industrial issues are managed. These involve how institutions operate; decisions are arrived at and executed. In this case, for sustainable development, there must exist a healthy and mutually supportive relation between governance, industrial development, as well as profitable exploitation and yet considerate supervision and conservation of the environment (URT, 1997).

The purpose of this cluster is to research on the interactive relationships that exists between the exploitation of the environment and industrial development that ends in positive effects rather than negative impacts on the mankind. Industrial production has to happen without degrading the environment and this necessitates careful planning and policy formulation and implementation.

3.3.1 Research Areas

- (i) Effects of reforms on the built-environment;
- (ii) Mining and conservation;
- (iii) Land use, conservation of natural resources and governance;
- (iv) Value addition to natural resources through manufacturing capabilities;
- (v) Alternative energy sources;
- (vi) Geology and mineral resources;
- (vii) Geo-technical sciences; and
- (viii) Effects of policies, legislation and regulations on conservation of natural resources and industrial development.

3.3.2 Key Players

Key players for this cluster will be administrators, engineers, technologists, industrialists, policy makers, lawyers, politicians, researchers, ecologists, environmentalist, geologists, scientists, conservationists, biotechnologists and architects.

3.4 Cluster 4: Gender, Professional Development, Policy Development and Policy Implementation

There is almost a direct relationship between gender, education, ICT and policy development, with *gender* correlated to *lower levels of educational attainment* and correlated in turn with *womenfolk* in terms of gender as opposed to men. Professional development that is aimed at self-sufficiency will necessarily have implications for a need to use various modes of content delivery, just as they will have imperatives for involving all the population segments in society, including the marginalised majorities (e.g. rural peasants, women and children) and the marginalised minorities (the handicapped, orphans, small ethnic and other vulnerable groups). Since the majority of people in Tanzania live in villages that are widely scattered across the country, one of the most promising uses of ICT is in distance education (tele-education system).

By use of satellite, broadband and wireless connectivity, it is possible to provide quality training to many people who cannot be reached at the present time and, in the foreseeable future, by land-based communications. Such technologies and approaches make it possible for rural communities to enjoy comparable educational opportunities and amenities as communities living in urban settings (Kallam, 2004).

The purpose of this cluster is to enhance research in the aspects of good governance, policy development and implementation of gender-related policies with regard to access to education, information, opportunities and equity.

3.4.1 Research Areas

Research areas under this cluster will focus on:

- (i) Gender inequality and promotion of gender equality;
- (ii) Empowerment of women and minority;
- (iii) Gender equity in access to educational opportunity;
- (iv) Gender mainstreaming policies and practice in education;
- (v) Educational transformation and school renewal;
- (vi) Professional education and service;
- (vii) Basic and continuing education and industrialisation;
- (viii) Education and self-employment;
- (ix) Effective use of un-utilized ICT capacity and infrastructure (Distance learning, Tele-medicine, e-health, e-learning), learning management systems;
- (x) Application of ICT in education, governance, agriculture, manufacturing, tourism and banking; and
- (xi) University-community engagement (UCE).

3.4.2 Key Players

Key players for this cluster will include educationists, scientists, social scientists, community, policy makers, technologists, development partners, entrepreneurs, students, researchers, librarians, journalists and lawyers.

3.5 Cluster 5: History, Culture, Language, Heritage and Sustainable Tourism

A nation's identity is well expressed in its history, culture and language. And these in themselves are an important heritage that serves as a key resource in tourism. These, in turn, require deliberate academic and research efforts for their advancement. For Tanzania and other parts of Africa, Kiswahili has been used as a medium of communication for nation-building and unity. Kiswahili has been an influential tool for change from pre-colonial, colonial and postcolonial periods serving various tasks such as liberating colonized countries to eradicating illiteracy. Kiswahili remains to be a much needed language in many aspects including fostering regional integration and tourism.

Tanzania has a great potential in using its cultural heritage and natural resources through tourism to tap both local and global leisure markets. The country's competitive strengths in tourism lie in the abundant and diverse wildlife, spectacular landscape, scenery, an unspoiled environment, friendly people and the existence of other economic sectors that have the potential to support the tourist sector. Tanzania is among top ten countries that have abundant natural resources (WEF, 2017), with economic contribution of tourism estimated to be 18% of GDP. However, this economic contribution could be elevated by using innovative and contextually based management approaches and appropriate policies. In relation to tourism, leisure and creative art are important elements in satisfying the leisure needs of local communities and tourists towards enhancing their quality of life. This can be done through tapping the cultural heritage and natural resources for tourism and entertainment. However, there is a need to maintain and use these resources properly so that they do not get degraded.

