



UNIVERSITY OF DAR ES SALAAM



UDSM-SIDA COOPERATION 2015-2020 PROGRAMME

**ANNUAL PLAN FOR 12 MONTHS EXTENDED PERIOD
JULY 2020 TO JUNE 2021**

**Towards Enhanced Sustainability of Strategic Research and Innovation Systems for Inclusive
Development in Tanzania**

MAY, 2020

Annual Plan 2020/21

Name of Programme: **Towards Enhanced Sustainability of Strategic Research and Innovation Systems for Inclusive Development in Tanzania**

Name of Institution: **UNIVERSITY OF DAR ES SALAAM**

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INSTITUTIONAL PLAN

AGGREGATED SUMMARY OF ALL SUB-PROGRAMMES AND PROJECTS

TOWARDS ENHANCED SUSTAINABILITY OF STRATEGIC RESEARCH AND INNOVATION SYSTEMS FOR INCLUSIVE DEVELOPMENT IN TANZANIA

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1. Summary of Achieved Results/Subprogramme Progress

1.1 Brief Overview of the Programme

Since 2005, Tanzania has registered a steady and decent economic growth of about 7% per year (Vision 2025, 2015). However, this rate of growth at the macro level is yet to improve the quality of life of the majority of its masses. Poverty levels, though recently have been reported to have decreased, are still arguably high for a significant proportion of its people. With this current reality on poverty situation, devised policies and strategies to improve growth momentum to reach set targets require research based information for effective implementation. The University of Dar es Salaam, guided by its Vision to become “a leading centre of intellectual wealth spearheading the quest for sustainable and inclusive development”, is committed to playing its rightful role in facilitating the achievement of the country’s vision. As part of this commitment, Tanzania-Sweden research partnership 2015-2020 was initiated with the aim of facilitating the UDSM aspirations “*Towards Enhanced Sustainability of Strategic Research and Innovation Systems for Inclusive Development in Tanzania*”. According to the agreement, UDSM-Sida Cooperation programme 2015-2020 has to implement its approved programme activities for five years with effect from July 2015 to June 2020. The programme budget for the five year duration was SEK One hundred fifty nine millions, nine hundred thousand (SEK 159,900,000).

The programme is divided into 12 sub programmes. Of these, 10 focus on research and 2 are support-programmes. UDSM-Sida Cooperation programme 2015-2020 has completed its fifth year of implementation whereby a number of expected milestones were achieved and the intended outcomes realized. The achievements have been identified in all subprogrammes including support programmes which consist of Strengthening the Research Management subprogramme and Strengthening Access to and Utilization of Research Information through Library services subprogramme. The 10 research based subprogrammes are Marine Science, Development of affordable adsorbent systems for fluoride and arsenic removal in the drinking water sources in Tanzania (DAFWAT), ENGendering AGribusiness Entrepreneurship (ENGAGE), the Sustainable Sanitation in Theory and Action (SUSTAIN), Smart GRID, Water Resources, Food Security, Sustainable Tourism, Mathematics and /MBB subprogramme. In addition, the subprogrammes are implementing their planned activities under the partnership of nine Swedish institutions which are Stockholm University, Swedish University of Agricultural Sciences, Chalmers University of Technology, University of Uppsala, University of Skövde, University of Gothenburg, Royal Institute of Technology, Lund University, Linköping University and Mälardalen University.

1.2 Overall Programme Budget (2015-2020)

The UDSM-Sida Research Programme 2015-2020 was given a total budget amounting to SEK **159,734,245** to implement the planned activities for the period of five years with effect from 1st July 2015 to 30th June 2020. The funds allocated to UDSM amounted to SEK **92,219,245** while Swedish Partner Institutions received SEK **53,554,000** and the ISP was allocated a total of SEK **13,961,000** to cater costs for student allowances. The table below provides details of the funds allocation on yearly basis according to the approved budgets of 2015/2016 to 2019/2020 budgeted years:

Table 1: Overall Programme Budget (2015-2020)

Institution /Year	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total (in SEK)
UDSM	19,871,000	15,720,545	25,303,400	17,804,400	13,519,900	92,219,245
SWEDEN and ISP Coordination	9,206,000	13,255,000	11,593,000	12,865,000	6,635,000	53,554,000
ISP Students All	2,113,000	3,001,000	3,007,000	3,145,000	2,695,000	13,961,000
Grand Total	31,190,000	31,976,545	39,903,400	33,814,400	22,849,900	159,734,245

1.3 Overall Execution Rate

During the implementation of the planned activities, the overall execution rate of the UDSM-SidaProgramme, in Tanzania up to 30th June 2020 is expected to be 93 %.

Subprogrammes' execution rate is displayed in the table below:

Table 2: Execution rate

S/N	Subprogramme	Execution Rate
	Research Management	92%
	Library	100%
	Mathematics	100%
	MBB	100%
	ENGAGE	100%
	Tourism	71%
	Marine Science	94%
	Food Security	90%
	IGRID	84%
	DAFWAT	91%
	SUSTAIN	100%
	Water Resources	94%

1.4 Major Accomplishments and Summary of Achieved Results

In general, the UDSM-Sida Programme has made a remarkable accomplishment on implementing its planned activities towards the realization of the expected outcomes aimed at building research capacity through postgraduate training and curricular development, improving research environment and infrastructure, increasing university visibility and academic reputation as well as establishing research networks and collaborations.

Human Resource Capacity Building

With regard to human resource capacity building, the programme focused in realization of the first specific objective aimed at increasing postgraduate curricula and the extent of research training for development in key strategic and priority areas.

✓ *postgraduate training*

On postgraduate training, the success can be reported with regard to enrolment and accomplishment of studies of both PhD and Masters Students received Sida support in the past five years. Specifically, 62 PhD candidates (37% female) out of a target of 64 were enrolled into various PhD programmes. This is a success rate of 97% achievement. In addition, 48 master students (48% female) were enrolled out of 36 enrolment target. This exceeded the target by 33%. With regard to accomplishment of studies, 11 PhD candidates have so far graduated and the remaining 51 candidates are at various stages of their studies. As for master's students, 21 students have graduated, while the remaining 27 students are at final stages of accomplishing their studies.

✓ *creation of curricula for postgraduate training*

In terms of creation of curricula for postgraduate training, **eight new taught PhD programmes and four master's programmes were developed and subsequently approved by the University Senate.** All eight (8) taught PhD and three (3) master's programmes have already been accredited by Tanzania Commission for Universities (TCU). Two taught PhD and two master's programmes are up and running. This achievement promises a substantial increase of qualified researchers hence improving the percentage of high skilled workers in the areas of agribusiness and entrepreneurship, sustainable tourism, food security, molecular bioscience, safe drinking water, mathematics in higher learning institutions, smart grid, sustainable water resources management, sanitation management, and marine science.

Enhancing Research Environment and Infrastructure

Improving the research environment and infrastructure at the University of Dar es Salaam through Sida support aims at increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines which is the main thrust of the second specific objective of UDSM-Sida programme. In this aspect, several activities were successfully performed such as undertaking short course training to junior academic staff through mentorship programmes, procurement of research equipment as well as developing various modules geared towards having comprehensive Research Information Management System and increasing use of ICT resources.

✓ *Mentoring Activities through Short Course Training Programmes*

The initiatives comprised of short training workshops on research methods, Intellectual Property Rights (IPR), scientific writing, training on fundable proposals and training on supervision of postgraduate students. Since 2015, several training workshops focusing on the above mentioned areas were undertaken which attracted more than 1350 participants (out of them, 30% of participants were women).

✓ *Procurement of Major Research Equipment and Furniture*

With regard to improving research infrastructure, four subprogrammes procured critically needed research equipment: iGRID, IMS, MBB, Food security and DAFWAT. MBB subprogramme acquired State of the Art Lab Equipment which was immediately put into use aimed at facilitating laboratory analysis of postgraduate student research projects and teaching of undergraduate students. While Food security subprogramme procured a newly HPLC Equipment used for separation and qualification of amino acid in banana and quantifying sugar and acids on juice.

✓ *Developing Research Information Management System and increasing the use of ICT resources*

The Sida also has supported UDSM Library to purchased subscriptions to various scientific electronic-journals for accessing online resources. So far, 441,991 full-text e-journal articles have been downloaded from 2015 to December 2019 which is 88.4% of the five year target of 500,000 download. In addition, the Research Information Management System (RIMS) was developed for the purpose of registering research projects. The introduction of RIMS has enabled researchers to register their projects online hence facilitating timely retrieval and submission of required reports to relevant authorities.

✓ *Establishment of Multidisciplinary Research Centres*

The programme also established three multidisciplinary basic and applied research centres. The established research centres have impacts of the various capacity building efforts in mathematics, tourism, marine science and to the other multidiscipline. This is out of target of establishing five research centres however the budget cuts due to refigures campaign in Sweden, affected the effort but did not completely frustrate the initiative. The established research centres are as follows:

- The East Africa Centre of Mathematics, which was officially launched in Kigali, Rwanda. The launching was held during the 10th Annual meeting of Inter-University Council for East Africa (IUCEA). The launching was officialised by Prime Minister and also attended by the Minister of education of the Government of Rwanda. The centre is hosted by IUCEA and it is collaborative research efforts between the University of Dar es Salaam-Department of Mathematics, Makerere University and University of Rwanda.
- Pangani Mari-culture Centre was officially launched on 29th March 2019 by the Chancellor, of the University of Dar es Salaam and the former President of United Republic of Tanzania, Dr. Jakaya Mrisho Kikwete. The centre is hosted by IMS in which various aquaculture researches are conducted.
- The Research Centre on Sustainable Tourism was established in 2018. The Centre, in collaboration with the Department of Marketing at UDSM and the Centre for Tourism at UoG, organised the 5th International Conference on Sustainable Tourism in Developing Countries (ICST-DC) in 2018. Moreover, the centre organized a one week training seminar on advanced scientific writing that was held at the APC Conference Centre, Mbweni, Dar es Salaam, from 17th to 23rd January, 2019.

This effort of establishment of the research centres is part of implementation of UDSM Corporate Strategic Plan 2014/15-2024/25 which, among others, intends to create research centres of excellence and technology parks, which can link research to the public and help to solve society problems.

Enhancing university visibility and academic reputation

In terms of enhancing the university visibility and academic reputation, this outcome was realized by making UDSM journals available online, enabling UDSM staff to more easily prepare and present papers at international conferences as well as encouraging UDSM staff to publish their academic papers in international peer reviewed journals.

✓ *Supporting UDSM Journals into International Standards*

The UDSM-Sida Programme since 2015 has been annually supporting the evaluation of UDSM Journals to upgrade them into international standards. So far 24 UDSM journals are accessible online in the UDSM Online Journal System. The 2018 evaluation report, showed that 10 out of the 24 journals subscribed in EBSCO, AJOL and Sabinet hence were considered as international journals as they are now included in some of the international citation databases.

✓ *Supporting UDSM Staff to disseminate their research findings at International fora*

In the course of implementing programme activities, 278 out of 300 papers from UDSM academic staff were accepted and presented in local and international conferences. This makes execution rate of 92%.

✓ *Supporting UDSM Staff and Sida Sponsored Students to publish their Scholarly Papers in Peer Reviewed Journals*

With regard to publication, So far 102/220 papers published in international peer reviewed journals which constitutes up to 46% execution.

Establishing Research Networks and Collaborations

Visibility and academic reputation can also be evidenced by university engagements in various partnerships and collaborations at national, regional and international levels.

✓ *Engagements in National and Regional Partnerships*

According to midterm self-assessment report (September 2018), 21 national and 26 international collaborations were formulated. In addition, 17 new partnerships were established. Out of these, 10 national collaborations were formalized, while 24 international collaborations were formally established. The major outcome of established collaborations and partnership is increasing of research funds apart from Sida. For instance, IMS subprogramme attracted extra research funds apart from Sida worth TZS 17,7 billion (SEK 70mill).

✓ *Linking Research and Industry*

The programme also undertook activities aimed at linking research with industry. The activities undertaken included organization of annual conferences on Research and Inclusive Development held in 2018 and 2019 respectively. During the said conferences 26 policy briefs were prepared and shared to more than 40 Members of Parliament, 50 senior Government Officials and more than 200 other stakeholders. The policy briefs covered different areas including sanitation, smart grid, food security, marine sciences, mathematics, agribusiness and gender, sustainable tourism, molecular bioscience, water resources and safe drinking water.

1.5 Rationale for the Extension of Programme Duration

In the five years of the implementation of the programme activities, UDSM-Sida Programme has made remarkable achievements in realizing its main objective aimed at generating sufficient analytical capacity and research based knowledge and technological innovations in addressing the problem of poverty and promoting sustainable and inclusive development. Substantial progress has been made towards human resource capacity building at UDSM through having highly skilled workers and qualified researchers, creating enabling research environment, enhancing university visibility as well as establishing research networks and collaborations.

Despite the impressive efforts made in realizing the programme objectives, there are few ‘unfinished’ businesses though very critical ones which need to be implemented to make the programme more successful. These ‘pending’ activities, some will need more time to be realized and others will need extra time and fund to be implemented. Some of the critical activities which have to be implemented beyond 30th June 2020 include training of 51 PhD candidates and 27 MSc students, production of the scholarly papers to be published in peer reviewed journals together with establishment of research networks and collaborations for sustainability of the research results for inclusive development.

It is against this fact that UDSM-Sida programme needs a 12 months extension to accomplish the remaining activities with effect from 1st July 2020 to 30th June 2021 with estimated budget amounting SEK 25,890,000 as summarized in the following tables.

Table 3: Total Request Budget

Institution/Year	Carried Forward	Extra Fund From Sida	Total
UDSM	8,604,000	8,084,987	16,689,000
Swedish Institutions	403,000	5,583,000	5,986,000
ISP Student Allowances	969,000	2,246,000	3,215,000
Total	9,976,000	15,914,000	25,890,000

The distribution of the funds to be executed by the 12 subprogramme is mentioned in the table below:

Table 4: Subprogrammes' Budgets

Sub-Programme		Funds expected to be forwarded from previous year	Extra Request from Sida/ Annual Allocation (July 2020-June 2021)	Total funds to be Executed
1	Research Management	2,045,800	2,617,400	4,663,000
2	Library	-	448,000	448,000
3	Mathematics	-	1,839,850	1,840,000
4	MBB	78,000	1,507,600	1,585,600
5	ENGAGE	-	2,282,650	2,283,000
6	Tourism	882,500	525,000	1,407,500
7	Marine Science	1,416,500	1,929,100	3,345,600
8	Food Security	2,573,400	1,079,500	3,652,900
9	IGRID	1,403,000	1,326,500	2,729,500
10	DAFWAT	1,150,000	1,060,000	2,210,000
11	SUSTAIN	252,300	1,237,287	1,490,000
12	Water Resources	174,100	54,700	228,800
13	Swedish coordination		-	
TOTAL (SEK)		9,976,000	15,914,000	25,890,000

1.6 Summary of the Extra Fund for the 12 Months Extension Period

As mentioned above, the total extra fund requested from Sida during the extension period is SEK 15,914,000 intended to finance activities for successful attainment of the programme objectives. With this budget, the University of Dar es Salaam is requesting SEK 8,084,987, while Swedish Research Partner Institutions will have a share of SEK 5,583,000 and the remaining SEK 2,246,000 will be used by ISP to pay student allowances during their stay in Sweden.

2. General Objectives and Expected Results

The overall objective of this programme is to generate sufficient analytical capacity and research based knowledge and technological innovations with appropriate and immediate valuable outcomes to relevant stakeholders (policy makers, industry, civil society etc.) in addressing the problem of poverty and promoting sustainable and inclusive development. In that spirit, the UDSM research and training during 2015-2020 is be guided by its Vision 2061 to be “A leading centre of intellectual wealth spearheading the quest for sustainable and inclusive development”. Taking into consideration the various achievements from earlier support from Sida and other development partners, the proposed research and training has the following specific objectives:

- (i) To increase postgraduate curricula and the extent of research training for development in key strategic and priority areas(i.e. Food Security and Agriculture, Tourism, Agribusiness, Integrated Sanitation Management, Marine Sciences, Molecular Biosciences, Mathematics in high learning education and Smart Grid).

- (ii) To improve research environment (that includes equipment and infrastructure, regulations, policies and guidelines).
- (iii) To increase the quality and use of research
- (iv) To Increase partnership with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3. Target (July 2020 – June 2021)

3.1 Programme objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

3.1.1 Planned and the specific activities to be carried out:

- i. To supervise 51 PhD students; and 27 Master students who are in various stages of their studies.
- ii. To complete development of taught Masters curricular of tourism and hospitality management

3.1.2 Expected Deliverables

- i. 1 Masters Curricula of tourism and hospitality management accredited by TCU.
- ii. 27 Masters Students graduated
- iii. 51 PhD students graduated
- iv. 8 Taught PhD Programmes and 4 Taught Programmes are up and running

3.2 Programme objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

3.2.1 Planned and the specific activities to be carried out:

- i. To expand and Integrate RIMS to other UDSM systems
- ii. To conduct sensitization of the use RIMS' modules to UDSM Researchers
- iii. To conducting training on IPR to researchers of Sida programme
- iv. To Support subprogrammes to write fundable research proposals for sustainability research at UDSM
- v. To Supervise 4 Postdocs enrolled at IMS-UDSM

3.2.2 Expected Deliverables

- i. 100% Completion of development of RIMS
- ii. Increase the use of RIMS by 100%
- iii. 19 sensitization workshops of the use RIMS' modules to UDSM Researchers conducted
- iv. 20 Drafts of Intellectual Property developed
- v. 150 Researchers of UDSM Programme equipped skills on IPR
- vi. 12 subprogrammes and 1 Institutional fundable research proposals submitted to Sida for possible funding in the next phase
- vii. 3 research centres supported
- viii. 4 Postdocs graduate
- ix. 5 patent initiated

3.3. Programme objective 3: Increase the quality and use of research relevant to high priority issues of national development

3.3.1 Planned and the specific activities to be carried out:

- i. To write and develop 10 policy briefs

- ii. To produce TV and Radio programmes based on research findings and innovations through SJMC.
- iii. To support 5 units to organize local and international conferences and exhibitions
- iv. To organise the 3rd Conference of Research and Inclusive Development in Zanzibar
- v. To organize the international conference on sustainable tourism in developing countries (ICST-DC)
- vi. To subscribe e-learning resources database
- vii. To dignitaries the print local content research items (Thesis and Dissertation Abstracts)

3.3.2 Expected Deliverables

- i. At least 100 Peer reviewed journal papers published
- ii. At least ten (10) policy briefs published
- iii. 50 TV and Radio programs of UDSM-Sida research findings and innovations disseminated
- iv. At least 59 conference papers presented at various conferences
- v. 5 units supported to organize local and international conferences and exhibitions
- vi. The 3rd Conference of Research and Inclusive Development organised in Zanzibar
- vii. international conference on sustainable tourism in developing countries (ICST-DC) organised
- viii. 4 E-learning resources databases subscribed
- ix. 1 subject-based online database used to access thesis and dissertation abstracts
- x. Publication of the Book: Tourism and Sustainable Development in Tanzania

3.4 Programme objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3.4.1 Planned and the specific activities to be carried out:

- i. To conduct stakeholders meeting with Strategic research collaboration and networking with key stakeholders, i.e., Government, industry and end-users.
- ii. To conduct outreach activities
- iii. To establish local, regional and international research collaborations and partnerships

3.4.2 Expected Deliverables

- i. 16 stakeholders meetings with Strategic research collaboration and networking with key stakeholders, i.e., Government, industry and end-users conducted.
- ii. 10 outreach activities in terms of seminars conducted for industry and practitioners
- iii. commercialization of research results
- iv. ARUA and EARIMA regional activities attended
- v. Each Subprogramme established at least one regional collaboration and Partnership

4. Analysis and Justification

Budget: In the extension period, the programme is planning to spend a total of SEK 25,890,000

(equivalent to Tshs 6,226,278,020), with the fifty one (51) PhD, four (4) Post doc and Twenty seven (27) MSc research activities in Tanzania to spend SEK 16,689,000 (Tshs 3,946,098,500), PhD student stays in Sweden (ISP allocation) SEK 3,215,000 (Tshs 843,540,000), Swedish counterparts (supervision) – SEK 5,986,000 (Tshs 1,436,639,520). **Therefore the Programme is requesting a total of SEK 25,890,000, in which SEK 9,976,000 is carried forward amount from 2015-2020 agreement and SEK 15,914,000 is extra fund from Sida,** to supplement the following major cost as detailed in the below analysis per partner institutions:

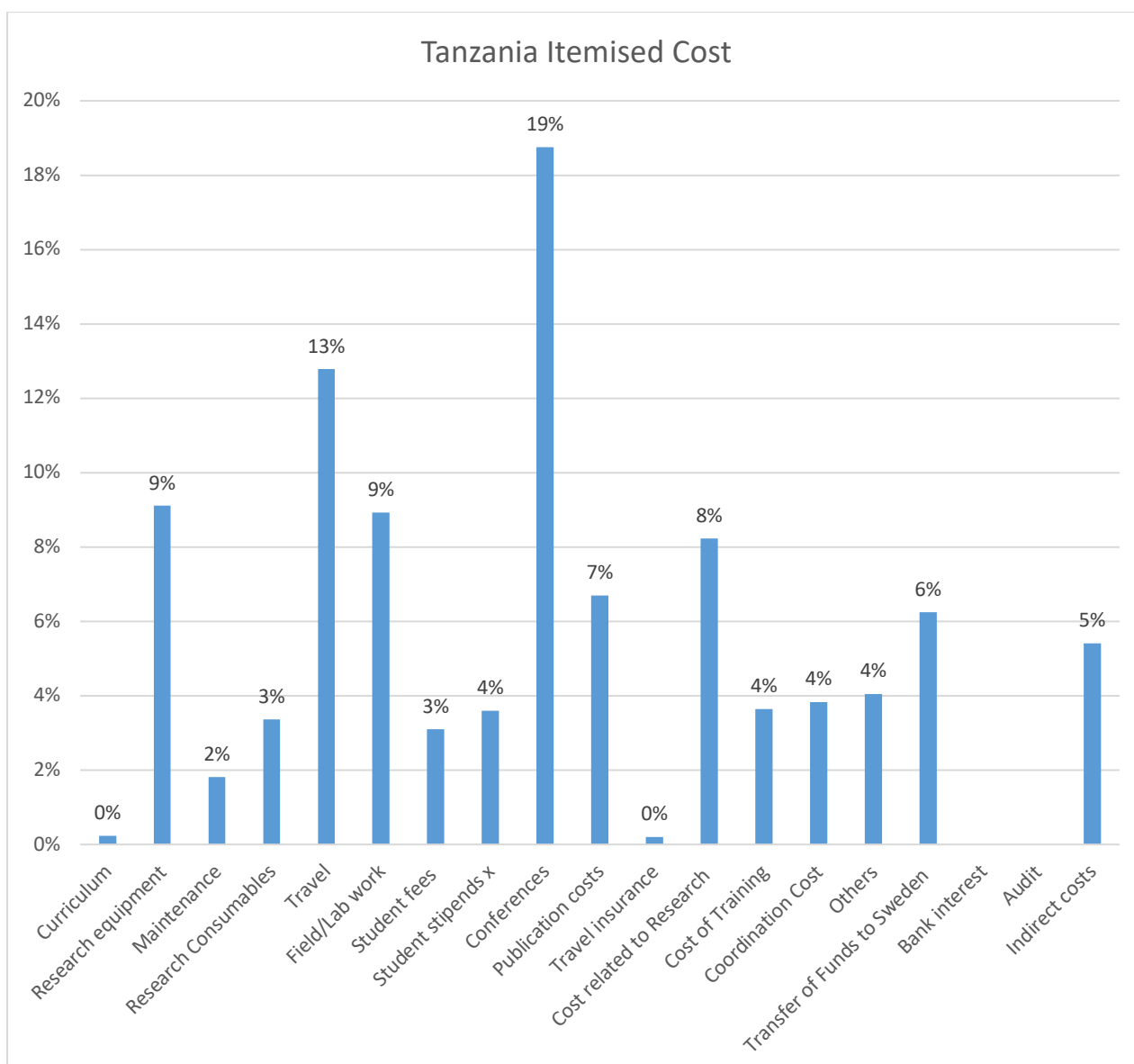
A. TANZANIA-University of Dar es Salaam

University of Dar es Salaam is requesting SEK 16,689,000 (Tshs 3,946,098,500) to implement various programme activities during extended period. Out of the requested budget for Tanzania, a total of SEK 8,604,000 (Tshs 2,106,970,100), which is over 52% is expected to come from the original budget while SEK 8,084,987 (Tshs 1,911,218,400) is extra fund requested from Sida. This means the programme is extended for period of one year (12 months) and the cost which is generally regarded as cost-base extension. This is because all 12 subprogrammes are requesting extra cost with minor and major deviations. The analysis as per cost item is as follows:

