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COLLEGE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

and

ROYAL INSTITUTE OF TECHNOLOGY (KTH)
SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGIES

Project Title:
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

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Sida Open Call: Research Training Partnership Programme – Tanzania 2015-2020
Summary

A number of policies and initiatives made by the government of Tanzania is an effort to improve the livelihood of its citizens by making Tanzania a middle income country by 2025. The higher learning institutions have subsequently responded by re-dressing their vision and objectives to support the government move through training and research. One of the attributes of the University of Dar es Salaam vision 2061 is to focus more on research and postgraduate training in order to provide high caliber human resource for other higher learning institutions and the industry to address societal challenges required to achieve the goal of becoming a middle income country.

One of the principle challenges to realize this vision of Tanzania is having reliable and affordable electrical power supply accessible to all for higher level of industrial investment and services. There are plans to (a) increase generation capacity to surpass demand (10 GW by 2025), and (b) to extend access to 60-70% in rural areas. However, the use traditional means to manage power network (i.e. monitoring and control) and its resources (only few intelligent meters and the SCADA system for the high voltage transmission network) makes delivery reliability poor. The expansion to the rural areas will pose an even greater challenge. Hence, the use of smart power grid is unavoidable. The iGRID research training programme intends to generate the necessary technical and scientific skills to ensure sustainable implementation of smart grid. iGRID plans to introduce taught PhD programmes focusing on society, innovation and entrepreneurship in iGRID aspects. The collaboration with the KTH ICT School will help to build capacity at the University of Dar es Salaam as detailed in the proposal. The iGRID project proposes to support 10 PhD students (8 taught PhD at UDSM and 2 sandwich), 4 staff for post doc training on PhD supervision and teaching PhD, 8 M.Sc. (taught M.Sc. at UDSM), remote training through video conferencing and emphasis on technology transfer from university to the society. The focus of the overall program is to integrate the knowledge triangle: education-research-innovation by the methodology and structures used in the proposal and interaction and integration to open innovation environments. Clearly sustainability after the project period can be achieved and institutional long term co-operation is enhanced via cotutelle agreement based double degree doctoral program.
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

Popular Science Description

The iGRID research training programme is intended to develop human technical and scientific capacity to facilitate implementation of automation of monitoring, evaluation, analysis, control and management of electrical power system (smart grid) in order to improve delivery efficiency and to optimize operational costs in the electrical power system in Tanzania. The triangulation of training, research and innovation emphasis in the iGRID research training programme is meant to make a difference in the manor that research students are being trained in Tanzanian institutions to generate a new breed that focuses on societal needs, relevance and in providing innovative solutions that invokes critical thinking. Smart grid realization has multiple dimensions that need to be addressed simultaneously to ensure success. It includes addressing communication challenges like choice of technologies and other related attributes, addressing security concerns since there will be data of individuals, businesses and companies, and to conduct studies on interfaces (like machine-to-machine interfaces) and facilities for monitoring, measuring and control of the grid and its facilities. Handling big data is an issue in smart grid that has to be addressed. It is perceived that internet-of-things (IoT) is vital in smart grid hence study on this areas forms an essential part of smart grid.

There are a number of isolated power grids that is an integral part of the Tanzanian electrical power system (referred to as micro grids). Their automation challenges differ from those of the national electrical power grid network. There are also localities without power to enable residents even to charge their mobile phones. They cannot be ignored in creation of better living environment and social inclusion for all. The human capacity development has clear focus on knowledge triangle integration: education-research-innovation and support for co-creation and co-innovation in form of challenge project driven education, doctoral training centers, and connection to OpenLab environments.
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

1. Introduction

This iGRID research training programme project is built along three basic pillars: innovation, research and education. All the three components will feature in this project encouraging entrepreneurs to develop sustainable innovative business opportunities in facilitating the use of ICT in the electrical power system by introducing intelligence at all levels of the system to ensure efficient and effective management of the electrical power system in Tanzania to provide conducive environment for business and services growth and comfort in households, and promote societal inclusiveness throughout the whole country. The iGRID project intends to address development of competent pool of researchers through incorporating Technology Transfer Alliance (TTA) training concept to all its PhD and M.Sc. candidates. This will also include introducing taught PhD programme in disciplines related to ICT aiming at developing innovation ability, applied research, entrepreneurship and business skills to increase the value of the PhD degree to students and the society in general. The approach intends to combine theory with applied practice, including ideas for helping to identify and develop innovative talents and acquire entrepreneurial skills at a doctoral level that can add a new dimension of relevance to graduate studies.

As one of the strategies to ensure that quality of post-graduates at UDSM is enhanced to similar levels as those in Swedish universities, a key factor emphasized by Sida in the call, both partners are committed to and will develop a joint double degree agreement and implement it this Sida cooperation.

1.1 Enabling Government Policies and Commitments

Tanzania has seen exclusive national development plans namely MKUKUTA [1], vision 2025 [2], and the 2010 five year development plan [3] aiming at improving the economy, living standards and livelihood of Tanzanians. Another initiative is the Big Results Now aiming at accelerating achievement of middle income status by 2025 and transition out of aid dependency by identifying and resolving constraints to results delivery in the Government’s priority areas that include energy [5]. Other applicable policies include the national energy policy [15] and the electricity act [16]. The drive to make Tanzania a middle income country clearly depends on having reliable, efficient and affordable electrical power supply for industries, services and households. This fact was acknowledged by Tanzania’s Growth and Poverty Reduction Strategy, MKUKUTA, setting it to be one of the preconditions for economic growth and social welfare. Furthermore, access to electricity will improve education and health services in the rural areas, provide conducive environment for small and medium scale industries and businesses to thrive, encourage expansion of services to underserved areas and communities and encourage value addition activities for agricultural products hence reducing migration to cities and towns in search for better life [7]. The government resolved to provide extensive access to electricity to both rural and urban communities from either national power grid or from isolated power sources from fossil fuel and renewable energy. The experienced economic growth and the expanding access to electrical power by Tanzanians has been increasing power demand forcing the government to take emergence measures of leasing power generation capacity. As a long term solution, the government started implementation of a Programme to increase sharply the electrical generation capacity using natural gas, coal, geo-thermal, water, heavy and jet fuel, solar and wind energy. Hence, the number of power sources will keep growing in different parts of the country with different capacities and types. As a conclusion more fine grained and

Fig. 1.1: Ratio of power sources in Tz
distributed integrated solutions are needed where electricity consumers can act also as electricity suppliers especially in remote community levels.

To facilitate rapid expansion of access to electricity, the government has established two entities to manage the installation of the electrical power network in Tanzania, namely Tanzania Electric Supply Company (TANESCO) dealing primarily with the urban areas, national grid and major generation sources and Rural Electric Agency (REA) which deals with supplying power to rural households and communities [17].

1.2 The Challenge for the Power System

The electrical power demand and power system has grown extensively in terms of sources, transmission and distribution, loads, and controls following the government’s drive to provide the majority of its citizens’ access to electricity and economical activities growth. However, the utility company still uses traditional power system management methods which are inefficient causing frequent power disruptions, long maintenance response period, costly and time consuming fault localization, etc. Therefore, the cost of electricity is high, which makes the cost of production processes and of products uncompetitive to imported products thereby killing local business (SMEs) growth [6]. The cost is also high because of high technical and non-technical losses. Therefore, there is need to use smart grid to introduce intelligence in the grid.

This research training project called iGRID is intended to improve reliability of services offered by the utility company by adding intelligence in the management of the entire electrical power system.

The University of Dar Es Salaam (UDSM) together with KTH – Royal Institute of Technology, Sweden plan to implement this iGRID research training programme. The University of Dar es Salaam has revisited its vision [4] and objectives following recommendations made in the Vice Chancellor’s visitation report that charted out the way forward for the next fifty years with emphasis on making the University a research and postgraduate institution. Hence, this iGRID research training programme is meant to enhance research activities and create new knowledge in line with the University’s vision of improving the quality of life and of creating economic growth in Tanzania and Africa.

1.3 The University and Project Objectives

Based on the visions set for Tanzania and in particular that of the University of Dar es Salaam, the specific objectives of the research training programme in relation to the mission of the university are:

- To support industries and community to solve their problems using knowledge and building on, skills and facilities at the University;
- To create new knowledge that focuses on national and local challenges while taking into consideration local context and going beyond the current state-of-the-art solutions and existing business models;
- To foster innovation that aims at producing job creators and generating new knowledge by systematically integrating the knowledge triangle (education-research-innovation) at all education levels; and
- To produce highly skilled manpower to provide futuristic leadership in addressing societal challenges by using the challenge driven TTA model and Doctoral Training Centre concepts.

The success of the iGRID project will ensure that the electrical power system is managed efficiently thus minimizing power cuts, improving power system overall efficiency and productivity hence optimizing energy costs by ensuring that there will be capable and competent researchers that can monitor, analyse and evaluate effectively iGRID issues and provide rational solutions.

Therefore, the following are the objectives for the iGRID research training programme project aiming at increasing efficiency in the management of electrical power system in Tanzania using ICT by introducing intelligence:
Objective 1: Explore research opportunities in different aspects of smart grid to address local power system challenges in order to increase societal inclusiveness.

Objective 2: Develop capacity through M.Sc. and PhD training in smart grid monitoring, management and control for the national and isolated grids and their integration for efficient and flexible energy supply system.

Objective 3: Identify potential products and services to support smart grid implementation in Tanzania in order to foster development of new business and entrepreneurs by using Openlab co-creation.

Objective 4: Review curriculum of existing programmes to accommodate innovation and entrepreneurship and develop taught PhD programme using the TTA model and Doctoral training centers and their interaction with OpenLab-type activities.

Objective 5: To provide input to policy makers towards setting Tanzania smart grid policy for societal development.

2. Background

2.1 The context of the Programme in Relation to the University Concept Paper
The iGRID research aims to address some of the remaining STI and R&D challenges given in the concept note namely:

- Inadequate access to safe and sustainable energy with low impact on environment and climate;
- Poor supportive environment for the SMEs; and
- Inadequate funding for research activities focusing on national priority themes.

The overall aim of the iGRID research training programme is to contribute to the attainment of the following objectives in UDSM University Concept Note:

- Theme No. 3 Energy sub-theme Nos 8-11
  8. Effective utilization of electrical power;
  9. Energy for rural development;
  10. Electrical power for rural and urban electrification; and
  11. Socio-economic, business, legal and regulatory aspects of energy.

- Theme No. 6 Entrepreneurship and Innovation sub-themes Nos 9-11
  9. Information and communication technology;
  10. Innovations in public sector governance for improved accountability; and
  11. Innovation diffusion and commercialisation of technology.

Under Objectives in 1.3 above, the proposed research training programme will focus on the following research theme(s) identified in the UDSM Concept Note: Energy theme 3 particularly Sub-theme 8-11: Entrepreneurship and Innovation theme 6, especially towards Sub-Theme 9-11.

2.2.1 Communications and Networks to Enable the Smart Grid

Communication and networking technologies are essential for the Smart Grid in order to access distributed sensor information and to communicate configurations and set-points to actuators. These are critical to enable automated and distributed energy generation and efficient bidirectional power flows [9]. Key tasks entail the integration, effective cooperation, and information interchange among the many interconnected elements of the electric power grid. Geographic distribution, scale, and heterogeneity become challenges that need to be addressed, in particular when realizing smartness in the energy distribution grid [10]. There is need to look for solutions to realize machine-to-machine (M2M)
communication with very high dependability and security standards, while satisfying real-time requirements posed by the targeted control application [11].

Therefore, the project plans to establish the communications needs and requirements specifications for smart Grid development in the context of the local conditions by studying the characteristics of the applications that will allow the Smart Grid to be realized in Tanzania. The existing and evolving communications systems that can best meet the needs of the Smart Grid for consumers and utilities in Tanzania and the region will be studied.

It is intended to reuse existing available technologies and infrastructures rather than to develop from scratch, hence forming a heterogeneous communication network in which varying communication properties need to be detected and managed. Major research effort is required to integrate these components, technologies, and protocols into a versatile communication solution that can support a wide variety of smart grid applications ranging from smart metering data collection and demand response to micro-grid management and interaction of medium-voltage substation control with low-voltage distribution grid management.

The study objective in communication is to identify communication requirements in various grid applications, analyse existing to develop communication network architectures and protocols as well as communication-centric data-management solutions meeting those requirements. The specific aspects to be studied include:

- Internet Connectivity: MAC Layer protocols, multiple access and traffic control of PLC and wireless technologies for smart grid, Low power link layer technologies (PLC and wireless);
- Electromagnetic emission quantification: channel configurations and emissions reduction;
- Resource management and cross-layer optimization for smart grid;
- Identifying different traffic model/trends/technologies for smart grid applications in Tanzania;
- Network and channel Capacity and planning, resource and service discovery;
- Communication protocols optimized for real-time information collection and control applications especially from the local Internet-of-Things to national cloud based systems;
- Data models and communication-aware data management solutions for Smart Metering and Smart Grids;
- Signal processing and coding techniques for energy related sensor information from perspective of Internet-of-Thing framework;
- Integrating wireless communication with power line technologies;
• PLC interconnection issues with other technology such as WiMax, Mobile Network, Very Small Aperture terminals, HSPDA Systems, TANESCO Fiber optics etc;
• Routing mechanisms in a multi-homed environment of Power line networks; and
• Investigate how PLC system can be used for services applications such as Automatic meter reading (AMR), Network grid management, home automation, improving power quality monitoring.

Research questions in communications and networks aspect of iGRID:

1. How can reliable and affordable internet connectivity be assured for effective operations of smart grid for the entire power network taking into account different technologies, protocols, controls and link power?
2. How can communication channels be configured to minimise electromagnetic emissions?
3. How can resources be managed efficiently and cross-layer optimisation be achieved for smart grid operation?
4. Which are the different traffic model/trends/technologies that are most appropriate for smart grid applications in Tanzania?
5. How can communication protocols be optimized for real-time information collection and control applications especially from the local Internet-of-Things to national cloud based systems?
6. Which data models and communication-aware data management solutions can be developed for Smart Metering and Smart Grids to improve performance of existing ones?
7. How can signal processing and coding techniques for energy related sensor information from perspective of Internet-of-Thing framework be innovated/adapted to suit local context applications in smart grids?
8. Which mechanisms can be used to integrate wireless communication with power line technologies to provide cost effective solution for smart grid communications?
9. Which are the PLC interconnection issues with other technology and how are they mitigated for use of PLC in smart grid?
10. How can PLC system be used for services applications such as Automatic Meter Reading (AMR), Network grid management, home automation, improving power quality monitoring?

2.2.2 Security

Smart Grid is composed of an interconnected power distribution network that streamlines transmission, distribution, monitoring, and control of electricity using an information network overlaying the traditional power grid.

Robust and secure communications and information management is essential to all aspects of the Smart Grid [14] since it includes collection of data from all endpoints such as automatic meter readers or smart meters and distribution automation devices; data aggregation and analysis; SCADA communications; substation networking; phasor measurement unit data, delivery, concentration, and analysis; cloud-based load aggregation, demand response and other managed services; enterprise and operations support systems such as outage management, etc. Security vulnerabilities are not tolerable since an attacker penetrating a network can gain access to control software and directly or indirectly destabilize the grid in a variety of ways [13].

There is need to reduce the risk of threats and vulnerabilities; detection to identify anomalous behavior and intrusions; response to initiate immediate actions to mitigate effects of an incident; and recovery to rapidly restore operations and services following an attack for the smart grid. The Smart
Grid is information-intensive calling for privacy considerations. The College of ICT in its ongoing curriculum review is developing M.Sc. programme in computer and network security because of its significance in Tanzania at present. We are also working to introduce Computer Emergency Response Team for the academia sector at the University following establishment of one at national level. The issues to be studied towards more autonomous system include:

- System securing: Tamper-resistant technologies, resilient Internet-of-Things and communication architectures, key management, authorization and access control;
- Managing: Security risk assessment, measurement and management;
- False data injection, detection and mitigation;
- Privacy preservation and inference; and
- Cyber and Cross-Domain (power to cyber) security event detection, analysis and response.

**Research questions on security aspects of iGRID:**

1. How can the smart grid system security be hardened using technologies, IoT, communication architecture, authorisation and access control techniques to guarantee data integrity, availability and privacy?
2. Which are the most appropriate schemes considering local context for assessing, measuring and managing security risks in smart grid operation?
3. Which innovations/adaptations can be introduced in detection and mitigation of fault data injection into the smart grid system?

### 2.2.3 Control

Building smart power grid requires developing/adapting/innovating control and operation architectures, algorithms, sensing, decision making, and actuating mechanisms to suit local context. Microgrids and distributed resources are to be included in the smart grid since they form part of the power system network in Tanzania.

The concepts and functionalities in microgrids and distribution systems have introduced new challenges to research communities to develop new architectures, control mechanisms, and operation systems. The issues that need to be studied include:

- Different scheduling and coordination algorithms controlling household appliances’ operations and the power system i.e. to develop and/or implement and evaluate to determine their efficiency against other ideas using a flexible simulation framework and facilitate local autonomous control;
- Microgrids and virtual power plants by looking at experiences of microgrids operating in grid-connected and islanded mode and mitigation of the variability of renewable supplies in the grid;
- Protection and faults in microgrids and distribution systems; and
- Control and management of microgrids and distribution systems.

**Research questions on control aspects of iGRID:**

1. What improvement can be made in scheduling and coordination algorithms to facilitate local autonomous control of household appliances and power systems?
2. Which are the microgrids operation experiences in grid-connected and islanded mode and the mitigation means for a variety of renewable supplies connected to the grid?
3. How can innovative control and operation architectures, algorithms, sensing, decision making, and actuating mechanisms be developed or adapted to suit local context operation of smart grid?
4. How can available protection and fault detection techniques be innovated or adapted for use in microgrids and distributed systems in smart grid applications?

2.2.4 Data Management

Big-data analytics are required to process data from numerous and spatially diffused phasor measurement units (PMUs) and/or smart-meters. Such analytics require communication, storage and computational systems that are suitable for speedy, secure and reliable processing. The issues to be studied are:

- Data management strategies: hierarchical strategies for wide-area monitoring and visualization, efficient data mining in connection to Internet-of-Things (IoT) framework;
- Analytics: "big data" issues, machine learning, real-time data analysis and decision making; and
- Application of data management and analytics to advanced metering infrastructure/smart meters and PMUs.

Research questions on big data aspects of iGRID:

1. How can IoT framework be used to realise hierarchical strategies for monitoring and visualisation over a wide area and in efficient data mining in smart grid?
2. How can one efficiently resolve database queries in massive amount of input data for real-time data analysis anticipated in smart grid operation?
3. How can the large scale machine learning problems anticipated in smart grid operation be solved?

2.2.5 Automatic Meter Reading/Smart Meters

Instruments that measure electrical usage (Wattmeters) have been a part of the electrical grid since its inception, with human meter readers and, later, digital wattmeters used to collect and to communicate customer usage data. By the 1990s, utility companies encouraged consumers to accept “smart” power meters that provide two-way communication via a newly installed network. These smart meters enabled demand-side management, enabling customers to choose their level of electrical service. In Tanzania electrical power system has five generations of power meters: electromagnetic, digital meters replacing functions of electromagnetic ones, pre-paid using swap card, pre-paid using token and of late for large consumers meters having communication link to the central server. There is need to investigate and develop solutions to smart metering/automatic meter reading issues and see how to add intelligence and communication to digital installed meters and study issues related to use of smart meters/automatic reading meters and integrate them in managing non-technical losses and power theft.

One such issue is to design a smart meter customized according to the local challenges and needs of Tanzania in collaboration with local companies. Tanzania uses both traditional and advanced meters. There is no unified system that manages the energy consumption at customer level. At the consumption level in homes and industries, there is need for advanced metering infrastructure (AMI) to enable the remote login capability to read and control basic functions within a building and home such as lighting and temperature control. A comprehensive study of Smart-meters with a bottom up approach is required in order to build a full-fledged Smart-grid eco-system in Tanzania.

Research questions on automatic meter reading/smart meters aspects of iGRID:

1. How can the proprietary pre-paid and post-paid electrical power meters be facilitated to enable remote monitoring and control by a remote server to minimise non-technical and revenue losses and introduce consumption control by consumer?
2.2.6 GIS Mapping of Sources, Transmission and Distribution Networks and Consumers

The overall objective shall be to develop an advanced power system information infrastructure and digital framework of the power system by using integrated Geographical Information Systems (GIS) and Information & Communication Technologies (ICT). GIS Applications in the power system are envisioned to facilitate planning, designing, development, management, operation and maintenance and future expansion. It shall also serve for real time monitoring, database creation, effective information exchange, service convergence and centralized management bringing operational effectiveness. This would enhance intelligence in the smart grid to improve working efficiency, make intelligent and sound informed management decision, and improve quality of the services to the public. This provides a more unique and holistic approach for the long term evolution of smart grid systems.

**Research questions on GIS aspect of IGRID:**
1. How can GIS be utilised to facilitate efficiency and effectiveness in the management functions of the electrical power grid?
2. How GIS mapping of the entire electrical power system including potential power sources can facilitate improved reliability in power supply and in responsiveness to consumers’ queries?

2.2.7 Micro-Grids and Local Power Generation

A micro-grid comprises a smaller generator coupled with a transmission line network serving a local cluster of customers. While this approach is not a new paradigm, when energy providers completely decentralize the electricity infrastructure (e.g., networks of micro-grids), the impact of a “grid” failure is highly localized. A micro-grid system is capable of isolating the damaged portion of the grid, while the balance of the entire power delivery infrastructure continues to operate independently. Networked microgrids address the damaged area by rerouting power until operators repair the damaged section. Electrification of significant numbers of local communities and towns are not connected to the national power grid but they are part of the electrical utility company. Hence, when improving management of the power system it has to include these numerous isolated power sources/sub-grids. The use of renewable energy is also on the increase worldwide and to some extent in Tanzania. The feed to national grid is not taking place at present but can happen in future, so there is need to prepare for that. There is also need to develop strategy for implementation of smart meters/automatic meter reading.

**Research question:**
1. How can one realise networked micro-grids control and management for a large number of isolated grids and sources to improve reliability of power supply in rural communities?
2. Which power storage techniques can be suitable for use in conjunction with renewable energy sources in remote and hostile environment in arid parts of Tanzania?