Cultural heritage is yet another area that compliments the growth of national tourism. However, tourism and cultural heritage industry is inadequately diversified, under-commercialized and there is limited participation of local owned enterprises in the top notch tourism market. Moreover, inappropriate management of the resources might lead into unsustainable economic, social, and cultural consequences.

In order to capitalize on natural and cultural for leisure and tourism in a country where industrialization is given utmost importance, this cluster focuses on research informing practitioners and policy makers on means of enhancing leisure and tourism for both domestic and international consumers. The purpose of this cluster is therefore to enhance the use of cultural heritage, and tourism resources sustainably through research that will inform management and policy. Therefore, the following research areas are proposed:

3.5.1 Research Areas

Research areas under this cluster will focus on:

- (i) History and cultural heritage, heritage promotion and tourism development;
- (ii) Sustainable tourism development and management;
- (iii) Accounting and taxation in tourism and creative arts;
- (iv) Preservation, coordination of heritage sites, restoration of historic buildings as well as archival materials;
- (v) Intangible cultural heritage and devise mechanisms for preservation;
- (vi) Indigenous knowledge and national advance (Socio-cultural and economic applications);
- (vii) Creative arts, performing arts and cultural tourism;

- (viii) The interaction of Kiswahili with other languages;
- (ix) Language and cultural identity and unity;
- (x) Language and literature development and ICT; and
- (xi) The role of the arts in industrial economy.

3.5.2 Key Players

Researchers, tour operators, artists, destination management organizers, researchers from partner countries, policy makers, conservationists, ecologists, architects and lawyers, educationists, archaeologists, linguistics, librarians, journalists and sociologists.

3.6 Cluster 6: Natural Resources, Environment and Technology

One of the reasons for the dismal economic performance of many developing countries in Africa including Tanzania-notwithstanding their endowment with many natural resources-is their inability to exploit and use technology to harness their resources for the benefit of an improved livelihood of their people as well as enhancing their regional and international competitiveness (EAC, 2011a; EAC, 2011b; SADC, 2011).

On the other hand, sustainability requires balancing of the use of natural resources to meet the changing human needs while ensuring the long productive potential of these resources and conservation of environmental functions. Society depends significantly on the natural resources for the basic needs and livelihoods. It should be noted that climate change poses hazardous effect on the ecosystems structure, function and productivity. Absence of a health ecosystem leads to vulnerability to community wellbeing, water availability, sustainable agriculture, health, and biodiversity (UN, 2015). In addition to that, human activities and natural processes affect ecosystem components, structure and functioning and national development.

Degradation of environment is accentuated by limited incentives for sustainable management, limited alternative livelihoods and unsustainable land management practices; and as a result it continues to propagate poverty vicious cycle. Research in sustainable uses of natural resources is crucial with growing pressure in the changing climate, urbanization and population increase.

The purpose of this cluster is to address issues concerning exploitation of natural resources sustainably, reduction of waste production, increasing efficiencies and access in the uses of energy, water, other natural resources, and adopting climate smart strategies. This would eventually lead to economic growth for the wider community as well as ensuring a clean, healthy and sustainable environment.

3.6.1 Research Areas

Research areas under this cluster will focus on:

- (i) Natural products, science and technology;
- (ii) Climate change and eco-systems;
- (iii) Challenges in the forest sub-sector (Deforestation, degradation and unsustainable practices);

- (iv) Biodiversity conservation, plantation forestry, agro-forestry and woodlots technology, forest utilisation and socio-economic and forestry management;
- (v) Solar energy and technology;
- (vi) Sustainable livelihoods;
- (vii) Climate change and environmental impacts;
- (viii) Climate change and environmental adaptation and resilience;
- (ix) Environmental engineering and production patterns;
- (x) Pollution (Traffic, ocean, lakes, rivers air) and development; and
- (xi) Biotechnology in waste management and ecological maintenance.