- (i) **Conference Supports (SEK 3,129,674):** This cost counts 19% of overall cost in which 42% of the cost is from original budget and 58% is from the extra funding from Sida. It is for the fact that, the programme will host two research conferences, which are the ICST-DC 2021 and 3rd Conference of Research and Inclusive Development. Furthermore, through this cost item students will be supported to attend international conferences and furthermore three tourism subprogramme stakeholders will be accommodated in Sweden to write papers for publication. This is because local and international conferences have been cancelled in 2020 because of Covid-19 pandemic and hence the activities have been forwarded to the 2020/2021 implementation year.
- (ii) **Travel Cost (SEK 2,133,147):** This cost counts 13% of overall cost in which 32% of the cost is from original budget and 68% is from the extra funding from Sida. This is fact that, more than 27 PhD students are registered in Sweden Universities and also 45 students are in Sandwich mode therefore, more than 30 students will be supported to travel to Sweden to finalize their studies and other students will be supported to attend conferences in various countries. Some students have to go back to Sweden from July because they have been interrupted by existence of Covid-19 in 2019/2020 implementation year.
- (iii) **Research equipment (SEK 1,520,500):** This cost item counts 9% of overall cost in which 96% of the cost is from original budget and only 4% is from the extra funding from Sida. 95% of procurement are done since inception of the programme however there are few remaining by DAFWAT, IGRID, Food Security and IMS subprogrammes. The delays were contributed with persistence situation of Covid-19 pandemic. However, most of them are at the final stage of procurement.
- (iv) **Research field costs (SEK 1,488,907):** This cost counts 9% of overall cost in which 42% of the cost is from original budget and 58% is from the extra funding from Sida. It is for the fact that, around 21/51 PhD and 3 PostDoc and 10/27 Masters Students will finalize their field work towards completion their studies.
- (v) **Cost related to Research (SEK 1,372,375):** This cost item counts 7% of overall cost in which 58% of the cost is from original budget and only 42% is from the extra funding from Sida. The cost item covers cost to finalize preparation of Research management information

systems, organization of 16 stakeholders' workshops and also cost of dissemination findings through soft and hard media.

- (vi) ***Students' stipends (SEK 594,596) and student's fees (514,148):*** This cost items count 8% of overall cost in which 60% of the cost is from original budget and only 40% is from the extra funding from Sida. This is for fact that more than 25 PhD students 'scholarship contracts are ended in 2021. Therefore, there are accrued students stipend and school fees in Tanzania.
- (vii) ***Transfer of Funds to Sweden (SEK 1,043,000):*** This cost item counts 6% of overall cost in which 100% of the cost is from original budget. The transfer of fund to ISP is to cover students allowance and Supervision cost in Sweden. The transfer is only made by Food Security subprogramme to enable to students to finalize their studies in Sweden Universities. This is because all eight (8) PhD students under food security are registered in in Sweden and so far, one one graduated and the remaining are at various level of their studies.
- (viii) ***Coordination Cost (SEK 640,000):*** This cost item counts 4% of overall cost in which 74% of the cost is from original budget and only 26% is from the extra funding from Sida. This cost item is significantly covers coordination activities for effective management of the programme. The activities include preparation of the next phase and also closure of the current phase.
- (ix) ***Indirect cost (SEK 903,349):*** This cost item counts 5% of overall cost in which 100% is from the extra funding from Sida. This is required institutional fee to support the implementation of the programme at the University of Dar es Salaam.
- (x) ***Other Cost:*** such as cost of training (4%), publication (7%), maintenance (2%), research consumable (3%) and other cost (4%).



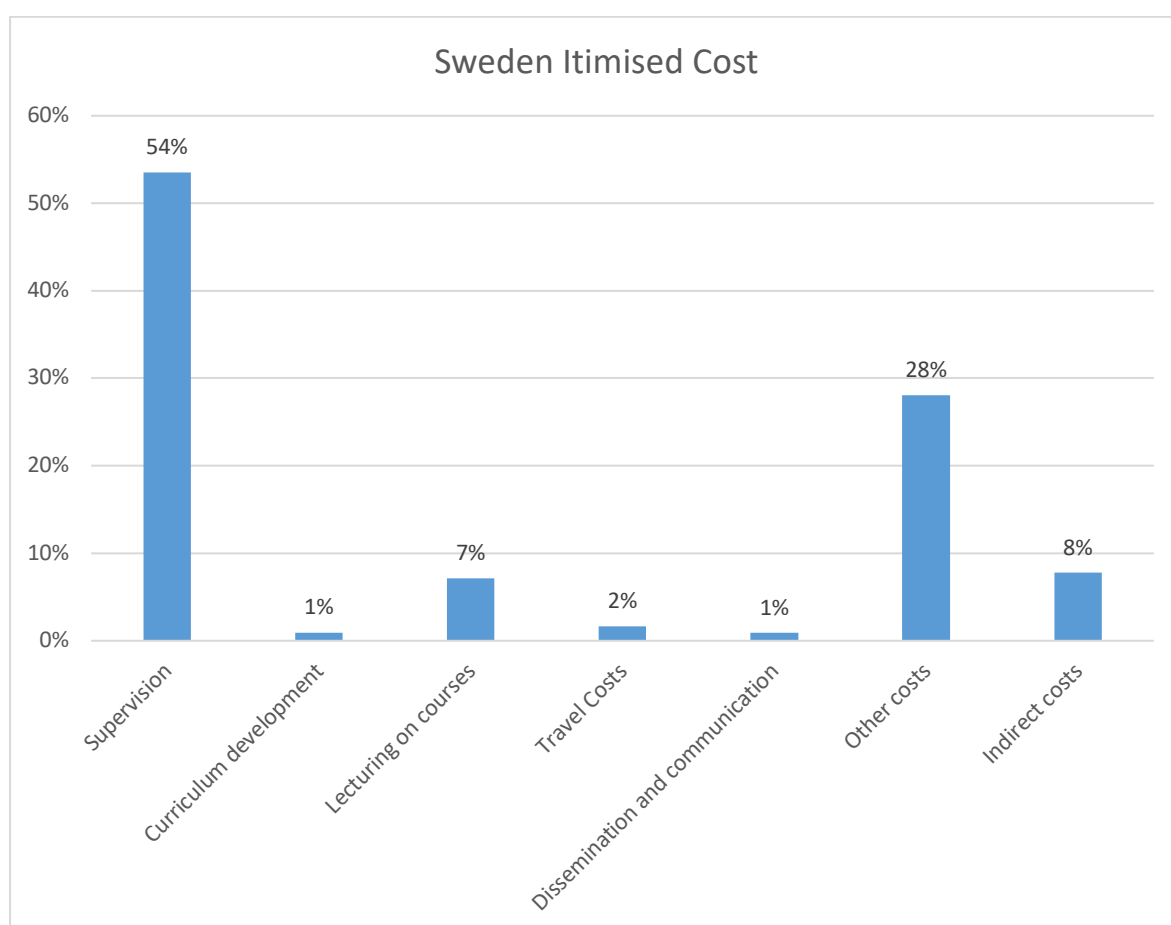
B. SWEDEN-Universities

Swedish High Learning Institutions are requesting SEK 5,986,000 (Tshs 1,436,639,520) to implement various programme activities in Sweden during the extended period. Out of the requested budget for Swedish High Learning Institutions, a total of SEK 5,583,000 (Tshs 1,339,919,520), which is over 80% is extra fund requested from Sida while SEK 403,000 (Tshs 96,720,000) is expected to come from original budget. Four out of eleven subprogrammes, include Tourism, Food security, SUSTAIN and Water resources in Sweden are requesting no-cost extension. The analysis as per cost item is as follows:

- (i) **Supervision (SEK 3,205,000):** This cost item counts 54% of overall cost in which 100% is from the extra funding from Sida. This is for fact that, there are more than 30 students will be supervised in Sweden to finalize their studies. However, the mathematic subprogramme accrued SEK 750,000 supervision cost which was not paid in 2019/2020 implementation year.
- (ii) **Curriculum development (SEK 57,000):** This cost item counts only 1% of overall budget and it is 100% extra funding from Sida. This is requested by ENGAGE subprogramme to

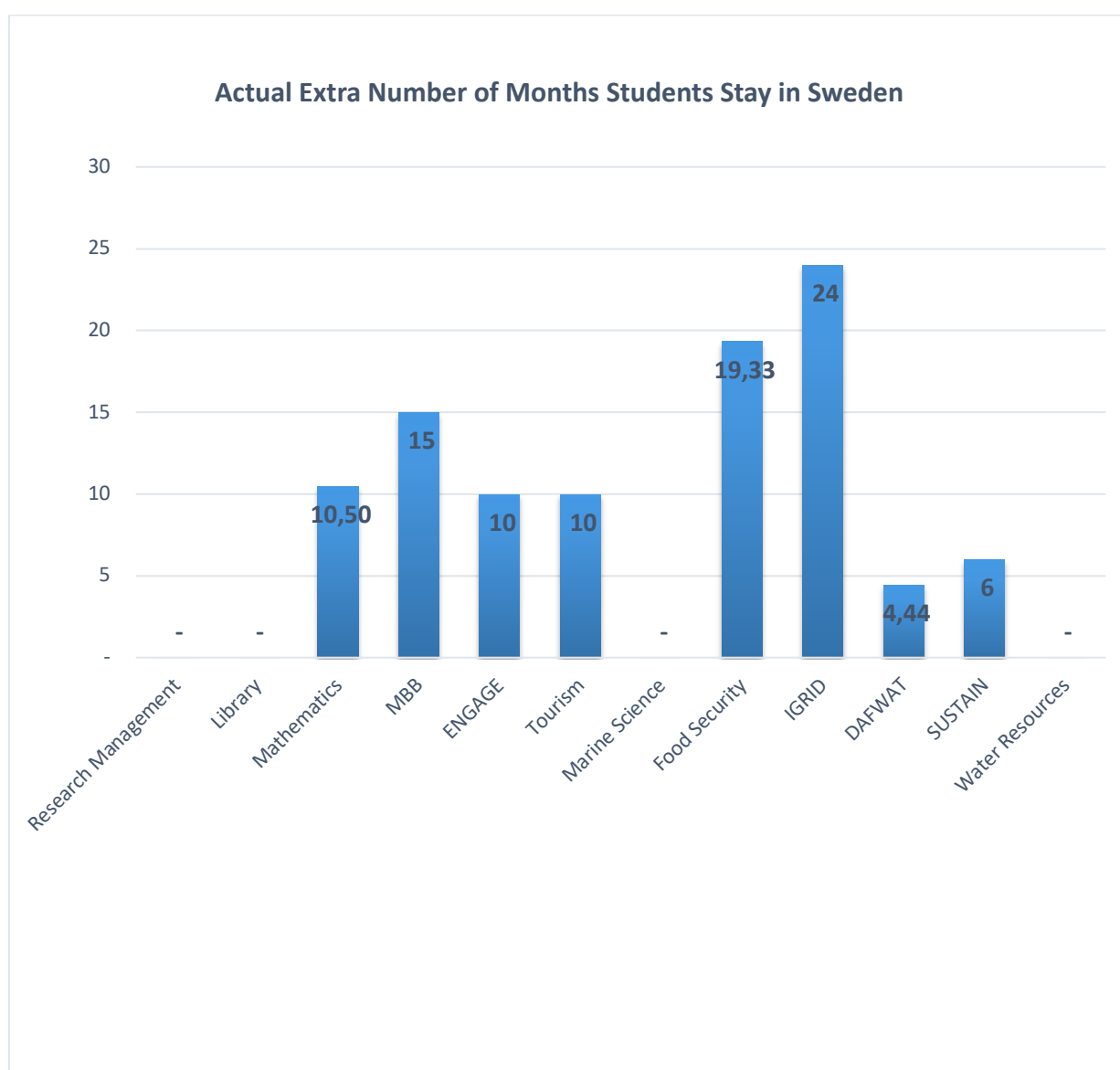
kick off the new curricular accredited by TCU. The curricular is expected to be operational from July 2020.

- (iii) **Lecturing on courses (SEK 429,000):** This cost item counts 7% of overall cost and it is 100% extra funding from Sida.
- (iv) **Travel Costs (SEK 97,000):** This cost item counts 2% of overall cost and it is 100% extra funding from Sida. This is to cover travel cost of visit partners in Sweden to Tanzania to engage supervision and other programme activities for example preparation of the subprogramme new phase proposals.
- (v) **Dissemination and communication (SEK 54,000):** This cost item counts 5% of overall cost and it is 100% extra funding from Sida. This for covering the conference attendance as the programme is approaching to the end and the students and supervisors will have research findings to communicate to wide end users.
- (vi) **Other costs (SEK 1,678,398):** This cost item counts 28% of overall cost in which 24% of the cost is from original budget and only 76% is from the extra funding from Sida.
- (vii) **Indirect cost to high learning Institutions (SEK 465,850):** This cost item counts 8% of overall cost and it is 100% extra funding from Sida. This is required institutional fee to support the implementation of the programme at the partners High Learning Institutions in Sweden.



C. SWEDEN-ISP Students Allowances

The total of SEK 3,215,000 (Tshs 843,540,000) to support to Students to stay in Sweden during the extended period for 178 months. Out of the requested amount, a total of SEK 2,246,000 (Tshs 610,980,000), which is over 70% is extra fund requested from Sida while SEK 969,000 (Tshs 232,560,000) is remaining balance from original budget. However, the mathematic subprogramme accrued SEK 378000 stipends allowance in Sweden because over stay of three students for 21 months (each 7 months, see in the table below) in 2019/2020. Remarkably, three out of ten research based subprogrammes, include Tourism and Water resources; are requesting no-cost extension in term of ISP-Students Allowances. The table below describes extra number of months students of each subprogramme will stay in Sweden:



D. Risk Assessment

Risks	Mitigation and Adaptation measures	Responsible person
Persistence existence of COVID-19 pandemic to affect the implementation of programme activities such conferences and travel	<ul style="list-style-type: none"> ➤ Online participation of the conferences and PhD viva voice ➤ Online Students Supervision ➤ Online attendance of APM and ARM ➤ Online participation of preparation of next phase subprogramme proposals. 	UDSM Sida Coordinator, PIs, Swedish counterparts, students and ISP coordinator
Delays of students to complete their studies	<ul style="list-style-type: none"> ➤ Close monitoring by the university through its machinery ➤ Good governance of Steering Committee and Close monitoring of UDSM Sida coordinator, PIs and Supervisors ➤ Postgraduate Supervision Training will be provided to supervisors ➤ Scientific writing and research methodology trainings will be provided to students ➤ Timely submission of student schedules for visit to Sweden ➤ Each subprogram to have coordination meetings with partner institutions. ➤ ISP to ensure harmonization of activities in Swedish partner institutions 	UDSM Sida Coordinators, PIs, Supervisors, heads of departments, Deans, DPGS, DRP and Swedish counterparts
Tedious and lengthy procurement process enforced by the Public Procurement Act and not all PIs are very conversant with this act.	<ul style="list-style-type: none"> ➤ Preparation of annual procurement plan and timely submission for processing. ➤ Procurement manual prepared ➤ Online government procurement used to simplify electronic tracking of requisitions. ➤ Decentralised tender boards established 	Sida Coordinator and Secretariat has budget set aside for this activity under Sida Research Management sub-program under Cost of training budget line.

5. Enclosures

1. UDSM Programme Overall Aggregated Budget
2. Programme Detailed Budget
3. Results Based Management (RBM) Matrix (July 2020-June 2021)
4. Aggregated Student Progress and Plan (July 2020-June 2021)

Enclosures 1: Programme Overall Aggregated Budget

UDSM-SIDA RESEARCH PROGRAMME 2015-2020													
OVERALL INSTITUTIONAL BUDGET FOR 12 MONTHS EXTENSION PERIOD: JULY 2020 - JUNE 2021													
Date: 30.05.2020													
Overall Programme: ANNUAL PLAN AND BUDGET													
Fiscal Year: 2020/2021 (12 MONTHS EXTENSION)													
Tanzanian Institution: UNIVERSITY OF DAR ES SALAAM													
JULY 2020 - JUNE 2021													
Sub-Programme		Funds expected to be forwarded from previous year				Annual Allocation (July 2020-March 2021)				Total funds to be Executed			
S/N		TZA	SWE	ISP Allowances	Total	TZA	SWE	ISP Allowances	Annual Allocation	TZA	SWE	ISP Allowances	TOTAL
1	Research Management	1,642,800	403,000	0	2,045,800	2,131,400	486,000	-	2,617,400	3,774,200	889,000	-	4,663,000
2	Library	-	0	0	-	448,000	-	-	448,000	448,000	-	-	448,000
3	Mathematics	-	0	0	-	279,400	993,450	567,000	1,839,850	279,400	993,450	567,000	1,840,000
4	MBB	24,000	0	54,000	78,000	1,112,600	125,000	270,000	1,507,600	1,136,600	125,000	324,000	1,585,600
5	ENGAGE	-	0	0	-	699,900	1,402,750	180,000	2,282,650	699,900	1,402,750	180,000	2,283,000
6	Tourism	882,500	0	0	882,500	110,000	415,000	-	525,000	992,500	415,000	-	1,407,000
7	Marine Science	1,140,500	0	276,000	1,416,500	696,100	885,000	348,000	1,929,100	1,836,600	885,000	624,000	3,345,600
8	Food Security	2,573,400	0	0	2,573,400	151,500	496,000	432,000	1,079,500	2,724,900	496,000	432,000	3,652,900
9	IGRID	1,403,000	0	0	1,403,000	816,500	430,000	80,000	1,326,500	2,219,500	430,000	80,000	2,729,500
10	DAFWAT	763,000	0	387,000	1,150,000	449,000	350,000	261,000	1,060,000	1,212,000	350,000	648,000	2,210,000
11	SUSTAIN	36,300	0	216,000	252,300	1,129,287	-	108,000	1,237,287	1,165,587	-	324,000	1,490,000
12	Water Resources	138,100	0	36,000	174,100	61,300	-	-	61,300	199,400	-	36,000	235,400
13	coordination								-		-		
TOTAL (SEK)		8,604,000	403,000	969,000	9,976,000	8,084,987	5,583,000	2,246,000	15,914,000	16,689,000	5,986,000	3,215,000	25,890,000

Enclosures 2: Programme Detailed Budget

UDSM-SIDA RESEARCH PROGRAMME 2015-2021											
OVERALL INSTITUTIONAL BUDGET FOR 12 MONTHS EXTENSION PERIOD: JULY 2020 - JUNE 2021											
Period: 1st July 2020 to 30th June 2021											
Tanzanian Institution/Dept: University of Dar es Salaam											
Date:30th May 2020 exchange rate 240 TZS/SEK											
OBS Student allowances should be under ISP											
	Tanzania	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
		SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1	Curriculum	39,000	9,360,000	-	-	-	-	-	-	39,000	9,360,000
2	Research equipment	1,458,500	380,040,000	25,000	6,000,000	25,000	6,000,000	62,000	12,000,000	1,520,500	362,040,000
3	Maintenance	100,000	24,000,000	100,833	24,200,000	100,833	24,200,000	201,667	48,400,000	301,667	72,400,000
4	Research Consumables	428,038	107,229,231	72,315	17,355,600	62,315	14,955,600	134,630	32,311,200	562,668	135,040,431
5	Travel	678,630	162,871,200	745,008	178,802,000	549,508	131,882,000	1,454,517	307,084,000	2,133,147	469,955,200
6	Field/Lab work	631,574	168,929,778	428,667	102,880,000	428,667	102,880,000	857,333	205,760,000	1,488,907	357,337,778
7	Student fees	289,000	69,360,000	113,894	27,334,444	24,894	27,334,444	227,787	54,668,889	516,787	124,028,889
8	Student stipends x	365,763	92,373,111	114,000	27,360,000	114,000	27,360,000	235,500	54,720,000	601,263	142,503,111
9	Conferences	1,316,520	315,964,800	861,440	206,745,520	951,715	228,411,520	1,813,154	435,157,040	3,129,674	751,121,840
10	Publication costs	690,941	168,825,920	212,517	51,004,000	214,817	51,556,000	427,333	102,560,000	1,118,275	268,385,920
11	Travel insurance	16,200	3,888,000	11,292	2,710,000	6,500	1,560,000	17,792	4,270,000	33,992	8,158,000
12	Cost related to Research	708,500	170,040,000	331,938	79,665,000	331,938	79,665,000	663,875	189,330,000	1,372,375	329,370,000
13	Cost of Training	365,000	87,600,000	121,667	29,200,000	121,667	29,200,000	243,333	58,400,000	608,333	146,000,000
14	Coordination Cost	473,000	113,520,000	83,500	20,040,000	83,500	20,040,000	167,000	40,080,000	640,000	153,600,000
15	Others	-	-	337,780	81,067,200	337,780	81,067,200	675,560	162,134,400	675,560	162,134,400
16	Transfer of Funds to Sweden	1,043,000	250,320,000	-	-	-	-	-	-	1,043,000	250,320,000
17	Bank interest	-	-	-	-	-	-	-	-	-	-
18	Audit	-	-	-	-	-	-	-	-	-	-
19	Indirect costs	-	-	438,557	103,866,552	424,431	100,476,312	903,349	204,342,864	903,349	204,342,864
	SUB TOTAL	8,604,000	2,106,970,100	3,998,200	958,230,400	3,777,400	926,588,200	8,084,987	1,911,218,400	16,689,000	3,946,098,500
	Sweden										
1	Supervision	-	-	1,708,000	409,920,000	1,496,750	359,220,000	3,204,750	769,140,000	3,205,000	769,140,000
2	Curriculum development	-	-	28,500	6,840,000	28,500	6,840,000	57,000	13,680,000	57,000	13,680,000
3	Lecturing on courses	-	-	214,500	51,480,000	214,500	51,480,000	429,000	102,960,000	429,000	102,960,000
4	Travel Costs	-	-	48,500	11,640,000	48,500	11,640,000	97,000	23,280,000	97,000	23,280,000
5	Dissemination and communication	-	-	27,000	6,480,000	27,000	6,480,000	54,000	12,960,000	54,000	12,960,000
6	Other costs	403,000	96,720,000	637,699	153,047,760	637,699	153,047,760	1,275,398	306,095,520	1,678,398	402,815,520
7	Indirect costs	-	-	232,925	55,902,000	232,925	55,902,000	465,850	111,804,000	465,850	111,804,000
	SUB TOTAL	403,000	96,720,000	2,897,124	695,309,760	2,686,000	644,609,760	5,583,000	1,339,919,520	5,986,000	1,436,639,520
	ISP - student allowances	969,000	232,560,000	1,123,000	303,120,000	1,123,000	269,520,000	2,246,000	610,980,000	3,215,000	843,540,000
	SUB-TOTAL ISP	969,000	232,560,000	1,123,000	303,120,000	1,123,000	269,520,000	2,246,000	610,980,000	3,215,000	843,540,000
	GRAND TOTAL	9,976,000	2,436,250,100	8,018,324	1,956,660,160	7,586,400	1,840,717,960	15,914,000	3,862,117,920	25,890,000	6,226,278,020

Enclosure 3: Results Based Management (RBM) Matrix (July 2020-June 2021)

Summary Problem Statement: UDSM has inadequate analytical, research infrastructure and innovation outputs to generate appropriate and valuable outcomes to the society

Overall objective: To generate and utilise sufficient analytical capacity and research based knowledge and technological innovations with appropriate and immediate valuable outcomes to relevant stakeholders (policy makers, industry, civil society etc.) in addressing problem of poverty and promoting sustainable and inclusive development.