2.3 The Relevance of the Research Area and Demand of Expertise in the Chosen Field for the Country’s Development Challenges, Within the Public Sector as well as the Private and Within Civil Society Organizations

2.3.1 Electrical Power Supply Reliability and Adequacy

Availability and accessibility of adequate electricity infrastructure is necessary for ensuring continued economic development. With 1,521.85MW of installed capacity (TANESCO grid and off
grid) in 2012 of which 41% was from thermal (IPP), 4% thermal isolated (T), 17% thermal in the grid (T), 37% hydro (T) in the grid and 1% imported isolated. Planned capacity is 5,570 MW by 2016 and 10 GW by 2025 [8]. With untapped hydro power potential of 4.7 GW, Tanzania’s power sector is bound to be the largest in East Africa. Currently Tanzania faces significant electrical energy and peak shortages particularly when one or more of the major power sources or major power station develops a fault. TANESCO currently uses traditional methods to monitor and manage its network and most of its users. This makes localizing and attending faults take long time hence frustrating consumers and is expensive since physical inspection has to be done unless reported by consumers. Tanzania is witnessing a tremendous growth in demand of electricity and if the plan to move to middle economy succeeds then the demand growth will be even sharper. More sources will be involved. With the sharply increasing number of users (customers) of which 72% were households in 2009 (which will increase because of the current drive to provide electricity to all), and of power transmission and distribution network and that of power theft; the use of traditional means to manage the network can no longer be efficient and effective. In fact, the Global Competitiveness Report (2012-2013) by World Economic Forum ranked Tanzania 132nd out of 144 countries worldwide in quality of electricity supply scoring 1.9 out of 7.0. Therefore, automation of monitoring and control of the electrical power system is a necessity. The use of electrical smart grid that extends from generation to consumers is the prudent way forward. The challenge may be not within major cities but to provide reliable electrical power supply to rural areas.

2.3.2 Impact of Inefficient Monitoring and Control Systems

The charge rate for electricity in Tanzania is seen by most users from domestic to industrial use as being on the high side. This motivates consumers to cheat, colluding with dishonest employees denying utility company income to finance its operations. Significant major consumers and small and medium scale entrepreneurs do not pay correct bills which reflect their actual electrical power consumption forcing the utility company to unjustly raise their charging rates. This creates unfair competition against law abiding citizens whose production costs become comparatively higher reducing their profit margins. The technical/non-technical losses therefore will appear to be high.

The basic structure of the electrical power grid has remained unchanged for a hundred years. It has become increasingly clear, however, that the hierarchical, centrally-controlled grid of the twentieth century is ill-suited to the needs of the twenty-first century. A future grid, in which modern sensors, communication links, and computational power are used to improve efficiency, stability, and flexibility, has become known as the “smart grid.” Smart grid implementation is feasible since the hardware to enable smart grids are continuous being developed and improved which includes “smart” meters or automatic reading meters, systems and equipment status sensors and distributed wireless sensor networks and smart actuators. TANESCO has acquired and deployed a limited number of electronic electrical power meters of varying capabilities and only high voltage transmission network is monitored by SCADA.

2.3.3 Need for Smart Monitoring and Control Systems

Since power system (generation, consumers and network) is growing and will continue to grow at a large pace per year, with an increasing share in renewable energy, requires smarter systems than is the case at present to manage it efficiently and effectively and ensure its stability and reliability to all its customers. It is important not only to manage the generation but also the transmission, distribution and loads in an optimum and efficient manner.
This can only be achieved using smart grid.

2.3.4 Knowledge and Skills Gap

The introduction of electrical smart grid poses serious challenges because of knowledge and skills gap in the area. However, the University of Dar es Salaam has embraced itself to develop new knowledge frontiers and to strengthen research and postgraduate training wishes to narrow this gap. This will be done by creating expertise in the area through research, development and training using its established systems and Swedish expertise in this area. KTH has a good record in this regard.

Smart Grids involves the application of advanced electrical engineering and service technologies, facilitated by ICT and accompanying solutions to more effectively and efficiently manage complex infrastructure systems. It comprises of a broad and evolving range of advanced technologies that can be applied along the full electricity supply chain – from generator, through transmission, distribution and metering, to end users (e.g. commercial & domestic buildings). Together, these technologies, which include advanced sensors, two-way communications and distributed computing, can increase the deployment of variable renewable energy generation, enable dynamic demand/pricing response and energy storage, improve the overall efficiency, reliability and safety of power delivery improve energy end use efficiency and cost in buildings, facilities and electric transport.

Smart Grids typically use a layer of technology, including software, sensor hardware and control and interface systems, which can be embedded in either new infrastructure or applied to existing infrastructure, harnessing and applying real time data to create more intelligent, interconnected and integrated systems which provide higher quality and higher efficiency services to the citizen. This is what is called Internet-of-Things for smart grids. The use of smart grid in Tanzanian power system is expected to improve operational reliability, reduce resource usage and costs, improve environmental quality (including enabling lower carbon emissions), improve governance in the power sector and new enterprise and job creation opportunities are envisaged.

Implementation of electrical smart grid in Tanzania introduces new requirements and challenges since policy makers, management and technical and scientific staff were used to and had perfected in their own way using traditional methods to manage and control the electrical power system. Therefore, in general, there is need to develop in Tanzania a strong research and operational capacity in smart grid systems and its components in energy and community policies. Other areas include industrial research base in software, data management and wider ICT, and an advanced electrical system. Together these factors when optimally utilized can ensure that non-technical losses in the electrical utility company are minimized and charge rates are reasonable and rational optimizing production costs. Optimal energy costs will provide a potential for competitive advantage over other countries in the region. It will also remove unfair internal competition which is working against the law abiding citizens that are not cheating in their power bills. It is also possible that the acquired knowledge and skills may provide support environment to stimulate creation of indigenous enterprise in this sector.

2.4 The Approach Chosen to Build Capacity:

All students that will join the project will do their studies through taught courses at both M.Sc. and PhD levels; M.Sc. taking two years and PhD taking 3 years for local research students. Some of those that shall successfully complete their M.Sc. studies timely showing good research, development and innovation skills shall continue with their research work for PhD studies. Local taught PhD students will be allowed research visits to Sweden to interact with peers in the field and to refine their approaches. There will also be PhD sandwich students who shall spend half of their study period in Sweden. Interaction between different research students shall be facilitated to promote innovation. For this purposes both the TTA challenge project driven educational model at M.Sc. level and Doctoral Training Center model at PhD- level are chosen. In order to create the critical mass various projects and
TTA groups and DTC activities are planned to be co-located and connected as much as possible to OpenLab co-creation and co-innovation environment. The local research students will be required to publish regularly so that they remain at par in competences with the sandwich research students.

3. Benefits and Added Value for the Partnership between the University of Dar es Salaam and KTH (in the short and the long term).
   - There is strong research infrastructure, competence in the proposed research area, connection to relevant industry, a diverse pool of research students working in different research issues relevant to this research, strong willingness to collaborate at all levels, and vast experience to work with foreign students and countries in the part of KTH;
   - Building UDSM staff capacity in technology transfer through project-driven concept facilitated by TTA courses, and enhance local research activities by increasing access to technology related knowledge and resources;
   - Adapting new technologies in local context by ensuring that all research activities aim to solve local socio-economic challenges through scientific means. The related new technologies to be introduced will only be a tool in the research activities;
   - Introducing innovation and entrepreneurial skills through training at DTC: The technical research, the innovation & entrepreneurship trainings are expected at the same time to create business opportunities in different fields; and
   - KTH will create networks with different institutions, groups and organizations, assess challenges of deploying new technologies in different remote locations and related environment.

4. Plans and Expected Outcome of the Selected Research Training Area of Focus.

The research training programme is expected to affect both the capacity of the institution and the surrounding society in such a way that it creates a sustainable academic system for societal development. A time plan indicating the proposed activities is given in table 1.1.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Result</th>
<th>Expected Commencement</th>
<th>Expected finalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection of PhD candidates</td>
<td>Target PhD candidates</td>
<td>Mid 2015, 2016, 2017*</td>
<td>Late starting late 2015</td>
</tr>
<tr>
<td>Supervising of PhD Students</td>
<td>Qualified PhD holders</td>
<td>Early 2016</td>
<td>Early 2020</td>
</tr>
<tr>
<td>Conducting of Post-doc research</td>
<td>• Improved quality and relevance of PhD holders</td>
<td>Late 2015</td>
<td>Late 2018</td>
</tr>
<tr>
<td></td>
<td>• UDSM staff better positioned to participate in Doctoral training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review of target curricula</td>
<td>innovation and entrepreneurship introduced</td>
<td>Mid 2015</td>
<td>Mid 2016</td>
</tr>
</tbody>
</table>
| Developing taught PhD programme on areas related to iGRID | • Programme in place  
• Taught PhD students enrolled | Mid 2015  
Mid 2016, 2017, 2018 | • Mid 2016  
• Mid 2020 and beyond |
| MSc students: three cohorts annual intakes until 2018 | MSc graduates          | Sept 2016, 2017, 2018 | Sept 2018, 2019, 2020 |
| Dissemination of research outputs             | Publications in conferences, journals and workshops                     | Continuous process from mid 2016 | To continue beyond project lifetime |
5. Capacity Development Process:

5.1. Training

There are several training schemes in iGRID research programme specifically designed to meet the long-term sustainability of the programme beyond the project life time. Such approach is a road to build a long term strategic partnership on research based on a win-win situation of UDSM and KTH institutions and the long term commitment of its leadership. Initially, post graduate training programme is the target and the first steps is forming the Cotutelle-agreement (Cotutelle de thèse) between KTH and UDSM in the areas of work, programme definition, and execution of the programme. This is done for purposes of sustainability beyond the programme period and for stronger commitment between KTH and UDSM for the proposed programs. The format what is to be used; doctoral training centers will support this extremely well and tie together Stockholm and Dar es Salaam. The outcome of the approach is:

i. Cotutelle agreement;
ii. Joint programme; and
iii. Double doctorate degrees.

Based on such approach, each training scheme has a well-defined process and targets explained as follows:

A. MSc training

The MSc training program: M.Sc. under the iGRID project shall be taught mode with the research component using problem based approach. The approach aims at producing better researchers and that their work directly addresses challenges in realizing smart grid. Furthermore, it is intended to build
potential for sustainability, awaken innovative potential inherent in humans and enhance business (entrepreneurship) skills through participation in TTA programme, and learn applied research. The main instrument, in addition of relevant courses, is TTA challenge projects.

**Purpose, Rationale and Description of the Programme**

The programme aims at Capacity development through M.Sc. training in ICT with focus in smart grid monitoring, management and control for the national and isolated grids and their integration. The grounds for introducing the programme include:

- Use of smart grid in Tanzanian power network is inevitable considering the expansion of the network and capacity but there are no scientific and technical capacities to support its installation and operations;
- To build a bridging gap for proposed taught PhD training in the discipline; and
- There is no such programme being offered currently in Tanzania.

The programme intends to develop competent pool of experts through incorporating Technology Transfer Alliance (TTA) training concept to all its M.Sc. candidates by introducing training in ICT disciplines related iGRID while aiming to develop innovation ability, applied research, entrepreneurship and business skills. The approach intends to combine theory with applied practice, including ideas for helping to identify and develop innovative talents and acquire entrepreneurial skills at a M.Sc. level that can add a new dimension of relevance to graduate studies. Also, the approach creates environment for multidisciplinary working groups and inter-institutional involvement.

**Curriculum Development**

The curriculum development will follow the following stages: Conduct SWOT analysis and needs assessment, develop programme structure taking into account TCU and UDSM guidelines, obtain feedback from Swedish partners, benchmark with other universities, develop contents, obtain additional feedback from Swedish partners, organize internal stakeholders’ workshop, improve the document, organize joint internal and external stakeholders’ workshop, improve further the document, submit to College Board and other University organs for approval and lastly submit to TCU for accreditation.

**Teaching and supervision Capacity**

The College has been offering taught M.Sc. by research in Telecommunication Engineering, Health Informatics, Computer Science and in Electronics and IT. It has also been offering M.Sc. and PhD by research. There are 12 PhD holders in the Computer Science and Engineering Department and 11 PhD holders in the Electronics and Telecommunications Engineering Department. Hence, the College has the potential to teach and supervise students in the proposed programme. What will be required however from KTH is to introduce the project based training approach to our students based TTA concept.

**Quality Assurance**

Quality assurance will be achieved through various mechanisms namely: Students’ feedback, monitoring by Quality Assurance Bureau, staff involved in teaching and supervision having necessary skills and competences, external evaluation by expert in the discipline of examinations and dissertation, continuous pegging to KTH best practices and accreditation by TCU.

**Students Admission Criteria, Target Group, Sponsorship and Selection Process**

It is expected that 8 students in this programme will be supported by Sida through this project, the rest will be self-sponsored or receive sponsorship from government agencies or Utility Company or other sources. It is envisaged to look at ways to make this a regional programme when fully functional. Female candidates will be encouraged to apply for the programme and in the offer of Sida sponsorship gender equity will be taken into consideration.

The planned initial student capacity for this programme is 15 which is expected to grow with time as the programme existence is promoted and its demand grows.
The minimum admission and selection criteria for the programme shall be that stipulated in the UDSM postgraduate admission guidelines and additional criteria set in the programme curriculum to be developed.

The catchment area for the programme shall be from academia and industry.

**Time Frame**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum development</td>
<td></td>
<td>4 Sida</td>
<td>4 Sida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch 1</td>
<td></td>
<td>4 Sida</td>
<td>4 Sida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch 2</td>
<td></td>
<td>4 Sida</td>
<td>4 Sida</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Batch 3</td>
<td></td>
<td>0 Sida</td>
<td>0 Sida</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Batch 4</td>
<td></td>
<td></td>
<td></td>
<td>0 Sida</td>
<td>0 Sida</td>
<td>0 Sida</td>
</tr>
</tbody>
</table>

1. Curriculum development process and approval process will be done during the first year
2. The programme is for two years and the first intake (1st batch will be admitted in 2nd year
3. The number indicate only those who shall be sponsored by Sida.

**Sustainability**

The approach for this programme is intended to deviate from the traditional teaching approach that focused on academic excellence without direct connection to the problems in the industry/society. The programme is to integrate the knowledge triangle: education-research-innovation and also incorporate entrepreneurship skills, hence graduates will be able to produce solutions that can easily be turned into business opportunities and hence generate income for themselves, the College and the society. We thus envisage that such an approach will make the programme popular and attract more and more students to be able to sustain itself.

The power industry is growing very fast because of the rapid economic growth not only in Tanzania but also in the region. Therefore, the need for experts and expertise in automation of management and control of power systems will keep growing.

The human capacity developed in this project will ensure that there is continued appropriate training and training capacity to maintain the programme beyond project duration.

**B. PhD training**

One of the objectives of this research training programme is to develop scientific and technology skills and competences through high calibre research in persons that will be transferable to other Tanzanians through different means; as academic staff, provision of specialized professional services, and consultancy in the area and participating in smart grid implementation processes. The training will embed innovation and entrepreneurship skills, applied research and other key relevant courses. This will be facilitated by Doctoral training Centers and interaction and integration towards OpenLab environment and KTH. The TTA approach and the others above to be used in this research training creates environment for multidisciplinary working groups and inter-institutional involvement.

**Cotutelle KTH-UDSM Agreement (double degree PhD program)**

As one of the strategies to ensure that quality of PhD graduates at UDSM (particularly at CoICT) is enhanced to similar levels as those in Swedish universities, a key factor emphasized by Sida in the call, both partners are committed to and will develop a joint double degree agreement and implement it this Sida cooperation. iGRID project is committed to initiate the commitment since we are envisaging active cooperation between the partners.

**Purpose, Rationale and Description of the Programme**

The aim of this programme is Capacity development through PhD training in ICT with focus in smart grid with respect to operational and technical issues. The graduates are expected to study and identify
iGRID operational problems, constraints and challenges and develop scientific and technical intelligent solutions to solve them. The grounds for introducing this programme include:

- Use of smart grid in Tanzanian power system network is unavoidable because of the expansion of the power system network and its capacity while there are no scientific and technical capacities to support its installation and operations.
- Smart grid efficient and effective operation involves a wide range of ICT related disciplines hence the programme intends to create high calibre experts with intra-ICT disciplines capacity. Currently there is no programme having such characteristics in Tanzania.
- There is need to have high calibre staff with research and development competences in iGRID issues to ensure effectiveness and efficiency in smart grid operations in Tanzania and the region.

The programme intends to develop a competent pool of experts/researchers through incorporating Technology Transfer Alliance (TTA) training concept to all its taught PhD students by introducing PhD training in ICT disciplines related to iGRID while aiming at developing innovation ability, applied research, entrepreneurship and business skills. The approach intends to combine theory with applied practice, including ideas for helping to identify and develop innovative talents and acquire entrepreneurial skills at M.Sc. level that can add a new dimension of relevance to graduate studies.

**Curriculum Development**

The curriculum development will follow the following stages: Conduct SWOT analysis and needs assessment, develop programme structure taking into account TCU and UDSM guidelines and the developed M.Sc. programme in the discipline, obtain feedback from Swedish partners, benchmark with other universities, develop contents, obtain additional feedback from Swedish partners, organize internal stakeholders’ workshop, improve the document, organize joint internal and external stakeholders’ workshop, improve further the document, submit to College Board and other University organs for approval and lastly submit to TCU for accreditation.

**Teaching and supervision Capacity**

The College has been offering taught M.Sc. and by research in Telecommunication Engineering, Health Informatics, Computer Science, and in Electronics Engineering and IT. It has also been offering PhD by research. There are 12 PhD holders in Computer Science and Engineering Department and 11 PhD holders in Electronics and Telecommunications Engineering Department some of whom are professors who have experience in PhD supervision. Hence, the College has the potential to teach and supervise students in the proposed programme. KTH will train local staffs to make UDSM run project-driven courses independently, i.e. using the TTA training concept. In addition we wish KTH to support creating multi-disciplinary training capacity involving: technology, management, innovation process, etc targeting training of PhD students and supervisors with the different skills using Doctoral Training Centre. Furthermore, the College requires to enhance capacity in taught PhD training and in effective and efficient supervision of PhD students using the PostDoc training to ensure higher completion rate.

**Quality Assurance**

Quality assurance will be achieved through various mechanisms namely: Students’ feedback, monitoring by Quality Assurance Bureau, staff involved in teaching and supervision having necessary skills and competences, external evaluation by experts in the discipline of examinations and thesis, continuous pegging to KTH best practices and accreditation by TCU.

**Time Frame**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum development</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sandwich</td>
<td>2 Sida</td>
<td>2 Sida</td>
<td>2 Sida</td>
<td>2 Sida</td>
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</tr>
<tr>
<td>Batch I UDSM</td>
<td>8 Sida</td>
<td>8 Sida</td>
<td>8 Sida</td>
<td>8 Sida</td>
<td>8 Sida</td>
<td></td>
</tr>
</tbody>
</table>
1. Curriculum development process and approval process will be done during the first year.
2. The programme is for three years for UDSM taught PhD and the first intake (1st batch will be admitted in 2nd year)
3. The programme is for five years for sandwich PhD and the intake will be in 1st year
4. The number indicate only those who shall be sponsored by Sida.

**Students Admission Criteria, Target Group, Sponsorship and Selection Process**

It is expected that 2 sandwich and 8 local students in this programme will be supported by Sida through this research training programme, the rest will be self-sponsored or receive sponsorship from government agencies, the academia or Utility Company or other sources. It is envisaged to look at ways to make this a Pan-African University programme when fully operational. Female candidates will be encouraged to apply for the programme and in the offer of Sida sponsorship gender equity will be taken into consideration.

The planned initial student capacity for this programme is 10 which is expected to grow with time and the programme existence becomes known and its demand grows.

The minimum admission and selection criteria for the programme shall be that stipulated in the UDSM postgraduate admission guidelines and additional criteria set in the curriculum for the developed programme.

The catchment area for the programme shall be from academia and industry.

**Dissemination, international exposure and networks**

All PhD students are required and have been provided for to present at least two papers in international conferences and in scientific and technical conferences/workshops to be organized in Tanzania. They are also expected to publish at least two journal papers. The publications will be jointly with supervisors at UDSM and KTH.

The local PhD students will spend at least two months in Sweden to build networks with Swedish experts and other PhD students, have in depth literature review, access to modern laboratory facilities, and international exposure.

To have weekly graduate students seminars so as to create networks within themselves, support each and complement other and hence speedup achievement and completion time. This will be complemented by training staff on effective and efficient supervision of PhD students as part of this project.

This research training programme intends to use TTA training concept and use co-located OpenLab as an effective means to build strong academic-industry network. Furthermore, the study is directed at solving a problem facing the electric power utility sector hence being beneficiaries we shall forge strong link with them.

**Sustainability**

The approach for this programme is intended to deviate from the traditional teaching approach that focused on academic excellence without direct connection to the problems in the industry/society. The programme is to integrate the knowledge triangle: education-research-innovation and also incorporate entrepreneurship skills, hence graduates will be able to produce solutions that can easily be turned into business opportunities and hence generate income for themselves, the College and the society. We thus envisage that such an approach will make the programme popular and attract more and more students.

The power industry is growing very fast because of the rapid economic growth not only in Tanzania but also in the region. Therefore, the need for experts and expertise in automation of management and control of power systems will keep growing.

The human capacity developed in this project will ensure that there is continued appropriate training and training capacity to maintain the programme beyond project duration.
It is our intention to look at means to make this programme part of the Pan-African University programmes hence expanding catchment area and sponsorship through African Union resources.

C. Postdoc training

PostDoc training will be used as a means of periodic upgrading of knew knowledge, methodologies and technologies in ICT related fields that is changing very fast to enable staff supervise effectively research students in developing new knowledge and skills in desired areas to solve local societal problems. It will serve as a principal means to develop College staff to support taught PhD programmes in the College as part of capacity building while supported by KTH human resource. The PhD holders will undergo training to build the much needed capacity in this area.

D. Development of Supervision skills

Supervisors play a key role in making a difference in the quality of research results and the capacity of individual students. It is imperative to make development of supervision skills of local supervisors as part and parcel of the research training programme. Though it is difficult to measure the outcome, the target is to raise those skills to be at par to that of the Swedish counter parts.

Since the local supervisors will be already assigned to the different research teams, the supervision development process will be on going. Some of the activities considered in the process include:

- Training to increase specific project management and quality control skills;
- Co-authoring peer-reviewed publications in key journals and conferences;
- Periodic training and experience sharing lectures by invited speakers from Swedish partnering universities; and
- Increase their networks at regional and international platforms (a) as invited lecturers (b) through participation as reviewers in journals and conferences.

E. TTA: Technology Transfer Alliance

This project will have TTA concept elements in its training programme. TTA is an initiative launched by KTH as a platform for network of Universities providing societal challenge and external stake-holder initiated project-driven learning activities with direct impact on the socio-economic development of the participating countries where each participating university needs to have a TTA course in their curricula. Such TTA courses identifies several projects to be run by teams of participating students proposed by external actors (companies, government institutes, NGOs, etc) or internally by the university staff or the students. A project team has at most 5 students, an assigned coach and a supervisor. All course activities are conducted through set of tools available in the TTA online portal allowing partners participate from anywhere. Also, workshop events are organized for training and information dissemination purposes.