3.6.2 Key Players

Conservationists, ecologists, scientists, destination management organisations, researchers, policy makers, engineers, industrialists, media and lawyers.

3.7 Cluster 7: Law and Integrated National Development

The field of law plays a vital role in the development of our society. The basis of law is the practice, norms, cultural and practice in the society. As the society and other emerging fields grow, so do different principles of regulating such growth emerge, developing to regulations and laws governing that society (ILC, 1975). It is evident; therefore that law and development go hand in hand. On the other hand, the field of law is essential in the development of the society as legal principles will shape the direction to which the societies will grow.

Law is vital in the development of every discipline. Even though law is invoked and utilised in the social science context of other disciplines, without these disciplines there is no law development (Davis and Trebilcock, 2008). The two are interdependent. It is the case that research in law is also research into the application of other disciplines. Law touches on many disciplines by providing a guiding and regulatory framework and is a backbone of other disciplines such as human rights and economic activities. This broadens the aspect of research as far as the field of law is concerned involving several thematic areas (Matsuura, 2005). However, there are major themes that will always take the front line in this field as they touch upon fundamental principles of life, humanity and development such as basic human rights and duties as enshrined in the Tanzanian Constitution (URT, 1977).

The purpose of this cluster is to stimulate studies that would activate legal issues and enhance legal solutions to different areas of application of the law and other disciplines. Through this, the researchers will be able to enhance good governance, promote human rights, advance technology and promote integrated national development of various aspects of the law and other disciplines.

3.7.1 Research Areas

- (i) Human rights and good governance (Labour law, gender, child protection, accountability, corruption and integrity, local government, international criminal law and transitional justice);
- (ii) Law in development (e.g. Mining and oil and gas laws, maritime law)
- (iii) Constitutional and public law;
- (iv) Intellectual property rights (IPR);

- (v) Regional integration;
- (vi) Land, environmental and natural resources laws;
- (vii) Information and communication technology and the law (e.g. Cybercrime, electronic evidence, telecommunications);
- (viii) Commercial and business transaction laws (e.g. Finance, international trade, taxation, consumer protection); and
- (ix) Refugee, forced migration and humanitarian law.

3.7.2 Key Players

Lawyers, policy makers, activists, industrialists, administrators, economists, technologists, researchers from partner countries, legislators, librarians, sociologists and journalists.

4.0 GENERAL GUIDELINES ON RESEARCH APPROACH

4.1 Background

Everyone subscribes to the idea that research – as clearly opposed to a mere “search” – is a process of scientific (scholarly) investigation or enquiry into a matter: a process involved in the search for understanding of society and its varied manifestations as well as a process involved in the construction of new knowledge or enrichment of prevailing knowledge. Instrumentally, *research* is the application to any situation – social or laboratory - of methods and procedures for the purpose of solving a problem, testing of a hypothesis, discovering of new phenomena or new relations among phenomena. This is basically true, regardless of whether the issues at stake are in what is called ‘the social sciences’ field or in what is referred to as ‘the physical sciences’. There are the four principal components that characterise dynamics of a research process namely:

- (a) Theories - inter-related explanations of how different aspects of society or a social situation, community, etc. work;
- (b) Hypotheses - propositions about society which, for their uncertainty, are in need of testing, proof or verification (otherwise ‘research questions’, particularly in *qualitative* study approaches);
- (c) Need for data - for observations - *from* or *of* the social world, i.e. of the social reality (that could result from hypothesis testing); a need that would have to be followed by:
 - (i) Selection
 - (ii) Adoption of data gathering methods; these being procedures involved both in collecting needed data and in developing/refining theories; and
- (d) Empirical generalisations – statements made on the basis of recurring regularities in our observations.

The process is illustrated by the diagram below (Figure 4.1), which demonstrates the inter-linkage of these elements. There will certainly be greater orientation towards one element or the other, depending on whether the thrust is towards original/basic research or towards applied research.