Specific Objective # 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas by 2021

Specific Objective # 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines) by 2021

Specific Objective # 3: To increase the quality and use of research relevant to high priority issues of national development by 2021

Specific Objective # 4: To Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas by 2021.

OVERALL RESULTS BASED MATRIX LOGFRAME

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
Specific Objective # 1: To increase the postgraduate curricula and the extent of research training for development applied in key strategic priority areas						
Taught PhD programmes in key strategic and priority areas prepared	1.1 At least 8 new PhD programmes accredited, by 2018	Number of PhD programmes accredited	6 existing Taught PhD programmes at UDSM in 2015	8 Taught PhD Programmes operational		
Taught Masters programmes in key strategic and priority areas prepared	1.2 At least 3 new Masters programmes accredited by	Number of Masters programmes accredited	75 existing Taught Masters programmes at UDSM in 2015	4 new Masters' Programmes operational 1 Taught Masters' of tourism accredited by TCU.		
Selected existing PhD programmes reviewed and revised	1.3 Two existing PhD programmes approved, by 2018	Number of PhD programs approved by UDSM Senate	One PhD programme reviewed and approved by Senate in 2015	Operational		
Selected existing Masters programmes reviewed	1.4 Four existing Masters programmes approved, by 2018	Number of Masters programs approved by UDSM Senate	One MSc programme reviewed in 2015	Operational		

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
Trained Masters graduates, half of which are women	1.5 At least 36 Masters graduates graduated by 2020.	Number of Master graduates	232 Masters students trained in previous Sida support phase	27/48(48% female) Masters supervised and graduated		
Trained PhD graduates, half of which are women	1.6 At least 64 PhD graduates enrolled and graduated by 2020.	Number of PhD graduates	80 PhD students trained in previous Sida support phase	51/62 (38% female) PhD students supervised and graduated		
Trained UDSM staff at PhD level	1.7 Academic staff with PhD increased by at least 10% by 2020.	% of academic staff with PhD	UDSM has 515 staff who are PhD holders	28 staff/PhD students supervised		
Assumptions for Specific Objective 1 <ul style="list-style-type: none"> ➤ External stakeholders to the University are involved in the design and development of the new programmes ➤ UDSM Senate and the Council are supportive of the multi-disciplinary curricula in new high priority areas ➤ Additional funding available for the new programmes 						
Specific Objective # 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines)						
Research agenda reviewed and revised	2.1 UDSM-wide research agenda approved by 2017	One UDSM Research Agenda document in place	UDSM Research Agenda 2009-2018	In use		
	2.2 Increase of (at least 50%) a research focused on UDSM research agenda, by 2020	Extent to which research focused on UDSM agenda	UDSM Research Agenda 2009-2018	In use		
New laboratory facilities	2.3 High quality research using the new equipment	Extent to which labs are used	50% utilization rate in previous Sida funding period	100% of the major procurement accomplished		
New state of the art lab equipment	2.4 Increased use of research facilities/lab by at least 10 externally funded research projects, by 2020	Extent to which staff and visiting researchers use equipment	6 Research projects conducted using the equipment acquired in the previous phase	Four funded projects (MBB, IMS, Food security, DAFWAT) use the facility procured in the current programme		
Upgraded ICT infrastructure	2.5 Increase of at least 100% use of online database by UDSM researchers	Number of downloads	90% students and 70% academic staff using online ICT materials	20% of UDSM staff using online ICT materials		
Research Information Management System developed and used	1.1 Timely reporting of the progress to the satisfaction of all stakeholders by December 2018.	<ul style="list-style-type: none"> • RIMS available and working • PIs are effectively using the system for 	<ul style="list-style-type: none"> • RIMS Phase-I which is in use since July 2017 • Fragmented research 	100% of the proper research management system in place		

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
		planning and reporting purposes • Online registrations and downloads of UDSM projects information	information available			
500 postgraduate students trained in scientific writing skills, research methodology, IPR 40% of which are female	2.6 At least 50% of students produce 1 scientific articles in peer reviewed journals	Number of publications produced, 40% produced by women students	60 students trained in 2014	-150 academic staff equipped with the skills on Intellectual Property Rights (IPR).		
300 Academic staff trained in postgraduate student supervision skills, 40% of which are female	2.7 At least 300 academic staff apply new postgraduate student supervision.	Number of academic staff trained	6 ToT and 117 members of staff trained in research supervision between 2009 – 2014	Done		
Multidisciplinary centres of excellence for public/private partnerships in research and innovation	2.8 At least 6 Innovation clusters formed with appropriate technologies for value additions in place	Number of research centres of excellency established	Two multidisciplinary centres in research, innovation and entrepreneurship	3 Research Centres supported		
Highly analytical capacities enhanced through postdoctoral research	2.9 At least 20 Postdocs enrolled at UDSM by 2020	Number of Postdocs enrolled	No postdocs in previous Sida support	4 postdocs enrolled and supervised.		
Assumptions for specific objective 2 • Research guidelines and policies are in place at UDSM • Research agenda developed and adopted • Programme Coordinators are aware of the procurement procedures • Research Information Management System developed and used • Research groups grow into Research Centres of Excellency						
Specific Objective # 3: To increase the quality and use of research relevant to high priority issues of national development						
Uploaded institutional research results in electronic database	3.1 Enhanced visibility and reputation of UDSM by 2018 3.2 At least 220 publications in peer reviewed local and	Higher ranking of UDSM nationally and internationally	UDSM Ranked 39 th in 2015 by journal consortium organization	UDSM ranked higher than the previous ranking At least 100 peer reviewed articles		

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
Publications in highly ranked peer reviewed journals increased	international journals by 2020	Number of peer reviewed articles	211 journal articles from the previous Sida support			
Patent in local and rational bodies increased	3.3 At least 3 patents granted by 2020	Number of patents approved	2 patents at UDSM	5 patent initiated		
Organization and hosting of dissemination conferences and workshops	3.4 At least four (4) Sida sponsored conferences hosted by 2020	(i) Number of conferences hosted (ii) Number of articles presented (iii) Number of articles published	2 conferences in previous Sida funding	(iv) 5 units to be supported to conduct dissemination conferences (v) The 3 rd Conference of Research and Inclusive Development Organised (vi) The conference Sustainable Tourism organised (vii) 50 TV and Radio programs of UDSM-Sida research findings and innovations disseminated		
	3.5 5 policy briefs from PhD candidates published and disseminated by 2020	(viii) Numer of policy birefs	0	(ix) 20 policy briefs available		
	3.6 Five (5) research findings/results successfully commercialised	(x) Number of Participants (xi) Number of findings	0	(xii) 300 participants/stakeholders from public and private organizations aware of research findings through policy briefs. 10 stakeholder workshop to be conducted. (xiii) At least Five (5) research findings/results successfully commercialised		
	3.7 5 UDSM research week Organised by 2010 to increase visibility	Research week supported annually Number of units participated in the event	1 research week organised in 2015 at UDSM. Number of visitors	One research week organised		

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
Outreach programmes increased	3.8 At least 10 outreach programmes performed in local communities by 2020	Number of outreach programmes	2 Outreach programmes in previous Sida funding	At least 3 outreach programme facilitated		
Assumptions for Specific Objective 3 <ul style="list-style-type: none"> UDSM continues to attract and retain highly qualified and trained staff to undertake quality research UDSM staff pursue high quality research that can be published in quality journals 						
Specific Objective # 4: To Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas						
Collaborative research with specific industries formulated	4.1 Threefold increase in collaborative joint efforts between researchers and industries in external settings, by 2020	Number of collaborative research projects involving use of University-based research	5 during previous Sida funding period	Collaborative research formulated (i) Up to five (5) research centres/Multi-disciplinary research groups focused on strategic national priorities established to enhance research networks and collaboration with key stakeholders of the project (ii) Up to five (5) professorial chairs supported in organizing their annual events. (iii) Sida programme based multidisciplinary research centres of excellence established to support the next Sida phase research activities. (iv) At least 10 groups supported to develop competitive proposals. (v) Proposals prepared and submitted for funding in the next phase of Sida support (vi) 5 staff attend ARUA meetings/workshops as a way of increasing UDSM visibility at international arena.		

Outputs	Outcomes	Performance indicator of outcome	Baseline	Annual Outcome Targets for 2020/21	Actual Outcomes Achieved: Results Observed in year (2020/21)	[Key] Outputs produced in year to obtain Outcome in 2020/21
				(viii) At least 5 networking visitations by DRP, DPS and PRO to the private and public organs supported.		
Dissemination workshops conducted	4.2 Double workshops for dissemination of research results, by 2020	Number of Sida funded workshop proceedings/ research papers cited/referenced	20 workshops during previous Sida funding period	At least 16 workshops organised		
Technical assistance/ advice to public offices and private firms provided	4.3 Double public policies developed/reviewed (in part) based on research results, by 2020.	Number of public policies	2 during the previous Sida – funded program	20 policy briefs available		
Researchers advisory roles in public and private institutional boards increased with at least 50% female researchers	4.4 Double public policies supported in part by researchers, by 2020	Number of researchers active in external boards	20 during the previous Sida support	5 researchers involved in advisory roles		
Scientific papers prepared and submitted to conferences	4.5 Double scientific papers in local, regional and international conferences by 2020.	Number of invitations to present scientific papers in local, regional and international conferences	230 presentations in the previous Sida funding phase	More than 59 papers presented in international and national conference		

Enclosure 4: Overall Aggregated Student Plan/Progress

A. Overall Aggregated PhD Student Plan/Progress

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden (<u>no. months</u>)	<u>Local PhD</u> Expected/ Year of <u>completion</u>	<u>Sandwich</u> <u>PhD</u> Expected/ Year of <u>completion</u>	<u>Progress</u> %	<u>Title of dissertation</u>
MATHEMATICS SUBPROGRAMME								
1.	Edward Ngailo	M	2016	40	NA	June 2020	95%	On the product of inverse covariance matrix and normal vector with applications to Discriminate analysis and Portfolio theory
2.	Pitos Seleka	M	2016	40.5	NA	Dec. 2020	90%	PageRank algorithms, Markov chains and matrix analysis for changing networks and analysis of big data
3.	Uledi Ngulo	M	2016	40	NA	June 2021	70%	An Investigation of decomposition methods for solving large-scale Multi-level Optimization models.
MBB SUBPROGRAMME								
4.	Juma Hussein	M	2016	39	NA	Completed	<u>100%</u>	Investigation of some economically important Mushrooms of Tanzania
5.	Stella Temu	F	2016	42	NA	October 2020	<u>80%</u>	Taxonomy of Tanzania cloud forest lichens
6.	3. Donatha Damian	M	2016	6	March 2021	NA	<u>70%</u>	Viral metagenomics and molecular epidemiology of vector-borne diseases in the wildlife-livestock interface
7.	HeriethRhodes Mero	F	2016	6	June 2021	NA	<u>65%</u>	Genetic diversity and Chloroplast genomics of cassava land cares and selected wild cassava relatives in Tanzania
8.	BernadetherRugumisha	F	2016	6	March 2021	NA	<u>70%</u>	Influence of inter-pregnancy interval after abortion on vaginal microbiome during the first trimester
9.	Jackson Thomas Mollel	M	2016	6	March 2021	NA	<u>70%</u>	Investigation of anti-HIV-1 activity and inhibitory properties of medicinal plants used for treatment and management of HIV/AIDS in Tanzanian
10.	Reuben Silas Maghembe	M	2016	6	March 2020	NA	<u>70%</u>	Molecular mapping of diversity and bioactivity of microalgae from selected marine and fresh water ecosystems in Tanzania
ENGAGE SUBPROGRAMME								
11.	Merezia Wilson Bambaganya.	F	2016	12	September2 020	NA	<u>60%</u>	Rural entrepreneurship in Tanzania: Socio-spatial context and women engagement in agribusiness

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden (no. months)	<u>Local PhD Expected/ Year of completion</u>	<u>Sandwich PhD Expected/ Year of completion</u>	<u>Progress %</u>	<u>Title of dissertation</u>
12.	Mesia Lomo Research.	M	2016	9	December 2020	NA	<u>70%</u>	Gender and participation of women and men in the rice value chain and rice marketplaces in Tanzania
13.	Mohamed A. Semkunde.	M	2016	9	January 2021	NA	<u>60%</u>	Rural Entrepreneurship in women Producer Groups: The case of Rice Producers in Tanzania
TOURISM SUBPROGRAMME								
14.	Msafiri Njoroge Ngajeni	M	2015		November 2019		100%	Entrepreneurial Orientation and Corporate Sustainability: A Study of Tourist Hotels in Tanzania
15.	Patrokil Kanje	M	2015		January 2020		100%	The Influence of Tourists' Motivation and Customer Engagement on Electronic Word of Mouth Behavior in Social Media
16.	Said Suluo	M	2015		June 2020		100%	Impact of Corporate Sustainability Practices on Financial Performance: The Case of Tourism Enterprises in Tanzania
17.	Theresia Busagara	F	2015		June 2020		100%	Firm Innovativeness through interactions and customer participation Behaviour in Tourism Firms of Tanzania
FOOD SECURITY SUBPROGRAMME								
18.	Maganira Justine Daudi	F	2016		NA	May 2020	100%	Transmission Biology of Taeniid Zoonotic Parasites: Assessment of Environmental Soil and Food Items Contamination By Taenia Solium Eggs
19.	Ibrahim Juma	M	2016	29	NA	Sept 2020	95%	Promotion of horticultural productivity for food nutrition and income generation; A case of avocado in Tanzania
20.	Peter R. Ruvuga	M	2016	26	NA	March 2021	80%	Rangeland management practices for intensification of livestock production in miombo woodlands
21.	Nuria Kudra Majaliwa	F	2016	28	NA	March 2021	85%	Potential role of protein-tannin interaction on banana Juice Extraction
22.	Matilda Stanslaus Ntiyakunze	F	2016	30	NA	March 2021	80%	Forest Dependency in Tanzania: Analysis of household's heterogeneity, household's revealed energy choices, links between forests and food security.

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden (no. months)	<u>Local PhD Expected/ Year of completion</u>	<u>Sandwich PhD Expected/ Year of completion</u>	<u>Progress %</u>	<u>Title of dissertation</u>
23.	Lufunyo Lulandala	M	2016	29	NA	March 2021	80%	The influence of tree vegetation cover, land use and soil characteristics on underground water recharge
24.	Aneth David Mwakilili	F	2016	32	NA	March 2021	75%	Microbiome analysis of push-pull companion plants in plant growth and protection
25.	Alice Isibika	F	2016	33.5	NA	March 2021	75%	Larvae composing of Food industrial waste with focus on banana wastes for production of animal feed protein
IGRID SUBPROGRAMME								
26.	Mr Daudi Mnyaghwalu	M	2016	2	Nov 2020		75	Optimal Sensor Network and Faults Classifications Algorithms for Automatic Faults Clearance in the Secondary Electrical Power Distribution Network
27.	Ms Rukia Mwifunyi	F	2016	2	May 2020		85	Automation of Fault Localization, Isolation and Service Restoration to Improve Reliability in Electrical Secondary Distribution Network
28.	Mr. Godfrey Chugulu	M	2016	2	Nov 2020		70	A Smart Grid Communication Architecture for Enhancing Automatic Faults Detection and Clearance in Tanzania Electrical Power Secondary Distribution Network
29.	Mr. Yona Andegelile	M	2016	2	Nov 2020		75	Cost Effective Resilient Communication System for Fault detection and Clearance Automation in Secondary Distribution Power Grid
30.	Mr. Shamte Kawambwa	M	2016	2	Nov 2020		75	Coordination of Distributed Energy Resources for Enhancing Fault Clearance and Service Restoration in Electrical Power Distribution Network
31.	Mr. Gilbert Gilbert	M	2016	2	Nov 2020		70	Integrated Computing Framework for Automatic Fault Clearance in Tanzania Electrical Power Grid
32.	Ms. Hadija Mbembati	F	2016	0	Nov 2021		40	Preparing proposal after maternity
33.	Mr. Ally Bitebo	M	2016	2	Nov 2021		50	A framework for Securing Communication Network for Fault Management in Secondary Electrical Power Distribution Network
34.	Mr. Aron Kondoro	M	2016	22		May 2020	95	Enhancing Security in Distributed Internet-of-Things Based Communication System for Agent Driven Smart Micro-grid

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden (<u>no. months</u>)	<u>Local PhD</u> Expected/ Year of <u>completion</u>	<u>Sandwich</u> <u>PhD</u> Expected/ Year of <u>completion</u>	<u>Progress</u> %	<u>Title of dissertation</u>
35.	Ms. Diana Rwegasira	F	2016	22		May 2020	95	Agent Based System for Improved Control and Monitoring of a solar driven DC micro grid
IMS SUBPROGRAMME								
36.	Leonard, L.	M	2015		2018	2019	100%	Potential for Aquaculture of Nile and Rufiji Tilapia Hybrids (Lead supervisor Dirk-Jan De Koning; CS.; Dr. Aviti Mmochi, Christos Palaikostas, Phillip Bwathondi, Mtolera, Matern)
37.	Nyangoko, B.	M	Jan 2017			Dec 2021	60%	Managing Mangrove Ecosystem Services for Livelihoods and Local Adaptations in Tanzania
38.	Mulokozi, D.	M	Oct 2016			December 2020	70%	Integrated aquaculture-agriculture (IAA) systems for diversified food production in Tanzania
39.	Kajungiro, R. A.	F	April 2016			October 2020	75%	Towards a Sustainable Nile Tilapia Breeding Program in Tanzania and the role of local strains
40.	Simon, C.	F	June 2016			October 2020	75%	Sustainable Tilapia Breeding in Tanzania and the Role of Rufiji Tilapia (<i>Oreochromis urolepis urolepis</i>)
41.	Yusuf, Y. S.	M	Jan 2016		Aug 2020		80%	Artificial Seed Production of Tropical Sea Cucumber (<i>Holothuria scabra</i>) in Tanzania.
42.	Mmanda, F. P.	M	April 2016			June 2020	85%	Nutritive value and use of locally available low-cost feed ingredients for Tilapia farming in Tanzania.
43.	Michael, A.	F	Jan 2016		June 2020		95%	The potential of the cyanobacterium (<i>Arthrospira fusiformis</i>) in providing cost effective and high quality feed for tilapia farming in Tanzania
44.	Tarimo, B.	M	April 2017			March 2021	65%	Mangrove-seagrass continuum: Linkages to Larval Fish Production, Dispersal and Growth
45.	Ismail, R. O.	M	Feb 2016			October 2020	85%	Balance between Productivity and Calcification in Tropical seagrass beds and its implication for Net Carbon sequestration
46.	John, O.	F	Jan 2016		August 2020			The impact of calcareous macroalgae and anthropogenic stress on production and carbon storage in tropical seagrass meadows
47.	Rashid, M. A.	F	May 2016		March 2021		60%	Pangani Basin hydrology and coastal environmental changes associated with climate change.
48.	Mbiru, M.	M	Jan 2017		October 2020		75%	Introduced Nile Tilapia Strains and Their Role in the Tanzania Tilapia Breeding Initiative

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden (no. months)	<u>Local PhD Expected/ Year of completion</u>	<u>Sandwich PhD Expected/ Year of completion</u>	<u>Progress %</u>	<u>Title of dissertation</u>
49.	Mapunda John	M	Nov 2017		March 2021		65%:	Brood-stock maturation, seed production and larviculture of Silver Pompano, Trachinotus Blochii (Lucepede, 1801) for mariculture in Tanzania
50.	Yahya, B.M.	F	Nov 2016		August 2020		80%:	Fish Assemblage Structure in Relation to Habitat Complexity in Seaweed farms and adjacent Seagrass Beds, and Coral Reefs
51.	Mtaki, K	F	Nov 2017		March 2021		60%	Artificial culture of rotifers as live feeds for optimal growth of tilapia larvae in Tanzania
DAFWAT SUBPROGRAMME								
52.	Vivian Kimambo	F	2016	30		June 2021	50%	Fluoride Removal with Improved Sorption Process for Groundwater Sources
53.	Regina Irunde	F	2017	30		June 2021	60%	Adsorptive removal of arsenic from drinking water source in Geita and Mara, Tanzania using local available materials.
54.	Ijumlan Julien Magezi	M	2016	30		March 2021	75%	Hydrogeological controls on spatial variability of geogenic contaminants in drinking water resources
55.	Fanuel Ligate	M	2016	30		March 2021	65%	Arsenic and Fluoride Contamination in the Groundwater Resources of Tanzanian Rift Valley: Source, Mobilization and Impacts on Drinking Water Quality
SUSTAIN SUBPROGRAMME								
56.	Seleman Amour	M	Oct 2016	6months	March, 2021		60%	Framework for desludging and transport of Faecal Sludge
57.	Isabela Thomas Mkude	F	Oct 2016	6months	March, 2021		60%	Framework for Resource Recovery and Reuse from Faecal Sludge
58.	Mary Kayombo	F	Oct 2017	4months	March, 2021		40%	Potential uses of high rate Algal ponds for Biological treatment of wastewater and resource recovery, Case study of Dar es Salaam
59.	Doglas Benjamin	F	Oct 2017	4months	March, 2021		40%	Local conditioners performance in treatment of faecal sludge from on-site sanitation from Agricultural use in the

S/N	PhD training Name of research student:	(M/F)	Year training <u>started</u>	Training in Sweden <u>(no. months)</u>	<u>Local PhD Expected/ Year of completion</u>	<u>Sandwich PhD Expected/ Year of completion</u>	<u>Progress %</u>	<u>Title of dissertation</u>
								Dar es Salaam
WATER RESOURCES SUBPROGRAMME								
60.	William Senkondo	M	2016	<u>6</u>		May, 2020	100%	Assessment of Water Resources in Tanzania's Kilombero Valley
61.	Edmond Alavaisha	M	2016	<u>6</u>		June, 2020	98%	Assessment of trade-offs between ecosystem services under gradients of land and water use
62.	Victor Mbande	M	2016	<u>6</u>		September ,2020	95%	Development of Policy and management strategy framework for public-private partnership and optimized water allocation in the Kilombero river basin

B. Overall Aggregated Masters of Science Students Plan/Progress

S/N	MSc training Name of student:	(M/F)	College/ Subprogramme	Year training started	Expected/ Year of completion	Name of Supervisors	Sandwich Program (Trip to Sweden)	Progress %	Title of dissertation
1.	Mathayo Gervas	M	CoET/ Food Security	2016	2018			100	
2.	Martha Chuya	F	CoET/ Food Security	2016	2020			75	
3.	Grace Michael	F	CoET/ Food Security	2016	2018			100	
4.	Jerard Mang'ena	M	CoET/ Food Security	2018	2020			60	
5.	Kilenga, Noela Gregory	M	CoET/ Food Security	2018	2020			60	
6.	Mustafa Aulath L.	F	CoET/ Food Security	2018	2020			50	

7.	Finias Fidelis	M	CoET/ Food Security	2018	2020			50	
8.	AyoubEliah	M	CoET/ Food Security	2018	2020			50	
9.	Tonola Beatrice	F	CoET/ Food Security	2018	2020			60	
10.	Mercy Kobelo	F	CoET/ Food Security	2018	2020			40	
11.	Merina Marcelino	F	CoICT/ iGRID	2016	2019			Graduated	A cost effective IoT based smart metering system using open source middleware
12.	Ms. Mwajua Shiraz	F	CoICT/ iGRID	2017	May 2020			50	Working on CDE challenge.
13.	Mr. Ramadhani Maulid	M	CoICT/ iGRID	2017	May 2020			50	Working on CDE challenge.
14.	Mr. Stephan Mgya	M	CoICT/ iGRID	2017	Nov 2020			40	Working on CDE challenge.
15.	Mr. Mkupete Mkupete	M	CoICT/ iGRID	2017	Nov 2020			40	Working on CDE challenge.
16.	Mr. Salim Yahya	M	CoICT/ iGRID	2016	May 2020			95	Wireless Sensor Network for enhancing power consumption visibility in secondary electrical distribution network
17.	Ms. Lucina Lawi	F	CoICT/ iGRID	2016	May 2020			95	Big Data visualizer for consumption data within the secondary distribution network of the electrical grid.