Typical activities include:

- Support course leaders manage the TTA course activities;
- Support teams tailor the set of tools available at TTA portal for specific project needs; and
- Increasing the quality of planning and execution of research projects through participation in the platform.

For this research training programme, project-driven TTA courses arrangements be made to facilitate offering them as part of UDSM curriculum. TTA is a platform for making such resources available. All the MSc and PhD students need to participate. KTH will provide experts needed to run the TTA course activities as part of capacity building activity and UDSM will through this project:

a) Collaborate with KTH experts;

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1 TTA portal [https://www.ttaportal.org/web/applications/home](https://www.ttaportal.org/web/applications/home)
b) Build the necessary infrastructure (acquiring equipment, setting up laboratories, Video conference systems etc); and

c) Create an academia-industry network.

The final objectives are:

a) To be able to continuously investigate and identify local challenges and make scientific studies to provide solutions and explore business opportunities through participation of local researchers and students;

b) To strengthen UDSM and local academia-industry network through TTA projects with research and innovation outcomes linked to education and commercial interests;

c) To graduate students who are ready to directly participate in local socio-economic activities through employment or by creating own startup business ventures; and

d) To train local staffs that will make UDSM run such project-driven courses independently as part of its curricula revision by the end of this research programme.

F. Doctoral Training in Innovation and Entrepreneurship

Understanding the complexity of technology is not enough for viable knowledge and technology transfer to happen. Technology research and education must be combined with innovation and entrepreneurship (I&E) skills to make use of the knowledge and technology for solving local problems.

The existing business activities are global in nature and require a good understanding of multi-disciplinary aspects: technology, management, innovation process, etc. Such multi-disciplinary approach is followed by the doctoral training center (DTC) with a target of training PhD students and supervisors with the different skills. KTH has been running a successful DTC at its premises and also in conjunction with ICT Labs at the European Institute of Innovation and Technology (EIT). PhD and M.Sc. students will pass through practical I&E training. Students make studies in projects with potential research results to create business opportunities or any socio-economic benefit. It will thus be beneficial for our research students to get training in these aspects to embed in them such desired qualities. DTC experts from KTH will provide such training at UDSM twice annually. Some of the project from TTA courses will be part of the DTC process.

The desired final objective in the long run is to find means to replicate the KTH DTC model at UDSM at discretion of UDSM. This will require building the necessary infrastructure and trained staff equipped with innovation and entrepreneurship skills. UDSM is part of the e-InfrAcademy initiative.

UDSM is also a stakeholder in the Dar OpenLab initiative to be hosted by COSTECH and the EU-Africa OpenLab initiative in the proposal stage. CoICT is expected to benefit from OpenLab through pedagogical support to train experts and in revision of curricula to introduce challenge driven project courses and education. In addition, it is envisaged that teams of students from UDSM will participate in workshops, events, and training modules organized by OpenLab. The researchers at UDSM may utilize research results in solving socio-economic challenges by proposing and commercializing innovative solutions in local context and probably Spin-off a few companies by graduate from UDSM to address employment issue.

5.2. The Research Environment

A: At UDSM

This research training proposal will be mainly implemented at the College of Information and Communication Technologies of the University of Dar es Salaam using its facilities and staff with support from the KTH counterparts. However, some additional research equipment on the need-to-be basis, some minor equipment, consumables, etc will be required to provide conducive environment for research activities. It is unrealistic to predict precisely all required equipment at this stage because of evolution in ICT equipment and dynamic situation of power system in the ground in Tanzania that we have to react to. Therefore, it is prudent to set aside funds for this purpose.
There shall be field work in selected sites; currently it is being suggested to use three sites, Dar es Salaam, Serengeti and Same as pilot sites for this work.

The College has four major areas of competences: electronics and telecommunications engineering, computer science and engineering, information systems and virtual learning.

B: At KTH

At KTH, ICT School will be involved in the training programme through its staff members at the departments. The sandwich PhD students who will train at the school shall attend courses to be prescribed by the school to meet requirements of KTH for such students. The School has the following areas of major competences among many others: Software and Computer systems (SCS), Communication systems (CS), and Electronics systems (ES). Among other things the School through respective department performs studies, techniques and methodologies for the design of electronic systems in areas such as System-on-Chip Design, Heterogeneous Integration, and Embedded Systems Design. It also runs Vinnova Excellence center iPack focusing on intelligent packaging, RFID systems, IoTs for healthcare and wellbeing applications. The School has good collaboration with Electric Power systems (ES) and Electrical Energy Conversion (E2C) experts.

5.3. The Available and Required Infrastructure

<table>
<thead>
<tr>
<th>Embedded Lab</th>
<th>Networking Lab</th>
<th>Electronics &amp; TeleCom Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-bit Microprocessor Trainer Kit (10)</td>
<td>Networking Tool Kit (5)</td>
<td>Spectrum Analyzer (2)</td>
</tr>
<tr>
<td>PC Basic Logic Analyzer (10)</td>
<td>Routers (10)</td>
<td>Signal Generators (10)</td>
</tr>
<tr>
<td>PC Universal Programmer (10)</td>
<td>Networking Switches (10)</td>
<td>Oscilloscopes (10)</td>
</tr>
<tr>
<td>FPGA Development Boards (10)</td>
<td>Servers (3)</td>
<td>Microwave Training Systems (3)</td>
</tr>
<tr>
<td>Universal devices programmer (10)</td>
<td>Pen Tablet (6)</td>
<td>Telecommunication Trainer Boards (3)</td>
</tr>
<tr>
<td>USB Serial PIC Programmer Kit (5)</td>
<td>Wheatstone Bridge Meters PCs (30)</td>
<td>AM/FM Modulation/Demodulation (3)</td>
</tr>
<tr>
<td>PCs (30)</td>
<td></td>
<td>Quad OTDR (4)</td>
</tr>
</tbody>
</table>

A: At UDSM University

The CoICT shall utilize laboratory infrastructure in the College and when necessary that in other colleges in the university. The three laboratories shown in fig. 1.4 shall form the core facilities for iGRID research training programme. However, the laboratory was not specifically designed for iGRID functional elements; therefore some additional facilities shall be necessary to ensure effective research work on iGRID components and its subsystems as shown below.

B: At KTH

For research activities related to internet-of-things and sensor systems, KTH and NOTE has recently established a joint laboratory in Electrum building within iPack VINN Excellence Centre\(^2\). The laboratory is equipped with the world first industrialized printing machine for electronics manufacturing. In addition to this, the laboratory is also equipped with other manufacture and integration machine such as wire bonding, flip-chip boning, climate chamber, and all characterization instruments. The iPack VINN Excellence Centre has complete measurement and characterization facilities for IoT systems.

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\(^2\) iPack VINN Excellence Center: http://www.kth.se/ict/forskning/centra/ipack
Enclosure 1: Research Training Programme

For broadband and green communications related projects, KTH has an integrated Network Systems laboratory\(^3\) (NS Lab). The NSLab is equipped with state-of-the-art facilities to conduct research in areas of Internet Infrastructures, Infrastructures for Healthcare and Wellbeing, Next Generation Peer-to-Peer Networks for Content Distribution, Security for Mobile Applications and Financial Services, Sustainable and Energy-Smart networking, and Network Performance Analysis.

Project-driven TTA courses managed by KTH are handled primarily through TTA portal\(^4\). Also, KTH has been equipped with completed software packages as donations from software vendors that are enough to perform circuit designs, modelling and simulations for this project.

KTH also has various models and mechanism to support innovation and entrepreneurship at various stages from curricula to business: Stockholm OpenLab for providing co-creation and co-innovation environment, KTH Holding AB is supporting patenting, EIT ICT Labs is supporting speed-up from research to innovations via education, business coaching, demonstrator projects, and access to European wide connectivity to customers and investors. Stockholm Innovation and Growth (STING) is providing turbo boosting for business development and internationalization.

5.4. Academic Networks Available
- Institution of Engineers Tanzania

5.5. Staff Mobility Issues and University Retention Policy

The University staff going for training for two years and above enters into contract to remain with the university for five years after graduation. Also, the government has continuously been increasing academic staff salaries to better others in the region. Moreover, there is in place consultancy policy that enables staff get additional income. The TTA activities will attract more interaction locally, regionally and internationally enabling staff to create international networks.

6. The Planned Contribution and Responsibility of Each of the Partners in the Proposed Research Training Programme

The envisaged contribution to the research training programme project by the different parties in this project is as shown in table 1.5.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Lead with efforts in Person Month – (PM)</th>
<th>Back with efforts in Person Month – (PM)</th>
<th>Decision</th>
<th>Total PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervision - Local PhD</td>
<td>UDSM (46 PM)</td>
<td>KTH (9 PM)</td>
<td>UDSM</td>
<td>55</td>
</tr>
<tr>
<td>Supervision - sandwich PhD</td>
<td>KTH (16 PM)</td>
<td>UDSM (6 PM)</td>
<td>KTH</td>
<td>22</td>
</tr>
<tr>
<td>Supervision - Postdoc</td>
<td>KTH (2 PM)</td>
<td>UDSM (3.5 PM)</td>
<td>All</td>
<td>5.5</td>
</tr>
<tr>
<td>Training &amp; supervision</td>
<td>UDSM (36 PM)</td>
<td></td>
<td>UDSM</td>
<td>36</td>
</tr>
<tr>
<td>- Master’s stud.</td>
<td>UDSM (9 PM)</td>
<td>KTH (3.25 PM)</td>
<td>UDSM</td>
<td>12.25</td>
</tr>
</tbody>
</table>

7. Management of Research Training Programme from Perspective of Partner Institutions

\(^3\) Network Systems Lab (NSLab): http://www.kth.se/en/ict/forskning/cos/research/nslab

\(^4\) TTA Portal https://www.ttaportal.org/web/applications/home
7.1 Administrative Resources Available
7.1.1 UDSM through the office of the Vice Chancellor for Research.
7.1.2 KTH to receive administrative support from central office through its international relations office for Africa.

7.2 Management of Career Opportunities for Participating Researchers and Research Students.
All students and researchers shall be recruited by the UDSM through the project. Their career opportunities depend on the successful accomplishment of M.Sc./PhD research training programme project.

7.3 Potential Internal and External Risks and Actions for Mitigation of the Risks.
Specific attention should be placed on outlining the risks shown in table 1.6 as regards to recruitment and retention of researchers.

Generally, we expect relatively modest risk in executing this research programme. The risks identified are listed below, followed by a brief description. The probabilities and effects are estimated to give the total risk index.

8 The Operational Issues of the Research Training Programme
8.1 Awarding degrees
UDSM is solely responsible in awarding Master’s and local PhD degrees. KTH is solely responsible in awarding sandwich PhD degrees but an application for a cotutelle agreement will be made to be able to give dual degrees from KTH and UDSM. KTH and UDSM will jointly award Postdoc certificates of recognition.

8.2 Governance
The overriding governance of the project shall be as shown in fig. 1.4. All policy and financial matters regarding the execution of the iGRID project shall follow operational policies and procedures operational in the two institutions. The project coordinators shall be responsible for operational matters, answerable to their respective management organs for research matters.

The role and responsibilities of the partnering universities is clearly stated in Enclosure 3.

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Risk type</th>
<th>Effect (E)</th>
<th>Probability (P)</th>
<th>Risk Index</th>
<th>Mitigation strategy</th>
<th>Contingency plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delays in approval of framework TTA by UDSM machinery</td>
<td>3</td>
<td>0.3</td>
<td>0.9</td>
<td>The first delivery be 2016</td>
<td>Make delivery as a support for research students to improve their skills</td>
</tr>
<tr>
<td>2</td>
<td>Sida approves partial funding</td>
<td>5</td>
<td>0.3</td>
<td>1.5</td>
<td>Revisit/reschedule activities</td>
<td>prioritize</td>
</tr>
<tr>
<td>No.</td>
<td>Issue Description</td>
<td>Risk Index</td>
<td>Probability</td>
<td>Measures Proposed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Fewer applicants available for research</td>
<td>5</td>
<td>0.2</td>
<td>1.0 Promote the programme to stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Start supporting M.Sc programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Uncooperativeness from the project stakeholders</td>
<td>3</td>
<td>0.1</td>
<td>0.3 Involve the stakeholders in project planning and implementation for mutual benefit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reach out to new partners with proven track record in joint collaboration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Delays in disbursement of funds</td>
<td>4</td>
<td>0.2</td>
<td>0.8 Reschedule activities and prioritize them</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Borrow funds from other sources for critical path activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Delays in procurement of additional research equipment</td>
<td>3</td>
<td>0.3</td>
<td>0.9 Limit researchers engaged to fit available resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Study procurement bottleneck and act accordingly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Researchers slow progress</td>
<td>5</td>
<td>0.2</td>
<td>1.0 Train and motivate supervisors and researchers, peer mentoring, weekly researchers seminars, supervisors training, improved access to literature, improved research coordination, team work in research groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTA, Post Doc and DTC training programmes,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Researchers dropout for their studies</td>
<td>5</td>
<td>0.1</td>
<td>0.5 Study to establish root causes and means to timely address them, close follow up of students’ progress vs study plan, make research activities directly linked to societal challenges and solutions readily applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTA, and DTC training programmes, counseling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Key researchers movement</td>
<td>4</td>
<td>0.1</td>
<td>0.4 Involve more staff and engage them</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Post Doc Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Gender and gender equity</td>
<td>3</td>
<td>0.1</td>
<td>0.3 Gender equity be taken into consideration in admission, groups formation, supervision, field work and visits, counselling services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Involve UDSM Gender Centre</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Risk Analysis Map ranking is made based on Risk Index = Effect*Probability

### 8.2.1 The Procedure for Selecting and Recruitment of Masters and PhD Students
- UDSM is responsible in the recruitment of all Masters and PhD students in consultation with KTH.
- For sandwich PhD students and Postdocs USDM and KTH will work jointly in the selection and UDSM shall make the decision. However, KTH may request revision of candidates selected providing grounds for that.
- UDSM is responsible for the selection of supervisors at UDSM and KTH for those from KTH that will participate in the capacity development process.

### 8.3 Available Procedures for Quality Assurance of the Research Training Programme
Quality assurance policy, research policy and postgraduate policy will be used to guide the conduct of activities in the iGRID research programme project at UDSM. Operations at KTH will be guided by their respective policies including that for collaboration with foreign partners.

8.4 Time Perspective of the Partnership and Sustainability Plans for the Programme
Collaboration based on mutual benefit between the collaborating partners, KTH supporting UDSM to build technology, scientific and methodology capacity including that for innovation and entrepreneurship to make participants in the project champion business creation for sustainability at the end of the project. KTH will be exposed to challenges, opportunities and experiences that Tanzanian environment presents.

8.5 Short and Long Term Financial Strategy
As a public institution, UDSM derives its main sources of funding from Tanzania Government. However, due to the economic limitations of the country, Government funding is limited to mainly recurrent and to a very limited extent development expenditure and an even more limited amount for staff and students research activities. The University also generates funds from internal sources, which are utilized to supplement the public funds to meet priority needs. We believe attracting local and regional student by increasing quality of education, creating active research groups with strong network, and participating in innovation activities is the strategy that ensures strong financial stability.

8.6 Monitoring and evaluation.
The project monitoring evaluation will be performed based on the following references.
- Meeting milestones;
- Individual study plans;
- Periodic reports;
- Direct supervision;
- Publications; and
- Research results.

8.6.1 Monitoring and Evaluation
The overall university coordination office in respective universities for research shall be responsible for the overall monitoring and evaluation and subsequent reporting to Sida for their part for finances received by them directly from Sida. It includes:
- Organisation and responsibilities for timely submission of annual audits;
- Organisation and timely submission of annual financial reports; and
- Organisation and timely submission of annual narrative results reports.

8.6.1.1 University of Dar es Salaam
The office of the Deputy Vice Chancellor for Research shall be responsible for the overall coordination of iGRID research training programme project activities at UDSM as per Sida guidelines.

8.6.1.2 KTH
The KTH International Office will have an Africa related activities administration support system lead by the Vice-President of International Affairs at KTH. This will have the overall coordination responsibility of SIDA projects.

8.6.2 Procedures for timely and regular collection of results and following progress within the programmes
Within the governance framework of the project, the parties shall hold monthly meetings for involving coordinators for the iGRID research training programme project which may also include different research student supervisors as shall be deemed appropriate at the time to the interest of good performance of the project using the Video conferencing facility to be installed at CoICT at UDSM to review milestones and evaluate progress. The University Dar es Salaam is connected to the national optic fibre backbone network and to the international community through submarine optical fibre cable
service offered by SEACOM which will ensure reliable communication between the collaborating partners.

9 **Organisation of the Personnel welfare related to exchange of staff between UDSM and KTH**
   The project coordinators at both UDSM and KTH will assist the researchers from Sweden and Tanzania respectively to access the documentation required for visa processing in good time before the planned travel. Advice and guidance in relation to other support functions such as welcoming, housing, allowances payment will also be offered to students, scholars and participating staff by the relevant university offices through the project coordinators.

10 **Ethical consideration**
   The conduct of this research training programme project will be guided by the UDSM Research Ethics Policy, National Research Ethics Policy, Professional ethics of different professionals that will be involved in the part of UDSM and that applicable to KTH and Sweden in the part of KTH.

11 **References**
   [17] Rural Energy Act No. 8 of 2005

12 **Intellectual Property Rights (IPR) and Patent Issue**

<table>
<thead>
<tr>
<th>ISSUES TO BE ADDRESSED AND AGREED UPON</th>
<th>Yes</th>
<th>No</th>
<th>Comments, Status and follow-up plans (deadline dates for when issue is agreed upon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are all key members of the partnership aware of/conversant with the IPR regulations of target country?</td>
<td>Yes</td>
<td></td>
<td>The members of UDSM, and all local partners are aware. Members of Swedish University should affirm awareness (November 30, 2014)</td>
</tr>
<tr>
<td>Question</td>
<td>Yes/No</td>
<td>Answer</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Are all key members of the partnership aware of/conversant with IPR related policies of the target university?</td>
<td>Yes</td>
<td>The members of UDSM and all local partners are aware. Members of Swedish University should affirm awareness (November 30, 2014)</td>
<td></td>
</tr>
<tr>
<td>Are all key members of the partnership aware of/conversant with IPR regulations of Sweden?</td>
<td>Yes</td>
<td>The members of Swedish University(ies) are aware. The members of UDSM and all local partners are aware</td>
<td></td>
</tr>
<tr>
<td>Are all key members of the partnership aware of/conversant with IPR related policies of the Swedish partner university?</td>
<td>Yes</td>
<td>The members of UDSM and all local partners are aware</td>
<td></td>
</tr>
<tr>
<td>Has the question of ensuring the protection of research findings and results obtained as part of the partnership been discussed by the partnership?</td>
<td>Yes</td>
<td>KTH has proposed a IPR agreement to UDSM to ensure IPR protection.</td>
<td></td>
</tr>
<tr>
<td>Has the question of coverage of costs related to IPR activities during the lifetime of the programme and after the end of the programme been discussed by the partnership?</td>
<td>Yes</td>
<td>The partners plan to discuss and agree on this (November 30, 2014)</td>
<td></td>
</tr>
<tr>
<td>Have the questions of “background ownership” (i.e. IPR ownership prior to the current partnership) been discussed by the partnership?</td>
<td>Yes</td>
<td>KTH has proposed a IPR agreement to UDSM to ensure IPR protection.</td>
<td></td>
</tr>
<tr>
<td>Have the questions of “foreground ownership” (i.e. IPR ownership as a direct consequence of the current partnership) been discussed by the partnership?</td>
<td>Yes</td>
<td>KTH has proposed a IPR agreement to UDSM to ensure IPR protection.</td>
<td></td>
</tr>
<tr>
<td>Has a decision been made on the policy of dissemination of research findings and results that come out of the partnership?</td>
<td>Yes</td>
<td>KTH has proposed a IPR agreement to UDSM to ensure IPR protection.</td>
<td></td>
</tr>
<tr>
<td>Has a decision been made by the partnership on the exploitation of results (products or services)?</td>
<td>Yes</td>
<td>KTH has proposed a IPR agreement to UDSM to ensure IPR protection.</td>
<td></td>
</tr>
<tr>
<td>Is there legal assistance in the Target Country to assist the partnership in IPR issues (including potential patents)?</td>
<td>Yes</td>
<td>There is a fully fledged legal department in UDSM University that advises on all legal issues.</td>
<td></td>
</tr>
<tr>
<td>Is there legal assistance available at the Swedish partner university to assist the partnership in IPR issues (including patents)?</td>
<td>Yes</td>
<td>KTH Innovation and KTH Research Office will assist KTH researchers</td>
<td></td>
</tr>
<tr>
<td>Is there a plan to develop capacity for IPR issues within the partnership?</td>
<td>Yes</td>
<td>The local office has a component in the application to support the IP office and training in IPR at UDSM University and partner public universities. KTH Innovation will support innovation activities stemming from the partnership</td>
<td></td>
</tr>
<tr>
<td>Other IPR and patent issues not addressed above</td>
<td>Yes</td>
<td>All IPR issues have been exhaustively covered</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>

Enclosure 1: Research Training Programme

iGrid
### Table 2.1: The Results Matrix for Specific Objective 1

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specific Objective # 1:</strong> Explore research opportunities in different aspects of smart grid to address local power system challenges in order to increase societal inclusiveness</td>
<td></td>
</tr>
</tbody>
</table>

- PhD Dissertations produced on different aspects of smart grid to address local power system challenges
- Articles published in peer reviewed journals on different aspects of smart grid to address local power system challenges
- Technical solutions developed to solve identified challenges
- Report on the current utility business process

<table>
<thead>
<tr>
<th>Performance indicator of Outcome (including target values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least one publication produced (dissertation/article) for each identified challenges</td>
</tr>
<tr>
<td>Technical solutions deployed to resolve the identified challenges</td>
</tr>
<tr>
<td>Percentage of developed Technical solutions deployed (30%)</td>
</tr>
<tr>
<td>At least 3 Smart grid Business opportunities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available publications in identified challenges</td>
</tr>
<tr>
<td>Available and working solutions</td>
</tr>
<tr>
<td>TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journals</td>
</tr>
<tr>
<td>Dissertations</td>
</tr>
<tr>
<td>Reports</td>
</tr>
<tr>
<td>TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method of collecting data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
</tr>
<tr>
<td>Questionnaire</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Internet study</td>
</tr>
<tr>
<td>Meetings with stakeholders</td>
</tr>
<tr>
<td>Field visits</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Survey</td>
</tr>
<tr>
<td>Reports</td>
</tr>
<tr>
<td>Field visits</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Survey</td>
</tr>
</tbody>
</table>
Assumptions for Specific Objective 1. Cooperation from the stakeholders, and the availability of facilities, equipment and human resources
Table 2.2: The Results Matrix for Specific Objective 2

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Outcomes</th>
<th>Performance indicator of Outcome (including target values)</th>
<th>Baseline</th>
<th>Data source</th>
<th>Method of collecting data</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.Sc. students enrolled (8 Sida funded)</td>
<td>At least 70% of student graduates by the end of programme</td>
<td>Percentage of trained MSc graduating by the end of Sida support programme (70%)</td>
<td>TBD</td>
<td>• Dissertations produced</td>
<td>• Analysis of Admission and graduation data</td>
</tr>
<tr>
<td>PhD students (8 Sida funded + 2 Sandwich) enrolled</td>
<td>At least 70% students graduates by the end of programme</td>
<td>Percentage of trained PhD graduating by the end of programme (70%)</td>
<td>TBD</td>
<td>• Dissertations produced</td>
<td>• Analysis of Admission and graduation data</td>
</tr>
<tr>
<td>4 PostDocs attended training on supervision and teaching of PhD courses in Sweden</td>
<td>4 Staff better in supervision and teaching PhD courses</td>
<td>Number of PhD candidates supervised and received support from the trained PostDocs</td>
<td>Current PhD students</td>
<td>Review of supervision list</td>
<td></td>
</tr>
<tr>
<td>15 publications produced</td>
<td>At least 50% of articles are published in peer reviewed journal</td>
<td>Number of Publications in Peer reviewed journals</td>
<td>TBD</td>
<td>• Journals</td>
<td>• Survey Document review</td>
</tr>
</tbody>
</table>

**Specific Objective # 2**: Capacity development through M.Sc. and PhD training in smart grid monitoring, management and control for the national and isolated grids and their integration for efficient and flexible energy supply system.
Assumptions for Specific Objective #2. The curriculum will be developed within 6 months period and approved before the end of first year.