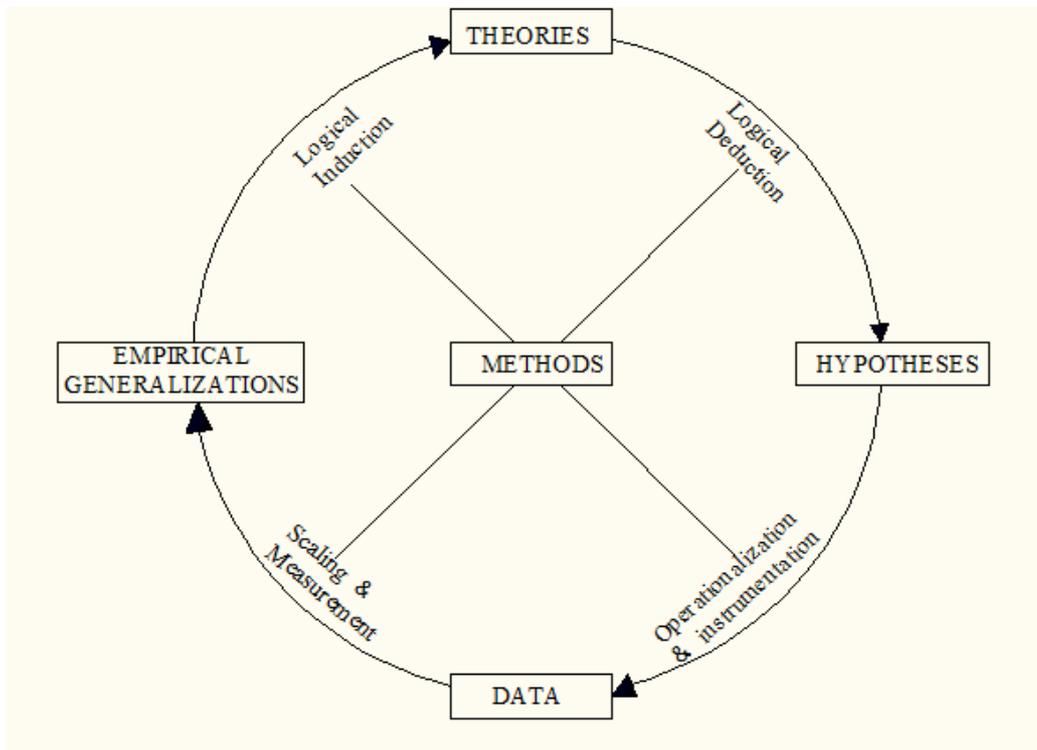


Fig. 4.1: Inter-linkage of major elements in research

Source: V. Pons (1992: xviii); adapted from Walter L. Wallace (1969: p. ix). ‘Data’ in Pons substitutes ‘Observations’ in Wallace. Essentially, both mean the same thing.

4.2 Inter-disciplinary/Cross-disciplinarity

It is now well-known and acknowledged that a research effort that pursues data or results from the context of viewpoints from many disciplines is much better and is apt to accrue many advantages than an effort that seeks such knowledge from only one disciplinary context. Two or more disciplines working together are more likely to offer more, wider, complementary and more interpretive perspectives than only one discipline.

To the extent of this possibility and advantage, researchers are better-advised to work in research milieus that offer possibilities of inter-disciplinary and/or cross-disciplinary approaches to issues at stake. Disciplines, if unchecked in their pursuit of specialisation, can be oblivious to the whole and easily go astray in their quest for comprehensive viewpoint and prediction of outcomes. UDSM is out to have both its teaching function and the wider society in Tanzania benefit from the effects and impact of multi-disciplinary research.

4.3 Field Research Approach

4.3.1 Data Collection Methods

The choice of data collecting methods to use is wide, but the particular combination of methods or tactics within methods will very much depend on the original orientation or general approach. These will, in turn, revolve around whether the kind of investigation is within the natural-science discipline or the social-science discipline. The following methods of research (elsewhere best described as data-collection or data-gathering methods or techniques) are presented not so much for the researcher to adopt all of them as for the researcher to appreciate the variety that there is. It is understood that the researcher would select one or a combination of several of the methods presented in order to meet his or her needs for the appropriate data (i.e. data that will provide answers to the original research questions). Categories of research approaches and specific research methods or data-collection techniques are summarised below. They provide a wide choice of approaches, methods and techniques for the intending researcher to choose from.

(a) Survey Methods

These are quite several, used, as the list indicates, largely in social contexts involving collectivities of human interacters, groups or categories of human beings.