18.	Mr. Bernard Sengo	M	CoICT/ iGRID	2016	Nov 2020			40	Big data analytics for power consumption visibility in electrical power secondary distribution network
19.	EDSON NZAGANYA NZAGANYA	M	MATH	OCT. 2017	May. 2020	Prof.Sa ntoch Kumar		90%	Topology of projective hypersurface
20.	EVELINA WILSON	F	CONAS/ Mathamatics	OCT. 2017	May 2020	Dr. Grayso n Kakiko		90%	Investigation on some more Properties of Ordered Sets
21.	FATMA ALI RASHID	F	CONAS/ Mathamatics	OCT. 2017	Nov. 2020	Prof.Sa ntoch Kumar		80%	Maximal Topology
22.	RICHARD OSWARD	M	CONAS/ Mathamatics	OCT. 2017	Nov. 2019	Dr.Mak unguM wanzali ma		100%	Further Investigation on Fixed Points, Variational Inequality and Equilibrium Problem
23.	SHOLASTICA LUAMBANO	F	CONAS/ Mathamatics	OCT. 2016	Nov. 2018	Dr. Grayso n Kakiko (UDSM)		100%	Some fixed point theorems for F-contraction mappings in partial metric spaces.
24.	JESLINE ELIEZA GOWELE	F	CONAS/ Mathamatics	OCT. 2016	Nov. 2018	Prof. Santoch Kumar (UDSM)		100%	The structure of Lipchitz – free Banach space (Approximation properties)
25.	FAUSTINE NZIKU	M	CONAS/ Mathamatics	OCT. 2016	Nov. 2018	Dr.Mak unguM wanzali ma		100%	Some Boyd And Wong Type Fixed Point Theorems In Partial Metric Spaces

						(UDSM) Dr. Jared Ongaro (UoN)			
26.	DAMAS KAMEL MGANI	M	CONAS/ Mathamatics	OCT. 2016	Nov. 2018	Dr. Marco Mpimbo (UDSM) &Prof. Dube (South Africa)		100%	On Hilbert Functions and h- vectors of Graded Modules for Finite Sets of Points in Projective Space.
27.	GhanimaChanzi	F	IRA/Water Resources	2015	2017	Joel Nobert Noah Pauline		100	Assessment of Water Availability and Uses in The Kilombero Basin Using SWAT and WEAP Models
28.	BatengaMaryRose	F	IRA/Water Resources	2015	2017	Madaka Tumbo		100	Vulnerability of Rural Livelihoods to Multiple Stressors in Kilombero Valley, Tanzania
29.	SamwelDaudiNyasan i	M	IRA/ Water Resources	2015	2017			100	Drivers and Land use/cover change: Implication on sustainable natural resources management: The case of Kilombero Valley, Tanzania.
30.	Mhepela, Bertha	F	COET/ SUSTAIN	2017	2018	Prof.Al oyce Mayo		100	The Suitability of Menstrual Cups as an Alternative to Disposable Pads and Other

						Dr. Sara Gabrielson			Traditional Menstrual Care Technologies in Tanzania
31.	HezronMagambo	M	COET/SUSTAIN	2017	2018	Prof. T.S.A. Mbwebwe Dr. Richard Kimwaga		100	The Potential of Simplified Sewerage System in increasing community access to affordable and acceptable sanitation in informal settlements in Dar es Salaam
32.	Abbas, Hidaya Abdullah	F	COET/ SUSTAIN	2017	2018	Prof. Al oyce Mayo Dr. Sara Gabrielson		100	Investigation on the potential causes of diarrheal persistence in Zanzibar
33.	Marcel, JumaKakulu	M	COET/ SUSTAIN	2017	2018	Prof. T.S.A. Mbwebwe Dr. Richard		100	Evaluation of the extent of the household's participation in Solid Waste Characterization and quantification for decentralized management Practice at Tambukareli Ward, Itigi District Council

						Kimwa ga			
34.	Mwamlima Petro	M	COET/ SUSTAIN	2018	2019	Prof. Al oyce Mayo, Dr. Richard Kimwa ga, Dr. Sara Gabriel ssonN. A		100	Potential use of faecal sludge char briquettes as a source of cooking energy in Dar es salaam Tanzania
35.	TenendeNuntwale	F	COET/ SUSTAIN	2018	2019	Prof. Al oyce Mayo, Dr. Richard Kimwa ga, Dr. Sara Gabriel ssonN. A		100	An exploratory study on social cultural norms and religious beliefs around menstrual hygiene management in Tanzania. A case study of Moshi district Potential use of faecal sludge char briquettes as a source of cooking energy in Dar es salaam Tanzania
36.	SwaiJackline Lucas	F	COET/ SUSTAIN	2018	2019	Prof. Al oyce Mayo, Dr. Richard Kimwa ga, Dr. Sara Gabriel		90	Assessment of menstrual waste manangement in secondary school of Ilala district of Dar es Salaam

						ssonN. A			
37.	Marco Suzan	F	COET/ SUSTAIN	2018	2019	Prof. Aloyce Mayo, Dr. Richard Kimwa ga, Dr. Sara Gabriel ssonN. A		90	Assessment of biodegradation of human placenta in an anaerobic digester at Mwananyamala Hospital Dar es salaam
38.	Brenda Anthony Mndolwa	F	COET/DAF WAT	2016	2018	Prof. Felix Mtalo		100%	Optimal composite composition of natural adsorbents for removal of fluoride and arsenic
39.	Dennis Dismas	M	COET/DAF WAT	2016	2018	Prof. Felix Mtalo		90%	Adsorptive removal of arsenic and fluoride using locally adsorbents from drinking water sources
40.	Bernard Lugayi	M	COET/DAF WAT	2016	2018	Prof. Felix Mtalo		100	Fluoride removal using bauxite and Magnesite
41.	Mohamed Abdallah	M	COET/DAF WAT	2018	2019	Prof. Felix Mtalo		98	

42.	OkokoKossam	M	COET/DAF WAT	2018	2019	Prof. Felix Mtalo		98	
43.	Agness Fataki	F	COET/DAF WAT	2018	2019	Prof. Felix Mtalo		98	
44.	Andrew Peter	M	COET/DAF WAT	2018	2019	Prof. Felix Mtalo		98	
45.	Malesa, F.M.	M	IMS	Oct. 2018	2020			80%: To complete by September 2020	
46.	Mtonga, K.J.	M	IMS	Oct 2018	2020			75%: To complete by September 2020	
47.	Joseph, V.	M	IMS	Oct 2018	2020			80%: To complete by September 2020	
48.	Iraba, N. T.	F	IMS	Oct 2018	2020			75%: To complete by September 2020	
	Total 45 (only 43 are Sida Funded)								

C. Overall Aggregated Postdoctoral Research Fellows Plan/Progress									
	Postdoctoral research fellows	(M/F)	College/ Subprogramme	Year research started	Expected/ Year of completion	Trip to Sweden	No of expected publications	Progress %	Title of manuscripts
	Name of researcher:								
1.	Libe Massawe	F	COICT-iGRID	2015	0		2016	Withdrew on Social grounds	N/A
2.	Richard Mgaya	M	COICT-iGRID	2015	0	N/A	-	Passed away	N/A
3.	Shililiandumi Naiman	M	COICT-iGRID	2016	2 months	N/A	2017	100	Completed
4.	Ellen Kalinga	F	COICT-iGRID	Jan 2017	2 months	N/A	Jan 2018	100	Completed
5.	Kwame Ibwe	M	COICT-iGRID	Jan 2017	2 months	N/A	Jan 2018	100	Completed
6.	Hellen Mazika	F	COICT-iGRID	June 2018	0	N/A	June 2019	50	On Research
7.	Leonard, L.	M	IMS	2020	2021				
8.	Soud, S.	M	IMS	2020	2021				
9.	Rushingisha, G.	M	IMS	2020	2021				
10.	Dr. David Koloseni	M	MATH	January 2018 - June 2018		6 Month		100%	Numerical Integration for multidimensional Choquetintegra
11.	Dr.ThadeiSagamiko	M	MATH	October 2018- June 2019	6 Months	Sweden	Linköping	100%	Optimal control of a threatened wildebeest-lion prey-predator system with

							Univers ity		prey species pool in the Serengeti ecosystem
12.	MadakaTumbo	M	Water Resources					Quitted	
13.	Dr.SubiraMunishi	M	Water Resources					Quitted	
14.	Dr. Noah Pauline	M	Water Resources					100%	
15.	Martic Chegele		IRA; Food security					100%	
16.	Liberata Mwita		CONAS; Food security					100%	
17.	Victor Vicent		COET, Food security					100%	
18.	Rita Morondo		COET; Food security					Withdrew on Social grounds	
	Total 18: Actual 13 Postdocu								

RESEARCH MANAGMENT AT THE UNIVERSITY OF DAR ES SALAAM

RESEARCH MANAGMENT AT THE UNIVERSITY OF DAR ES SALAAM

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1. Subprogramme Overview

The fast expanding research needs and challenges demand for more effective and efficient research management capacities. Research management encompasses the whole spectrum of activities that are involved in the initiation, implementation and coordination of research. These include possession of a critical mass of qualified and well-motivated researchers, identification of research areas, accessing sources of research funds, managing research resources and disseminating of research outputs. Only through effective and efficient research management can research resources be harnessed to support the country's effort towards poverty alleviation and equitable development. Effective research management contributes to the provision of conducive and competitive research environment to staff, postgraduate students, postdoctoral fellows nationally, regionally and internationally to undertake multidisciplinary and interdisciplinary research in cutting edge science and technology. Strengthening research management at the University of Dar es Salaam (UDSM) is in line with the wider aspirations of the UDSM Vision 2061 as well as the National Development Vision (Vision 2025) regarding quality livelihood and international competitiveness.

The Research Management subprogramme expected outputs connotes improved research management at all levels of the University through training, having the necessary infrastructure such as ICT facilities and increased participation of academic staff members in research disseminations forums. This will in turn lead to improved quality and quantity of research outputs that are relevant to knowledge development and socio-economic development of Tanzania, and the world. The subprogramme is implemented jointly by the University of Dar es Salaam and the Department of Computer and Systems Sciences (DSV) of Stockholm University.

2. Subprogramme Objectives and Expected Results 2015-2020

The general objective of the project is to enhance the management and administration of research at the University of Dar es Salaam so as to maximize the impact of research outputs locally and internationally.

The specific objectives of the project are:

1. To strengthen efficiency on research management at UDSM;
2. To increase research capacity and quality of outputs;
3. To increase dissemination of research results to end-users; and
4. To strengthen research networks and collaboration with key stakeholders.

2.1 Subprogramme Budget (2015-2020)

The Research Management Subprogramme budget to implement the planned activities is **SEK 21,462,000** (UDSM: **SEK 19,262,000** and Sweden: **SEK 2,200,000**) for the period of July 2015 - June 2020 as detailed in the table below:

Institution	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total (SEK)
UDSM	3,034,000	4,182,000	3,552,000	3,635,000	4,859,000	19,262,000
SWEDEN	567,000	754,000	364,000	245,000	270,000	2,200,000
Grand Total (SEK)	3,601,000	4,936,000	3,916,000	3,880,000	5,129,000	21,462,000

2.2 Overall Execution Rate

During the implementation of the planned activities, the overall execution rate of the research management subprogramme up to 30th June 2020 is expected to be about 95%.

2.3 Summary of Achieved Results

The summary of the achieved results can be categorized in four major aspects aimed at creating enabling research environment, mentoring of researchers and research managers through short course training subprogrammes, forging networks and collaborations with stakeholders as well as facilitation of dissemination of research results. The table below summarizes actual performance of the research management subprogrammes since its inception in July 2015:

S/N	Output	Planned KPI (including target values)	Actual performance
Specific objective #1: <i>Improved efficiency on research management at UDSM</i>			
1.1	A research information management system (RIMS) developed and research repository consolidated and upgraded annually.	(xiv) Research information management system and repository links fully developed	✓ Research information management system (RIMS) developed ✓ Four (4) new RIMS modules are in development stage ✓ RIMS not yet integrated with other subsystems including research repository
1.2	Research management ICT-equipments procured	(i) (1) server, one (1) heavy duty photocopier and software procured	✓ Some ICT equipment procured

S/N	Output	Planned KPI (including target values)	Actual performance
			✓ Procurement of other ICT equipment is in progress
1.3	Orientation course conducted to Sida PIs, Administrators, Accountants and Procurement Officers	(i) Sida PIs, Accountants, Procurement Officers and Administrative officers orientated on Sida programme administration and coordination	✓ Training of Accountants, Procurement Officers and Administrative officers to be held in Morogoro
1.4	Exchange visits conducted between Sweden and Tanzania Research Management personnel	(i) 8 members of staff participated in exchange visits (ii) Itinerary, travel documents and reports	✓ 7 UDSM staff had benchmarking visit at Stockholm University
1.5	Training on project management conducted to staff at Directorate of Research and Knowledge Exchange	(i) Ten (10) staff at Directorate of Research and Knowledge Exchange trained (ii) List of trainees (iii) Training certificates	✓ 14/10 staff at the Directorate of Research and Publication attended the workshop on RBM (25% female)
1.6	UDSM researchers trained on Intellectual Property Rights (IPR)	(i) 60 researchers trained annually on IPR issues (ii) Number of patented research outputs	✓ 91/300 (32% female) academic staff and student researchers from 2017 to 2019 out of 300 trainees planned to be given skills on Intellectual Property Rights. ✓ 33 potential projects have been identified and processed for patents or copyrights
Specific objective #2: Enhanced research capacity and quality of research outputs			
2.1	Training on writing fundable research proposals conducted to UDSM researchers	(i) 150 researchers trained on writing fundable proposals (ii) Number of Research proposals submitted annually.	✓ 212/150 (40% female) staff were trained on writing competitive fundable research proposal ✓ A total of 429 research proposals submitted in 2018 and 2019
2.2	Junior staff and postgraduate students trained on research methods, research ethics, and writing skills for thesis and manuscripts.	(i) 500 Junior staff and postgraduate students trained (ii) Number of postgraduate students graduating annually.	✓ 591/500 (40% female) postgraduate students trained in writing skills, research methods and ethics
2.3	Training on supervision of postgraduate research conducted to academic staff	(i) Train 300 academic staff trained (ii) Timely completion of theses and dissertations (iii) Supervision roles clearly defined	✓ 465/300 (37% female) academic staff trained in postgraduate supervision skills

S/N	Output	Planned KPI (including target values)	Actual performance
2.4	Methodology and tools for assessing and rewarding quality research results developed	(i) Compendium of research results (ii) List of awardees	✓ Draft Quality Assurance Policy with research quality assessment tools in place
Specific Objective 3: Enhance dissemination of research results			
3.1	High quality Books, Journals and Brochures disseminating UDSM research results published	(i) At least 300 articles published in international peer reviewed journals by 2020 (ii) At least 15 UDSM journals published in international indexed journals	✓ 102/300 papers published in international journals ✓ 22 UDSM Online journals evaluated annually ✓ 10 UDSM journals indexed by EBSCO, Sabine, Econbiz, AfriBib and AJOL.
3.2	SJMC capacity to communicate and disseminate research findings and innovations enhanced	(i) Hundred (100) staff trained (ii) Equipment and invoices procured	✓ 26 SJMC staff trained, 10 were female
3.3	Research results disseminated through SJMC radio and TV programmes	(i) A total of 240 radio and 300 TV programs produced by 2020	✓ Work in plan
3.4	UDSM scholars presented research findings in local and international conferences	(i) Support at least 30 per annum (ii) Conference proceedings	✓ 149 Scholars supported since 2015
3.5	Local, Regional and International dissemination Conferences organized and facilitated	(i) At least 10 dissemination conferences supported (ii) Number of Proceedings (iii) Number of networks established	✓ 15 Conferences organized by 8 academic units were supported from 2015
3.6	University Research Week and research exhibitions facilitated annually	(i) Number of participating units and awards given during exhibitions (ii) Number of researchers recognized (iii) Showcasing University research competence	✓ 2015 (95), 2016 (98), 2017 (144), 2018 (288), 2019 (412) participants ✓ 15 awards for recognition
Specific Objective 4: To enhance research networks and collaboration with stakeholders			
4.1	Establishment of Multi-disciplinary research groups, research centres and professorial chairs focused on strategic national priorities supported	(i) Number of multi-disciplinary research programmes established and supported (ii) At least 2 Multi-disciplinary research groups, research centres and professorial chairs formed annually (iii) Number of Policy briefs	✓ ARUA and EARIMA collaborations active ✓ Professorial chairs are active and supported ✓ 3 Centres of Excellency/ multidisciplinary groups established (Tourism, Mathematics, IMS) ✓ 26 Policy briefs prepared and communicated to policy makers through 1 st and 2 nd Annual Conference of

S/N	Output	Planned KPI (including target values)	Actual performance
			Research and Inclusive
4.2	Frameworks for strategic research collaboration with key stakeholders such as Government, industry and end-users created.	(i) Number of MOUs signed (ii) Number of collaborative programmes and networks established (iii) Number of Policy briefs	✓ Collaboration with COSOTA, BRELLA, TPSF, MoFP ✓ 26 Policy briefs prepared and communicated to policy makers

2.4 Rationale for the Extension

In general, the progress of research management subprogramme is remarkable as indicated by the achieved results. However, some of the activities are still in progress and therefore the need for extension. Firstly, some of students have not completed their studies. Dissemination of their findings through publication of articles is needed. Secondly, most of subprogramme outputs have been realised. The available research outputs should be translated into actual processes, products and services through knowledge transfer and commercialisation. Thirdly, the support and facilitation are necessary to accelerate activities of other eleven (11) subprogrammes. Therefore, major activities of research management subprogramme during the extension will focus to the support and facilitation for accelerating completion of studies for postgraduate students; improvement of efficiency of research management and administration systems; enhancing sustainability of research activities and visibility of research outputs; awareness of IPR and the protection of research products; production of fundable research proposal for ensuring financial sustainability as exit plan of Sida; enhancing academia, industry and Government linkage for socio-economic development; speeding up the implementation of plans for all UDSM/Sida subprogrammes; and enhancing dissemination of research outputs, networking and international visibility for Sida funded projects.

Budget: In the extension period, the project is planning to spend a total of SEK 4,663,000 in which SEK 2,617,400 is a new request to Sida.

3. Target (July 2020 – June 2021)

3.1 Project objective 1: Strengthening Efficiency on Research Management at UDSM

3.1.1 Planned and the specific activities to be carried out:

- vi. Integration of RIMS to other UDSM systems (systems development and integration)
- vii. Sensitization of the use RIMS' modules to UDSM Researchers
- viii. Benchmarking visit to Stockholm University for UDSM staff (Exchange study visits, Sweden-Tanzania) to share research experience and prepare the next Sida proposal)
- ix. Training on IPR and preparation of patent and copy right application for UDSM-Sida subprogrammes

3.1.2 Expected Deliverables

- x. 100% completion of development of RIMS
- xi. Increase the use of RIMS by 100%
- xii. 19 sensitization sessions of the use RIMS' modules to UDSM Researchers conducted

- xiii. 7 UDSM staff attended a benchmarking visit to SU
- xiv. 20 Draft of IP developed
- xv. 50 Researchers of UDSM Programme equipped with skills on IPR

3.2 Project Objective 2: Increased research capacity and quality of research outputs

3.2.1 Planned and the specific activities to be carried out:

- i. Supporting subprogrammes to write fundable research proposals for sustainability research funding and Sida next phase

3.2.2 Expected Deliverables

- i. 12 subprogrammes proposals and 1 Institutional fundable research proposals developed for sustainability research funding and Sida next phase
- ii. 10 fundable proposals developed and submitted for funding

3.3. Project Objective 3: Increased dissemination of research results

3.3.1 Planned and the specific activities to be carried out:

- viii. Production of Media Mass programmes (Podcast, Infographics, documentaries, Radio/TV) for disseminating research results
- ix. Supporting Units to organize local and international conferences and exhibitions
- x. Organisation of the 3rd Conference of Research and Inclusive Development to be held Zanzibar

3.3.2 Expected Deliverables

- xi. 50 TV and Radio programmes of UDSM-Sida research findings and innovations disseminated
- xii. 10 UDSM Conferences organized
- xiii. More than 300 papers presented and published
- xiv. The 3rd Conference of Research and Inclusive Development conducted in Zanzibar and more than 50 academic papers presented

3.4 Project Objective 4: To enhance research networks and collaboration with stakeholders

3.4.1 Planned and the specific activities to be carried out:

- iv. Supporting and coordination the establishment of research Centres of Excellency
- v. Supporting stakeholders meeting with Strategic research collaboration and networking with key stakeholders, i.e., Government, industry and end-users.
- vi. Coordination of all UDSM/Sida subprogrammes including facilitating the winding up network meetings at sub-programme level (Tanzania Side); facilitation of preparation of next phase concept note and proposals; facilitating collaborative workshops of UDSM PIs and Swedish Counterparts for the preparation of the end of phase report; supporting Sida programme performance review meeting (PIs and Swedish partners); organization of networking and cultural events during the Performance Review Week; and preparation of documentation and publication for End of Phase Report

3.4.2 Expected Deliverables

- vi. 4 stakeholders meetings with Strategic research collaboration and networking with key stakeholders, i.e., Government, industry and end-users conducted.
- vii. Number of MoUs signed
- viii. 10 research Centres of Excellency supported
- ix. 100% of UDSM/Sida programme activities coordinated

4. Analysis and Justification

The fast expanding research needs, diversity of research activities, and challenges demands for more effective and efficient research management capacities both at Unit and University levels. The proposed programme aims at progressively sustaining efforts which started in previous Sida support phases as well as further strengthening the research management at UDSM. The University of Dar es Salaam appreciates the value of research for the technological and economic development of the society and understands that a University should generate, refine and advance knowledge as well as use it to enrich research activities for societal solutions. The UDSM/Sida (2015-2020) has enriched research capabilities; hence the extension of the programme up to June 2021 will assist in providing a more effective research environment at UDSM. In order to achieve this mission, the following assumptions are considered:

- i. The Swedish collaborator to assist in getting the trainers for research management and administration training.
- ii. It is expected that PIs will remain committed to their responsibilities of supervision on students and researches
- iii. Researchers in sub-programmes will continue to work hard to timely meet their planned objectives particularly in accelerating the students' completion rate
- iv. Stakeholders availability and willingness to collaborate with UDSM
- v. The Sida cooperation will provide the extra funding to support the activities.