Table 2.3: The Results Matrix for Specific Objective 3

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Outcomes</th>
<th>Performance indicator of Outcome (including target values)</th>
<th>Baseline</th>
<th>Data source</th>
<th>Method of collecting data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Objective # 3: Identifying potential products and services to support smart grid implementation in Tanzania in order to foster development of new business and entrepreneurs by using Openlab co-creation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Products identified, innovated, and developed | • Challenges in implementing smart grid addressed through innovative solutions (15) | • Number of devices certified for Smart grid applications.(15) | TBD | • Literature review | • Survey
• Literature review
• Questionnaire
• Interviews
• Document |
| • Services identified, innovated, and developed | • Electrical power system reliability improved (95%) | • Percentage of customers capable of receiving information from the grid (80) | TBD | • Literature review | • Survey
• Literature review
• Questionnaire
• Interviews
• Document |

Assumptions for Specific Objective #3. Cooperation from the manufactures
Table 2.4: The Results Matrix for Specific Objective 41

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Outcomes</th>
<th>Performance indicator of Outcome (including target values)</th>
<th>Baseline</th>
<th>Data source</th>
<th>Method of collecting data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Objective # 4: Curriculum review of existing programmes to accommodate innovation and entrepreneurship project and develop taught PhD programme through TTA and Doctoral training centers and their interaction with OpenLab-type activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Taught PhD programme that is embedded with Innovation and entrepreneurship developed | • Influence in changing of existing curriculum to incorporate aspects of innovation and entrepreneurship | • Availability of new curriculum | • Existing curriculum | • Curricular for existing related programmes | • Documents review  
• Workshops  
• Reports |
| • Taught PhD programme in established and students enrolled | • New curriculum approved by Senate and TCU | • Number of PhD student in the programme | | • Admission data | • Analysis of data |
| • PhD graduates | • Graduate students better equipped to address societal challenges | • Number of graduates  
• Number of publications | | | Graduation and publication data |
### Assumptions for Specific Objective 4.

*OpenLab project will be funded and start timely*
Table 2.5: The Results Matrix for Specific Objective 5

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Outcomes</th>
<th>Performance indicator of Outcome (including target values)</th>
<th>Baseline</th>
<th>Data source</th>
<th>Method of collecting data</th>
</tr>
</thead>
</table>
| • Meetings/workshops with individual stakeholders held | Endorsed policy issues by stakeholders | • Number of policy issues endorsed by the meeting of stakeholders | TBD | • Meeting minutes | • Meeting  
• Workshops |
| • Reports on key policy recommendations produced (on smart grid data to safeguard consumer privacy) | Identified key policy issues used to inform new policy changes and formulation | • Number of identified policy issues incorporated into the policy changes and formulation | Existing policy | • Ministries  
• TANESCO  
• REA  
• EWURA | • Consultations  
• Surveys  
• Workshops  
• Seminars  
• Ministerial and CEOs briefs |

**Specific Objective # 5:** To provide input to policy makers towards setting Tanzania smart grid policy for societal development.

- Meetings/workshops with individual stakeholders held
- Endorsed policy issues by stakeholders
- Number of policy issues endorsed by the meeting of stakeholders
- TBD
- Meeting minutes
- Meeting
- Workshops

Assumptions for Specific Objective #5.
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

a. UDSM – University of Dar es Salaam – Local coordinator

As the local coordinator and the major beneficiary of the outcome, UDSM is responsible for following the overall project progress.

- Provide team leadership;
- Focus the team on the tasks according to the requirements;
- Coordinate team logistics;
- Communicate partners status, task accomplishment;
- Identify and engage with different stakeholders including both private and public sector;
- Work on the local side administrative issues of the project;
- Supervision;
- Identification and recruitment of students and researchers;
- Curriculum development; and
- Organizing participation in TTA events.

<table>
<thead>
<tr>
<th>Team UDSM</th>
<th>Responsibilities</th>
<th>Total person month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal - CoICT College level Sida coordination</td>
<td>5% = 0.6 PM x 5 years = 3 PM</td>
<td></td>
</tr>
<tr>
<td>Nerey H Mvungi (Professor) Coordinator, Supervision, etc.</td>
<td>20% = 2.4 PM x 5 years = 12 PM</td>
<td></td>
</tr>
<tr>
<td>Herald N Kundaeli Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Honest C. Kimaro Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Justinian Anatory Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Christiane Mwase Researcher</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Hamisi Ndyetabura Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Supervisor A Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Supervisor B Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>Supervisor C Supervision</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
<td></td>
</tr>
<tr>
<td>7 co-supervisors Supervision</td>
<td>7% = 0.84 PM x 5 yrs x 7 = 29.4 PM</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>106.4 PM</strong></td>
<td></td>
</tr>
</tbody>
</table>

b. KTH – Swedish coordinator

KTH is the main coordinator of the Swedish side consortium. Apart from actively participating in the capacity development activities, KTH is also responsible in managing the overall project progress.

- Lead training and research activities;
- Keep track of partners and evaluate progress based on the technology transfer objectives;
- Manage the operational and administrative issues of the project;
- Supervise sandwich PhD students;
- Offer periodic DTC trainings;
- Responsible TTA project courses and related activities;
- Identify and involve experts as required; and
- Control the quality and evaluate the technology transfer aspect of the project.

Table 3.2: KTH staff additional personal man-months for iGRID activities

<table>
<thead>
<tr>
<th>Team KTH</th>
<th>Responsibilities</th>
<th>Total person month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hannu Tenhunen (Professor)</td>
<td>Coordinator, Supervision, DTC training, Curriculum development</td>
<td>20% = 2.4 PM x 5 years = 12 PM</td>
</tr>
<tr>
<td>Bjorn Pehrson (Professor)</td>
<td>TTA courses, Supervision,</td>
<td>15% = 1.8 PM x 5 years = 9 PM</td>
</tr>
<tr>
<td>Awet Yemane Weldezion (Senior Researcher)</td>
<td>Project management, DTC training, TTA courses</td>
<td>25% = 3.0 PM x 5 years = 15 PM</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>36 PM</strong></td>
</tr>
</tbody>
</table>

c. Activity responsibility chart

The total effort in PM contributed by each partner towards the research training program is estimated based on the current course work and supervision activities in the respective institutes.

Table 3.3: Total additional personal man-months

<table>
<thead>
<tr>
<th>UDSM</th>
<th>KTH</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>106.4 PM</td>
<td>36 PM</td>
<td><strong>142.4 PM</strong></td>
</tr>
</tbody>
</table>

Most of these efforts are distributed over tangible activities that we can estimate. Some efforts are difficult to measure. The following responsibility matrix is the detail of these activities defined in the main research and training program document (Enclosure 1). For each activity, responsible partners are assigned and efforts in person per month (PM) are estimated. Partners are also identified in cases on activities that may require decisions to be made.

Notes for table 3.4:

- The person-month efforts are estimated based on the actual involvement of the partners in the project. The total project cost reflects the actual involvement and the Sida funding covers only a portion of the total cost.
- Each year minimum 8 regular graduate courses are offered
- DTC training and TTA course are offered for second year masters students and PhD researchers.
- A total of 1 PM efforts per course is only for the actual teaching time allocated by the university. The preparation and irregular discussion with students in not measured. The teaching time for a course is calculated based on
  - 8 lectures x 2 hour per lecture = 16 hours
  - 8 tutorials & exercises x 2 hour per tutorial x 3 groups = 96 hours
  - 4 labs x 4 hours per lab x 3 groups = 48 hours
  - Total 16+96+48 = 160 hours
- There are some activities which are difficult to measure the efforts. For example the online training and discussions over video-conferencing and through emails are done in semi-irregular fashion.
Table 3.4: Responsibility Matrix

<table>
<thead>
<tr>
<th>Activity</th>
<th>Lead (Person Month - PM)</th>
<th>Back (Person Month - PM)</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity development</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervision of Local Taught PhD students (8)</td>
<td>UDSM (8)</td>
<td>KTH (2 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Supervision of Sandwich PhD students (2)</td>
<td>KTH (16 PM)</td>
<td>KTH (8 PM)</td>
<td>KTH</td>
</tr>
<tr>
<td>Supervision of Postdocs (4)</td>
<td>KTH (16 PM)</td>
<td>KTH (8 PM)</td>
<td>KTH</td>
</tr>
<tr>
<td>PhD supervision skills</td>
<td>UDSM (2 PM)</td>
<td>KTH (1 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Taught PhD capacity building</td>
<td>UDSM (7 PM)</td>
<td>KTH (2 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>TTA training and assessment skills</td>
<td>UDSM (4 PM)</td>
<td>KTH (2 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td><strong>Master’s program</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>KTH (2 PM)</td>
<td>UDSM (4 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>TTA</td>
<td>KTH (2 PM)</td>
<td>UDSM (4 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Applied research</td>
<td>KTH (1 PM)</td>
<td>UDSM (4 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td><strong>Courses and training events</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular Master’s courses</td>
<td>UDSM</td>
<td>KTH</td>
<td>UDSM</td>
</tr>
<tr>
<td>Local PhD courses</td>
<td>UDSM</td>
<td>KTH</td>
<td>UDSM</td>
</tr>
<tr>
<td>Sandwich PhD courses</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
</tr>
<tr>
<td>Training Supervisors</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
</tr>
<tr>
<td>TTA project courses</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
</tr>
<tr>
<td>TTA workshop events</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
</tr>
<tr>
<td>DTC – innovation and entrepreneurship trainings</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
</tr>
<tr>
<td><strong>Curriculum development</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programme structure</td>
<td>KTH (0.5 PM)</td>
<td>UDSM (4 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Contents</td>
<td>KTH (1 PM)</td>
<td>UDSM (10 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Stakeholders inputs</td>
<td>KTH (0.5 PM)</td>
<td>UDSM (6 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Final document</td>
<td>KTH (0.5 PM)</td>
<td>UDSM (6 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Approval processing</td>
<td>KTH (0 PM)</td>
<td>UDSM (2 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative &amp; operational issues in Tanzania</td>
<td>UDSM (4 PM)</td>
<td></td>
<td>UDSM</td>
</tr>
<tr>
<td>Administrative &amp; operational issues in Sweden</td>
<td>KTH (2 PM)</td>
<td></td>
<td>KTH</td>
</tr>
<tr>
<td>Organizing consortium meetings</td>
<td>UDSM (1 PM)</td>
<td>KTH (1 PM)</td>
<td>All</td>
</tr>
<tr>
<td>Update project documentation</td>
<td>UDSM (1 PM)</td>
<td>KTH (0.5 PM)</td>
<td>All</td>
</tr>
<tr>
<td>Control project scope</td>
<td>UDSM (1 PM)</td>
<td>KTH (0.5 PM)</td>
<td>UDSM</td>
</tr>
<tr>
<td>Control project time</td>
<td>UDSM (1 PM)</td>
<td>KTH (0.5 PM)</td>
<td>All</td>
</tr>
<tr>
<td>Control project quality</td>
<td>KTH (1 PM)</td>
<td>All (0.1 PM each)</td>
<td>All</td>
</tr>
<tr>
<td><strong>Closing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalize the project report</td>
<td>KTH (1) &amp; UDSM (1 PM)</td>
<td></td>
<td>All</td>
</tr>
<tr>
<td>Master’s degree awards</td>
<td>UDSM</td>
<td></td>
<td>UDSM</td>
</tr>
<tr>
<td>Local PhD degree awards</td>
<td>UDSM</td>
<td></td>
<td>UDSM</td>
</tr>
<tr>
<td>Sandwich PhD degree awards</td>
<td>KTH</td>
<td></td>
<td>KTH</td>
</tr>
<tr>
<td>Postdoc awards (Joint certificate of recognition)</td>
<td>UDSM &amp; KTH</td>
<td></td>
<td>UDSM &amp; KTH</td>
</tr>
</tbody>
</table>
Some other activities such as course works can be offered in parallel with the ongoing courses given at the Swedish partners. KTH and other partners are putting enough time in the plan towards such unmeasurable activities.
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

1.5.1 Prof. Nerey Henry Mvungi

1. Higher education degree:
   - B.Sc. in Engineering (Electrical Engineering), University of Dar es Salaam, 1978
   - M.Sc. in Electronic Control, Salford University, UK, 1980
     Project: High Speed Check Weighing. Automatic Control of weighing tablets (drugs) at production rate based on impact
     Projects:
     a) Development of microscope automatic focusing system for video recording/playback head profile measurement using video camera image information
     b) Developing automatic measurement of screen mask to screen distance from screen surface using optical techniques to facilitate minimization of loses in production of colour television tube.

2. Doctoral degree:
   Leeds University, UK, 1989; Electronic Control
   Project: Sensorless control of switched reluctance (SR) motor using its magnetic characteristics. 8-bit microprocessor was used for data acquisition, processing and control of a four SR motor. Motor excitation and its response were used to deduce rotor position relative to the stator.

3. Postdoctoral work:
   2011, 2012, 2013; Tanzania Communication Regulatory Authority (three to four months each year on part-time basis)
   - Study on interoperability set-top-box for terrestrial digital television broadcasting in Tanzania
   - Setting up of national level Computer Emergency Response Team for Tanzania
   - Studying the migration process and phase one switch-off of analogue television transmitters in Tanzania
   - Studying telephone connectivity problems between Dar es Salaam and Kibaha

   Associate Professor and Principal of College of Informatics and Virtual Education, University of Dodoma, Aug. 2008 – April 2012
   Professor and Principal College of Informatics and Virtual Education, University of Dodoma, May 2012 – June 2012

4. Qualifications as research fellow/associate professor:
   - External Examiner, Makerere University, Uganda
   - External Examiner, Busitema University Uganda
   - External Examiner, Jomo Kenyatta University of Agriculture and Technology, Kenya
   - External Examiner, Nelson Mandela African Institution of Science and Technology, Arusha
   - External Examiner, University of Dodoma
   - External Examiner, Dar es Salaam Institute of Technology
   - External Examiner, St Joseph College of Engineering and Technology
   - External Examiner, Institute of Basic Sciences, Technology and Innovation of Pan African University, hosted in Kenya

5. Specialist certification or equivalent
   - 2010 IBM Faculty Award
   - Registered Professional Engineer (TZ)
Commonwealth Scholarship for PhD training
British Council Scholarship for Masters Training
NUFIC Scholarship for Practical Training at Phillips Center for Technology

6. Current position, period of appointment, share of time spent in research.
   Professor; May 2012

7. Previous positions and periods of appointment.
   - Principal, College of Information and Communication Technologies, June 2012 – November 2013
   - Associate Professor July 2008
   - Senior Lecturer
   - Lecturer
   - Ag. Associate Dean for Undergraduate Studies Faculty of Engineering
   - Ag. Director, Bureau for Industrial Cooperation, Faculty of Engineering, UDSM
   - Head, Electrical Engineering Department
   - Head, Computer Systems Engineering Department
   - Coordinator; Engineering Research Capacity Building – Sida/SAREC supported project

8. Interruptions in research.
   1992 – 1998 due to research funding problems

9. Individuals who have completed their masters/doctoral degree under your supervision or postdoctoral period under your main supervision.

   M.Sc.                                      PhD
   Prof. Justinian Anatory                 Prof. Justinian Anatory
   M. Kayange                                Dr. Fatuma Simba
   M. Makoko                                 Dr. Hamisi Ndyetabura
   S. Naiman                                 Dr. Salehe Mrutu
   J. Damas (I have 6 PhD students at various stages of their studies)
   Martin                                    M.Sc.
   J. Richard                                J.S. Wandwi
   L. Ngeze                                  H.U. Iddi
   J. Matogolo                                J. Ngatunga

   Note: In Tanzania we are following the British/American education system with Bachelors degree,
   then M.Sc. and finally PhD. M.Sc. by research work takes two years of research work after
   B.Sc.

   - I have been an academic staff member since 1978, starting as a tutorial assistant rising to a rack of
     full professor.
   - I have taught a number of courses at undergraduate and postgraduate levels over the years and have
     supervised final year students’ projects at undergraduate levels.
   - I have coordinate a number academic functions at undergraduate and postgraduate levels which
     includes examinations, projects and industrial practical training.
   - I have attended at least three short courses on teaching methodology including using multimedia to
     support delivery organized by the University.
   - I have participated and supervised curriculum review a number of times in some cases going
     beyond engineering and ICT.

11. Other information of importance to the application
   https://udsm.academia.edu/nereymvungi
   http://cse.udsm.ac.tz/index.php/people/staff/14-bios/92-prof-mvungi
1. Higher education degree(s)
   
2. Doctoral degree (year, discipline/subject area, dissertation title, and supervisor).
   
3. Postdoctoral work (year and placement).
   • Acting Associate Professor of Electronics, Electronics Laboratory, Tampere University of Technology, Finland, Sept. 1985-June 1986
   • Acting professor, Tampere University of Technology, 1986-88
   
4. Qualification/appointments as research fellow/associate professor (year).
   • Associate professor 1988, Tampere University of Technology
   • Formally qualified by expert evaluators to multiple professor positions 1988-92 period
   • Full professor (fulmakt professor) 1992 Royal Institute of Technology (KTH),
   • Visiting professor, Cornell University, USA, 1998
   • Honorary Doctor (Dr.h.c.) Tallinn Technical University, Estonia,
   • Honorary professor, Fudan University, Shanghai, & Beijing Jiatong University, China,
   • Adjunct professor, Chinese University of Hong Kong., 2001-2006, 20006-2011
   • Research fellow at Turku Center for Computer Science, 2002
   • Nokia Fellow, 2005
   • Professeur Invite’, Institut National Polytechnique de Grenoble, France, 2005
   • Invited professor, University of Turku, Finland. 2006-2010
   • Permanent Member of Academy of Engineering Sciences of Finland, 2009 forward
   
5. Specialist certification or equivalent
   • Docent, Tampere University of Technology, 1994 (Digital Systems), Helsinki University of Technology, 1999 (VLSI System Design), University of Turku, 2001 (Nanoelectronic systems).
   
6. Current position, period of appointment, share of time spent in research.
   • Professor (fulmakt professor, chair professor), Kungl Tekniska Högskolan/Royal Institute of Technology, Stockholm, Sweden, 1992 forward. (time spent on research: 70%)
   
7. Previous positions and periods of appointment.
   • Associate professor and acting professor, Tampere University of Technology, 1985-1991.
   • Head of Laboratory, Digital Signal Processing Laboratory, Tampere University of Technology, 1988-1990
   • Dean, School of Information Technology, Royal Institute of Technology, 2001-2005
   • Invited professor of nanoelectronics, University of Turku, Finland, 2006-2010.
   • Director of Turku Centre of Computer Science, Åbo Akademi University, Turku, Finland, 2006-2010.
   • Professor Invite´, Institute National Polytechnique de Grenoble (INPG), 2005-2006
   • Invited visiting professor, Cornell University, Ithaca, NY, 1998
   • Adjunct Professor, Chinese University of Hong Kong, China, 2006-
   • Honorary professor, Fudan University, Shanghai, China
   • Honorary professor, Beijing Jiatong University, Beijing, China

8. Interruptions in research. Specify the reason(s) and give the time and dates of the interruption.
- On leave of absence from KTH between 2006-2010 to work as Director of TUCS, Finland, an interdisciplinary research and education center integrating different disciplines to its operations and providing three different distinct Masters and PhD degrees in engineering, natural sciences, and economics. He was also a director of the TUCS doctoral school with over 110 PhD students. Sabbatical year as prestigious Senior Individual Grant Holder, SSF, 2005

9. Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.