- (i) Exploratory survey: which might be a longitudinal survey or a cross-sectional survey;
- (ii) Observation: which might be participant observation or Non-participant observation;
- (iii) Structured observation *or* Non-structured observation;
- (iv) Interview: standardised *or* un standardised; structured *or* unstructured; and
- (v) Documentation: Archival *or* library.

Research instruments or tools used in such methods are many and varied, e.g. observation schedule in the case of an observation method or technique, interview schedule (interview), questionnaire (survey interview), or some combination of or refinements from the above-mentioned instruments.

(b) Experimental Methods

Experimental methods involve measuring or testing in one form or another, anticipating results, responses or behaviour patterns that may be cross-compared as a result of differential treatment of two or more variables on some condition. Thus, experimentation – whether in laboratory or in the field conditions – involves an *experimental* group (which is *subjected to conditions hypothesised* to have a relationship - causal or co-relational - with the properties of the group) *and* a *control* group (which is *treated in the normal conditions*) so as to compare the effects of or on both groups and to draw conclusions accordingly.

While experimentation is a most common method of investigation in the natural or physical sciences, say in chemistry, physics, biology, etc., it is rarely used in the social sciences in its basic form, where unpredictable reactions, motivations, responses and other dynamics especially among human beings, cannot be predicted or guaranteed to yield to externally imposed treatments and manipulation as would be conducted on physical objects. Furthermore if not properly controlled experimentation can lead to adverse effects to different kinds of the population. Therefore the methods and results must be subjected to falsification.

(c) Case Study Methods

A case study is, by definition, a qualitative research approach that excels in situations of a complex or tantalizing issue in need of multiple forms of enquiry and often with multi-disciplinary insights in order to arrive at a fairly deep understanding of its nature or its relationships. Such an approach helps also to extend experience or add strength to what is already known, or else verify what has previously not been ascertained. A case study research method has been otherwise defined as: An empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and when multiple sources of evidence are used (Yin,2014).

Ordinarily, a case study will involve an *intensive use of multiple methods* and strategies in order to generate information on a particular contemporary phenomenon or issue in its real-life context, using multiple sources of evidence. – E.g. observation, interview with different sets of subjects, experimentation, documentary review, etc. It is hoped that the results of the research – any research - conducted through one or a combination of the methods enumerated above will meet the indicators of a scientific study, namely:

- (i) Systematisation [systematic procedure];
- (ii) Empiricism (achievable through use of any or a combination of five human senses, namely sight, smell, taste, touch and hearing);
- (iii) Objectivity;
- (iv) Validity; and
- (v) Reliability

4.3.2 Research Report Writing

The ultimate purpose of the research is to prepare a report on the basis of which some action (social action or other measure) could be taken. What does the report structure look like? The following is an indicative listing of what are considered to be important components of a research report.

1.0 INTRODUCTION

- 1.1 Background (to the problem)
- 1.2 Statements of Research Problem
- 1.3 Purpose of the Study (and Specific Objectives)
- 1.4 Significance of the Study

2.0 METHODOLOGY

Encompassing the following:

- 2.1 Area of study selected (and why)
- 2.2 Study population
- 2.3 Sample selected, sampling frame and sampling approach and techniques
- 2.4 Data gathering methods, *with* each of the selected methods indicating:
 - 2.4.1 The rationale (i.e. why it was selected/used);
 - 2.4.2 The specific question it was designed to ask;

- 2.4.3 Exactly how it was used;
- 2.4.4 Comments on difficulties experienced, especially those that might have affected the results; and
- 2.4.5 The data obtained.

3.0 ANALYSIS/RESULTS/INTERPRETATION

4.0 CONCLUSIONS/IMPLICATIONS/RECOMMENDATIONS

4.4 Modes of Collaboration

The nature and mode of collaboration for interdisciplinary research are dictated by the nature of the research problem to be tackled. But, essentially, the new levels of collaboration being suggested refer to greater initiatives towards inter-college or inter-campus, inter-faculty and inter-departmental consultations on research issues and questions where results could yield greater dividends in terms of impact on social policy and on society. This might even involve inter-faculty seminars and for an arranged seminars for discussion of different facets of a problem in need of wider and deeper investigation.