As mentioned above, the total extra fund requested from Sida during the extension period is SEK 12,493,340 intended to finance activities for successful attainment of the programme objectives. With this budget, the University of Dar es Salaam is requesting SEK 6,132,800, while Swedish Research Partner Institutions will have a share of SEK 4,842,540 and the remaining SEK 1,518,000 will be used by ISP to pay student allowances during their stay in Sweden.

The table below describes the risk and mitigation measures for the Research Management subprogramme during the extension period.

Risk	Level	Remedial action	Responsibility
Persistence existence of COVID-19 pandemic to affect the implementation of programme activities such	High	<ul style="list-style-type: none"> ➤ Online participation of the conferences and PhD viva voice ➤ Online Students Supervision ➤ Online attendance of APM and ARM 	UDSM Sida Coordinator, PIs, Swedish counterparts, students and ISP coordinator

conferences and travel		Online participation of preparation of next phase subprogramme proposals.	
Inadequate number of Trainers	Low	Follow-up being made in advance	Director of Research and Publication, Director of Public Service, and Swedish partners
Inadequate capacity to develop research management subsystems	Low	Promote team work of ICT experts	Director of Research and Publication, Colleges, Schools, Institutes
Failure to prepare good proposal for the next phase	Low	Begin preparation as early as possible	Sub-programme coordinators
Researchers not publishing on time	Low	Monitor the progress	Sub-programme coordinator, Supervisors & Swedish coordinator
Researchers not translating research outputs to patents	Low	Begin awareness on IPR as early as possible	Director of Research and Publication, Intellectual Property Management Office, UDIEC, Director of Public Service, Sub-programme coordinators, and Swedish partners
Failure to disseminate research solutions to the society	Low	Engage mass media institutions for publicity of research solutions	School of Journalism and Mass Communication, Sub-programme coordinators, and Swedish partners

5. Enclosures

5. UDSM Programme Overall Aggregated Budget
6. Programme Detailed Budget
7. Results Based Management (RBM) Matrix (July 2020-June 2021)
8. Aggregated Student Progress and Plan (July 2020-June 2021)
9. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Figure 1: UDSM Programme Overall Aggregated Budget

UDSM-SIDA RESEARCH PROGRAMME 2015-2020

OVERALL INSTITUTIONAL BUDGET FOR 12 MONTHS EXTENSION PERIOD: JULY 2020 - JUNE 2021

1st July 2020 to 30th June 2021

ian Institution/Dept: University of Dar es Salaam

1st May 2020

udent allowances should be under ISP

nia	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total allocated funds		Total funds to b	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
ulum		0		0		0	-	-	-	-
ch equipment		0		0		0	-	-	-	-
nance		0		0		0	-	-	-	-
ch Consumables		0		0		0	-	-	-	-
ab work	114800	27552000	168,000	40,320,000	168,000	40,320,000	336,000	80,640,000	450,800	
t fees	0	0		0		0	-	-	-	-
t stipends x	0	0		0		0	-	-	-	-
ences	208,000	49920000	625,000	150000000	625000	150000000	1,250,000	300,000,000	1,458,000	
tion costs	42,000	10080000		0		0	-	-	42,000	
insurance		0		0		0	-	-	-	-
lated to Research	440,000	105600000	75,000	18000000	75,000	18000000	150,000	66,000,000	590,000	
T Training	365,000	87600000	0	0	0	0	-	-	365,000	
nation Cost	473,000	113520000	83,500	20040000	83500	20040000	167,000	40,080,000	640,000	
		0		0		0	-	-	-	-
er of Funds to Sweden	0	0	0	0	0	0	-	-	-	-
interest		0		0		0	-	-	-	-
		0		0		0	-	-	-	-
t costs		0	94,000	22560000	94,000	22560000	228,360	45,120,000	228,360	
TOTAL	1,642,800	394,272,000	1,045,500	250,920,000	1,045,500	250,920,000	2,131,400	531,840,000	3,774,200	
en										
ision		0		0		0	-	-	-	-
ulum development		0		0		0	-	-	-	-
ng on courses		0		0		0	-	-	-	-
Costs		0		0		0	-	-	-	-
ination and										
unication		0		0		0	-	-	-	-
costs	403,000	96720000	243,000	58,320,000	243,000	58,320,000	486,000	116,640,000	889,000	
t costs		0		0		0	-	-	-	-
TOTAL	403,000	96,720,000	243,000	58,320,000	243,000	58,320,000	486,000	116,640,000	889,000	
udent allowances							0	0	0	
TOTAL_ISP	-	-	-	-	-	-	-	-	-	-
ND TOTAL	2,045,800	490,992,000	1,288,500	309,240,000	1,288,500	309,240,000	2,617,400	648,480,000	4,663,000	1

Annex 2: Research Management Subprogramme Detailed Budget

Enclosures 1: RM Subprogramme Activity Implementation Plan (July 2020-June 2021)														
			Source of Fund		2020						2021			Acti Justifi
Planned Activity	Origin of the Activity ¹	Proposed Budget	Original Budget ²	Extra Fund ³	Ju l	Au g	Se p	Oc t	No v	De c	Ja n	Fe b	Ma r	
	(New/Carrie d over)	SEK	SEK	SEK										
Objective 1: Strengthening Efficiency on Research Management at UDSM Planning and the Specific Activities to be carried out Expected Activities														

LANs

Integration of RIMS to other UDSM systems	New	150,000		150,000										A need to improve efficiency of research management administration
Awareness of RIMS' modules to Researchers	Carried Over	82,000	82,000											Work in progress
Exchange study visits (Sweden-Tanzania) to share research experience and for preparation	New	336,000		336,000										Sharing research experience with partners in Sweden and discussing

of next Sida proposal														research for next p
Training on IPR and preparation of patent and copy right application for UDSM-Sida Subprogrammes	Carried Over	125,000	125,000											The dem skills of high and protection research toward commerc n is neces
		807,800	321,800	486,000										

HOLM UNIVERSITY PLANS

Systems development and integration	New	133,000		133,000										A need for expertise improve efficiency effective systems at UDSM
Benchmarking visit to SU- for UDSM colleagues	New	-		-										Sharing of research management experience essential
IPR expert training sessions from SU	New	60,000		60,000										A need for experts. focus of is IPR

Programme coordination	Carried Over	185,000	185,000												Work in
OH and LKP	Carried Over	218,000	218,000												Work in
		596,000	403,000	193,000											

Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

LANS

Support Sida subprogrammes to write fundable research proposals for sustainability of research funding	Carried Over	83,000	83,000	0											Production fundable proposal necessary ensuring financial sustainability exit plan in 2026
		83,000	83,000	0											

Objective 3: Increase the quality and use of research relevant to high priority issues of national development

LANS

Organisation of the 3 rd Conference of Research and Inclusive Development in Zanzibar	New	1,250,000		1,250,000											Dissemination research networking international visibility
--	-----	-----------	--	-----------	--	--	--	--	--	--	--	--	--	--	--

		1,250,000	-	1,250,000										
--	--	-----------	---	-----------	--	--	--	--	--	--	--	--	--	--

HOLM UNIVERSITY PLANS

Librain (Open Access)	New	116,000		116,000										To maintain access of articles
Audit costs	New	40,000		40,000										Checking compliance expenditure
Transport & Accommodation	New	75,000		75,000										Supporting and accommodation
		231,000		231,000										

Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

PLANS

Support coordination of Sida programme activities	New	167,000		167,000										Speeding implementation of plans UDSM/S subprogramme
Preparation of the Concept paper and research proposals at UDSM level	Carried Over	87,840	87,840											Work in progress

Preparation of the Concept paper and research proposals for Research Management subprogramme	Carried Over	51,000	51,000												Work in
Winding up meetings and retreats at sub-programme level (Tanzania Side)	Carried Over	125,000	125,000												Work in
Joint Retreat workshops with PIs and Swedish Counterparts for the preparation of the end of phase report	Carried Over	125,000	125,000												Work in
Banquet dinner with cultural events during the Performance Review Week	Carried Over	42,000	42,000												Work in
Documentation and Publication of End of Phase Report	Carried Over	42,000	42,000												Work in
		639,840	472,840	167,000											
1 BUDGET		3,607,640	1,280,640	2,327,000											

institutional fee		228,360		228,360										
SKHOLM T (SEK)		827,000	403,000	424,000										
TOTAL (SEK)		4,663,000	1,208,000	2,179,040										

Table 3: Results Based Management (RBM) Matrix for July 2020–June 2021

	Outcomes	Performance indicator of outcome (including target values)	Baseline	Data source	Method of collection of data
Objective #1: Improved efficiency on research management at UDSM					
Integration of RIMS to other UDSM	<ul style="list-style-type: none"> Research information visible internationally Indexed publications accessible online Profile of researchers accessible online 	<ul style="list-style-type: none"> 100% completed and usage of research information system and repository links fully developed 	<ul style="list-style-type: none"> Limited information Only 742 out of >1500 CVs uploaded 	<ul style="list-style-type: none"> UDSM website www.udsm.ac.tz/ Other UDSM data base 	<ul style="list-style-type: none"> Internet survey
Effectiveness of RIMS' modules to researchers	<ul style="list-style-type: none"> Improved coordination and accountability of research projects and resource management 	<ul style="list-style-type: none"> 19 sensitization sessions of the use RIMS' modules to UDSM researchers Sida PIs, researchers, Administrative officers orientated on administration and coordination of research projects 	<ul style="list-style-type: none"> New staff members involved in the coordination of Sida programme Inadequate capacity 	<ul style="list-style-type: none"> Training reports Progress reports Accounting and procurement reports 	<ul style="list-style-type: none"> Review of reports Interviews with trained personnel
Exchange study visits (Sweden- Tanzania) to share research experience and preparation of next Sida proposal	<ul style="list-style-type: none"> Enhanced experience on effective and efficient research management Improved research management 	<ul style="list-style-type: none"> 7 members of staff participated in exchange visits Itinerary, travel documents and reports 	<ul style="list-style-type: none"> Inadequate experience/experience 	<ul style="list-style-type: none"> Directorate of Research and Publication Financial reports 	<ul style="list-style-type: none"> Review of reports
Training on IPR and preparation of copyright application for Sida subprogrammes	<ul style="list-style-type: none"> Increased awareness of Intellectual 	<ul style="list-style-type: none"> 50 researchers trained annually on IPR issues 	<ul style="list-style-type: none"> Low awareness on IPR 	<ul style="list-style-type: none"> Progress Reports 	<ul style="list-style-type: none"> Review of reports

	Outcomes	Performance indicator of outcome (including target values)	Baseline	Data source	Method of collection of data
	Property issues to UDSM researchers	<ul style="list-style-type: none"> 20 draft of IP developed 			

Options for specific objective #1:

Availability of funds

Objective #2: Enhanced research capacity and quality of research outputs

Support Sida subprogrammes to write research proposals for availability of research funding	<ul style="list-style-type: none"> Improved quality of research proposals from UDSM Improved solicitation of research funds from competitive sources 	<ul style="list-style-type: none"> 150 researchers trained on writing fundable proposals 12 subprogramme proposals submitted 10 fundable proposals submitted for donor funding 	<ul style="list-style-type: none"> Inadequate skills to write competitive proposals 	<ul style="list-style-type: none"> University reports 	<ul style="list-style-type: none"> Review of
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Options for specific objective #2:

Availability of funds

Objective 3: Enhance dissemination of research results

Production of Media Programmes (Infographics, documentaries, etc) for disseminating research	<ul style="list-style-type: none"> Improved production of research dissemination programmes 	<ul style="list-style-type: none"> 50 TV and Radio programmes of UDSM-Sida research findings and innovations disseminated 	<ul style="list-style-type: none"> Very few research dissemination programs 	<ul style="list-style-type: none"> CD ROM and audio tapes 	<ul style="list-style-type: none"> Review of visual resources and reports
Support local and international conferences and exhibitions	<ul style="list-style-type: none"> Enhanced dissemination and sharing of research experiences Improved research networking 	<ul style="list-style-type: none"> 10 UDSM Conferences organized More than 300 papers presented and published in conferences 	<ul style="list-style-type: none"> Few units organize dissemination conferences annually 	<ul style="list-style-type: none"> Proceedings, financial reports, facts and figures 	<ul style="list-style-type: none"> Review of

	Outcomes	Performance indicator of outcome (including target values)	Baseline	Data source	Method of collection of data
	<ul style="list-style-type: none"> Increased number of publications 				
Organisation of the 3 rd Conference of Ministers of Education and Inclusive Development in	<ul style="list-style-type: none"> Enhanced visibility of UDSM Improved research networking Increased number of publications 	<ul style="list-style-type: none"> More than 50 academic papers presented Showcasing University research outputs 	<ul style="list-style-type: none"> University research results Showcased only in trade fairs 	<ul style="list-style-type: none"> Proceedings, financial reports, facts and figures 	<ul style="list-style-type: none"> Review of

ions for specific objective #3.

ity of funds

Objective 4: To enhance research networks and collaboration with stakeholders

Support multi-disciplinary research research centres and professorial chairs focused on strategic national	<ul style="list-style-type: none"> Increased number of multidisciplinary researches 	<ul style="list-style-type: none"> 10 multidisciplinary research centres of Excellency supported At least 2 Multi-disciplinary research groups, research centres and professorial chairs formed annually 	<ul style="list-style-type: none"> 22 existing centres in place 7 existing professorial chairs 	<ul style="list-style-type: none"> University reports 	<ul style="list-style-type: none"> Review of
Strategic research collaboration and engagement with key stakeholders, i.e., Government, industry and end-users.	<ul style="list-style-type: none"> Enhanced networking and collaboration with key stakeholders Increased application and use of research evidence to support policy making 	<ul style="list-style-type: none"> 4 stakeholders meetings with Strategic research collaboration and networking with key stakeholders, i.e., Government, industry and end-users conducted 	<ul style="list-style-type: none"> Existing MOUs not fully exploited 	<ul style="list-style-type: none"> CC&STC reports 	<ul style="list-style-type: none"> Review of

	Outcomes	Performance indicator of outcome (including target values)	Baseline	Data source	Method of collection
		<ul style="list-style-type: none"> • Number of MoUs signed • Number of Policy briefs 			

Plans for specific objective #4:

Partners commitment

Partners availability and willingness to collaborate with UDSM

Enclosure 5: Research Management Subprogramme Original Budget 2015-2020

Date 11April 2015						
Sub Program						
Period: 2015-2020						
Tanzanian Institution/Dept: UDSM Directorate of Research						
Collaborating Institution/s in Sweden: SU						
OBS! All major budget items should be the same for all.						
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Tanzania	SEK	SEK	SEK	SEK	SEK	SEK
Cost of Training	513,750	785750	835750	691750	525750	3,352,750
Research equipment						-
Research consumables	1,526,000	1,818,000	1,415,000	1,228,000	1,323,000	7,310,000
Travel	264,800	385,200	360,000	405,600	428,000	1,843,600
Field/Lab work						-
Student fees						-
Student stipends						-
Conferences						-
Publication costs						-
Travel insurance						-
Audit						-
Other costs	408,400	745,600	561,000	707,000	970,000	3,392,000
Institutional fee	325,000	448,100	380,600	363,800	389,550	1,907,050
SUB TOTAL	3,037,950	4,182,650	3,552,350	3,396,150	3,636,300	17,805,400
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Sweden	SEK	SEK	SEK	SEK	SEK	SEK
Cost of Training	47,200	188,800		0		236,000
Research Cosumable	70800	94,400	94,400			259,600
Travel	225,000	250,000	50,000	25,000	50,000	600,000
Other costs	184,600	179,800	179,800	177,400	177,400	899,000
Audit Cost	40000	40000	40000	40000	40000	200,000
SUB TOTAL	567,600	753,000	364,200	242,400	267,400	2,194,600
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
GRAND TOTAL	SEK	SEK	SEK	SEK	SEK	SEK
	3,605,550	4,935,650	3,916,550	3,638,550	3,903,700	20,000,000

**STRENGTHENING ACCESS TO AND
UTILIZATION OF RESEARCH INFORMATION
AT UDSM**

**UDSM LIBRARY PROGRAMME
STRENGTHENING ACCESS TO AND UTILIZATION OF RESEARCH
INFORMATION AT UDSM**

Contact information

University of Dar es Salaam Library	
Address: P.O. Box 35092 Dar es Salaam, Tanzania Contact Person: Dr. Esther Ndenje-Sichalwe Tel: 255 22410241 E-mail : esther.sichalwe@udsm.ac.tz	

1. Summary of the programme and progress

The overall objective of the proposed programme is to increase access and utilization of research information at University of Dar es Salaam through providing efficient/timely access and effective dissemination and utilization of research information. Major areas covered in this programme include provision of access to research information, increase the use of online databases, creation of subject database, publish UDSM library journal and increase skills in online journal publishing. The expected outcomes are an increase in quality and quantity of research outputs by members of the University community. In all, the financial support from Sida has allowed the University community to have access to current, timely, and quality information that enhances the quality of academic programmes and other core activities of the University. Besides, the UDSM library has managed to create two local content databases, publish seven issues of UDSM Library Journal and conduct workshops on online journal publishing systems.

2. Programme objectives and expected results

Programme objectives

The overall objective of this programme is to increase access to and utilization of research information at University of Dar es Salaam through providing efficient/timely access and effective dissemination and utilization of research information. The following are the specific objectives:

Specific Objective 1: To increase access and use of e-resources for quality research, teaching and learning at UDSM.

Specific Objective 2: To increase use of online journal publishing skills and knowledge for enhancing the visibility of UDSM research outputs.

Expected results (2015-2020)

Specific Objective 1: To increase access and use of e-resources for quality research, teaching and learning at UDSM

Expected results

- 1.1 At least 20 online databases subscribed and used
- 1.2 At least 500,000 full-text e-journal articles downloaded
- 1.3 At least 5 local content online databases created
- 1.4 At least 10,000 brochures produced and distributed for marketing e-resources

Specific Objective 2: To increase use of online journal publishing skills and knowledge for enhancing the visibility of UDSM research output

Expected results

- 2.1 At least 100 researchers utilize online publishing systems
- 2.2 At least 100 UDSM journal editors use online journal publishing system
- 2.3 At least 10 issues of UDSM Library Journal published online

3. Target (July 2020 – June 2021)

3.1 Specific Objective 1: To increase access and use of e-resources for quality research, teaching and learning at UDSM

Planned, specific activities to be carried out and expected deliverables

Output: One (1) Subject-based online databases subscribed

Activities to be carried out:

Subscription of online databases: selection of databases, communication with publishers, endorsing license agreements to the lawyer, processing payment for subscription, communicating information of subscribed databases to end users on access and use.

Expected deliverables:

1. One (1) online databases used by academic staff and students
2. Ten thousand (10,000) full-text e-journal articles downloaded

Output: Local content subject-based database created

Activities to be carried out:

Digitization of print local content research items: print materials collected for the use of creating local content subject- based online database will be scanned, sorted, cleaned and an interface for the databases will be designed.

Expected deliverables:

1. One (1) subject-based online database accessed and used

4. Analysis and Justification

4.1 Analysis

Generally, through the help of funds from Sida, the UDSM library has been able to sustain its provision of e-resources to the University community through Sida funded databases. Whereas some planned activities were fully implemented, other activities such like subscription to online databases were partially implemented. This activity has been partially implemented because the services providers did not produce contract agreement in time to allow the University Library time to make payments. Previously, the Library made these payments through INASP who, since the end of last year, ended this arrangement. Regarding timely subscription to online database, the Library has learned a lesson and now contracts are requested early enough to ensure that there is enough for all the activities involved in this process

4.2. Risks and Mitigation Measures

S/N	Risks	Mitigation Measures
1	Slow internet connectivity	Increase bandwidth in the library for users
2	Inaccessibility of e-resources outside university premises due to IP addresses limitations and license restrictions	Adoption of e-resources access enhancing tools such as LibHub (Kiosk).
3	Low attendance in the training sessions and workshops	Flexible training schedules to take into account the convenience of users through outreach programs
4	Limited computer literacy among students deter the effective usage of e-resources	The university in collaboration with UCC should support the provision of basic computer literacy skills to all students
5	Untimely disbursement of funds	Timely disbursement of funds so that activities can be implemented as planned

5. Enclosures

- 10. Sub-programme Overall Aggregated Budget
- 11. Sub-programme Detailed Budget
- 12. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 13. Sub-programme Original Budget 2015-2020 (Compiled Summary)

Enclosure 1: Sub-program Overall Aggregated Budget

Date: 1st March 2020 Sub Program: Strengthening Access to and Utilization of Research Information at UDSM Period: 1st July 2020 to 30th June 2021 Tanzanian Institution/Dept: University of Dar es Salaam OBS Student allowances should be under ISP											
Tanzania		Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
		SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1	Curriculum		0		0		0	-	-	-	-
2	Research equipment		0		0		0	-	-	-	-
3	Maintenance		0		0		0	-	-	-	-
4	Research Consumables		0		0		0	-	-	-	-
5	Travel		0		0		0	-	-	-	-
6	Field/Lab work		0		0		0	-	-	-	-
7	Student fees		0		0		0	-	-	-	-
8	Student stipends x		0		0		0	-	-	-	-
9	Coferences		0		0		0	-	-	-	-
10	Publication costs		0		0		0				
11	Travel insurance		0		0		0	-	-	-	-
12	Cost related to Research		0		0		0	-	-	-	-
13	Cost of Training		0		0		0	-	-	-	-
14	Coordination Cost		0		0		0	-	-	-	-
15	Others	0	0	200,000	48000000	200,000	48000000	400,000	96,000,000	400,000	96,000,000
16	Transfer of Funds to Sweden	0	0	0	0	0	0	-	-	-	-
17	Bank interest	0	0		0	0	0	-	-	-	-
18	Audit		0		0		0	-	-	-	-
19	Indirect costs		0	24,000	5760000	24,000	5760000	48,000.00	11,520,000	48,000	11,520,000
	SUB TOTAL	-	-	224,000	53,760,000	224,000	53,760,000	448,000	107,520,000	448,000	107,520,000
	Sweden										
1	Supervision		0		0		0	-	-	-	-
2	Curriculum development		0		0		0	-	-	-	-
3	Lecturing on courses		0		0		0	-	-	-	-
4	Travel Costs		0		0		0	-	-	-	-
5	Dissemination and communication		0		0		0	-	-	-	-
5	Other costs		0		0		0	-	-	-	-
6	Indirect costs		0		0		0	-	-	-	-
	SUB TOTAL	0	0	0	0	0	0	-	-	-	-
	ISP - student allowances							0	0	0	0
	SUB-TOTAL_ISP	-	-	-	-	-	-	-	-	-	-
	GRAND TOTAL	-	-	224,000	53,760,000	224,000	53,760,000	448,000	107,520,000	448,000	107,520,000

Enclosure 2: Sub-programme detail Budget Plan (July 2020-June 2021)

S/N				Source of Fund		2020						2021						Activity Justification
	Planned Activity	Origin of the Activity ¹	Proposed Budget	Original Budget ²	Extra Fund ³	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
		(New/Carried over)	SEK	SEK	SEK													
OB1					Objective 1: To increase access and use of e-resources for quality research, teaching and learning at UDSM													
1.1	Subscription to online databases	Carried over	170,850	0	170,850													This is one of the major activities for the library project which is providing researchers with current and up to date research materials The fund will be used to subscribe to Wiley Online Library (USD 18,000).
1.2	Digitization of print local content materials/research items	Carried over	229,150	0	229,150													These are core activities in the creation of online databases (i.e. Local content database)
	Sub Total		400,000		400,000													
	Library Institutional Fee		48,000		48,000													
	Grand Total		448,000		448,000													

NB: ¹ Please indicate whether the activity was carried over from 2015 approved budget line or it is a new activity.