* PhD graduates under my supervision. Individuals marked with @ have reached professor or associate professor status

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jouni Isoaho @</td>
<td>1994</td>
</tr>
<tr>
<td>2</td>
<td>Jari Nurmi @</td>
<td>1994</td>
</tr>
<tr>
<td>3</td>
<td>Teppo Karemä</td>
<td>1994</td>
</tr>
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<td>4</td>
<td>Tawfiq Lazaq</td>
<td>1995</td>
</tr>
<tr>
<td>5</td>
<td>Bengt Jonsson</td>
<td>1999</td>
</tr>
<tr>
<td>6</td>
<td>Bengt Oelmann @</td>
<td>2000</td>
</tr>
<tr>
<td>7</td>
<td>Henrik Olson</td>
<td>2000</td>
</tr>
<tr>
<td>8</td>
<td>Peeter Ellervee@</td>
<td>2000</td>
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<tr>
<td>9</td>
<td>Matias O’Nils@</td>
<td>1999</td>
</tr>
<tr>
<td>10</td>
<td>Kalle-Tammemäe@</td>
<td>1999</td>
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<td>11</td>
<td>Yonghong Gao</td>
<td>2001</td>
</tr>
<tr>
<td>12</td>
<td>Li-Rong Zheng@</td>
<td>2001</td>
</tr>
<tr>
<td>13</td>
<td>Inmed ben Dahou@</td>
<td>2002</td>
</tr>
<tr>
<td>14</td>
<td>Andreas Gothenberg</td>
<td>2002</td>
</tr>
<tr>
<td>15</td>
<td>Li Li</td>
<td>2004</td>
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<td>16</td>
<td>Li Bingxin</td>
<td>2003</td>
</tr>
<tr>
<td>17</td>
<td>Dinesh Pamunuwa@</td>
<td>2003</td>
</tr>
<tr>
<td>18</td>
<td>Steffen Albrecht</td>
<td>2005</td>
</tr>
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<td>19</td>
<td>Xinzhong Dru</td>
<td>2005</td>
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<td>20</td>
<td>Meigen Shen</td>
<td>2005</td>
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<tr>
<td>21</td>
<td>Maxim Teslenko</td>
<td>2008</td>
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<tr>
<td>22</td>
<td>Adam Strak</td>
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<tr>
<td>23</td>
<td>RoshanWeerasekera@</td>
<td>2008</td>
</tr>
<tr>
<td>24</td>
<td>Majid B-Nejad@</td>
<td>2008</td>
</tr>
<tr>
<td>25</td>
<td>Ethiopia Nigussie,2010</td>
<td>2011</td>
</tr>
<tr>
<td>26</td>
<td>Sampo Tuuna</td>
<td>2011</td>
</tr>
<tr>
<td>27</td>
<td>Masoud Daneshtab</td>
<td>2011</td>
</tr>
<tr>
<td>28</td>
<td>Zou Zhuo</td>
<td>2012</td>
</tr>
<tr>
<td>29</td>
<td>Waqar Ahmed</td>
<td>2013</td>
</tr>
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<td>30</td>
<td>Amir Rahmani</td>
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<tr>
<td>31</td>
<td>Alexander Yin</td>
<td>2012</td>
</tr>
<tr>
<td>32</td>
<td>Liang Guang</td>
<td>2012</td>
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<tr>
<td>33</td>
<td>Canhao Xu</td>
<td>2012</td>
</tr>
<tr>
<td>34</td>
<td>Yasar Amin</td>
<td>2013</td>
</tr>
<tr>
<td>35</td>
<td>Geng Yang, 2013</td>
<td>2013</td>
</tr>
<tr>
<td>36</td>
<td>Liang Rong</td>
<td>2013</td>
</tr>
<tr>
<td>37</td>
<td>Rajeev Kanth</td>
<td>2013</td>
</tr>
<tr>
<td>38</td>
<td>Khalid Latif</td>
<td>2013</td>
</tr>
<tr>
<td>39</td>
<td>Masoumeh Ebrahim</td>
<td>2013</td>
</tr>
<tr>
<td>40</td>
<td>Moazam Nazi</td>
<td>2014</td>
</tr>
</tbody>
</table>

*Post-docs starting in my laboratory after their PhD and who have reached docent or professor level positions:

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Year</th>
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<tbody>
<tr>
<td>1</td>
<td>Prof. Doc. Ahmed Hemani (KTH),</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Prof. Doc. Elena Dubrova (KTH)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Prof. Doc. Axel Jantsch (KTH)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Prof. Doc. Ana Rusu (KTH)</td>
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</tr>
<tr>
<td>5</td>
<td>Prof. Doc. Li-Rong Zheng (Dean at Fudan University),</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Prof. Adam Postula (Univ. of Brisbane),</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Doc. Assoc.Prof. Juha Plosila (UTU),</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Doc. Ass.Prof. Pasi Liljeberg (UTU),</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Doc. Adj.Prof Tiberiu Seceleanu (Principal Scientist, ABB Corporate Research and Mälardalen Högskolan).</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Prof. Sashi Kumar (Jonköping University)</td>
<td></td>
</tr>
</tbody>
</table>

10. Pedagogic experience:
- Prof. Tenhunen was actively involved in the establishment of International Masters Programmes at KTH and has given lectures in over 30 different courses at graduate and post-graduate levels. he has established and directed multiple doctoral schools, and have been Director of Education for European Institute and Technology EIT ICTlabs. he has contributed to over 120 journal publications and book chapters, over 600 international reviewed conference publications, 9 international patents. He has cited over 5000 times.

11. Other information of importance to the application
- Prof. Tenhunen received prestigious Mongolian Silver Award from City of Shanghai in 2014 for the contributions to develop Shanghai. For detailed CV and education & research activities see: http://web.ict.kth.se/~hannu/
1.5.3 Prof. Bjorn Pehrson

1. Higher education degree:

2. Doctoral degree:
   Tekn.Dr. 1975 in Automatic Control, "Computer Control of a Concrete Mill", Prof Birger Qvarnström CTH

3. Postdoctoral work
   Uppsala University

4. Qualifications as research fellow/associate professor:
   • Professor Competence in Computer Technology at CTH 1983
   • Docent in Computer Systems from Uppsala Universitet 1983
   • Adjunct professor at KTH in Computer Networks at KTH 1987
   • Full professor in Telecommunication Systems at KTH 1992

5. Specialist certification or equivalent
   N/A

6. Current position, period of appointment, share of time spent in research.
   Prof Em and Senior researcher from 2011, 90% research 10% Teaching

7. Previous positions and periods of appointment.
   • Programmer IBM Sweden and IM Nordic Laboratories 1964- 1967
   • Teaching assistant and Associate professor, Uppsala University 1969-1985
   • Laboratory Manager at Swedish Institute of Computer Science (SICS) 1985-1992
   • Full professor in Telecommunication Systems at KTH 1992-2011
   • Prof Em and Senior researcher since 2011

8. Interruptions in research.
   N/A

9. Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.

    I have more than 40 years teaching experience since 1970. I have designed and directed two MSc programs in Internetworking (1999) and ICT Entrepreneurship (2001) and taught some 20 courses on graduate school in Computer Networks. I coordinated the implementation of a national distributed graduate school in Teleinformatics 1997-2001
    In my mind, the by far most important course is the problem-oriented project driven full semester course on Commnication Systems Design for senior year Master and first year PhD students, that is also the foundation of the Technology Transfer Alliance. The basic concepts go back to my time at Uppsala University and has developed gradually also at KTH from 1992 and on, not least during the Sweden Silicon Valley Link program with Stanford University 1997-2000. I am still teaching it.

11. Other information of importance to the application.
    • Coordinator of the feasibility study for AU-EU AfricaConnect 2008-2009 (www.feastproject.org), the AAU Fibre study for West and Central Africa 2008-2009 (www.aau.org/renu) and the SARUA Fibre project 2005-2006 mid-wifing www.ubuntuinet.net)
    • Co-initiator and management committee member of the Tanzania ICT4RD program (www.ict4rd.ne.tz)
    • KTH representative in EU Support Actions Erina4Africa.eu, euroafrica-ict.org, and ei4Afric.eu
    • Co-chair of Africomm 2014 in Kampala with Julianne Sansa-Otim, Makerere University.
• Co-inititor and co-chair of the International Workshop on Open Access, 2003-2009 supported by Sida and UN ICT Task Force (www.wideopenaccess.net)
• Coordinator of the Vinnova-funded CARENET project doing research on robust residential gateways for telemedicine applications. (www.carenet-se.se)
• Co-chair and program committee member of IEEE LANMAN 2002-2004
• Member of Academic Advisory Committee, University of Colombo School of Computing 2003-2007
• Principal investigator of K&A Wallenberg-funded Sweden-Silicon Valley Link program 1996-1999
• Visiting professor at Stanford University 1997-1999 and at UTS, University of Technology, Sydney, Feb 1993
• Member of the executive committee of the Strategic Research Program on Personal Computing & Communication 1996-98
• Several assignments as PhD dissertation opponent, PhD grading committee member, program committees (IIIFIP Autonomic Networking 2006, Tridentcom 2005 WONS 2004, FIP PSTD, FORTE, PHSSN and IFIP Congress-94, IEEE 1st conf. on Global Networking, ISS95), reviewer, etc
• Member of the editorial board of the Journal High-Speed Networks, IOS Press, 1991-93 and of the Journal of Computer Networks and ISDN Systems since 1993-95
• One of three members in a Danish research council committee for evaluation of computer science research in Latvia after the Independence from the Soviet Union, 1992

1.5.4 Prof. Herald Nkya Kundaeli

1. Higher education degree:
• M.Sc. in Electronic Engineering, 1982, Philips International Institute, Eindhoven, Netherlands, "The Design of a Multiprocessor Computer System"
• Postgraduate Diploma, 1981, Philips International Institute, Eindhoven, Netherlands, “The design of a weather station”.
• B.Sc. in Education (Hons), 1979, University of Dar es Salaam, Tanzania, with majors in Physics and Chemistry, minors in Mathematics.

2. Doctoral degree:

3. Postdoctoral work:
• Visiting Lecturer, Department of Physics, University of Bergen, 7th August-17th May, 2005.
• Visiting Lecturer, Department of Physics, University of Bergen, 31st August-22nd September, 1999.
• Visiting Lecturer, Department of Physics, University of Bergen, 3rd August-29th September, 1998.
• Visiting Researcher, International Centre for Theoretical Physics, Trieste, Italy, July-October, 1997

4. Qualifications as research fellow/associate professor:
• Associate Professor, University of Dar es Salaam, Tanzania, 2002

5. Specialist certification or equivalent
N/A

6. Current position, period of appointment, share of time spent in research.
7. Previous positions and periods of appointment.
- Postgraduate Coordinator, College (CoICT), University of Dar es Salaam, 2011 forward
- Faculty of Science Representative, Senate Higher Degrees Committee, 2002-2005
- Principal Investigator, Light and Life in African Environments UDSM Project.
- Senior Lecturer, Department of Physics, University of Dar es Salaam, 1996 - 2002
- Lecturer, Department of Physics, University of Dar es Salaam, 1987 - 1996
- Assistant Lecturer Department of Physics, University of Dar es Salaam, 1982 - 1987
- Tutorial Assistant Department of Physics, University of Dar es Salaam, 1979 – 1982

8. Interruptions in research.
N/A

9. Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.
- Kwame S. Ibwe, 2013

- Actively involved in the offering courses in analogue electronics, digital electronics, telecommunications, signal processing and opto-electronics in the department of Physics and later department/unit of Electronics and Communication, and currently department of Electronics and Telecommunications Engineering, University of Dar es salaam, Tanzania since 1979.
- Actively involved in the establishment of the degree in Electronics Science and Communication, University of Dar es Salaam, Tanzania.
- Currently involved in the establishment of the degree in Communication and Network Engineering, College of Information and Communications Technologies, University of Dar es Salaam, Tanzania.

11. Other information of importance to the application
- Project Leader: Enhancing Education and Research in Networking and Communications Engineering (ENhANCE), Joint CoICT - Aalto (Finland) Project, 2013-2015.
- Project leader: Light and Life in African Environments. Follow-up research project after expiry of NUFU/Norway support in 2002-2006.
- For detailed CV and education & research activities see (on request)

1.5.5 Dr. Honest Christopher Kimaro

1. Higher education degree:
- M.Sc. in Technical Informatics, 1999 – 2001, Faculty of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology, the Netherlands

2. Doctoral degree:
- PhD in Information Systems, 2003-2006, The Faculty of Mathematics and Natural Sciences, University of Oslo, Norway
"Decentralization and Sustainability of ICT based Health Information Systems in Developing Countries: A case Study from Tanzania”

3. **Postdoctoral work**
   N/A

4. **Qualifications as research fellow/associate professor:**
   - Lecturer, 2006 – To date, Department of Computer Science and Engineering, The University of Dar es Salaam, Tanzania.

5. **Specialist certification or equivalent:**
   Awarded Golden Certificate from the University of Dar es Salaam in recognition of my outstanding achievement in Development of Human Resources Information System (HRIS) for the Ministry of Health in Tanzania on 25th October, 2012 during the climax of UDSM Golden 50th Anniversary Celebrations

6. **Current position, period of appointment, share of time spent in research.**
   - Lecturer and Postgraduate Coordinator, Department of Computer Science and Engineering, The University of Dar es Salaam, Tanzania, 50% Research, 50% Teaching

7. **Previous positions and periods of appointment:**
   - Assistant Lecturer, 2001-2006, University of Dar es Salaam, Tanzania
   - Lecturer, 2006-To date, University of Dar es Salaam, Tanzania
   - Postgraduate Coordinator, 2007-To date, Department of Computer Science and Engineering, University of Dar es Salaam, Tanzania
   - Research Coordinator, College of Information and Communication Technologies, University of Dar es Salaam, 2012-2014

8. **Interruptions in research.**
   N/A

9. **Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.**
   - I am supervising two (2) PhD students who at different stages of their research and thesis writing.
   - I also supervise about 10 MSc dissertations and thesis per year in Computer Science and Informatics
   * Some of MSc graduates under my supervision.
     (1) Mathew Mndeme
     (2) Ntwa Katule
     (3) Christian Budoya
     (4) Achilles Kiwanuka
     (5) Ntwa Katule
     (6) Mawazo Magesa
     (7) Ambele Mwafula
     (8) Happiness Koda
     (9) Bakar Abubakar
     (10) Anthony Mwambeki
     (11) Emanuel Ndilanha
     (12) Aleswa Swai

10. **Pedagogic experience.**
    - I have been teaching a number of courses for undergraduate and postgraduate programmes. I have been teaching courses such as Computer Architecture, Systems Analysis and Design, Distributed databases, and Information systems implementation in organizations
    - I played a key role in developing curricular on Health Informatics and Revised curriculum for Computer Science masters programme.
    - I also had opportunity to be invited as guest lecturer at University of Dodoma in Tanzania where I taught a course on advanced Information systems with focus on health contexts.

11. **Other information of importance to the application**
    I have initiated and become project coordinator and member for various nationally funded research projects since 2007.
    - Team leader: Development and implementation of the national health data warehouse (DHIS2) in Tanzania: CoICT based NORAD and Global Funds sponsored project : 2010-2015
• Team leader: Development and implementation of the comprehensive human resources information system software in the health sector of Tanzania: CoICT based JICA sponsored project: 2009-2014
• Project Manager: Enhancing Education and Research in Networking and Communications Engineering (ENhANCE), Joint CoICT - Aalto (Finland) Project, 2013-2015.

1.5.6 Awet Yemane Weldezion

1. Higher education degree:
• MBA in Innovation and Growth 2010-2012, University of Turku, Turku, Finland.
• Attended M.Sc. level courses in Technology Entrepreneurship 2006-2007, and coached projects run at Telecommunication Systems Laboratory (TSLab) at KTH, Kista, Sweden.

2. Doctoral degree:

3. Postdoctoral work
N/A

4. Qualifications as research fellow/associate professor:
N/A

5. Specialist certification or equivalent:
N/A

6. Current position, period of appointment, share of time spent in research.
• PhD Researcher in Electronic Systems Design at KTH - Royal Institute of Technology, Stockholm, Sweden.

7. Previous positions and periods of appointment:
• Revots PLC, Addis Ababa, 2002 - 2004, Research Engineer, Co-Founder, Duties: Worked in maintenance and PCB design of industrial modules and devices.
• High Tech Park PLC, Addis Ababa, 2000 – 2002, Research Engineer, Duties: Worked in firmware coding for 80c51 controllers based systems

8. Interruptions in research.
N/A

9. Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.
N/A

In the last seven years, worked as Teaching & Lab assistant for several undergraduate and graduate courses at KTH including Embedded Systems, Embedded Electronics, VLSI Design, ASIC Design and Digital Design. Also coached teams of students working for project driven communication systems design (CSD) course.

11. Other information of importance to the application
Awet Yemane Weldezion has been involved in EU FP7 projects and European Institute of Technology and Innovations (EIT) - ICT Labs educational activities. Also participated in previous Sida call for Uganda and EU-Horizon 2020 call for eInfrastructure for Africa.
1.5.7 Prof. Justinian Anatory

1. Higher education degree:
   • BSc. in Engineering (Electrical) (Hons), University of Dar es Salaam (UDSM), Dar es Salaam, Tanzania, (September, 1994 - June, 1998)

2. Doctoral degree:
   • PhD in Telecommunications Engineering: Department of Telecommunications Engineering, ECSE, CoET, University of Dar es Salaam (UDSM), Tanzania, (July 2004 to October 2007). Research Title “Investigation of Broadband access over Power-Line Network for Communication Services provision in Developing Countries”.

3. Postdoctoral work
   • Post-Doctoral Training, Division for Electricity, Department of Engineering Science, Uppsala University, Box 534, 75121, Uppsala, Sweden. Main them: Broadband Power Line Communications Systems. (March, 2008 – September 2008)
   • In 2012 he was requested by Hindawi Publishing Cooperation to lead a team of experts as Guest Editor and publish a special issues in the Journal of Electrical and Computer Engineering with a theme: Power-Line Communications: Smart Grid, Transmission, and Propagation which was published on 15th May, 2013.
   • Technical programme committee member in various conferences such as IEEE ISWTA2012, Indonesia, IEEE PEOCO2012 Malaysia and IEEE PEOCO2013 Malaysia.

4. Qualifications as research fellow/associate professor (year):
   • Nigeria Communications Commission (NCC), 2011: Customer Complains Resolutions
   • April 2006-December 2006, 8-Months visit Division of Electricity and Lightning Research, Uppsala University, Uppsala Sweden: Research on Broadband Power-line Communications (BPLC).
   • November 2004-May 2005, 6-Months visit Division of Electricity and Lightning Research, Uppsala University Sweden: Courses in Electromagnetic Compatibility and research on Broadband Power-line Communications (BPLC).
   • March 2002-July 2002, 4-Month Visit Centre of Telecommunications Access and Services, University of Witwatersrand, Johannesburg, South Africa: Advanced Telecommunication Networks.
   • Invited speaker, Justinian Anatory, ICT in Engineering Practice and Global Knowledge Economy, presented on 11th ANNUAL ENGINEERS DAY 2013, MLIMANI CITY CONFERENCE CENTRE, Dar es Salaam, SEPTEMBER 5 - 6, 2013

5. Specialist certification or equivalent (year, discipline/subject area)
• Corporate Governance strategies in Washington DC, USA, June, 2011,
• Human Resources management for Board Members, Mbabane, Swaziland, January 2012
• Utility Regulation and Strategy and Practicing Leadership in a Political Environment in Florida, USA, January 2010

6. Current position, period of appointment, share of time spent in research.
• Dean, School of Informatics, College of Informatics and Virtual Education, University of Dodoma, w.e.f. January 2013 to date.
• Associate Professor in Telecommunications Engineering, Department of Telecommunications and Communications Networks, University of Dodoma, w.e.f. May 2012 to date.
• Member of the IEEE Communications Society, IEEE Power and Energy Engineering Society (PES), IEEE Computer Society, IEEE Vehicular Technology Society and IEEE Education Society (USA). He sit at various committees and Boards as a member.

7. Previous positions and periods of appointment.
• Board Member of the Tanzania Communications Regulatory Authority (TCRA) from April, 2009- April 2013.
• TCRA Complaints Committee of the TCRA Board from 3rd June, 2011-to April, 2013.
• Intellectual Property Officer, College of Engineering and Technology at the University of Dar es Salaam (2007-2008).
• Dean, School of Virtual Education, College of Informatics and Virtual Education, University of Dodoma, w.e.f. September 2008 to January 2013.
• Senior Lecturer, School of Virtual Education, College of Informatics and Virtual Education, University of Dodoma, w.e.f. September 2008 to May 2012.
• Lecturer: ( 2007-to 2008): The Department of Computer and Systems Engineering, Faculty of Electrical and Computer Systems Engineering (ECSE), College of Engineering and Technology (CoET), University of Dar es Salaam.
• Assistant Lecturer: 2004-2007: The Department of Computer and Systems Engineering, Faculty of Electrical and Computer Systems Engineering (ECSE), College of Engineering and Technology (CoET), University of Dar es Salaam.

8. Interruptions in research.
N/A

9. Individuals who have completed their doctoral/MSc. degree under your supervision or postdoctoral period under your main supervision.
• M.Sc.
1.5.8 Dr. Ndyetabura Yahaya Hamisi

1. Higher education degree:
   - B.Eng in Electrical & Electronics, University of Mysore – India, 1990
   - MSc in Electronics & Information Technology, University of Dar es Salaam – Tanzania, 2003
     Project: Effect of videoconferencing packets on narrow bandwidth computer network.
   - Ph.D in Computer Engineering & Information Technology, University of Dar es Salaam-Tanzania, 2014.
     Thesis: Modelling of intelligent traffic control systems with dynamic networking and resource sharing in Dar es Salaam City.

2. Postdoctoral work
   - Design and implementation of green design – Dar City Project, July 2014.

3. Research Project

4. Specialist certification or equivalent
   - Registered Consulting Engineer in Electrical & Electronics by ERB, 2005.

3. Current position:
   Lecturer, UDSM, 2005

4. Other information of importance to the application
   - Worked in the Ministry of Works for 15 years, where I started as Assistant Electrical Engineer and raised up to Senior Electronics Engineer, when I took a voluntarily transfer from field to academic works at the University of Dar es Salaam in 2005.
   - Undergraduate and Master’s Program courses: I have taught Computer Programming in Pascal, Measurement and Instrumentation Engineering, Computer Networking, Computer Based Techniques for Measurements and Control
   - Short courses attended: Research methodology
   - Consultancy work carried: CoICT curriculum review and development, CoICT master plan development.

1.5.9 Dr. Richard Hans Mgaya

1. Higher education degree(s)
   - B.Sc. In Mathematic, 2004, St. Augustine’s University, Raleigh, NC, USA

2. Doctoral degree.
   - Ph.D. in Computer and Information Systems Engineering, Tennessee State University, Nashville, TN, USA, in 2012, “Distributed Control System and Architecture for Integrated Controls and Diagnostics of Turbine Engines”, Supervisor: Professor Saleh-Zein Sabatto

3. Postdoctoral work.
   - N/A

4. Qualification/appointments as research fellow/associate professor.
   - N/A

5. Specialist certification or equivalent
6. **Current position, period of appointment, share of time spent in research.**
   - Lecturer, University of Dar-es-Salaam, 2012 forward. Time spent on research: 40%

7. **Previous positions and periods of appointment.**
   - Research Assistant, Tennessee State University, 2004-2012.

8. **Interruptions in research. Specify the reason(s) and give the time and dates of the interruption.**
   - N/A

9. **Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.**
   - N/A

10. **Pedagogic experience:**
    - Actively involved in the University’s curriculum review process.

11. **Other information of importance to the application**
    - IEEE member since 2007

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**IEEE member since 2007**

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**1.5.10 Ms. Christine Mwase**

1. **Higher education degree(s) (year, subject area)**
   - M.Sc. in Communications Systems and Signal Processing, 2004, University of Bristol, UK.
   - B.Sc. in Electrical and Electronic Engineering, 2002, University of Bath, UK.

2. **Doctoral degree:**
   - N/A

3. **Postdoctoral work (year and placement):**
   - N/A

4. **Qualifications as research fellow/associate professor (year):**
   - N/A

5. **Specialist certification or equivalent (year, discipline/subject area):**
   - Registered Graduate Engineer, Engineers Registration Board.