Maximisation of collaborative multi-disciplinary research possibilities could also result from active exchange of research priorities and themes generated from faculties and schools across colleges and trading such priorities and themes with sister colleges, the purpose being possibilities of raising researcher interests for collaborative work. Towards this goal, information on departmental and faculty/school research seminars should be publicised more than has been the practice in the past.

4.5 Funding of the Research

The University has invested extra efforts to soliciting funds from development partners such as Sida (Sweden), NORAD (Norway), DANIDA (Denmark), Governments of the UK, Germany, Switzerland, Ireland and the World Bank for rehabilitation of old infrastructure and construction of new ones to cater for unmet needs. Some of the examples of donor-assisted research agenda include environment and climate change (CCIAM, BSU, SIDA), growth and employment (BSU) and '*Kilimo Kwanza*' (COSTECH).

5.0 GENERAL GUIDELINES ON RESEARCH ETHICS

Guidelines on research ethics are aimed at promoting awareness of ethical principles and issues in the conduct of research activities at the University of Dar es Salaam (UDSM, 2008). The guidelines apply to all members of staff, graduate and undergraduates students who are involved in research in one way or another. In addition, any person who is not affiliated with UDSM and who wishes to conduct research in collaboration with UDSM students and/or staff is bound by the same ethics guidelines as indicated below.

5.1 Intellectual Property Rights

It is recommended that local researchers involved in collaborative research with external researches should draw contract agreements detailing:

- (a) How intellectual property matters shall be dealt with,
- (b) Anticipated benefits and risks that may have to be shared
- (c) Contribution of each researcher
- (d) How benefits and risks shall be shared between researches, sponsors and society
- (e) The methods of dissemination of research results including publication

5.2 The Duty of Honesty and Integrity

Researchers are expected to maintain highest standards of honesty and integrity. Any form of academic dishonesty, including but not limited to the following shall be treated as a serious offence:

- (a) Falsification of data: This is an act of manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not adequately represented in the research record;
- (b) Plagiarism: This refers to the appropriation of another person's ideas, processes, results, or words without giving appropriate credit;
- (c) Fabrication of data: cooking of data;
- (d) Non-declaration of conflict of interest;
- (e) Any other form of dishonesty in research that lands the University into disrepute.

5.3 Environment

All research shall be conducted in a manner that it does not result in a environment that does not harm the environment. The environment must be protected, for the benefit of present and future generations. Pollution and ecological degradation must be avoided in order to:

- (a) Promote conservation;
- (b) Secure an ecological sustainable development and use of natural resources while promoting justifiable economic and social development.

5.4 Materials Transfer Agreement

All research protocols must clearly indicate how specimens and samples will be handled. Materials and/or specimens may be transferred outside the University under special agreement. Reasons for transferring the materials and specimens must be detailed in the

protocol and agreed between the participating institutions. No materials and specimens shall be transferred out of UDSM without approval and clearance by the UDSM authority and in conformity with the laws of the land.

5.5 Confidentiality

Researchers are obliged to keep sensitive data sets confidential before publication. When the research results are in the public domain, the data should be available to other researchers and interested parties. In no way do the requirements for data availability override the right to confidentiality and privacy of individuals who are the subjects of research.

5.6 Capacity Building

Whenever possible, proposal writing should incorporate an aspect of mentoring and capacity building for younger team members. Strategies for capacity building should be developed to include:

- (a) Early involvement of the study community or industrial partner in the design, development and implementation process;
- (b) Scientific exchange, knowledge and skills transfer;
- (c) Support for development of local ethical review capacity;
- (d) Support for education, information technology; and
- (e) Support for consensus building.

5.7 Bio-hazards

All persons working in research laboratories must be protected from possible harm resulting from exposure to hazardous biological or chemical materials. Research personnel must be appropriately trained to work with hazardous biological or chemical materials and must be supplied with proper working gear.

5.8 Animal Rights

During animal experimentation, care must be exercised to ensure as much as possible that the animal is free from pain, stress, discomfort, suffering or permanent damage (URT, 2001).

5.9 Acknowledging University Support

University support for research must be acknowledged in any publication emanating from research funds and general facilitation granted from the University.

5.10 Citation and Acknowledgement

Proper citation of sources must be indicated.