²Total Original Budget should tally with subprogramme balance expected to remain by July 2020.

³The extra fund connotes amount of money requested from Sida⁴Attach the Original approved Budget

Enclosure 3: Sub-programme Detailed Budget

Date: 02/03/2020

Name of Sub-Programme: Strengthening Access to and Utilization of Research Information at UDSM

Fiscal Year: July 2020- June 2021

Tanzanian Institution/Dept: Library

Collaborating Institution in Sweden: None

Exchange rate: 270

OBS! Major budget items should be the same for all. The budget details may differ.

		Unit	Cost/unit	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total funds allocated		Total funds to be executed	
		No.	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Tanzania													
1	Curriculum develop												
2	Research equipment												
3	Maintenance												
4	Research consumable												
5	Travel												
6	Field/Lab work												
7	Student allowance												
8	Student stipends												
9	Conferences												
10	Publication costs												
11	Travel insurance												
12	Other costs												
	1. E-resources subscription	1	41,004,000			170,850	41,004,000	0	0	170,850	41,004,000	170,850	41,004,000
	2. Digitization libr.materials	11,000	54,996,000			129,150		100,000	24,000,000	229,150	54,996,000	229,150	54,996,000
13	Audit												
14	Indirect cost									48,000		48,000	
	TOTAL		96,000,000			400,000	41,004,000	100,000	24,000,000	448,000	107,520,000	448,000	107,520,000

Enclosure 4: 4. Results Based Management (RBM) Matrix (July 2020-June 2021)

Outputs	Outcomes	Performance Indicator of Outcome	Baseline	Annual Outcome Targets for July 2020-June 2021	Actual Outcomes Achieved: Results Observed in Year 2019/2020	(Key) Outputs produced in the year to obtain outcome in 2020/2021
Specific Objective 1: To increase access and use of e-resources for quality research, teaching and learning at UDSM						
1.1E-resources used	1.1 10,000 full-text e-journal articles downloaded by 2021	Number of full-text journal article downloads	78,632 full-text journal articles downloaded in 2019/2020	10,000 full-text e-journal articles downloaded by June 2021	89,323 full text journal articles downloaded	1. 6 commercial databases have been subscribed in 2018
1.2 Online databases subscribed	1.2 One online databases used by 2021	Number of online databases used	6 online databases subscribed.	One online databases used by 2019	i) 4 commercial databases have been subscribed and used for 2019	i) 4 commercial databases have been subscribed for 2019
1.3 Subject-based databases created and used	1.3 At least 1 subject-based database created	Number of documents entered into the database	2 Subject-based database created	At least one subject-based database created	1subject-based database created	Availability of dissertations and theses in UDSM Library
Assumptions: <ul style="list-style-type: none"> • Reliable power source is available • Efficient internet access is available ➤ Adequate information literacy skills and knowledge 						

Enclosure 5: Summary of Approved Budget (2015-2020)

Objectives	Activities	Process and quantity	PERIOD (SEK)					Total
			2015/16	2016/17	2017/18	2018/19	2019/20	
Enhance access to research information	Conduct needs assessment of end users	Data collection, processing, analysis and report production, publication	21,186	-	21,186	-	-	42,372
	Identification, selection and collection of databases and publications		102,046	102,042	102,042	102,042	102,042	510,214
	Digitization of publications and quality control		80,509	80,509	42,372	42,372	30,042	275,804
	Negotiation and subscription to the e-resource databases	Subscription to e-databases (SEK 688,470 per year) x 5years	688,470	688,470	688,470	688,470	688,470	3,442,350
	Awareness creation and marketing of e-resources	Brochure production SEK 4237 per year x5	4,237	4,237	4,237	4,237	4,237	21,185
	Conduct survey to establish the extent of utilisation of e-resources	Data collection, processing, analysis and report production and publication	-	-	42,373	-	42,373	84,746
	Conduct impact assessment of e-resource usage on the research outputs		-	-	42,373	-	42,373	84,746
	Disseminate research findings at conferences/works hops		-	45,662	45,662	45,662	45,662	182,648
	Sub-total		896,448	920,920	988,715	882,783	955,199	4,644,065
Provide training on online	Publishing research findings through the OJS	Publishing 10 volume of UDSM Library Journal	25,000	25,000	25,000	25,000	25,000	125,000

publishing	Training of trainers	SEK 254,237 (5 workshops for journal editors, researchers, and academics)	46,187	46,187	46,187	46,187	46,187	230,935
	Sub-total		71,187	71,187	71,187	71,187	71,187	355,935
Grand total (SEK)			967,635	992,107	1,059,902	953,970	1,026,386	5,000,000

6. Budget description/justification

In the extension period, the project is planning to spend a total of SEK 448,000. The project is expecting Sida will grant approval for the request of such funds to cover below budgeted activities.

6.1 Subscription to e-resources

The sub-programme requests funds (SEK 170,850) to support subscription to one (1) online database (i.e. Wiley Online Library) e-resources for year 2021. Subscription to e-resources is one of the major activities for the library project which is providing researchers in academic institutions in Tanzania with current and up to date research findings. Most of these research findings are published in international journals.

6.2 Digitization of library materials

To increase access to and use of e-resources, the library requests funds (SEK 229,150) to support digitization of print library resources. The plan is to digitize eleven thousand (11,000) abstracts of dissertations and theses. Digitization is one of core activities in the creation of online databases

**CAPACITY BUILDING OF MATHEMATICS IN
HIGHER EDUCATION IN TANZANIA
(CBOMHET)**

Sub program: Research Training in Mathematics UHR Identification Number 2275-2014.

PLAN SUB-PROGRAMMES/PROJECTS (July 2020 - June 2021)

TITLE OF THE SUBPROGRAMME:

Capacity Building of Mathematics in Higher Education in Tanzania (CBoMHET)

Contact information

Cooperating Institution: University of Dar Es Salaam	Swedish Institution(s): Linköping University
Address: Department of Mathematics, Box35091, Dares Salaam Contact person: Dr.Sylvester E. Rugeihyamu Tel: +255 713775365 e-mail: rugeihyamu@yahoo.com / sylvesterrugeihyamu@gmail.com	Address: Department of Mathematics, Linköping University, SE-581 83 Sweden Contact person: Dr.BengtOveTuresson Tel: +46 13281436 e-mail: bengt-ove.turesson@liu.se

1. Summary of Achieved Results/Subprogramme Progress

The overall goal of this sub-programme is to build capacity in mathematics teaching and research at the University of Dar es Salaam (UDSM) by training postgraduate students through collaboration with Swedish partner universities. The expected outcomes are well-trained graduates, who can participate in teaching and research, needed to meet the demands of higher institutions of learning and the society. The focus of the sub-programme is to increase the quantity and enhance the quality of teaching and research outputs.

The capacity for research and teaching is being developed jointly by partners in Swedish universities and UDSM. The training is based on the development of a new PhD programme consisting of a coursework component and research component leading to a dissertation. The research capacity is also being strengthened through, for instance, some postdoctoral fellowships, support for academic staff to present their research in international conferences and also by organising and participating in local conferences. This sub-programme focus to accomplish all planned activities by June 2021.

The sub-programme aims at broadening and strengthening the regional collaboration by using existing networks. This will enable mathematicians in the region to explore synergies aimed toward enhancing and fortifying effective and efficient use of human potential and other resources.

This sub sub-programme in the period of five years from 2015 – 2020 planned to implement the following activities

- a) To train 3 PhD students sandwich mode registered in Sweden
- b) To award 3 postdoctoral fellowships
- c) To train 8 MSc students in the area of pure mathematics
- d) To developed new taught PhD curriculum
- e) To Review two MSc curricula for MSc Curriculum for Modelling and in Pure Mathematics.
- f) TorehabilitateICT infrastructure
- g) To strengthen regional collaboration

Progress to be made until June 2020

- (a) Three 3 PhD students sandwich mode were recruited in Sweden 2016:
 - Mr. Edward Ngailo now in Sweden will defend thesis on 8th June 2020.
 - Mr. Pitos Seleka now in Sweden to defend thesis in November 2020.
 - Mr. Uledi Ngulo came to January in Tanzania for funeral of his father and failed to go back in Sweden due Covid-19. Expecting to complete in June 2021.
- (b) Three postdoctoral fellowships were awarded each for six months in Sweden:
 - The first postdoc is Dr. David Koloseni made the visit in Sweden from January to June 2018
 - The second postdoc is Dr. Thadei Sagamiko made the visit in Sweden from November to April 2019.
 - The third postdoc is Dr. John Andgwisye is now in Sweden from January to June 2020 and will return as soon as it is possible to travel.
- (c) This sub-programme sponsored 8 MSc in pure mathematics. The first batch of 4 students enrolled in 2016 and all successfully graduated in 2018. The second batch of 4 students enrolled in 2017 and one student graduated in October 2019 and other two students were supposed to graduate in May 2020. The fourth student is continuing with studies to graduate in November 2020.
- (d) The sub-programme developed new taught PhD curriculum in 2016, approved by Senate in 2016 and was accredited by TCU in May 2019.

- (e) The two MSc Curricula (Modelling and in Pure Mathematics) were reviewed in 2015 and approved by Senate in 2016 and accredited by TCU in May 2019.
- (f) The ICT infrastructure was rehabilitated in the department in 2016, downloading speed improved.
- (g) Regional collaborations were strengthened within the period of five years and to mention few activities which were jointly implemented:
 - Developed jointly new PhD curricula in Mathematics for UDSM, UR and Makerere University.
 - Reviewed jointly MSc curricula in Mathematics for UDSM, UR and Makerere University.
 - Established 11 regional research groups in Mathematics.
 - Established the East African Centre for Mathematical Research being hosted at IUCEA with nodes at UDSM, UR, UoN and Makerere University.

Summary of Budget for the period of five years:

This sub-programme was given SEK 10,000,000 for the period of five years with 2,026,000 for 2015/2016, 2,548,000 for 2016/2017, 2,078,000 for 2017/2018, 2,178,000 for 2018/2019 and 1,167,000 for 2019/2020. The amount of each was distributed as follows:

Institution/Year	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total (in SEK)
UDSM	614,000	760,000	800,000	612,000	683,000	3,471,000
SWEDEN	1,079,000	1,455,000	945,000	1,209,000	295,000	4,983,000
ISP	333,000	333,000	333,000	357,000	189,000	1,545,000
Total	2,026,000	2,548,000	2,078,000	2,178,000	1,167,000	9,999,000

This sub-programme at UDSM in five received SEK **3,471,000** and by June 2020 will have zero balance.

Planned Activities from 1st July 2020 to 30th June 2021

1. This sub-programme has only 3 PhD students on sandwich mode. The three PhD students are at different stages toward completing their studies. All three students need more time in Sweden to complete their studies as:
 - Mr. Pitos Seleka needs 2 months to visit Sweden to finalize his studies and defend the thesis in November 2020. Mr. Pitos now is in Sweden and would like to remain in

- Sweden until November 2020. He will get 3 months from Sida due to funds allocated for covid-19 and 2 months from this sub-programme, to have total of 5 months to take him from July to November 2020.
- Mr. Uledi Ngulo needs 10 months from September 2020 to June 2021. Mr. Uledi came in Tanzania from end of January 2020 and failed to go back due to covid-19.
2. Preparation for proposal writing for the next phase of Sida support:
 - Two staffs to visit partners in Sweden to brainstorm and write plan for the next application
 - Retreat of 4 staffs to produce draft of the proposal
 - Share document and draft of proposal online
 3. Preparation for the next phase of Sida application
 - Two staffs to visit Swedish partners to write proposal for the next phase
 4. Activities of the EACMaR centre at UDSM:
 - Retreat for 5 days to write action plan and proposal for requesting fund
 5. The department will organise ICT training for postgraduates and primary and secondary school teachers in September or October 2020.
 6. The department will organise training on the use software at the department of staffs and postgraduate students in September or October 2020.

Total extra fund being requested is as follows: UDSM SEK 279,250, Sweden SEK 993,450 and ISP SEK 567,000. Total is **SEK 1,839,690**. There is no carry-over fund.

2. General objectives and expected results

The overall objective of this programme is to generate sufficient analytical capacity and research-based knowledge and technological innovations with appropriate and immediate valuable outcomes to relevant stakeholders in addressing the problem of poverty and promoting sustainable and inclusive development.

The Department of Mathematics at UDSM has a number of untrained staff members that need to be trained. There is also a need for establishing sustainable local PhD training by coursework and dissertation in mathematics and to improve the research environment in the department to increase

its research output. The existing M.Sc. programmes should also be strengthened to ensure that they are of high international quality and well aligned with the new PhD programme.

Taking into consideration the various achievements from earlier support from Sida and other development partners, the proposed research and training has the following specific objectives:

General Objective:

To strive for and achieve national, regional and international recognition by recruiting and training dedicated and highly qualified academics that will be committed to improving the teaching and learning of mathematics as well as conducting research and solving problems in the private and public sectors in Tanzania.

Specific objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

Specific Objective 3: Increase the quality and use of research relevant to high priority issues of national development

Specific Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3. Target (July 2020 – June 2021)

3.1 Specific objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

3.1.1 Planned and the specific activities to be carried out are:

- Two PhD students (Mr. Pitos and Mr. Ngulo) on Sandwich mode:
 - **Mr. Pitos Seleka:** Now is in Sweden was supposed to come back in June 2020 and to make the last visit in October, but since there is no transport, requested to remain in Sweden until November 2020. He will defend thesis in November 2020. This sub-programme will cover his stipend only for two months, other three months will be covered by Sida from the fund allocated due to covid-19.

- **Mr. Uledi Ngulo:** Now is in Tanzania, he came back in January for the funeral of his father and failed to go back due covid-19. If the situation of covid-19 will improve, expecting to visit Sweden from September 2020 to June 2021. He will defend thesis in June 2021.
- One MSc student Ms. Ms. Fatma Ali Rashid
This student failed to complete on time for family problems, now she is continuing with studies under the extension no costs. She will complete her studies in November 2020.

3.1.2 Expected Deliverables are:

- One PhD student Mr. Pitso will graduate by December 2020
- One PhD student Mr. Uledi will complete studies in June 2021
- One MSc student will complete her studies in November 2020
- At least three papers will be published in Peer-reviewed Journals

3.2 Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

3.3.1 Planned and the specific activities to be carried out

NIL

3.3.2 Expected Deliverables are

NIL

3.3 Specific objective 3: Increase the quality and use of research relevant to high priority issues of national development

3.3.1 Planned and the specific activities to be carried out:

- (a) The department will organise at the department ICT training for postgraduate students and Primary and secondary teachers from neighbour schools.
- (b) The department will organise at the department training on the use of mathematics software for both postgraduate students and some staffs.
- (c) Retreat for 5 days to write action plan and research proposals for activities of the EACMaR centre at UDSM

Expected Deliverables are:

- Increase use of ICT in teaching and learning in schools
- Increase use of software in teaching, learning and research
- *Draft of action plan and implementation plans for centre*
- *Draft of proposals for centre*

3.4. Specific objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3.3.2 Planned specific activities to be carried out:

- Two staffs to visit Sweden to discuss with partners and put plans for the next phase of Sidaapplication
- Organize variousonline meetings with partners
- To write the proposal

3.3.3 Expected Deliverables are:

- Proposal prepared

4. Analysis and Justification

Risks and actions for mitigation of the risks

Risk	Level	Remedial action	Responsibility
PhD students and MSc student fail to complete studies on time due to covid-19	Low	<ul style="list-style-type: none">• Monitor their progress monthly• Student will not complete planned time will be included in the next phase.	Sub-programme coordinators and supervisors
Masters student abscondment	Low	Follow-up being made in advance	UDSM coordinator and HoD
Failure to prepare good proposal for the next phase	Low	Begin preparation as early as possible	Sub-programme coordinators
Not publishing on time	Low	Monitor the progress closely	Sub-programme coordinator, Supervisors & Swedish coordinator
PhD students in Sweden or Tanzania failed to come back due to covid-19	High	<ul style="list-style-type: none">• Those have completed their studies or research to begin write proposals or begin other researches with their mentors and other people.• Those still on studies to continue with studies through online platforms	Coordinators and supervisors

5. Enclosures

Enclosures 1: Sub-programme: Mathematics Activity Implementation Plan (July 2020-June 2021)

Enclosures 1: Mathematics Activity Implementation Plan from July 2020 - June 2021																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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1,6	Stipends for Pitos Seleka to spend 2 months in Sweden to defend his thesis in November and December 2020	Carried Over	36 000		36 000														Stipend for Mr. Pitos Seleka for one month in Sweden during the PhD defense in November and December 2020
1,7	Stipends for UlediNgulo a PhD students to spend 10 months in Sweden	Carried Over	180 000		180 000														Subsistence for Mr. UlediNgulo for 10 months in Sweden to be able to finalize his PhD studies
1,8	Refund for extra stipends for 19.5 months already paid to our PhD students	Carried Over	351 000		351 000														3 PhD students on sandwich mode during their studies from 2016 to June 2019 on average each stayed 30,5 months in Sweden, but actual period was supposed to be 24 months. All 3 students have 19.5 extra months
Subt otal			567 000		567 000														
OB2	Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines																		
UDSM PLANS																			
Subt otal																			
OB3	Objective 3:Increase the quality and use of research relevant to high priority issues of national development																		
UDSM PLANS																			
3,1	Phase III ICT training for one week for 20 postgraduate students and 20 primary and secondary school teachers in September/ October 2020	Carried Over	56 200		56 200														The department will organize in the department ICT training for postgraduate students and Primary and secondary teachers from neighbouring schools

[illegible]

[illegible]

Enclosures 2: Sub-program Overall Aggregated Budget

Date: 1st March 2020 Sub Program: Capacity Building of Mathematics in Higher Education in Tanzania (CBoMHET) Period: 1st July 2020 to 30th June 2021 Tanzanian Institution/Dept: University of Dar es Salaam OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum		0		0		0	-	-	-	-
Research equipment		0		0		0	-	-	-	-
Maintenance		0		0		0	-	-	-	-
Research Consumables		0	9,475	2274000	9,475	2274000	18,950	4,548,000	18,950	4,548,000
Travel		0	22,500	5400000	22,500	5400000	45,000	7,200,000	45,000	7,200,000
Field/Lab work		0		0		0		-	-	-
Student fees		0		0		0		-	-	-
Student stipends x		0		0		0	7,500		7,500	
Coferences		0	70,000	16800000	70,000	16800000	140,000	33,600,000	140,000	33,600,000
Publication costs		0		0		0		-	-	-
Travel insurance		0	0	0		0		-	-	-
Cost related to Research		0		0		0		-	-	-
Cost of Training		0		0		0	-	-	-	-
Coordination Cost		0		0		0	-	-	-	-
Others		0	19,000	4560000	19,000	4560000	38,000	9,120,000	38,000	9,120,000
Transfer of Funds to Sweden	0	0	0	0	0	0	-	-	-	-
Bank interest	0	0	0	0	0	0	-	-	-	-
Audit		0		0		0	-	-	-	-
Indirect costs		0	14,970	2,205,600	14,970	2,205,600	29,940	4,411,200	29,940	4,411,200
SUB TOTAL	-	-	135,900	31,239,600	135,900	31,239,600	279,400	58,879,200	279,400	58,879,200
Sweden										
Supervision		0	375,000	90000000	375,000	90000000	750,000	255,000,000	750,000	255,000,000
Curriculum development		0	0	0	0	0				
Lecturing on courses		0	0	0	0	0				
Travel Costs		0	0	0	0	0				
Dissemination and communication		0	0	0	0	0				
Other costs		0	74,800	17952000	74,800	17952000	149,600	35,904,000	149,600	35,904,000
Indirect costs		0	46,925	11262000	46,925	11262000	93,850	22,524,000	93,850	22,524,000
SUB TOTAL	0	0	496,725	168,886,500	496,725	168,886,500	993,450	313,428,000	993,450	313,428,000
ISP - student allowances		0	283,500	68040000	283,500	68040000	567,000	174,420,000	567,000	174,420,000
SUB-TOTAL ISP	-	-	283,500	68,040,000	283,500	68,040,000	567,000	174,420,000	567,000	174,420,000
GRAND TOTAL										
	-	-	1,730,320	268,166,100	916,125	268,166,100	1,840,000	546,727,200	1,840,000	546,727,200

BUDGET DESCRIPTIONS

1. Curriculum development

NIL

2. Research equipment

Retreat for 4 staffs for five days for writing proposal for next phase of Sida. The cost will be as follows:

- Transport for 4 people @ TZS 50,000 – total TZS 200,000
- Subsistence for 4 staffs for 5 days @ TZS 120,000 – total TZS 2,400,000
- Venue for 5 days @ TZS 250,000 – Total TZS 1,250,000
- Meals for 4 staffs for 5 days – Total TZS 500,000
- Stationary TZS 200,000
- **Grand-total TZS 4,550,000 = SEK 18,950. The funds will go to UDSM.**

3. Maintenance

NIL

4. Research Consumables

NIL

5. Travel

- Return-tickets for 1 PhD sandwich student¹, the cost of ticket is SEK 15,000. **The funds will go to UDSM.**
- Two air-tickets for 2 staffs from UDSM to Sweden for 5 days to discuss with partners the proposal for second phase of Sida @ SEK 15,000 = Total SEK 30,000. **The funds will go to UDSM.**

6. Field/Lab work

NIL

7. Student stipends

Stipend of Mr. UlediNgulo PhD student now in Tanzania for 3 months July to Sept @ TZS 600,000 per month – total TZS 1,800,000 = SEK 7,500. **The funds will go to UDSM.**

8. Student fees x

NIL

9. Workshops

9.1 Phase III ICT training for one week for 20 postgraduate students and 20 primary and secondary school teachers in September 2020

- Local transport for 40 participants @ TZS 30,000 for 6 days = Sub-total **TZS 7,200,000**
- Tea and Meals 40 participants @ TZS 20,000 for 6 days = Sub-total **TZS 4,800,000**
- Time compensation for 5 facilitators @ TZS 50,000 for 6 days = Sub-total **TZS 1,500,000**

Grand-Total = TZS 13,500,000 = SEK 56, 200. The funds will go to UDSM.