6. **Current position, period of appointment, share of time spent in research.**
   - Assistant Lecturer, Department of Electronics and Telecommunications Engineering (ETE), College of Information and Communications Technology (CoICT), University of Dar es Salaam (UDSM), 2005 to date
   - Coordinator, Undergraduate Projects, Department of ETE, CoICT, 2006 to date
   - Coach, University of Dar es Salaam ICT Incubator (UDICTI) Program, 2010 to date

7. **Previous positions and periods of appointment (Specify type of position):**
   - IPR Officer, University of Dar es Salaam, 2007 to 2011.
   - Member, Technology Development and Transfer Centre (TDTC) Management Advisory Committee, 2011.
   - Departmental Representative, University Planning Committee, 2007 to 2008.

8. **Interruptions in research.**
   - N/A

9. **Individuals who have completed their doctoral degree under your supervision or postdoctoral period under your main supervision.**
   - N/A

10. **Pedagogic experience:**
    - Curriculum development: actively involved in the development of the Department of ETE postgraduate and undergraduate curriculum.
Coaching: actively involved in the establishment and coordination of UDICTI, as well as in the coaching of the incubatees.

Others: actively involved in the establishment of a professional development program on Mobile Application Development that trains the public on developing mobile apps. Also involved in research and consultancy activities.

11. **Other information of importance to the application**
- I am currently participating in a Team Mastery training program for team coaches of innovation, incubation and entrepreneurial activities.
iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

1.6.1 Prof. Nerey H. Mvungi

5. Salehe I. Mrutu, Anael Sam and Nerey H. Mvungi, “Assessment of Non Transmittable Codewords Enhancement to Viterbi Algorithm Decoding”, Accepted for publication in IJCSIS September 2014 issue (Vol. 12, No. 9).

1.6.2 Prof. Dr.h.c. Prof.h.c. Hannu Tenhunen, Ph.D.

Enclosure 5: Publications List  

iGRID


1.6.3 Prof. Bjorn Pehrson

1. Amos Nungu, Robert Olsson, Björn Pehrson, Jiawei Kang, Daniel Kifetew and Alisher Rustamov, "Inclusive Ubiquitous Access - A Status Report", IEEE Africomm, Yaounde, Cameroon, November 2012


5. Amos Nungu and Björn Knutsson and Björn Pehrson, "On Building Sustainable Broadband Networks in Rural Areas". Presented at the ITU Technical Symposium, October 2011, (Published in IEEE Xplore).


1.6.4 Prof. Herald Nkya Kundaeli


1.6.5 Dr. Honest Christopher Kimaro


1.6.6 Awet Yemane Weldezion


1.6.7 Prof. Justinian Anatory


1.6.8 Dr. Ndyetabura Yahaya Hamisi


1.6.90 Dr. Richard Hans Mgaya

I

iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

1. Background

1.1 Introduction

The focus of the proposed five-year project is on developing capacity and capability to improve the performance of the Tanzanian electrical power system being managed by the power utility company Tanzania Electric Supply Company (TANESCO) through governance improvement in its totality of the power system using smart grid concept. The capacity is to be developed through research, development and innovation of the different aspects of the smart grid. Through monitoring, analysis and control of the grid using ICT solutions, intelligent sensors and actuators, it is expected that reliability and efficiency of power delivery services to consumers will improve significant and indication of areas that are chronic in power theft to the relief of most consumers since unnecessary increase in energy charges will disappear. It is expected that opportunities for local entrepreneurs can be opened up through this iGRID research project where participants shall not only be doing research but also learn how to be innovative and entrepreneur in their work from the KTH peers.

The costs for the iGRID project are summarized into the following categories: equipment necessary to enable quality research in iGRID aspects to complement equipment and facilities in place, minor equipment, consumables, travels costs both within the country and abroad, field allowance costs, subsistence grants to enable research students meet living costs, and salaries for KTH staff for activities they will undertake in this project. Table 6.1 shows summary of proposed allocation of the requested funds to participating institutions.

Table 6.1 presents an overview of the iGRID research project costs. The numbers in brackets indicates the number of students/candidates to be supported for a given program area – as applicable. Table 6.2 is a further breakdown by budget line. A detailed narrative for each of the program areas follow.

1.2 University of Dar es Salaam Contribution

The contribution of the University of Dar es Salaam in this project shall be in kind focusing on three areas: (a) Human resource in man months at a rate of 22,000 SEK, (b) Services which includes water, electricity, internet, cleanness, etc which can be estimated at 53,000 SEK per month (c) working space for researchers and supervisors at 4,000 SEK per month per researcher/staff.

These costs are not charged to the project, for example no staff is paid salary by the project for his/her inputs to the project. This is to be perceived as in kind contribution to the project by the participating institutions. Any payment to staff or students shall be for direct costs and expenses only.
1.3 KTH Contribution

The salary and other expenses charged by KTH in this project is only a part of the actual amounts the amount in excess shall be the contribution of KTH to the project.
Table: 6.0: Budget summary showing amounts for collaborating institutions for its staff and students projects activities and equipment

<table>
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<tr>
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<th>Tanzania 2015/16</th>
<th>Tanzania 2015/16</th>
<th>Tanzania 2015/16</th>
<th>Tanzania 2015/16</th>
<th>Tanzania 2015/16</th>
<th>TOTAL SEK</th>
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<tr>
<td></td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
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<tr>
<td>Curriculum development</td>
<td>382,340</td>
<td>79,640</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>461,980</td>
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<tr>
<td>Research equipment</td>
<td>635,800</td>
<td>244,000</td>
<td>198,000</td>
<td>48,000</td>
<td>48,000</td>
<td>1,173,800</td>
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<tr>
<td>Research consumables</td>
<td>30,000</td>
<td>82,000</td>
<td>84,000</td>
<td>72,000</td>
<td>40,000</td>
<td>308,000</td>
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<td>Travel</td>
<td>84,000</td>
<td>84,000</td>
<td>182,300</td>
<td>182,300</td>
<td>0</td>
<td>532,600</td>
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<td>Field/lab work</td>
<td>22,000</td>
<td>44,000</td>
<td>250,800</td>
<td>250,800</td>
<td>0</td>
<td>567,600</td>
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<td>student fees</td>
<td>25,200</td>
<td>281,120</td>
<td>358,480</td>
<td>281,120</td>
<td>178,560</td>
<td>1,124,480</td>
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<tr>
<td>students stipend</td>
<td>355,860</td>
<td>658,260</td>
<td>748,400</td>
<td>647,600</td>
<td>201,600</td>
<td>2,611,720</td>
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<td>conferences</td>
<td>0</td>
<td>168,000</td>
<td>434,000</td>
<td>500,000</td>
<td>352,020</td>
<td>1,454,020</td>
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<tr>
<td>publication costs</td>
<td>0</td>
<td>16,000</td>
<td>48,000</td>
<td>40,000</td>
<td>32,000</td>
<td>136,000</td>
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<td>Travel insurance</td>
<td>3,000</td>
<td>8,000</td>
<td>8,000</td>
<td>4,000</td>
<td>2,500</td>
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<td>other costs</td>
<td>52,700</td>
<td>40,000</td>
<td>40,000</td>
<td>36,000</td>
<td>34,500</td>
<td>203,200</td>
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<td>indirect costs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>SUB TOTAL</strong></td>
<td><strong>1,590,900</strong></td>
<td><strong>1,705,020</strong></td>
<td><strong>2,351,980</strong></td>
<td><strong>2,061,820</strong></td>
<td><strong>889,180</strong></td>
<td><strong>8,598,900</strong></td>
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</table>

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<th></th>
<th>Sweden 2015/16</th>
<th>Sweden 2015/16</th>
<th>Sweden 2015/16</th>
<th>Sweden 2015/16</th>
<th>Sweden 2015/16</th>
<th>TOTAL SEK</th>
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</tr>
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<td>Supervision</td>
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</tr>
<tr>
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<td>81,150</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Lecturing courses</td>
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<td>216,400</td>
<td>216,400</td>
<td>82,100</td>
<td>731,300</td>
</tr>
<tr>
<td>Coordination and project management cost</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
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<td>1,200,000</td>
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<tr>
<td>Cost per researcher/student visiting Sweden</td>
<td>140,000</td>
<td>140,000</td>
<td>180,000</td>
<td>180,000</td>
<td>0</td>
<td>640,000</td>
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<tr>
<td><strong>SUB TOTAL</strong></td>
<td><strong>861,150</strong></td>
<td><strong>1,077,550</strong></td>
<td><strong>1,036,400</strong></td>
<td><strong>1,036,400</strong></td>
<td><strong>322,100</strong></td>
<td><strong>4,333,600</strong></td>
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<table>
<thead>
<tr>
<th></th>
<th>GRAND TOTAL 2015/16</th>
<th>GRAND TOTAL 2015/16</th>
<th>GRAND TOTAL 2015/16</th>
<th>GRAND TOTAL 2015/16</th>
<th>GRAND TOTAL 2015/16</th>
<th>TOTAL SEK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
<td>SEK</td>
</tr>
<tr>
<td>Excluding UDSM Institution fees</td>
<td>2,452,050</td>
<td>2,782,570</td>
<td>3,388,380</td>
<td>3,098,220</td>
<td>1,211,280</td>
<td>12,932,500</td>
</tr>
<tr>
<td>12% institution fees*</td>
<td>119,892</td>
<td>184,476</td>
<td>257,280</td>
<td>222,468</td>
<td>113,424</td>
<td>897,504</td>
</tr>
<tr>
<td>Including UDSM 12% Institution fees</td>
<td>2,532,000</td>
<td>2,927,200</td>
<td>3,645,700</td>
<td>3,320,800</td>
<td>1,324,700</td>
<td>13,750,400</td>
</tr>
</tbody>
</table>

*Note that the 12% applies for funds to be received at UDSM only. Funds at KTH for UDSM are excluded

Note: The budget items for KTH indicated in table 6.0 does not include that which is for use by UDSM at KTH to acquire video conferencing equipment, students stipend, etc.
### Table 6.1: Overview of Projects Costs in SEK by Program Area

<table>
<thead>
<tr>
<th></th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
<th>UDSM</th>
<th>KTH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Curriculum</td>
<td>463,500</td>
<td>160,800</td>
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<td>-</td>
<td>-</td>
<td>624,300</td>
<td>510,300</td>
<td>114,000</td>
</tr>
<tr>
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<td>150,000</td>
<td>590,200</td>
<td>1,375,300</td>
<td>1,363,300</td>
<td>852,200</td>
<td>4,330,900</td>
<td>3,914,900</td>
<td>416,000</td>
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<td>PhD Sandwich (2)</td>
<td>838,400</td>
<td>960,400</td>
<td>1,004,400</td>
<td>1,004,400</td>
<td>-</td>
<td>3,807,600</td>
<td>1,027,600</td>
<td>2,780,000</td>
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<tr>
<td>M.Sc. at UDSM (8)</td>
<td>100,000</td>
<td>244,200</td>
<td>474,300</td>
<td>234,200</td>
<td>-</td>
<td>1,052,600</td>
<td>1,052,600</td>
<td>-</td>
</tr>
<tr>
<td>Post Doc (4)</td>
<td>230,700</td>
<td>282,700</td>
<td>30,000</td>
<td>-</td>
<td>-</td>
<td>543,300</td>
<td>319,300</td>
<td>224,000</td>
</tr>
<tr>
<td><strong>KTH Coordination of Programme</strong></td>
<td>248,000</td>
<td>248,000</td>
<td>248,000</td>
<td>248,000</td>
<td>248,000</td>
<td>1,240,000</td>
<td>40,000</td>
<td>1,200,000</td>
</tr>
<tr>
<td>TTA and Innovation Course</td>
<td>0</td>
<td>216,400</td>
<td>216,400</td>
<td>216,400</td>
<td>82,100</td>
<td>731,300</td>
<td>392,000</td>
<td>339,300</td>
</tr>
<tr>
<td>Research Support Component</td>
<td>381,500</td>
<td>40,000</td>
<td>40,000</td>
<td>32,000</td>
<td>29,000</td>
<td>522,500</td>
<td>222,500</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>Total Direct Costs</strong></td>
<td>2,412,100</td>
<td>2,742,700</td>
<td>3,388,400</td>
<td>3,098,300</td>
<td>1,211,300</td>
<td>12,852,500</td>
<td>7,479,200</td>
<td>5,373,300</td>
</tr>
<tr>
<td>UDSM institution fees (12%)</td>
<td>119,892</td>
<td>184,476</td>
<td>257,280</td>
<td>222,468</td>
<td>113,424</td>
<td>897,504</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Project Total being requested from Sida</strong></td>
<td>2,532,000</td>
<td>2,927,200</td>
<td>3,645,700</td>
<td>3,320,800</td>
<td>1,324,700</td>
<td>13,750,000</td>
<td>8,376,700</td>
<td>5,373,300</td>
</tr>
<tr>
<td>(c) Universities Contributions</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>KTH</td>
<td>810,220</td>
<td>1,165,330</td>
<td>1,165,330</td>
<td>1,165,330</td>
<td>455,110</td>
<td>4,761,320</td>
<td>0</td>
<td>4,761,320</td>
</tr>
<tr>
<td>UDSM</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>8,392,000</td>
<td>8,392,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total in kind contribution (UDSM/KTH)</strong></td>
<td>2,488,620</td>
<td>2,843,730</td>
<td>2,843,730</td>
<td>2,843,730</td>
<td>2,123,510</td>
<td>13,153,320</td>
<td>8,392,000</td>
<td>4,761,320</td>
</tr>
<tr>
<td><strong>Total Project Cost Request From Sida + UDSM and KTH in kind Contribution</strong></td>
<td>4,210,400</td>
<td>4,605,600</td>
<td>5,324,100</td>
<td>4,999,200</td>
<td>3,003,100</td>
<td>22,142,000</td>
<td>16,768,700</td>
<td>10,134,620</td>
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</tbody>
</table>

**Note:** KTH Coordination of Programme costs involves salary for efforts to coordinate the research programme, supervision and management of 8 local PhD students, 4 Postdocs, and 4 local supervisors for 3 months per year @80000 SEK per month. For conducting planning and review meetings of the programme @8000 SEK per year.
Table 6.2: Breakdown by program and by budget item

<table>
<thead>
<tr>
<th>Program</th>
<th>Equipment</th>
<th>Minor Equipment</th>
<th>Consumables</th>
<th>Travel</th>
<th>Allowance</th>
<th>Fieldwork</th>
<th>Subsistence</th>
<th>Grants</th>
<th>Salaries</th>
<th>Total by program</th>
<th>% cost</th>
</tr>
</thead>
<tbody>
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<td>Curriculum</td>
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<td>0</td>
<td>309,760</td>
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<td>0</td>
<td>48300</td>
<td>624,280</td>
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<tr>
<td>Local PhD at UDSM (8)</td>
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<td>0</td>
<td>4,330,860</td>
<td>33.7</td>
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<tr>
<td>PhD Sandwich (2)</td>
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<td>580,800</td>
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<td>66,000</td>
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<td>0</td>
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<td>29.6</td>
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</tr>
<tr>
<td>M.Sc. at UDSM (8)</td>
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<td>357,440</td>
<td>88,000</td>
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<td>0</td>
<td>0</td>
<td>1,052,640</td>
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<td>Post Doc (4)</td>
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<td>40,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,200,000</td>
<td>0</td>
<td>1,240,000</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>TTA and Innovation Course</td>
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<td>0</td>
<td>0</td>
<td>339,300</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>392,000</td>
<td>731,300</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>522,500</td>
<td>4.1</td>
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</tr>
<tr>
<td>Total by budget item (excluding UDSM institution fee)</td>
<td>1,035,500</td>
<td>236,000</td>
<td>2,513,260</td>
<td>2,648,120</td>
<td>567,600</td>
<td>2,611,720</td>
<td>3,240,300</td>
<td>0</td>
<td>12,852,500</td>
<td>12.8</td>
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<tr>
<td>% by budget item</td>
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<td>1.8</td>
<td>19.6</td>
<td>20.6</td>
<td>4.4</td>
<td>20.3</td>
<td>25.2</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>UDSM institution fees (12%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>897,504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Budget being requested from Sida</td>
<td>1,035,500</td>
<td>236,000</td>
<td>2,513,300</td>
<td>2,648,100</td>
<td>567,600</td>
<td>2,611,700</td>
<td>3,240,300</td>
<td>0</td>
<td>13,750,000</td>
<td></td>
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</tr>
</tbody>
</table>

Note: The budget does not provide any allocation under Faculty Funds and hence this budget item is not included in Table 2.
### Table 6.2B: Annual allocation to collaborating partners

<table>
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<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UDSM</td>
<td>KTH</td>
<td>UDSM</td>
<td>KTH</td>
<td>UDSM</td>
</tr>
<tr>
<td>Curriculum</td>
<td>406,500</td>
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<td>103,800</td>
<td>57,000</td>
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</tr>
<tr>
<td>Local PhD at UDSM (8)</td>
<td>150,000</td>
<td>-</td>
<td>590,200</td>
<td>-</td>
<td>1,167,300</td>
</tr>
<tr>
<td>PhD Sandwich (2)</td>
<td>134,400</td>
<td>704,000</td>
<td>268,400</td>
<td>692,000</td>
<td>312,400</td>
</tr>
<tr>
<td>M.Sc. at UDSM (8)</td>
<td>100,000</td>
<td>-</td>
<td>244,200</td>
<td>-</td>
<td>474,300</td>
</tr>
<tr>
<td>Post Doc (4)</td>
<td>118,700</td>
<td>112,000</td>
<td>170,700</td>
<td>112,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Coordination of Programme</td>
<td>8,000</td>
<td>240,000</td>
<td>8,000</td>
<td>240,000</td>
<td>8,000</td>
</tr>
<tr>
<td>TTA and Innovation Course</td>
<td>-</td>
<td>-</td>
<td>112,000</td>
<td>104,400</td>
<td>112,000</td>
</tr>
<tr>
<td>Research Support Component</td>
<td>81,500</td>
<td>300,000</td>
<td>40,000</td>
<td>-</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>Sub Total Direct Costs KTH/UDSM</strong></td>
<td><strong>999,100</strong></td>
<td><strong>1,413,000</strong></td>
<td><strong>1,537,300</strong></td>
<td><strong>1,205,400</strong></td>
<td><strong>2,144,000</strong></td>
</tr>
<tr>
<td>UDSM Institution fees (12%)</td>
<td>119,892</td>
<td>184,476</td>
<td>257,280</td>
<td>222,468</td>
<td>113,424</td>
</tr>
<tr>
<td><strong>Total Direct Costs</strong></td>
<td>2,532,000</td>
<td>2,927,200</td>
<td>3,645,700</td>
<td>3,320,800</td>
<td>1,324,700</td>
</tr>
</tbody>
</table>
2. Overview of Budget

This section presents the full cost of planned activities classified under ten broad categories. As appropriate, the budgets include funds requested from Sida as well as additional funds from other sources such as funders and national contributions.

2.1 Cost of Curriculum Development and Review

A budget for MSc and PhD taught Curriculum development (i.e. developing curriculum for two programmes) costs includes:

(i) An allocation of 105,220 SEK for conducting needs assessment
   (a) Travel
      Provision of 95,220 SEK for field data collection. The amount will cover expenses for transport, local travel, accommodation, living expenses, communication.

      Details:
      Perdiem: 390 SEK/day
      Transport within region: 450 SEK/day
      Travel to regions: 360 SEK per trip per person
      Communication with stakeholders: 200 SEK per person
      Total Cost per field research assistant: \((390\text{SEK} + 450\text{SEK}) \times 5\text{ days} + (360\text{SEK} + 200\text{SEK})\) = 4760 SEK
      Total Cost for 20 research assistants = 4760 SEK \times 20 \text{ people} = 95,220 SEK

   (b) Consumables
      Provision of 10,000 SEK for production of data instruments, stationary, toner, etc

(ii) Curriculum review and development retreats considered as consumables
      Three retreats: Survey data analysis, Report writing and curriculum Development;

      Details:
      Retreats
      Travel: 300 SEK \times 3 \text{ retreats} \times 6 \text{ people} = 5,400 SEK
      Full Board retreat facilities package: 1,020 SEK per day \times 3 \text{ retreats} \times 6 \times 7 \text{ days} = 128,520 SEK

(iii) Curriculum review workshops (two workshops) involving internal and external stakeholders.
      Details:
Internal stakeholders Workshop
Venue: Day workshop package per person @ 335 SEK per participant per day
Transport: 300 SEK per person per day
Consumables: (Photocopy, Printing, Binding, stationery) = 50 SEK per participant
Total costs cost for 30 participants: (335 SEK + 300 SEK + 50 SEK) × 30 participants = 20,550 SEK

External stakeholders Workshop
Venue: Day workshop package per person @ 335 SEK per participant per day
Transport: 300 SEK per person per day
Consumables: (Photocopy, Printing, Binding, stationery) = 50 SEK per participant
Total costs cost for 30 participants: (335 SEK + 300 SEK + 50 SEK) × 50 participants = 34,250 SEK

(iv) Allocation of 17,520 SEK for Curriculum Finalization retreat considered as consumables for conference facilities and transport.

Details:
Travel: 300 SEK × 1 retreat × 6 people = 1,800 SEK
Full Board retreat facilities package: 1,020 SEK per day × 1 retreat × 6 people × 7 days = 42,840 SEK

(v) KTH expert in Tanzania for support in curriculum development: 4 work days, three experts to also participate in 2 workshops
a. Travel 10,000 SEK per person/workshop i.e. 60,000 SEK and allowance 2,300 SEK per day per person/workshop i.e. 54,000 SEK
b. Honoraria 8,050 SEK per person per visit i.e. 48,300 SEK

(vi) Visiting Sweden for benchmarking:
- Visiting universities in Sweden for benchmarking the curriculum being developed. Travel to Sweden three people: ticket 30,000 SEK; 3 days at 3,000 SEK i.e. 27,000 SEK
- Workshop on the curriculum development: Travel to Sweden three people: ticket 30,000 SEK; 3 days at 3,000 SEK i.e. 27,000 SEK

(vii) Accreditation fee 35,000 SEK per programme
### Table 6.3: Breakdown of cost of curriculum development

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
<th>UDSM</th>
<th>KTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs assessment for graduate program in iGRID study area’</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Travel</td>
<td>95,220</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>95,220</td>
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<td></td>
</tr>
<tr>
<td>(b) Consumables</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum development Retreats as consumables</td>
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<td>44,640</td>
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<td>0</td>
<td>0</td>
<td>174,960</td>
<td>174,960</td>
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</tr>
<tr>
<td>Stakeholders Workshops</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Workshops as consumables</td>
<td>54,800</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>54,800</td>
<td>54,800</td>
<td></td>
</tr>
<tr>
<td>(b) KTH experts Support-Travel</td>
<td>81,150</td>
<td>81,150</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>162,300</td>
<td>48,300</td>
<td>114,000</td>
</tr>
<tr>
<td>Benchmarking with Swedish Universities</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Visiting university in Sweden</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Travel</td>
<td>30,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii) Allowances</td>
<td>27,000</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>27,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum accreditation fee as consumables</td>
<td>35,000</td>
<td>35,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>70,000</td>
<td>70,000</td>
<td></td>
</tr>
<tr>
<td>Sub total</td>
<td>463,500</td>
<td>160,800</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>624,300</td>
<td>510,300</td>
<td>114,000</td>
</tr>
</tbody>
</table>

Note: The costs involves preparing curriculum for PhD and M.Sc. programmes.