5.11 Consent

Researchers must make sure that participants understand and thereby agree to take part in the research voluntarily without any element of coercion, inducement or pressure. In the process, the informed consent of the prospective research subject must be obtained.

6.0 GENERAL EXPECTATIONS

What kind of expectations does a new agenda for research, as proposed in this document, can be realistically be upheld for the University of Dar es Salaam and for the Tanzanian society as a whole? Surely the proposed research agenda – and the proposed platforms and disciplinary clusters - create a number of expectations. They are summarised below:

6.1 Renewed Hopes for the Results of Research Work

For developing countries, much as is for developed ones, the question as to whether research can serve as a vehicle to generation of knowledge, insights and skills in the process of national development is really no longer an issue in doubt. To-day, many governments, officials in the various state bureaucracies have already accepted the potency of research in the development pathways of any nation – not only in terms of scientific explorations and inventions out of the raw material the nation is endowed with in its land, population and space, but also in terms of a critical and creative world-outlook and social change created amongst the population. While it took very long among nations, especially those in Africa, to realise and accept that information is power, the fact now is accepted as a *sine qua non* of development wherever it occurs.

There are lots of advantages that accrue from research. One clear advantage is the power and authority that go with well-documented and well-stored research results – in form of a copyrighted journal article or research bulletin, a book or, indeed a patented production or invention. The lowest common denominator among these is their value as intellectual assets for development and change in a society.

6.2 Direct Contributions to Society

Research-based insights and outcomes increase the reliability of decision-making and policy options for action, whether this is in innovation and introduction of a new idea, in renovation and remedy of an existing situation or in reform of a pre-existing policy pattern. Research that relies on multi-disciplinary insights and collaboration stands a much bigger chance of resulting in more reliable and more valid results which, in turn, give decision-makers and policy makers a much wider basis for selection or even prioritising options for action for the future. So, multidisciplinary research efforts, networks and collaboration are never in vain.

Much of the problem in the past, particularly in developing countries and especially in Africa, has been the mutual distrust between governments and researchers in academic institutions, not the least universities. Very luckily, this situation is steadily disappearing as more and more of those getting into the “corridors of power” are products of universities and of postgraduate research programmes of the university, this increasing the coalescence or mutuality of opinion on the potency of research for rationality of decision-making and policy options. With an increasing number of such products in public service arenas, appreciation for research and the need for research-based decision-making are changing the environment for the better. And luckily also, the ‘*Research Agenda*’, being a compilation of the collective sets of opinions of researchers within the University, is, as structured along major platforms and research-need clusters, pointing to areas of relevance, priority and multidisciplinary advantage for articulation towards future ‘targeted’ purposes in investigation and innovation. Governments and institutions in developed countries but now also in an increasing number of

developing nations in the world-such as India, Pakistan, Korea, Malaysia, Singapore and Hong Kong-cast their bait in the direction of optimum potential catch!

6.3 Scientificity of Policy and Practice

Closely related to the point above, is the reality that, because of the multi-disciplinarity of the research approach and of the research results, the scientificity of the conclusions and recommendations of research in any particular case is boosted. Along with this the predictability and/or anticipation of future possibilities is heightened. With this there is a possibility of pre-planning for future scenarios.

6.4 Optimal Sharing of Research Information

A multidisciplinary research process involves more than one researcher as either an investigator or as a beneficiary of research results. Therefore, at any given moment in a multidisciplinary research process, informational data accrue to more than one person, just as conclusions made from the research results emanate from more than one lone researcher. There is therefore sharing of information, which, by this very nature, cannot and will not be confined to individual personal or private custodianship. This is an advantage in itself, since multidisciplinary research is aimed at maximising usability of research results for optimal benefits to the client-community and to society at large.

6.5 Social Change

Here social change refers to an overall situation indicative of overall qualitative changes in socio-economic performance, cultural behaviour patterns and lifestyle that characterise a society's population as on a qualitatively higher plane, as compared to a previous state of affairs. Social change is, in no way, a rapid, easily quantifiable social process. But its effect or impact is identifiable. Research – more particularly of the kind of research approach being proposed here – is apt to provide dividends in social, economic, cultural and other terms of Tanzania's development. As has been demonstrated historically elsewhere, research can be vital in creating wealth for a nation.

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