9.2 Training for one week for 20 postgraduate students and 15 staffs on the use of Mathematical software in September/October 2020

- Local transport for 35 participants @ TZS 30,000 for 6 days = Sub-total **TZS 6,300,000**
- Tea and Meals 35 participants @ TZS 20,000 for 6 days = Sub-total **TZS 4,200,000**
- Time compensation for 4 facilitators @ TZS 50,000 for 6 days = Sub-total **TZS 1,200,000**
- **Grand-Total = TZS 11,700,000 = SEK 48,700. The funds will go to UDSM.**

9.3 Retreat for 5 days for 9 staffs from three research groups of the centre at UDSM to write action plan and research proposals the cost will be as follows:

- Transport for 9 staffs @ TZS 50,000 – total TZS 450,000
- Subsistence for 9 staffs for 5 days @ TZS 120,000 – total TZS 5,400,000
- Venue for 5 days @ TZS 250,000 – Total TZS 1,250,000
- Meals for 9 staffs for 5 days @ TZS 25,000 – Total TZS 1,125,000
- Stationary TZS 200,000
- Grand-total TZS 8,425,000 = SEK 35,100. The funds will go to UDSM.

10. Publication costs

NIL

11. Travel insurance

NIL

12. Cost of Training

NIL

13. Cost related to research management

NIL

14. Project Coordination Costs

NIL

15. Other costs

Subsistence for 2 staffs from UDSM to Sweden for 5 days to discuss with partners the proposal for second phase of Sida support @ SEK 3800 per person per day = Total SEK 38,000. The funds will go to UDSM

16. Indirect costs (Institutional Fee)

The overhead on the UDSM side has been calculated using a level of 12%. **The funds will go UDSM.**

17. Audit

NIL

18. Indirect cost

NIL

Total Budget for UDSM: Total budget for UDSM is SEK 279,250. **This fund will go UDSM**

SWEDEN

1. Supervision

Refund for the supervision fee for three PhD students for 2019-2020 @ SEK 250,000. **This fund will go Sweden**

2. Curriculum development

NIL

3. Lecturing on courses

NIL

4. Travel Costs

The Swedish coordinator will make two visits to Tanzania to evaluate the progress of the programme. The transport costs will be SEK 30,000. **The funds will go to Sweden.**

5. Other costs

5.1 The Swedish coordinator will make two visits in Tanzania to monitor the progress of the programme. Each visit will be for 7 days. The accommodation and subsistence two visits SEK 1000/night and per diem SEK 400 per day. Total cost will be SEK 19,600. **The funds will go to Sweden.**

5.2 Support for visits in Sweden, Inter-universities visits in Sweden and regional activities for the following activities:

- Support local visits in Sweden for PhD students, postdocs and supervisors
- Support Inter-universities visits in Sweden on the activities related to this project. This should cover local transport in Sweden, transport for discussions with supervisors in Sweden, transport to meetings being arranged in Sweden, accommodation for the Swedish partners in connection with meetings in Sweden etc.

A total of SEK 100,000 reserved for Inter-universities visits and regional Activities and the visits connected to Tanzania and certain activities in Sweden. **The funds will go to Sweden.**

6. Indirect costs

6.1 Audit

Audit on Swedish side is SEK 40,000 per year. **This will be kept in Sweden.**

6.2 Overhead 36%

The overhead on the Swedish side has been calculated using a level of 36%. **The fund will go to Sweden.**

Total Budget of Sweden

Tota

I budget for Sweden is SEK 993,450. **This fund will go to Sweden.**

7. ISP

7.1 Stipends for one PhD student Mr. PitosSeleka to stay in Sweden for 2 months November and December to defend his thesis. Total Stipend SEK 36,000.

7.2 Stipends for 1 PhD student Mr. UlediNgulo to stay in Sweden for 10 months in 2020/2021 to finalize his studies. Total stipend is 10 months x SEK 18,000 = SEK 180,000.

7.3 Refund for Stipends for extra period of 19.5 months the three PhD students spent in Sweden during the period from 2015 – 2020. Total stipends are 19.5 months x SEK 18,000 = SEK 351,000.

Total budget for ISP is SEK 567,000. **This fund will go to ISP.**

8. Overall Budget

8.1 Total fund for UDSM SEK 279,250.

8.2 Total fund for Sweden SEK 993,450

8.3 Total fund for ISP SEK 567,000

8.4 OVERALL BUDGET

Overall budget for 2020/2021 is (item 8.1+8.2+8.3) = **SEK 1,879,690.**

14. Enclosures3: Sub-programme Detailed Budget

		Unit	Cost/unit	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total funds allocated		Total funds to be executed	
				SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
	Tanzania	No.	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1.	Curriculum development												
	1.												
2.	Research equipment												
3.	Maintenance												
	1												
4.	Research Consumables												
	1.	Four staffs retreat for five days on proposal writing for next phase of Sida						18,950	4,548,000	18,950	4,548,000	18,950	4,548,000
5.	Travel												
	5.1	One air-ticket1 for 1 PhD student on Sandwich mode to Sweden				15,000	3,600,000	0		15,000	3,600,000	15,000	3,600,000
	5.2	Two air-tickets for 2 staffs from UDSM to Sweden for 5 days to discuss with partners the proposal for second phase o Sida						30,000	7,200,000	30,000	7,200,000	30,000	7,200,000
6.	Field/Lab work												
	1.												
7.	Student allowances/ISP												
8.	Student fees x												
9.	Student stipends x												
	9.1	Stipend of Mr. Uledi Ngulo PhD student now in Tanzania for 3 months July to Sept.				7500	1800000					7,500	1,800,000
10	Conferences/Workshop												

	10.1	Phase III ICT training for for one week for 20 postgraduate students and 20 primary and secondary schools teachers in September 2020				0	56,200	13,488,000	0	0	0	56,200	13,488,000	56,200	13,488,000
	10.2	Training for one week for 20 postgraduate students and 15 staffs of use of Mathematical software in Teaching and Research					48,700	11,688,000	0	0	0	48,700	11,688,000	48,700	11,688,000
	10.3	Retreat for research groups of the centre at UDSM to plan and write research proposals for 9 staffs for 5 days								35,100	8,424,000	35,100	8,424,000	35,100	8,424,000
10		Publication costs													
	1.														
11		Travel insurance													
12		Other costs													
	12.1	Subsistence for 2 staffs from UDSM to Sweden for 5 days to discuss with partners the proposal for second phase o Sida								38,000	9,120,000	38,000	9,120,000	38,000	9,120,000
13	Audit														
14		Indirect costs													
	1	Overhead 12%					15,200	3,669,100	14,600	3,515,000	29,800	6,968,100	29,800	7,184,100	
		SUB TOTAL			0	0	142,600	34,245,100	136,650	32,807,000	271,750	##### #	279,250	##### #	

		Unit	Cost/unit	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
	Sweden	No.	SEK	SEK	TZS	SEK	TZS	SEK	TZS
1.	Supervision								

		Refund for supervision fee for 3 PhD students not paid for 2019/2020 @ SEK 250,000			750 000	180 000 000			750 000	180 000 000
2.	Curriculum development									
	1.									
3.	Lecturing on courses									
	1.									
4.	Other costs									
	4,1	Two air-tickets for the Swedish coordinator to make two visits to Tanzania			15 000	3 600 000	15 000	3 600 000	30 000	7 200 000
	4,2	Accommodation and subsistence for the Swedish coordinator participating on evaluation of the programme SEK 1400 per day for 7 days per year			9 800	2 352 000	9 800	2 352 000	19 600	4 704 000
	4,3	Support for inter-Universities Visits and logistics in Sweden SEK 100,000 per year.			50 000	12 000 000	50 000	12 000 000	100 000	24 000 000
5.	Indirect costs									
	1.	Audit			20 000	4 800 000	20 000	4 800 000	40 000	9 600 000
	2.	Overhead 36%			26 920	6 462 720	26 920	6 462 720	53 850	12 925 440
	SUB TOTAL				871 720	197 952 000	121 720	60 330 200	993 450	261 346 000
					Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
	ISP		Unit	Cost/unit						
			No.	SEK	SEK	TZS	SEK	TZS	SEK	TZS
1.	Stipends									
	1,1	Stipends for 1 PhD student on sandwich mode to spend 2 months in Sweden			36 000	8 640 000			36 000	8 640 000
	1,2.	Stipends for 1 PhD student on sandwich mode to spend 10 months in Sweden			90 000	21 600 000	90 000	21 600 000	180 000	43 200 000

	Stipends for 3 PhD students for extra 19.5 months stayed in Sweden			351 000	84 240 000			351 000	84 240 000
	SUB TOTAL			477 000	114 480 000	90 000	21 600 000	567 000	136 080 000

	GRAND TOTAL	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
		SEK	TZS	SEK	TZS	SEK	TZS
		1,491,320	357,916,800	348,370	83,608,800	1,839,690	441,525,600

15. Enclosures4: Sub-programme Results-Based Management Logical Framework for Plan from July 2020 to June 2021

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 1: To increase the quantity and quality of postgraduate programmes and the extent of research training for development of Mathematics in higher institutions in Tanzania						
Trained 3 PhD Graduates in Mathematics	1.1 One student graduated in June 2020 and other two PhD students on sandwich mode one to graduate in November 2020 and the second to complete in June 2021	Number of PhD graduates	Three PhD students supported by Sida	2 PhD students defended their theses		
Trained 8 MSc Graduates in Mathematics	1.1 Seven (7) students graduated in May 2020 and one students to graduate in November 2020	Number of MSc graduates	8 MSc students supported by Sida	1 MSc student complete studies		
Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines						
NIL						

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 3: Increase the quality and use of research relevant to high priority issues of national development						
Papers Published in peer reviewed journals	2.2 At least 3 papers published in peer reviewed journals by June 2021.	Number of publications	2 papers published per year	Conference organised and one postdoc awarded		
ICT training Organized	2.3 One-week training on the ICT organized in Sept//Oct 2020	Number of ICT training	2 ICT training	Increase use of ICT in teaching and research		
Training on the use of Mathematics Software Organized	2.3 One-week training on the use of mathematics software organized in Sept//Oct 2020	Number of trainings	Zero trainings	Increase use of software in research to get results to increase publications		
Retreat for writing action plan and research proposals for activities of the EACMaR centre at UDSM	2.4 Five days retreat on proposal writing of the centre organized in March/ 2021	Number of trainings	Zero trainings	Promote the centre at UDSM		
Specific Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas						
Proposal writing for the next phase	3.1 Draft proposal prepared by May 2021	Number of partners established	Available networks	Organized at least three meetings with Swedish partners by March 2021		

16. Enclosure 5: Aggregated Student Progress and Plan (July 2020-June 2021)

PhDtraining Name of research student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of Completion	Progre ss %	Prel. title of dissertation
PhD students							
Edward Ngailo	M	2016	40	-	June 2020	95%	On the product of inverse covariance matrix and normal vector with applications to Discriminate analysis and Portfolio theory
Pitos Seleka	M	2016	40.5	-	Dec. 2020	90%	PageRank algorithms, Markov chains and matrix analysis for changing networks and analysis of big data
Uledi Ngulo	M	2016	40	-	June 2021	70%	An Investigation of decomposition methods for solving large-scale Multi-level Optimization models.
Total PhD: 3							
MSc. students							
EDSON NZAGANYA NZAGANYA	M	OCT. 2017	24	Nov. 2019	-	100%	Topology of projective hypersurface
EVELINA WILSON	F	OCT. 2017	24	Nov. 2019	-	100%	Investigation on some more Properties of Ordered Sets
FATMA ALI RASHID	F	OCT. 2017	24	Nov. 2019	-	80%	Maximal Topology
RICHARD OSWARD	M	OCT. 2017	24	Nov. 2019	-	100%	Further Investigation on Fixed Points, Variational Inequality and Equilibrium Problem
SHOLASTICA LUAMBANO	F	OCT. 2016	24	Nov. 2018	-	100%	Some fixed point theorems for F-contraction mappings in partial metric spaces.
JESLINE ELIEZA GOWELE	F	OCT. 2016	24	Nov. 2018	-	100%	The structure of Lipchitz –free Banach space (Approximation properties)
FAUSTINE NZIKU	M	OCT. 2016	24	Nov. 2018	-	100%	Some Boyd And Wong Type Fixed Point Theorems In Partial Metric Spaces
DAMAS KAMEL MGANI	M	OCT. 2016	24	Nov. 2018	-	100%	On Hilbert Functions and h-vectors of Graded Modules for Finite Sets of Points in Projective Space.
Total MSC: 8							

17. Enclosure 6: Students Individual Plans and Popular Summary of the Study

Study Plan for Mr. PitosSeleka

Sida Mathematics Project
University of Dar es Salaam
ACTIVITY AND ACTION PLAN

Name of Student: **Pitos Seleka Biganda**
Name of Supervisor: **Professor Sergei Silvestrov**
Institution: **Mälardalen University**

Month	Activity details	Remarks
October 2020	Thesis writing	<ul style="list-style-type: none">- Finalizing thesis parts and composition and preparation to submit the pre-final draft of the thesis to my supervisors for quality assessment and final enhancements before final printing and PhD defence.- Working on corrections as per supervisors' and others comments to produce final thesis draft.- Finalising remaining course examinations and required formalities and documentation for the application for the PhD defence and all required files and steps for printing the thesis
November 2020	Preparations for defence	<ul style="list-style-type: none">- Printing the thesis and preparing presentation slides together with supervisors;- Give a seminar talk in the workshop in Västerås on the results in PhD thesis as opportunity of training before the PhD defence.- Give expected seminar talk at the department as a rehearsal for the PhD defence and making suggested improvements and final preparations for the PhD defence.
December 2020	PhD defense	Specific date to be determined later.

Expected Date, Month and year of Graduation:

December 2020 (date not yet known)

Signature of Student.....*PL*.....

Date.....*2020-02-21*.....

Signature of Supervisor *Sergei Silvestrov*

Date 2020-02-21

Plan for Mr. UlediNgulo

Sida Mathematic Project
ACTIVITY AND ACTION PLAN

Name of Student: **Uledi Ngulo**

Name of Supervisor: **Torbjörn Larsson**

Institution: **Linköping University**

Month	Activity details	Remarks
November 2019	Submit revised paper I	Done
December 2019	Finalize paper II and courses	
January 2020	Submit paper II	
February 2020	Paper III: Structure problem	
March 2020	Develop theory, implementation	
April 2020	Computations	
May 2020	Write paper III	
June 2020	Submit paper III	
July 2020	Paper IV: Structure problem	Revise paper II (possibly)
August 2020	Develop theory, implementation	
September 2020	Computations	
October 2020	Write paper IV	
November 2020	Write paper IV	Revise paper III (possibly)
December 2020	Submit paper IV	
January 2021	Write thesis introduction (kappa)	
February 2021	Write thesis introduction (kappa)	
March 2021	Write thesis introduction (kappa)	
April 2021	Submit thesis	Revise paper IV (possibly)
May 2021	Buffer time	
June 2021	Defense	

Expected Date, Month and year of Graduation: **June 2021**

Signature of Student *Uledi Ngulo* and Date *2nd December 2019*

Signature of Supervisor *Torbjörn Larsson* and Date *2 Dec 2019*

18. Enclosure 7: Sub-programme Original Budget 2015-2020 (Compiled Summary)

Date: 11th April 2015

Sub Program: Research Training in Mathematics UHR Identification Number 2275-2014

Period: 1st July 2015 – 30th June 2020

Tanzanian Institution/Dept: Mathematics , University of Dar es Salaam

Collaborating Institution/s in Sweden: Linköping University

OBS! All major budget items should be the same for all.

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Tanzania	SEK	SEK	SEK	SEK	SEK	SEK
Curriculum development	66150					66150
Research equipment	190,000					190,000
Research consumables	40,000	57,500	37,500	37,500	37,500	210,000
Travel	80,000	45,000	60,000	60,000	45,000	290,000
Field/Lab work						0
Student fees		140,000	140,000	140,000	140,000	560,000
Student stipends		223,200	223,200	223,200	115,200	784,800
Conferences		150,000	150,000		150,000	450,000

Publication costs		12,000	32,000	12,000	50,000	106,000
Travel insurance		1,200	1,200	1,200		3,600
Audit						0
Other costs	172,200	50,900	72,900	72,900	72,900	441,800
Indirect costs	65,700	81,000	83,400	65,500	73,100	368,700
SUB TOTAL	614,000	760,000	800,000	612,000	683,000	3,471,000
Sweden	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
Supervision	600,000	600,000	600,000	600,000		2,400,000
Curriculum development	99,400					99,000
Lecturing on courses		377,600		188,800		566,000
Other costs	169,600	169,600	169,600	169,600	169,600	848,000
Indirect costs	210,700	308,000	175,900	250,600	125,500	1,070,000
SUB TOTAL	1,079,000	1,455,000	945,000	1,209,000	295,000	4,983,000
ISP - student allowances	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
SUB TOTAL	333,000	333,000	333,000	357,000	189,000	1,545,000
GRAND TOTAL	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
	2,026,000	2,548,000	2,078,000	2,178,000	1,167,000	9,999,000

CAPACITY BUILDING IN INTERDISCIPLINARY MOLECULAR BIOSCIENCES

2.11 TITLE OF THE SUBPROGRAMME

Capacity building in Interdisciplinary Molecular Biosciences

Contact information

University of Dar-es-Salaam	Swedish Institution:
Department of Molecular Biology and Biotechnology Address: P.O. Box 35179 Dar-es-Salaam, Tanzania Prof. Donatha Damian Tibuhwa Tel: +255688075353 email: dtibuhwa@yahoo.co.uk	Uppsala University Department of Systematic Biology, Institute for Organismal Biology, Address: Norbyvägen 18D, 75236 Uppsala, Sweden. Dr. Sanja Tibell Tel: +46 768092584 e-mail: sanja.tibell@ebc.uu.se

1. Summary of Achieved Results/Subprogramme Progress

The overall objective of this sub-programme is to build capacity in Inter disciplinary Molecular Biosciences by training postgraduate students in collaboration with Swedish partner universities, thus strengthen knowledge in molecular biology, biotechnology and mycology including lichens in Tanzania and enhance technological development in the country.

Despite the fact that there was un expected delays in procurement of the planned equipment and late commencement of the taught PhD program in Intermolecular Biosciences by a year, the program have been successful. Under this subprogram, a taught PhD curriculum in Molecular Biosciences was developed, accredited by Tanzania Commission for Universities (TCU) and enrolled Five PhD students supported by the Project. Students are now in their final year expected to complete their studies by the end of the year (November 2020). Two PhD students were enrolled in mycological Sciences one has successfully defended his thesis on 17 April 2020 and another one is expected to graduate in September 2020. Major equipment to support Molecular Biosciences research were procured although very late, and two technical staff hands-on training at Uppsala and Gothenburg Universities was ongoing and expected to be completed in April 2020 but unfortunately it has been hampered by the Covid -19 saga.

Conclusion:

The Program is very grateful to Sida for facilitation of the activities. It is our anticipation that Sida will continue to support the Program in strengthening the knowledge in molecular biology; biotechnology and mycology for enhance technological development in Tanzania.

Budget: In the extension period, the project is planning to spend a total of **SEK 1,601,734** (equivalent to **TZS 400,433,375**), on completing training of the Seven (7) PhD research activities in Tanzania and Sweden. – SEK 54,000 (TZS 13,500,000), student stays in Sweden (ISP allocation) is carried over while SEK 270,000 (TZS 67,500,000) is requested as a new ISP allocation to support the 5 students stuck in Sweden due to Covid-19, for extra three month each. – SEK 45,600 (TZS 11,400,000) for return ticket and refund for ticket change to the two technical staff and one PhD who came back due to Covid19 chaos. SEK – SEK 108,000 (TZS 27,000,000) student stipend in Tanzania for the period July 2020- June 2021. – SEK 640,000.00 (TZS 160,000,000) is for local taught PhD sample analysis that was outsourced due to delays in procuring the equipment. – SEK 125,000 (TZS 31,250,000) for Swedish counterparts (supervision). – SEK 77,280 (TZS 19,320,000) is for Swedish partner support for attending annual meeting in TZ and preparation for next phase with TZ partners while Institutional fees is SEK 135,354 (TZS 30,509,400). Out of the requested budget a total of SEK 78,000 (TZS 16,500,000) is expected to come from the original budget (last disbursement) and the remainder is requested from Sida. Therefore the Program is requesting a total of SEK 1,601,734 (TZS 400,433,375) to supplement research costs, cover extra cost due to Covid-19 saga, supervision and other costs (institutional fees, PhD defense and support for Swedish partners to attend annual meeting).

2. General objectives and expected results

The general objective of this programme is to build capacity in Interdisciplinary Molecular Biosciences thus, strengthen knowledge in molecular biology, biotechnology and mycology including lichens in Tanzania and enhance technological development in the country.

This sub sub-programme in the period of five years from 2015 – 2020 planned to implement the following objectives:

- i. Develop a taught PhD in Inter disciplinary Molecular Biosciences
- ii. To train human resource with expertise for research in molecular biosciences
- iii. To procure research equipment for IMB laboratories equipped with modern facilities
- iv. To train human resource with expertise for research in mycological science including lichens
- v. To train technical staff with skills for maintain and repair procured equipment.

Progress to be made until June 2020

- i) A taught PhD curriculum in Inter disciplinary Molecular Biosciences accredited by the Tanzania Commission for Universities (TCU). This objective has been completed by 100%.
- ii) Human resource with expertise for research in molecular biosciences Activities under this objective are ongoing. The developed taught PhD program in Molecular Biosciences enrolled a total of Six PhD students out of which five are sponsored by the program. This first cohort of graduates were expected to complete studies by November 2020 but due to Covid19 they might delay up to March 2021.
- iii) The major research equipment for IMB researches were successfully procured and installed
- iv) Human resource with expertise for research in mycological science including lichens. This objective is ongoing, and it involved training two PhD students. One graduated on 17 April 2020, another is planned to graduate in September/October 2020.
- v) Technical staff with skills to maintain and repair procured equipment. This objective is was ongoing, where by two technical staff were being trained on hands-on skills at two partner Universities, Uppsala and Gothenburg. It was expected to be completed by end of April 2020 but the program has been interfered by Covid-19 saga, thus the staff had to return home first. The plan is for them to go back and complete the training once the condition calms down.