### 2.2 Cost of Training

This section presents a breakdown of costs of training for the PhD (local and sandwich), postdoc, and MSc students.

#### 2.2.1 Doctoral Education

### Table 6.4: Breakdown of cost of Doctoral Education

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowances for visiting lecturers - TTA course</td>
<td>0</td>
<td>48,300</td>
<td>48,300</td>
<td>48,300</td>
<td>0</td>
<td>144,900</td>
<td>0</td>
<td>144,900</td>
</tr>
<tr>
<td>Honorarium fee for visiting lecturers - TTA course</td>
<td>0</td>
<td>56,000</td>
<td>56,000</td>
<td>56,000</td>
<td>0</td>
<td>168,000</td>
<td>168,000</td>
<td></td>
</tr>
<tr>
<td>Airfare TTA course lecturers from Sweden to Tanzania</td>
<td>0</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
<td>0</td>
<td>90,000</td>
<td>0</td>
<td>90,000</td>
</tr>
<tr>
<td>Airfare innovation and entrepreneurship trainers from Sweden to Tanzania</td>
<td>0</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>40,000</td>
<td>0</td>
<td>40,000</td>
</tr>
<tr>
<td>Allowances for visiting lecturers - Innovation course</td>
<td>0</td>
<td>16,100</td>
<td>16,100</td>
<td>16,100</td>
<td>16,100</td>
<td>64,400</td>
<td>0</td>
<td>64,400</td>
</tr>
<tr>
<td>Honorarium fee for visiting lecturers - Innovation course</td>
<td>0</td>
<td>56,000</td>
<td>56,000</td>
<td>56,000</td>
<td>56,000</td>
<td>224,000</td>
<td>224,000</td>
<td></td>
</tr>
<tr>
<td>Audit costs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sub total</td>
<td>0</td>
<td>216,400</td>
<td>216,400</td>
<td>216,400</td>
<td>82,100</td>
<td>731,300</td>
<td>392,000</td>
<td>339,300</td>
</tr>
</tbody>
</table>

This section presents a breakdown of costs of training for ten PhD (8 local and 2 sandwich), four PostDoc, and 8 MSc students. The respective budgets for these are presented from Table
5 – 8. Table 4 presents the doctoral education training budget that caters for cross-cutting activities across all the training.

**2.2.2 Cost of Training for PhD students**

An allocation of

**Local Taught PhD Student Budget**

A PhD research student will spend 4 years at UDSM. The budget per student includes:

(i) Field work research funds for PhD at UDSM in Tanzania approximated for 14 days per year at 1100 SEK per year per student which is 46,200 SEK to cater for field work expenses including local travel, data collection, accommodation and subsistence per program. The 14 days duration for local PhD students is because they have only two field sessions.

(ii) A subsistence grant of 25,200 SEK per year at a rate of 2,100 SEK per month to cater for subsistence allowance which is 75,600 SEK per programme of three years for PhD candidates in Tanzania

(iii) Each local PhD student shall receive tuition expenses of 22,380 SEK per year towards tuition fees which is 67,410 per programme;

(iv) PhD student will be supported to attend two conferences per program at a rate of 10,000 SEK air ticket plus 4 days at 3,000 SEK per day per conference (i.e. 22,000 SEK per conference) and two journal publication at 4,000 SEK (i.e. 8,000 SEK for 2 publications).

(v) PhD students research visit to Sweden allocate air ticket 10,000 SEK, stipend 16,000 SEK per month for months which is 32,000 SEK per programme

(vi) Consumables: 10,000 SEK lump sum per year for papers printers, literature, etc

(vii) Minor equipment to support research work 6,000 SEK per student

(viii) Equipment for research 400,000 SEK (80,000 SEK actuators, 120,000 SEK power system status monitoring, 90,000 SEK communication, 50,000 SEK security, 60,000 SEK data processing)

**Sandwich PhD student budget**

Sandwich students will spend six months per year in Sweden and same period in Tanzania. The budget for sandwich students includes:

(i) PhD student will be supported to attend two conferences per program at a rate of 10,000 SEK air ticket plus 4 days at 3,000 SEK per day per conference (i.e. 22,000 SEK per conference) and two journal publication at 4,000 SEK (i.e. 8,000 SEK for 2 publications)

(ii) Minor equipment to support research work 6,000 SEK per student

(iii) Supervision: Salaries for the Swedish supervisors at 200,000 SEK per year for PhD student

(iv) Field work: Field work research funds for PhD sandwich in Tanzania approximated for 10 days per year at 1100 SEK per year per student which is 66,000 SEK to cater for field work expenses for three sessions starting 2nd year which include local travel, data collection, accommodation and subsistence per program per year. This lower by four days compared to local students since they have three sessions.

(v) A subsistence grant and travel:
   • 16,000 SEK per month while in Sweden which is 384,000 SEK for 24 months per programme
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- 2,100 SEK per month while in Tanzania for 24 months which is 50,400 SEK per programme to cater for subsistence allowance for PhD candidates
- PhD student will be supported to travel to KTH once per year at a rate of 10,000 SEK per air ticket which is 40,000 SEK for four years per programme.

(vi) Each PhD (sandwich) student shall receive an allowance of 12,600 SEK per year towards tuition and research support

(vii) Consumables:
- 10,000 SEK per year for papers printers, literature, etc while in Tanzania
- 50,000 SEK per year for office services and consumable while in Sweden

In addition, the proposal has taken note that for UDSM it is expected that the employment regulations and conditions for staff on training in relation to salary and stipends payment while on studies shall be followed.

Table 6.5: Costs for training for (8) PhD (Taught UDSM) student

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
<th>UDSM</th>
<th>KTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary for Local PhD students in Sweden</td>
<td>0</td>
<td>178,560</td>
<td>178,560</td>
<td>178,560</td>
<td>178,560</td>
<td>714,240</td>
<td>714,240</td>
<td></td>
</tr>
<tr>
<td>Consumables for 8 local PhD in Tanzania</td>
<td>0</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
<td>160,000</td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>Consumables for 8 local PhD in Sweden</td>
<td>0</td>
<td>0</td>
<td>80,000</td>
<td>0</td>
<td>160,000</td>
<td>0</td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>Publication cost / Reg. fees for 8 local PhD</td>
<td>0</td>
<td>0</td>
<td>32,000</td>
<td>32,000</td>
<td>32,000</td>
<td>96,000</td>
<td>96,000</td>
<td></td>
</tr>
<tr>
<td>Tanzania local PhD student in conference _perdiem</td>
<td>0</td>
<td>0</td>
<td>48,000</td>
<td>96,000</td>
<td>96,000</td>
<td>240,000</td>
<td>240,000</td>
<td></td>
</tr>
<tr>
<td>Airfare local PhD to conference attendance abroad</td>
<td>0</td>
<td>0</td>
<td>40,000</td>
<td>80,000</td>
<td>80,000</td>
<td>200,000</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>Salary for Local PhD students in Tanzania</td>
<td>0</td>
<td>201,600</td>
<td>201,600</td>
<td>201,600</td>
<td>201,600</td>
<td>806,400</td>
<td>806,400</td>
<td></td>
</tr>
<tr>
<td>Salary for Local PhD students in Sweden</td>
<td>0</td>
<td>0</td>
<td>128,000</td>
<td>128,000</td>
<td>0</td>
<td>256,000</td>
<td>0</td>
<td>256,000</td>
</tr>
<tr>
<td>Field work allowance - for local PhD research in Tanzania</td>
<td>0</td>
<td>0</td>
<td>184,800</td>
<td>184,800</td>
<td>369,600</td>
<td>369,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor equipment for 6 local PhD students</td>
<td>0</td>
<td>0</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
<td>144,000</td>
<td>144,000</td>
<td></td>
</tr>
<tr>
<td>Airfare local PhD to Sweden</td>
<td>0</td>
<td>0</td>
<td>40,000</td>
<td>40,000</td>
<td>80,000</td>
<td>80,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowances for visiting supervisors for local PhD &amp; Postdocs</td>
<td>0</td>
<td>0</td>
<td>48,300</td>
<td>48,300</td>
<td>96,600</td>
<td>96,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airfare supervisors to local PhD and Postdocs from Sweden to Tanzania</td>
<td>0</td>
<td>0</td>
<td>30,000</td>
<td>30,000</td>
<td>60,000</td>
<td>60,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowance Tanzania supervisors attending conference</td>
<td>0</td>
<td>0</td>
<td>96,000</td>
<td>96,000</td>
<td>96,000</td>
<td>288,000</td>
<td>288,000</td>
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</tr>
<tr>
<td>Airfare local supervisors to conference attendance abroad</td>
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<td>0</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>180,000</td>
<td>180,000</td>
<td></td>
</tr>
<tr>
<td>Innovation and entrepreneurship workshops</td>
<td>0</td>
<td>20,000</td>
<td>20,000</td>
<td>20,020</td>
<td>80,020</td>
<td>80,020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory equipments</td>
<td>150,000</td>
<td>150,000</td>
<td>100,000</td>
<td>0</td>
<td>0</td>
<td>400,000</td>
<td>400,000</td>
<td></td>
</tr>
<tr>
<td><strong>SubTotal</strong></td>
<td>150,000</td>
<td>590,200</td>
<td>1,375,300</td>
<td>1,363,300</td>
<td>852,200</td>
<td>4,330,900</td>
<td>3,914,900</td>
<td>416,000</td>
</tr>
</tbody>
</table>
Table 6.6: Costs for training for (2) PhD (Sandwich) student

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total UDSM</th>
<th>KTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervision</td>
<td>400,000</td>
<td>400,000</td>
<td>400,000</td>
<td>400,000</td>
<td>0</td>
<td>1,600,000</td>
<td>0</td>
</tr>
<tr>
<td>Cost per student while in Sweden</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>0</td>
<td>400,000</td>
<td>0</td>
</tr>
<tr>
<td>Tuition fees while in Tanzania</td>
<td>25,200</td>
<td>25,200</td>
<td>25,200</td>
<td>25,200</td>
<td>0</td>
<td>100,800</td>
<td>0</td>
</tr>
<tr>
<td>Consumables for 3 sandwich PhD in Tanzania</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>0</td>
<td>80,000</td>
<td>0</td>
</tr>
<tr>
<td>Publication costs for 2 Sandwich PhD</td>
<td>0</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>0</td>
<td>24,000</td>
<td>0</td>
</tr>
<tr>
<td>Airfare sandwich PhD to conference attendance abroad</td>
<td>0</td>
<td>0</td>
<td>20,000</td>
<td>20,000</td>
<td>0</td>
<td>40,000</td>
<td>0</td>
</tr>
<tr>
<td>Tanzania sandwich PhD student in conference</td>
<td>0</td>
<td>0</td>
<td>24,000</td>
<td>24,000</td>
<td>0</td>
<td>48,000</td>
<td>0</td>
</tr>
<tr>
<td>Salary for Sandwich PhD students in Tanzania</td>
<td>25,200</td>
<td>25,200</td>
<td>25,200</td>
<td>25,200</td>
<td>0</td>
<td>100,800</td>
<td>0</td>
</tr>
<tr>
<td>Salary for Sandwich PhD students in Sweden</td>
<td>192,000</td>
<td>192,000</td>
<td>192,000</td>
<td>192,000</td>
<td>0</td>
<td>768,000</td>
<td>0</td>
</tr>
<tr>
<td>Field work allowance - for sandwich PhD research in Tanzania</td>
<td>0</td>
<td>22,000</td>
<td>22,000</td>
<td>22,000</td>
<td>0</td>
<td>66,000</td>
<td>0</td>
</tr>
<tr>
<td>Minor equipment for 2 sandwich PhD students</td>
<td>12,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12,000</td>
<td>0</td>
</tr>
<tr>
<td>Airfare sandwich PhD to conference attendance abroad</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>0</td>
<td>80,000</td>
<td>0</td>
</tr>
<tr>
<td>Allowance Tanzania supervisors visiting in Sweden</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
<td>0</td>
<td>96,000</td>
<td>0</td>
</tr>
<tr>
<td>Airfare local supervisors to Sweden</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>0</td>
<td>80,000</td>
<td>0</td>
</tr>
<tr>
<td>Allowance Tanzania supervisors attending conference</td>
<td>0</td>
<td>64,000</td>
<td>64,000</td>
<td>64,000</td>
<td>0</td>
<td>192,000</td>
<td>0</td>
</tr>
<tr>
<td>Airfare local supervisors to conference attendance abroad</td>
<td>0</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
<td>0</td>
<td>120,000</td>
<td>0</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>838,400</td>
<td>960,400</td>
<td>1,004,400</td>
<td>1,004,400</td>
<td>0</td>
<td>3,807,600</td>
<td>1,027,600</td>
</tr>
</tbody>
</table>

Table 6.6 (b): Annual costs for training PhD (Local) students and PhD (Sandwich) students

<table>
<thead>
<tr>
<th></th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
<th>UDSM</th>
<th>KTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD Taught UDSM (8)</td>
<td>150,000</td>
<td>590,200</td>
<td>1,375,300</td>
<td>1,363,300</td>
<td>852,200</td>
<td>4,330,900</td>
<td>3,914,900</td>
<td>416,000</td>
</tr>
<tr>
<td>PhD Sandwich (2)</td>
<td>838,400</td>
<td>960,400</td>
<td>1,004,400</td>
<td>1,004,400</td>
<td>0</td>
<td>3,807,600</td>
<td>1,027,600</td>
<td>2,780,000</td>
</tr>
<tr>
<td>Total - PhD Training</td>
<td>988,400</td>
<td>1,550,600</td>
<td>2,379,700</td>
<td>2,367,700</td>
<td>852,200</td>
<td>8,138,500</td>
<td>4,942,500</td>
<td>3,196,000</td>
</tr>
</tbody>
</table>

2.2.3 Cost of Training Postdoc researchers at local University

PostDocs candidates will spend two months per program in Sweden. The budget for PostDocs candidate is at 56,000 SEK per candidate that includes:
(i) A travel allocation of 10,000 SEK per program to KTH
(ii) PostDoc trainee will be supported to attend conferences per program at a rate of 10,000 SEK air ticket plus 4 days at 3,000 SEK per day per conference (i.e. 22,000 SEK per conference) and one journal publication at 4,000 SEK

(iii) A subsistence grant of 36,000 SEK per program to cater for the two-month subsistence allowance for Postdocs candidates in Sweden at a rate of 18,000 SEK per month

(iv) A subsistence grant of 21,000 SEK per programme for 10 months at a rate of 2,100 SEK per month to cater for subsistence allowance while in Tanzania

(v) Field work: Field work research funds for PhD sandwich in Tanzania approximated for 10 days per year at 1100 SEK per year per student which is 44,000 SEK to cater for field work expenses including local travel, data collection, accommodation and subsistence per program.

(vi) Minor equipment to support research work 6,000 SEK per student

(vii) Allocation of 10,000 SEK for consumables while in Tanzania

\[
\begin{array}{|l|c|c|c|c|c|c|c|}
\hline
\text{Budget Item} & \text{2015/16} & \text{2016/17} & \text{2017/18} & \text{2018/19} & \text{2019/20} & \text{Total} & \text{UDSM} & \text{KTH} \\
\hline
\text{Publication costs 4 Postdoc researcher} & 0 & 8,000 & 8,000 & 0 & 0 & 16,000 & 16,000 & \\
\text{Consumables for 4 Postdoc researcher in Tanzania} & 10,000 & 10,000 & 0 & 0 & 0 & 20,000 & 20,000 & \\
\text{Salary for Postdoc researchers in Tanzania} & 66,660 & 66,660 & 0 & 0 & 0 & 133,320 & 133,320 & \\
\text{Salary for Postdoc researchers in Sweden} & 72,000 & 72,000 & 0 & 0 & 0 & 144,000 & 144,000 & \\
\text{Field work allowance - for Postdoc research in Tanzania} & 22,000 & 22,000 & 0 & 0 & 0 & 44,000 & 44,000 & \\
\text{Minor equipment for 4 Postdoc researchers} & 40,000 & 40,000 & 0 & 0 & 0 & 80,000 & 80,000 & \\
\text{Airfair Postdoc to Sweden} & 20,000 & 20,000 & 0 & 0 & 0 & 40,000 & 40,000 & \\
\text{Airfare Postdoc to conference attendance abroad} & 0 & 20,000 & 10,000 & 0 & 0 & 30,000 & 30,000 & \\
\text{Allowance Postdoc attending conference} & 0 & 24,000 & 12,000 & 0 & 0 & 36,000 & 36,000 & 0 \\
\hline
\text{Sub total} & 230,700 & 282,700 & 30,000 & 0 & 0 & 543,300 & 319,300 & 224,000 \\
\hline
\end{array}
\]

2.2.4 Cost of Training for Masters Students

It is considered prudent to training M.Sc. research students so that we can have appropriate ones to joint PhD training in the respective areas will spend 24 months at UDSM. The budget per research student includes:

(i) Field work: Field work research funds for M.Sc. is approximated for 10 days per year at 1100 SEK per student which is 88,000 SEK to cater for field work expenses including local travel, data collection, accommodation and subsistence for the eight students.

(ii) A subsistence grant of 25,200 SEK per year at a rate of 2,100 SEK per month to cater subsistence allowance which is 50,400 SEK per programme of two years for PhD candidates in Tanzania

(iii) Each MSc student shall receive tuition expenses of 38,780 SEK per program towards tuition fees

(iv) M.Sc. student will be supported to attend one conference per program at a rate of 10,000 SEK air ticket plus 4 days at 3,000 SEK per day per conference (i.e. 22,000 SEK per conference) and one journal publication at 4,000 SEK
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(v) Consumables: 3,000 SEK lump sum per year for papers printers, literature, etc.
(vi) Equipment: Actuators 70,000 SEK, System communication 40,000 SEK, end-user monitoring 34,000 SEK, transmission and distribution monitoring 40,000 SEK, complementary power for systems 20,000 SEK

<table>
<thead>
<tr>
<th>Table 6.8: Cost of training for 8 Masters Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget Item</strong></td>
</tr>
<tr>
<td>Tuition fees</td>
</tr>
<tr>
<td>Consumerbles</td>
</tr>
<tr>
<td>Allowance fieldwork</td>
</tr>
<tr>
<td>Subsistence grants</td>
</tr>
<tr>
<td>Equipment</td>
</tr>
<tr>
<td><strong>Total SEK</strong></td>
</tr>
</tbody>
</table>

2.2.5 Cost of Research Dissemination and Programme Promotions to the Public

2.2.5.1 Research Dissemination

A. Participation in Exhibitions

It is the intention of iGRID research project to disseminate to the public the results of the iGRID work. Researchers therefore will be supported to participate in major annual public exhibitions events to showcase their research outputs. The national annual public exhibition events includes

i. TCU Exhibitions

ii. SABASABA Exhibitions

iii. Engineers Day

A budget for participation to public exhibition events includes a provision for

a. Poster production at rate of 2,300 SEK per participant.
b. Fliers production 15,000 SEK
c. Exhibition materials refinement (prototype packaging, etc) budget allocation, a lump sum allocation of 35,000 SEK is planned per year.
d. Exhibitors participation expenses for maximum of seven days for a maximum of three exhibitors per exhibition allocate lump sum of 87,700 SEK

(i) Exhibitors local travel expenses

(ii) Miscellaneous expenses

(iii) Participation fee

B. Participation in Conferences, Workshops and Seminars and Organizing Technical/Scientific Conferences
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i. Participation in Conferences, Workshops and Seminars held in Tanzania and abroad. The provision is to support researchers whose publications have been accepted in such conferences. For local participation, an allocation of 2640 SEK per person per travel made (includes inter-Tanzania regional return travel expenses at 400 SEK per trip, local travel 240 SEK per day and Perdiems rate at 320 per night), based on a 4 days trip. For international participation, an allocation of 25000 SEK apply per person per travel

2.2.6 Cost of Field Supervision Visits

The MSc and local PhD training will require students where necessary to spend time for field work through attachment at local industry/community to look at means to address the problem/challenges faced by industry/community, and/or for pilot testing or data collection or provide feedback.

Supervisors being part of the research team will play supervisory role through visits when necessary to assess progress, provide guidance, revisit methodology and get feedback on the research activities.

Two supervisory visits are recommended for student attached on field works. For each supervisory visit, the budget allocation SEK 2,640 is provided based on a four days trip, providing regional transport expenses, daily local transport expenses and perdiem as follows:

a. A return fare (by bus) to regional field site being a maximum of 400 SEK
b. A four days local transport expenses at 960 SEK, rate of 240 SEK per day
c. A four days Perdiem at 1280 SEK, rate of 320 SEK per day

2.2.7 Cost of Research Support

To promote supportive environment for research a room equipped with programme specialized hardware and software will be dedicated to provide for computer-lab services to Researchers. A budget for high-performance computer hardware and environmental modeling and simulation software and sensor devices is sought for this purpose. A total budget allocation of 522,500 SEK is made as follows:

a. 2 Tables and 30 chairs for Innovation incubator lab 17,700 SEK.
   (Each table @5000 SEK and each chair @300 SEK)
b. 5 desktop computers for innovation incubator lab 27,500 SEK.
   (Each desktop @5500 SEK)
c. Wifi access point for video conferencing 6,300 SEK.
   (3 access point each @2100 SEK)
d. Video conferencing system + Smart board 300,000 SEK.
   (Video conferencing @175000 SEK and Smartboard @125000 SEK)
e. Maintenance 40,000 SEK.
(For maintenance of laptops, equipment and software @8000 SEK per year)

f. Library and electronic resources 40,000 SEK.
   (For buying books and connecting to electronic local and international journals for researchers)

g. Training as consumables 40,000 SEK.
   (For training of technical staff on new video conferencing systems, software and operational of research equipment)

h. Insurance as consumables 25,500 SEK.
   (For paying travel insurance for each trip @500 SEK for visiting abroad average for a week)

i. Visa as consumables 25,500 SEK.
   (For visa application fee for each trip @500 SEK per application)

Table 8 summarizes the cost of training across all the individual student programs (PhD, Postdoc, Masters) described in sections 2.2.2 to 2.2.4. This cost of training is 69% of the project budget to be funded by SIDA.

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD UDSM (8)</td>
<td>-</td>
<td>420,160</td>
<td>1,069,260</td>
<td>1,157,260</td>
<td>676,160</td>
<td>3,322,840</td>
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<tr>
<td>PhD Sandwich (2)</td>
<td>394,400</td>
<td>412,400</td>
<td>456,400</td>
<td>456,400</td>
<td>-</td>
<td>1,719,600</td>
</tr>
<tr>
<td>Post Doc (4)</td>
<td>230,660</td>
<td>282,660</td>
<td>30,000</td>
<td>-</td>
<td>-</td>
<td>543,320</td>
</tr>
<tr>
<td>Masters (8)</td>
<td>-</td>
<td>190,160</td>
<td>424,320</td>
<td>234,160</td>
<td>-</td>
<td>848,640</td>
</tr>
<tr>
<td><strong>Total Scholarships</strong></td>
<td><strong>625,100</strong></td>
<td><strong>1,305,400</strong></td>
<td><strong>1,980,000</strong></td>
<td><strong>1,847,800</strong></td>
<td><strong>676,200</strong></td>
<td><strong>6,434,400</strong></td>
</tr>
</tbody>
</table>

2.3 Cost related to exchange of personnel

Under personnel exchange program a budget has been set aside for three TTA visits per year for four years, and one DTC visit per year for five years. The cost for each TTA/DTC visit is set at 33,050 SEK and shall include:

(i) An allocation of 25,000 SEK per travel
(ii) A Honorarium of 8,050 SEK per visit
(iii) The total cost for one TTA/DTC visit is 33,050 SEK which gives a total cost of personnel exchange of 561,850 SEK for the planned seventeen TTA/DTC visits

<p>| Table 6.10: Summary of costs related to exchange of personnel between local university and KTH |
|-----------------------------------------------|----------|----------|----------|----------|----------|----------|</p>
<table>
<thead>
<tr>
<th>2015/16</th>
<th>2016/17</th>
<th>2017/18</th>
<th>2018/19</th>
<th>2019/20</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,305,400</td>
<td>1,980,000</td>
<td>1,847,800</td>
<td>676,200</td>
<td>4,614,400</td>
<td>1,820,000</td>
</tr>
</tbody>
</table>
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iGRID

<table>
<thead>
<tr>
<th>TTA/DTC Courses</th>
<th>Total in SEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>0 104,400 104,400 104,400 26,100 339,300</td>
</tr>
<tr>
<td>Honorarium</td>
<td>0 112,000 112,000 112,000 56,000 392,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0 216,400 216,400 216,400 268,600 731,300</td>
</tr>
</tbody>
</table>

2.4 Subsistence allowance/salary

Subsistence allowances and salaries have been provided in support of visits by Swedish lecturers to local University and in support of PhD/Postdoc students and staff from local University to travel to Sweden and/or for conference participation. In summary, allocations have been made in consideration of the following:

(i) For PhD and Postdoc students while in Sweden, the subsistence allowance rates applied are as per the SIDA guidelines of 16,000 SEK/month for PhD candidates and 18,000 SEK/month for Postdocs.

(ii) Salaries have been provided for Swedish supervisors of PhD sandwich students at a rate of 200,000 SEK/per student per year in accordance with the SIDA guidelines and the regulations at KTH.

(iii) An honorarium shall be provided to Swedish guest lecturers at local university under the TTA, DTC and Curriculum development activities. The rate per activity at Local University shall be 8,050 SEK.

(iv) Local University supervisors are expected to receive their salaries in accordance with University regulations and no additional provision has been catered for in this budget. The salaries will contribute to the indirect costs by Local University.

(v) For conference travel and/or visits to PhD sandwich students, the subsistence allowance for local supervisors and students has been budgeted at a per diem allowance of 2,940 SEK per night that includes meals, accommodation and inland travel to the destiny countries. The total amount per 4-day trip would then be 12,600 SEK. The rate applied is per the local university travel rules for senior staff.

<table>
<thead>
<tr>
<th>Table 6.11: Summary of Subsistence Allowances/Salaries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget Item</strong></td>
</tr>
<tr>
<td>Doctoral Program and Curriculum Development</td>
</tr>
<tr>
<td>Swedish Lecturers (TTA) (3 visits* (48,300+56,000+30,000)* 3 years)</td>
</tr>
<tr>
<td>Swedish Lecturers (Enhancing and developing new research content, and fostering interaction under DTC) (16,100+56,000+10,000) one visit per year*4 years</td>
</tr>
<tr>
<td>Swedish Lecturers (Curriculum development) ( 2 people *(8,050+10,000+2,300)*4)*2 trips</td>
</tr>
<tr>
<td>A salary 3 months per year @80000 SEK per month for KTH efforts to coordinate and oversee the research programme, to establish and manage a new graduate program, for supervision of 8 local PhD students, 4 Postdocs, and training 5 local supervisors.</td>
</tr>
<tr>
<td><strong>PhD (UDSM) training - 8 students</strong></td>
</tr>
<tr>
<td>PhD (UDSM) – KTH visit</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD (UDSM) – Conference</td>
<td>1,004,000</td>
</tr>
<tr>
<td>Local university supervisors</td>
<td>0</td>
</tr>
<tr>
<td><strong>PhD (sandwich) training - 2 students</strong></td>
<td></td>
</tr>
<tr>
<td>PhD (sandwich) – KTH visit</td>
<td>1,364,000</td>
</tr>
<tr>
<td>PhD (sandwich) – Conference</td>
<td>424,000</td>
</tr>
<tr>
<td>Local university supervisor</td>
<td>0</td>
</tr>
<tr>
<td><strong>Postdoc training - 4 postdocs</strong></td>
<td></td>
</tr>
<tr>
<td>Postdoc – KTH visit</td>
<td>264,000</td>
</tr>
<tr>
<td>Postdoc – Conference</td>
<td>82,000</td>
</tr>
<tr>
<td>Postdoc – Guest lecturer (regional collaboration)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Masters training - 8 students</strong></td>
<td></td>
</tr>
<tr>
<td>MSc students annual stipend</td>
<td>403,400</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
</tr>
<tr>
<td>Participation in annual review meetings</td>
<td>220,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,191,500</td>
</tr>
</tbody>
</table>

#### 2.5 Costs for “sandwich” doctoral training in Sweden

For “sandwich” doctoral training in Sweden the maximum standard sum for the collaborating Swedish university/universities per student is SEK 250,000 per student per year. Included in this is:

a. Supervision in Sweden: SEK 200,000

   (i) 2 months’ full-time salary including social security fees and overheads (approx. SEK 175,000)
   (ii) 1–2 visits per year to cooperating partner university/institution (approx. SEK 25,000)

b. Cost per student while in Sweden (SEK 50,000)

   (i) Office/laboratory space for student
   (ii) Chemicals and consumables
   (iii) Access to computer with Internet connection
   (iv) Library services
   (v) Telephone in the office, photocopies
   (vi) Books, computer programmes
   (vii) Insurance, if applicable
   (viii) Participation in conferences and seminars for presentation of research results
   (ix) Page fee when publishing in international journals
   (x) Cost for thesis printing and defense of thesis
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It should be noted that the “sandwich” doctoral training cost at KTH is 605,110 SEK per year. The balance of 355,110 SEK is contributed by KTH.

2.6 Allowances and per Diem

The allowances and per diem to be catered for have been computed in accordance with the regulations at local University and at KTH. As noted in Sec. 4, the subsistence allowances and per diems have been computed as follows:

(i) For conference travel and/or visits to PhD sandwich students, the subsistence allowance for Local university supervisors and students has been budgeted at a per diem allowance of 3,150 SEK per night that includes meals, accommodation and inland travel to the destiny countries. The total amount per 4-day trip would then be 12,600 SEK. The rate applied is per the Local university travel rules for senior staff.

(ii) For PhD and Postdoc students in Sweden, a rate of 16,000 SEK and 18,000 SEK respectively per month has been catered for.

2.7 Costs related to research supporting components

Annual review meetings have been provided for so as to facilitate meetings at both institutions. It is expected that meetings will be hosted at local University and at KTH. The budget has provided a travel allowance of 25,000 SEK for one person travel as required. In addition to the annual travel, other administrative/research supporting components include provisions for minor equipment, consumables, support for one project staff (at a rate of 3,500 SEK per month), etc.

(i) Minor equipment to support research work 6,000 SEK per student

(ii) Maintenance of software and hardware 8000 SEK per year

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Tables and 30 chairs for Innovation incubator lab</td>
<td>17,700</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17,700</td>
</tr>
<tr>
<td>5 desktop computers for innovation incubator lab</td>
<td>27,500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27,500</td>
</tr>
<tr>
<td>Wifi access point for video conferencing</td>
<td>6,300</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6,300</td>
</tr>
<tr>
<td>Video conferencing system + Smart board</td>
<td>300,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>300,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Library and electronic resources</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Training as consumables</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>8,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Insurance as consumables</td>
<td>3,000</td>
<td>8,000</td>
<td>8,000</td>
<td>4,000</td>
<td>2,500</td>
<td>25,500</td>
</tr>
<tr>
<td>Visa as consumables</td>
<td>3,000</td>
<td>8,000</td>
<td>8,000</td>
<td>4,000</td>
<td>2,500</td>
<td>25,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>381,500</strong></td>
<td><strong>40,000</strong></td>
<td><strong>40,000</strong></td>
<td><strong>32,000</strong></td>
<td><strong>29,000</strong></td>
<td><strong>522,500</strong></td>
</tr>
</tbody>
</table>

2.8 Costs of travel abroad
Proposed to break down by Swedish travel and Local university travel

2.8.1 UDSM Supervisors Attending Conferences and Visiting their Students in Sweden

Attending conferences

4 days conference at 3,000 SEK per day, ticket 10,000 SEK, registration fee 4,000 SEK per person per conference for accepted publications. Two publications per year for 4 years, i.e. 104,000 SEK for one supervisor. For four supervisors it is 416,000 SEK.

Supervision Visits in Sweden

A UDSM supervisor of sandwich PhD student will visit Sweden once a year for 4 days:

Ticket 10,000 SEK, allowance 3,000 SEK per day i.e. 22,000 SEK per year per supervisors. This becomes 66,000 SEK for three visits. For three supervisors it becomes 198,000 SEK

2.9 Cost of audits

The project audit will be conducted at university level, and hence we have not made a separate allocation.

2.10 In kind contribution by collaborating institutions

The total cost for the proposed five-year program is 23,494,185 SEK of which 15,102,185 SEK is requested from SIDA. The total costs to be absorbed by the universities as part of the co-funding are 8,392,000 SEK and 4,761,320 SEK for Local University and KTH respectively.

2.10.1 In kind contribution by UDSM

Table 6.13: in kind contribution by UDSM

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>Total SEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab and Office Space</td>
<td>636,000</td>
<td>636,000</td>
<td>636,000</td>
<td>636,000</td>
<td>636,000</td>
<td>3,180,000</td>
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<tr>
<td>Services</td>
<td>574,240</td>
<td>574,240</td>
<td>574,240</td>
<td>574,240</td>
<td>574,240</td>
<td>2,871,200</td>
</tr>
<tr>
<td>GRAND TOTAL SEK</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>1,678,400</td>
<td>8,392,000</td>
</tr>
</tbody>
</table>

2.10.2 In kind contribution by KTH

Table 6.14: In kind contribution by KTH

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total SEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra cost for 2 sandwich Student</td>
<td>710220</td>
<td>1065330</td>
<td>1065330</td>
<td>1065330</td>
<td>355110</td>
<td>4,261,320</td>
</tr>
<tr>
<td>KTH person-months - project activities</td>
<td>100000</td>
<td>100000</td>
<td>100000</td>
<td>100000</td>
<td>100000</td>
<td>500,000</td>
</tr>
<tr>
<td>Total SEK</td>
<td>810,220</td>
<td>1,165,330</td>
<td>1,165,330</td>
<td>1,165,330</td>
<td>455,110</td>
<td>4,761,320</td>
</tr>
</tbody>
</table>
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KTH are aiming to have a central coordination for our Tanzania-cooperation for phase IV to be able to offer a professional support and guidance to the involved parts from Tanzania, KTH other Swedish Universities as well as Sida’s programme coordinators involved in the programmes.

For this there will be certain cost to be partly covered within the Sida programme phase IV, partly co-financed by KTH. KTH have a SPOC (Single Point of Contact) at our International Relations office with the mission to support and guide involved persons with any questions and problems coming up during the programme phase (2015-2020). Depending of the size of the programmes and the quantity and art of accepted Full Applications, this cost will vary and therefore KTH hope to have a dialog with Sida once the Full Applications are admitted and budget settled. Below list of support offered by KTH coordinator at KTH IR office.

- Support for agreements
- Support for IPR
- Support team at KTH central level to sandwich students and researchers within the programmes.
- Support for visiting delegations
- Support for strategic matters regarding the Sida bilateral research cooperation
- Relocation service
- Insurance
- Auditing – collect and compile
- Scrutinize auditing reports, comments, feedback from partners etc
- General information about Sida’s cooperation regulations for phase IV
- Financial reporting – collecting documentation from partners and compile annual reports
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Cost of Curriculum development</td>
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<tr>
<td>Needs assessment for graduate program in 'Networking and Communications'</td>
<td></td>
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<td></td>
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<tr>
<td>Adminstrative costs</td>
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<td></td>
<td></td>
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<tr>
<td>Field work allowance - for Postdoc research in Tanzania</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor equipments for 8 local PhD students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Consumables for 4 Postdoc researcher in Tanzania</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Actuators</td>
<td>70,000</td>
<td>40,000</td>
<td>240,000</td>
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<td>380,000</td>
<td>380,000</td>
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<td>380,000</td>
<td>380,000</td>
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<td>380,000</td>
</tr>
<tr>
<td>System communication</td>
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<td>20,000</td>
<td>7,000</td>
<td>20,000</td>
<td>84,000</td>
<td>84,000</td>
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<td>For Tanzania local PhD students attending an international conference abroad for four days @10,000 SEK per person</td>
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<td>3 people from Tanzania in curriculum development will visit 3 different institutions to study their programs and experiences</td>
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<td>For Tanzania in curriculum development will visit 3 different institutions to study their programs and experiences</td>
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<td>In Tanzania, minor equipment and software will be purchased for 2 local PhD students per year</td>
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<td>Sub Total</td>
<td>861,150</td>
<td>1,077,550</td>
<td>1,036,400</td>
<td>1,036,400</td>
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<td>ISP Students Allowances</td>
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<td>Grand Total</td>
<td>2,452,050</td>
<td>2,782,570</td>
<td>3,388,380</td>
<td>3,098,220</td>
<td>1,211,280</td>
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<td>Excluding UDSM Institution fees</td>
<td>2,532,000</td>
<td>2,927,200</td>
<td>3,645,700</td>
<td>3,320,800</td>
<td>1,324,700</td>
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<td>Including UDSM 12% Institution fees</td>
<td>2,452,050</td>
<td>2,782,570</td>
<td>3,388,380</td>
<td>3,098,220</td>
<td>1,211,280</td>
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<td>Total</td>
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Memorandum of Understanding

between

University of Dar es Salaam (UDSM),
Dar es Salaam, Tanzania

and

KTH Royal Institute of Technology
Stockholm, Sweden

Preamble
In furtherance of their mutual interests in the fields of education and research, KTH Royal Institute of Technology (hereafter KTH) and the University of Dar es Salaam (hereafter UDSM) hereby agree upon the following areas of cooperation:

- To engage in joint efforts in curriculum development, research and consultancy on agreed topics of common interest;
- To work together in the area of university management, including exchanges of administrative and managerial staff where appropriate;
- To collaborate in the expansion of links with industry and agencies for public administration and public services;
- To develop the exchange of research and academic staff and student mobility with a view to promoting learning and culture and fostering close friendship between the two universities on the basis of principles of mutual benefit and equality.

This collaboration will be developed between appropriate schools, departments and units at the two universities, specified in agreements which are linked to this Memorandum of Understanding (MoU).

Article 1
The parties agree to seek mutually beneficial ways to share professional experiences and exchange information on research and teaching methodology, curricula, the training of specialists, and to explore and implement other forms of professional interaction and exchange.

Article 2
The parties agree to encourage the exchange of scholarly and educational publications and materials, as well as biographical, reference and other pertinent literature. The exchange of periodicals and other
publications will be carried out by the libraries of the two universities based on mutual needs and interests.

**Article 3**

Each party agrees to invite representatives of the other party to participate in major congresses, conferences and symposia of mutual interest.

**Article 4**

This MoU encompasses the successful proposals listed in Appendix B – Endorsement letter. This MoU does not exclude the possibility of organizing other forms of cooperation or expanding this MoU should both parties so desire.

**Article 5**

Each university will nominate its own representative and such representative will be responsible for all measures to be undertaken under this MoU. Representatives for this MoU are listed in Appendix A.

**Article 6**

This MoU shall come into effect on the day of approval by both universities with duration of five (5) years. Either university may terminate this MoU provided that written notice of the intent is given at least six months prior to termination.

**Article 7**

Amendments or changes to this MoU shall be made in writing and signed by the duly authorized representatives of the universities.

**Article 8**

The MoU has been signed in duplicate, of which each university will keep one copy.

**Signatures**

*Place and Date: Dar es Salaam 16/10-2014*

For KTH Royal Institute of Technology

Prof. Ramon Wysz
Vice-President or International Affairs

*Place and Date: Dar es Salaam 16/10-2014*

For University of Dar es Salaam

Prof. Florens Dominic Luoga
Acting Vice Chancellor, UDSM

**Vice Chancellor**

**University of Dar es Salaam**

P.O. Box 35091

DAR-ES-SALAAM
Appendix A

LEGAL DOMICILE

**KTH**
President
Brinellvägen 8
100 44 Stockholm
Sweden

**UDSM**
Vice Chancellor
P. O. Box 35091
Dar es Salaam
Tanzania

ADMINISTRATION OF MoU

**KTH**
Name: Ms. Erika Svensson
E-mail: erika2@kth.se
Tel: +46-8-790 6561

Postal adress:
International Relations Office
Brinellvägen 8
SE-100 44 Stockholm
Sweden

**UDSM**
Name: Professor Cuthbert Z. M. Kimambo
E-mail: principalcoe@udsm.ac.tz, kimambo@udsm.ac.tz
Tel: +255 222 410753; Mobile: +255 787 717102

Postal adress:
Principal, College of Engineering and Technology
University of Dar es Salaam,
P.O. Box 35131,
Dar es Salaam, Tanzania.
Appendix B

The MoU encompasses the successful Proposals listed in the Endorsement letter for the Sida financed bilateral cooperation, signed by the President at KTH, enclosed.
Endorsement letter for partnership on the Sida Research Training Partnership Programme – Tanzania

This partnership will be formed by University of Dar es Salaam (UDSM) and the Royal Institute of Technology (KTH) / a Swedish consortium with KTH as lead partner. It is a partnership based on mutualism, respect, friendship and professionalism. Our cooperation is also founded on a conviction that all partners are willing to share and learn from each other on these premises.

The overall structure of the partnership between the KTH-consortium and University of Dar es Salaam (UDSM) falls into two main components:

I. Research training

II. Research supporting components

Proposals are submitted by those departments, schools or centers who will be most concerned. However, all proposals and their corresponding research groups form part of the university-wide partnership and for the Swedish participation there will be one overall coordination function facilitated by KTH.

This endorsement letter encompasses the following proposals:

1. Proposal title: Land Use, Settlement Planning and Management in Tanzania
   Coordinator UDSM: Dr. Hannibal Bwire, bw_hann@yahoo.co.uk
   Coordinator KTH: Zeinab Tageldeen, zeinab.tageldeen@abe.kth.se

2. Proposal title: Centre for Applicative Research and Innovations in infrastructure and land use management and settlements planning
   Coordinator UDSM: Dr. Hannibal Bwire, bw_hann@yahoo.co.uk
   Coordinator KTH: Zeinab Tageldeen, zeinab.tageldeen@abe.kth.se

3. Proposal title: Provision of Sustainable Energy In Tanzania
   Coordinator UDSM: Prof. Isack Legonda legondaia@gmail.com
   Coordinator KTH: Prof. Wlodzimierz Blasiak, blasiak@kth.se

4. Proposal title: Entrepreneurship, Private Sector and Innovation for Sustainable Development
   Coordinator UDSM: Prof. Wineaster Anderson, Wineaster@udbs.udsm.ac.tz,
   Coordinator KTH: Prof. Mats Wilhemsson, Mats.wilhemsson@abe.kth.se
5. **Proposal title**: Enhanced Knowledge Based Sustainable Environmental Management, Climate Change Mitigation and Adaptation  
   **Coordinator UDMS**: Jamidu Katima, jkatima@katima.org  
   **Coordinator KTH**: Nandita Singh nandita@kth.se

6. **Proposal title**: iGRID: Smart Grid Capacity Building and Enhancement in Tanzania  
   **Coordinator UDMS**: Prof. Nerey Henry Mvungi, nhmvungi@udsm.ac.tz  
   **Coordinator KTH**: Prof. Li-Rong Zheng, KTH-ICT School, lirong@kth.se

7. **Proposal title**: iMAMEC: Using ICT for Monitoring, Adoption and Mitigation of Environmental and Climate Change in Tanzania  
   **Coordinator UDMS**: Dr. Honest Christopher Kimaro, honest_c@yahoo.com  
   **Coordinator KTH**: Prof. Hannu Tenhunen, KTH-ICT School, hannu@kth.se

8. **Proposal title**: innoBuzi: Establishing a Center for ICT Innovation and Business Incubation at UDSM  
   **Coordinator UDMS**: Prof. Herald Nkya Kundaeli, UDSM, CoICT, hkundaeli@udsm.ac.tz  
   **Coordinator KTH**: Dr. Zhuo Zou, KTH-ICT School, zhuo@kth.se

9. **Proposal title**: Capacity Building In Materials Science and Technology Research for Exploitation of Natural Resources  
   **Coordinator UDMS**: Dr. B.S. Ndazi, bndazi@udsm.ac.tz  
   **Coordinator KTH**: Emma Strömberg, emmast@kth.se and Monica Ek, monicaek@kth.se

10. **Proposal title**: Research and Human Resource Capacity Development in Ocean and Coastal Infrastructure Programme  
    **Coordinator UDMS**: Prof. Alfonse Dubi, alfonsedubi@gmail.com  
    **Coordinator KTH**: Vladimir Cvetkovic vdc@kth.se

11. **Proposal title**: Entrepreneurship and Innovation Research Training and Research Supporting Components  
    **Coordinator UDMS**: Prof. Bavo Nyichomba, nyichomba@udsm.ac.tz  
    **Coordinator KTH**: Ramon Wyss, wyss@nuclear.kth.se

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*Place and Date*

Stockholm, Nov. 11, 2014

Peter Gudmundson  
President  
KTH Royal Institute of Technology