3. Target (July 2020 – June 2021)

3.1 Programme objective 1: Develop a taught PhD curriculum in Interdisciplinary Molecular Biosciences. This activity is completed by 100%.

3.1.1 Planned and the specific activities to be carried out

NIL

3.1.2 Expected Deliverables are

NIL

3.2: Programme objective 1: Increase human resource with expertise for research in Molecular Biosciences

3.2.1 Planned and the specific activities to be carried out:

This objective involve training of 5 PhDs and it is on ongoing. It is expected to be Completed between November 2020 and March 2021. The five PhD students will continue with:

- Laboratory analysis,
- Writing their thesis,
- Attend conference,
- Publish their results and
- Defend their thesis.

3.2.2 Expected Deliverables

- i) Five PhD graduates
- ii) At least twelve papers published in peer-reviewed journals
- iii) At least one potential patent

3.3 Programme objective 3: Increase human resource with expertise for research in Mycological science including lichens –

This objective involved training of 2 PhDs and it is ongoing. PhD Hussein Juma has successfully Defended his PhD on 17 April 2020.

3.3.1 Planned and the specific activities to be carried out:

- PhD student Stella Temu to continue writing manuscripts and thesis
- Defend her PhD in September/October 2020

3.3.2 Expected Deliverables

- i) Two PhD graduates specializing in Mycology and Lichen Sciences, It should be noted that this will be the first PhD in lichen science in the country and region.
- ii) Six papers published in peer-reviewed journals
- iii) One potential patent

3.4 Programme objective 4: To train technical staff with skills for maintain and repair procured equipment. Activity for this objective was ongoing and planned to be completed by April 2020 but unfortunately has been hampered by Covid-19 saga.

3.4.1 Planned and the specific activities to be carried out

NIL

3.4.2 Expected Deliverables

NIL

3.5 Programme objective 5: To procure research equipment for IMB laboratories equipped With modern facilities. Major equipment's were successfully procured. To enhance smooth functioning by procuring small gadgets and chemicals is ongoing.

3.5.1 Planned and the specific activities to be carried out

Procure chemicals and small gadgets to enhance proper functioning of the equipment's

3.5.2 Expected Deliverables

A functioning Molecular Bioscience Laboratory

4. Analysis and Justification

The IMB program had five objectives out of which three will be completed by the end of June 2020. One PhD in mycological Sciences has already completed his studies. Three activities remaining are based on training 6 PhD students and enhancing smooth running of the procured major equipment. Five are trained in Molecular biosciences recruited on the developed taught PhD program under the Project. One PhD student in Lichen science will complete her studies in September/October 2020. Procure small gadgets, and chemicals to enhance proper functioning of the procured equipment. Our first PhD in the subprogram, Juma Mahmud Hussein, was fully informed about the Covid-19 situation in Sweden, but he decided to stay and then successfully defended his thesis at Uppsala University on the 17th of April, partly via a Zoom-link.

Risks assessment and actions for mitigation of the risks

Due to the covid-19 situation in the world, but particularly in Sweden and Tanzania, we are fully aware that some things with respect to our plans may be prolonged or even postponed. Therefore, we are carefully trying to identify potentially threats and hazards considering the current covid-19 situation. Five PhD students are in Sweden just now: Reuben in Lund; Jackson in Gothenburg; and Donath Damian, Bernadether and the recently graduated Juma Hussein are in Uppsala. They are all well informed and aware of the present health-hazard situation there, and they are affecting social-distancing when possible. However, their work is to some extent affected by the covid-19 situation:

- Some courses and interactions might have been changed at Universities in Sweden, since new rules apply and most of the teaching now is on-line to accommodate the covid-19 situation. In addition, teaching/university staff are encouraged to work from home.

- Right now, is impossible to go back to Tanzania because no flights Sw-Tz are available and we do not know exactly when they will effectively start again. The time needed for extensions of their visa (if necessary) might be longer than expected, and will led to unplanned additional costs.

Our two PhD students, Stella and Herieth, are still in TZ, since no flight are operating to Sweden. This will result in a - hopefully short - postponing of Stella's PhD Défense at Uppsala University from planned September to October. Herieth was planning to come to Sweden for training, but is now awaiting the situation. Due to closure of the international flights, and working from home, the process for paying the cost for sample analysis were delayed together with delays caused by sample shipment difficulties. All these has caused her sample to degrade and will have to re do the work. This will amount into her delayed completion from March 2021 to June 2021.

Our two technicians, Winnie and Kelvin, started their training in Sweden (Uppsala and Gothenburg) in the beginning of March, but due to the covid-situation the decision to return to TZ was made. Hopefully it will be possible for them to return to Sweden to finish their education. This will be led to additional cost of

procuring new tickets and cost incurred for rescheduling the flights

Then, last but not the least, the University of Dar es Salaam was officially closed for two months, and is now planning to open again in the beginning of June. This has generally affected the students' progress and the extension of at least three months might be required to fill the lost time. The general summary for the Risks assessment and actions for mitigation of the risks are presented in the Table below:

Table: Risks assessment and actions for mitigation of the risks

Risk	Level	Remedial action	Responsibility
PhD students not graduating on time	Low	Monitor their progress monthly	Sub-programme coordinators, and Supervisors
Failure to prepare good proposal for the next phase	Low	Begin preparation as early as possible	Programme coordinator, Research team members and Swedish partners
Not publishing on time	Low	Monitor the progress and Abiding to rule as students need to publish before graduation	Supervisors
COvid19 effect led to failure to complete some of the planned project activities including ➤ student not finish their studies on time ➤ Insufficient budget due to abrupt budget implication caused by Covid 19	High	<ul style="list-style-type: none"> ➤ Request and grant supported studentship extensions to March 2021 ➤ Request extra budget to cover the unexpected expenses due to Covid 19 	Sida to fund the extra budget Respective Universities to grant studentship extensions

5. Enclosures

19. Subprogramme Activity Implementation Plan (July 2020-June 2021)
20. Sub-program **Overall Aggregated Budget**
21. Subprogramme Detailed Budget
22. Results Based Management (RBM) Matrix (July 2020-June 2021)
23. Aggregated Student Progress and Plan (July 2020-June 2021)
24. Students Individual Plans and Popular Summary of the Study
25. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 2: Sub-program Overall Aggregated Budget: EXCHANGE RATE 1 SEK = 250.00 TZS

	Tanzania	Funds to be forwarded		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total allocated funds		Total funds to be executed	
		SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1	Curriculum	0	0	0	0	0	0	0	0	0	0
2	Research equipment	0	0	0	0	0	0	0	0	0	0
3	Maintenance	0	0	0	0	0	0	0	0	0	0
4	Research Consumables	0	0	0	0	0	0	0	0	0	0
5(i)	Travel: Tickets for 3 Swedish partners to Annual meeting in TZ, and one supervisor attend defence in Sweden	12,000	3,000,000	36,000	9,000,000	0	0	36,000	9,000,000	48,000	12,000,000
5(ii)	Travel: Tickets for 3 (student and tech staff) to return to Sweden after Covid-19	0	-	36,000	9,000,000			36,000	9,000,000	36,000	9,000,000
5(iii)	Refund for changing the ticket	0	0	9,600	2,400,000			9600	2,400,000	9,600	2,400,000
6	Field/Lab work	0	0	640,000	160,000,000	0	0	640,000	160,000,000	640,000	160,000,000
8	Student fees	0	0	0	0	0	0	0	0	0	0
	Student stipend			72,000	18,000,000	36,000	9,000	108,000	27,000,000	108,000	27,000,000
10	Conferences			0	0	0	0	0	0	0	0
11	Publication costs/Thesis production	12,000	3,000,000	0	0	0	0	0	0	12,000	3,000,000
12	Travel insurance			1,500	375,000	0	0	1,500	375,000	1,500	375,000
13	Others: Subsistence allowances 3 Swedish partners to TZ for Annual meeting and One TZ supervisor attend defense in Sweden			77,280	19,320,000	0	0	77,280	19,320,000	77,280	19,320,000
	Preparation of Stakeholders meeting as a follow-up of Dodoma Conference for Adopting Mushroom as a National Strategic crop for improving livelihood in Tanzania	0	0	60,000	15,000,000.00	0	0	60,000	15,000,000	60,000	15,000,000
	Retreat for 5 PhD students and supervisors to accelerate their training completion	0	0	25,000	6,250,000.00	0	0	25,000.00	6,250,000.00	25,000.00	6,250,000
14	Institutional fees 12%		0	114,886	28,721,500	4,320	1,080	110,566	29,801	135,354	30,509,400
	SUB TOTAL	24,000	3,000,000	1,072,266	268,066,500	40,320	10,080	1,103,946	248,374,801	1,152,734	284,854,400
	Sweden			Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total allocated funds		Total allocated to be executed	
				SEK	(TZS)	SEK	(TZS)	SEK	(TZS)	SEK	(TZS)
1	Supervision			125,000	31,250,000		0	125,000	31,250,000	125,000	31,250,000
2	Curriculum development				0		0	0	0	0	0
3	Lecturing on courses				0		0	0	0	0	0
4	Other costs			0	0		0	0	0	0	0
5	Indirect costs			0	0		0	0	0	0	0
	SUB TOTAL			125,000	31,250,000		0	125,000	31,250,000	125,000	31,250,000
6	ISP - student allowances			Allocated funds July-		Allocated funds Jan-		Total		Total	
				SEK	(TZS)	SEK	(TZS)	SEK	(TZS)	SEK	(TZS)
	Student allowances	54,000	13,500,000	270,000	67,500,000	0	0	270,000	67,500,000	324,000	81,000,000
	SUB TOTAL			270,000	67,500,000	0	0	270,000	67,500,000	324,000	81,000,000
				Allocated funds July-		Allocated funds Jan-		Total		Total	
				SEK	(TZS)	SEK	(TZS)	SEK	(TZS)	SEK	(TZS)
	GRAND TOTAL	78,000	16,500,000	1,467,266	366,816,400	0	0	1,498,946	374,736,400	1,601,734	400,433,375

26. Enclosures 4: Sub-programme Results-Based Management Logical Framework for Plan from July 2020 to June 2021

Summary Problem Statement:

Different communities in Tanzania have utilized various plants and microbes for medicinal purposes. However, scientific information on the benefits of the various indigenous remedies is very minimal due to lack of expertise and infrastructure required to conduct these researches. The IMB programme will intended to lay a foundation that will enable building of a strong public-private partnership for moving discoveries from the bench, to industry, to the bedside ii) Produce experts in mushrooms endophytic fungi, and lichens a lacking specialty by sandwich model.

Overall Objective (2015-2020):

The general objective of this programme is to build capacity in Interdisciplinary Molecular Biosciences thus, strengthen knowledge in molecular biology, biotechnology and mycology including lichens in Tanzania and enhance technological development in the country.

Specific objective 1: Develop a taught PhD in Inter disciplinary Molecular Biosciences

Specific Objective 2: To train human resource with expertise for research in molecular biosciences

Specific Objective 3: To procure research equipment for IMB laboratories equipped with modern facilities

Specific Objective 4: To train human resource with expertise for research in mycological science including lichens

Specific Objective 5: To train technical staff with skills for maintain and repair procured equipment.

Result Matrix

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 1: Develop a taught PhD in Inter disciplinary Molecular Biosciences						
Develop a curriculum for taught PhD in Molecular Biosciences	A taught PhD curriculum Developed	Accredited taught PhD	None	A credited taught PhD program	A running PhD taught program	A taught PhD with enrolled students
Specific Objective 2: To train human resource with expertise for research in molecular biosciences						
Train5 PhD Graduates in Molecular Biosciences	1.1 Five PhD students on sandwich mode graduate by December 2020	Number of PhD graduates	None	Five PhD students successful defended their PhD theses	Five PhD graduates with experts in Molecular Biosciences	Five PhD graduates with experts in Molecular Biosciences
	1.2 Proposal writing for the next phase	1.2 Draft proposal prepared by March 2021	Number of partners established, Planned objectives and activities put in place, Meeting with partners	Proposal submitted	A feasible fundable proposal is available	Feasible fundable proposal in place
Proposal writing for the next phase	3.1 Draft proposal prepared by March 2021	Number of partners established	Available networks	Meet with Swedish partners for finalizing proposal by March 2021	Proposal submitted	Proposal for phase two completed
Specific Objective 4: To train human resource with expertise for research in mycological science including lichens						
	4.1 Two PhD students on sandwich mode graduate by September 2020	Number of PhD graduates	One PhD in mycology None in Lichenology	Two PhD students successful defended their PhD theses	Two PhD graduates with experts in Mycology and Lichenology	Two PhD graduates with experts in Mycological Sciences

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 5: To train technical staff with skills for maintain and repair procured equipment.						
	5.1 Two technical staff trained on hands-on skills by April 2020	Number of technical staff trained	None	Two technical staff successful trained on how to run the equipment	Two technical staff with skills of operating the procured equipment	Two technical staff with skills of operating the procured equipment

Enclosures 5: Aggregated Student Progress and Plan (July 2020-June 2021)

PhDtraining Name of student:	(M/F)	Year training <u>started</u>	Training in Sweden (<u>no.</u> <u>months</u>)	<u>Local PhD</u> Expected/ Year of <u>completion</u>	<u>Sandwich</u> <u>PhD</u> Expected- <u>Completion</u>	<u>Progress</u> %	<u>title of dissertation</u>
PhD students							
1. Juma Hussein	M	2016	39		Completed	<u>100%</u>	Investigation of some economically important Mushrooms of Tanzania
2. Stella Temu	F	2016	42		October 2020	<u>80%</u>	Taxonomy of Tanzania cloud forest lichens
3. Donatha Damian	M	2016	6	2020	March 2021	<u>70%</u>	Viral metagenomics and molecular epidemiology of vector-borne diseases in the wildlife-livestock interface
4. HeriethRhodes Mero	F	2016	6	2020	June 2021	<u>65%</u>	Genetic diversity and Chloroplast genomics of cassava land cares and selected wild cassava relatives in Tanzania
5. BernadetherRugumisha	F	2016	6	2020	March 2021	<u>70%</u>	Influence of inter-pregnancy interval after abortion on vaginal microbiome during the first trimester
6. Jackson Thomas Mollel	M	2016	6	2020	March 2021	<u>70%</u>	Investigation of anti-HIV-1 activity and inhibitory properties of medicinal plants used for treatment and management of HIV/AIDS in Tanzanian
7. Reuben Silas Maghembe	M	2016	6	2020	2020	<u>70%</u>	Molecular mapping of diversity and bioactivity of microalgae from selected marine and fresh water ecosystems in Tanzania
Total: 07							

Enclosure 6: Students Individual Plans and Popular Summary of the Study

Preamble

Interdisciplinary Molecular Biosciences (IMB) is a five-year (2015 -2020) capacity building program jointly implemented by University of Dar es Salaam (UDSM), Tanzania and the Lund University, Swedish University of Agricultural Sciences and Uppsala University, Sweden. The project sponsors sponsored 7PhD students.

Progress in terms of studies completion rate

Seven (7) PhD students, enrolled for PhD students, two registered in Sweden at Uppsala University (April 2016) under sandwich mode while 5 registered at UDSM (October 2016) under the developed taught Intermolecular Bioscience PhD program (IMB).

The two students in Sweden are in their final year One successfully defended his PhD on 17 April 2020 while the second had maternity leave for three month and her defense is planned in September 2020.

The five PhD student registered at UDSM are finalizing data collection, doing Laboratory work and data analysis for manuscript and dissertation writing. They are expected to complete their studies by the end of this year.

Students' activities and action plan are provided in table 1 to 7 in the order of preceded by the respective popular summary of their studies:

- Table 1-1: Hussein Juma Mahmud
- Table 1-2: Stella G. Temu
- Table 1-3: Reuben S.Maghembe
- Table 1-4: Donath Damian
- Table 1-5: Jackson T.Mollet
- Table 1-6: Herieth R. Mero
- Table 1-7: Bernadether T. Rugumisa

Table 1-1: Hussein Juma Mahmud (2017-07-00205)

1.1 Popular summary:

Fungi represent a large group of eukaryotic organisms including both microbial (yeasts and moulds) and familiar fresh mushrooms (macrofungi, macromycetes, higher fungi). Mushrooms are mediators in many biological processes in land ecosystems. They take part as saprophytes (major

contributors to the degrading and recycling all plants and animals), parasites (often on crops, in forests or sometimes on humans), and symbionts furnishing plants with vital living conditions such as mycorrhiza and entering symbioses with different organism. Mushrooms are also an excellent source of proteins, vitamins, minerals, fibers, trace elements, and have low/no calories and cholesterol. The first part of this project focuses on classical and modern approaches using morphological and molecular techniques to describe large polyporoid edible mushroom from the West arc of the Usambara Mountains that at maturity one fruit body weighs more than 10 kg. This mushroom has a long history of being used as food and medicine by "Sambaa" people in Tanzania. Results from morphology and molecular data have shown that the studied mushroom is new to Science. Therefore, a new genus and species name has been proposed to accommodate this mushroom in *Laetipoaceae* Family. Further studies will be done to determine bioactive compounds associated with this mushroom. In the second part of the study involves a polyporoid parasitic mushroom from Southern parts of Tanzania that has been observed to cause wilting and death of cashew trees, eucalyptus, cassava, and other local indigenous trees. Morphological and molecular approach, combined with pharmacognosy and chemical ecology will be used to describe and determine metabolic pathways and a possibility to mitigate its parasitism in plants. NGS technology will serve as an interface between chemistry and biology in characterizing this fungus.

Geographic locations: Usambara, Korogwe, Lushoto –Tanga, Mtwara

The research questions: (i) What is the phylogenetic position of studied mushrooms? (ii) Which bioactive compounds are found in studied mushrooms? (iii) What are the possible pathways to mitigate plants parasitism in the studied mushroom?

1.2 Action plans

S/ N	Activity details	2019		2020										
		N ov	De c	Ja n	Fe b	M ar	A pr	M ay	Ju n	J u l	A ug	Se p	Oc t	No v
1	Submitted second manuscript to the journal of Mycologia, waiting for review responses													
2	Data analysis to determine protein structure, the results will contribute to the third manuscript													
3	Revise the third manuscript on cysteine rich peptide from Kusaghiporiausambarensis													
4	Analyse data from GCMS and write forth manuscript													
	Writing thesis													
5	Submission													
6	Defend PhD						17 th							
7	Revise manuscripts and prepare them for submission to the journal													

Table 1-2: Stella G. Temu (870626-8581)

2.1 Popular summary

Lichens are formed by two intimately associated organisms, usually alga or cyanobacterium and a fungus (most often an ascomycete). Lichens are sensitive to environmental changes and have often been used as bioindicators in surveying different types of environmental conditions. One of the major threats in Tanzania presently is deforestation and climatic change, which both have a very adverse effect on montane rainforests. Lichens have the ability to absorb water directly from the air and to capture atmospheric water which significantly influences the ecology and soil properties of rainforests. Therefore, this project aims at investigating the taxonomy, secondary chemistry, bioactivity and ethnomycology of lichens in Tanzania.

Geographic locations: Usambara, Korogwe –Tanga, Kilimanjaro

The research questions: (i) What are the lichen species found in the Tanzanian montane forests (ii) Which bioactive compounds are found in lichens? (iii)What is the efficacy of the bioactive compounds found in lichens?

2.2 Action plan

Year	2019		2020							
Months/ Activity	No v	De c	Jan	Feb	Mar	Apr	Jun	Jul	Aug	Sept
Writing manuscript III and submission to MycoKeys Journal.										
Data analysis and phylogenetic studies for objective IV and writing manuscript IV, submitting manuscript to lichenology Journal.										
Laboratory work for objective V, PCR amplifications and sequencing, writing manuscript and submission to Cryptogamie Journal.										
Literature reading/reading club.										
Thesis kappa writing.										
Poster preparation and presentation at International Lichenological Symposium, Brazil.										
Thesis printing, administration procedures in Uppsala University towards completions of a PhD and defence.										

Table 1-3: Reuben Maghembe (2016-07-00295)**3.1 Popular summary**

Microalgae present a group of prokaryotic and eukaryotic microorganisms capable of carrying out photosynthesis on a wide range of habitats from marine, fresh water and waste water to terrestrial habitats. Microalgal diversity has enabled microalgae to colonize and adapt a various ecological condition including those of alkaline water and hot springs. The ability of microalgae to produce various organic compounds amid environmental challenges has created an evolving bioprospecting research arena. Contemporary research is mainly focused on the value of microalgae as a source of nutraceuticals, biofuels, animal feed, bioremediation, and bioactive therapeutic compounds, among others. This research focuses on metagenomic phylogenetic characterization of microalgae from two saline lakes (Lake Natron and Lake Rukwa) and the coast of Indian Ocean (marine ecosystem). The project also aims at studying the bioactivity of extracts from selected microalgal genera on selected viral strains and cancer cell lines and characterizing the chemistry of the extracts and related mechanism of action of the most potent compound.

Geographic locations: Rukwa, Arusha, Tanga

Research Questions :(i) What is the phylogenic pattern of microalgal communities from the selected ecosystems (ii) What are the effects of the extracts from microalgae on viral strains? (iii)What are effects of the extracts from microalgae on cancer cell lines? (iv) What is the chemical ingredients and structures of bioactive compounds in the extracts? (v) How does the most potent compound medicate antiviral or anticancer activity?

3.2Action plan

		2019		2020											
	Activity details	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	Revise manuscript and submit to journal (<i>Antibiotics</i>)														
2	Receive and analyse DNA and RNA seq data from MacroGen (Objective I)														

3	Receive and analyse proteome and metabolome data from Creative Proteomics (objective III)														
4	Cultivate Spirulina for biomass production														
5	Chemical extraction and antiviral assays (Objective II)														
6	Proteomics and metabolomics II and bioinformatics														
7	Thesis writing and submission														

Table 1-4: DONATH DAMIAN (2016-07-00292)

4.1 Popular summary

Ticks are important vectors and reservoirs of broad range of pathogens which are capable of causing diseases in humans, livestock and wild animals. They have been implicated as arthropod vector of many viral, bacteria and protozoa agent. Their long life cycle, expansive range of habitats and ability to feed on wide array of vertebrates immensely contribute to their potential for disseminating infectious agents to susceptible hosts. They are second only to mosquitoes as important arthropod vectors for spreading viruses from wildlife to domestic animals and humans. Therefore, this project aims at undertaking metagenomic profiling approach to identify ticks and tick-borne viral diversities circulating within the wildlife-livestock ecosystem in Mvomero district, Tanzania.

Geographic locations. Wildlife-livestock interface of Mvomero district, Morogoro, Tanzania

Research Questions: (i)What are the most common ticks species found within wildlife-livestock interface in Mvomero District, Tanzania?(ii)Which ticks species are the most important carriers of viruses?(iii)What is the genetic diversity of tick-borne virus present in wildlife-livestock interface, Mvomero District?

4.2 Action plans

		2019		2020											
	Activity details	N	D	J	F	M	A	M	J	J	A	S	O	N	
1	Manuscript writing and responding the comments from supervisors (Objective 1)														
2	Analysis of sequences of DNA and writing the first draft of Manuscript (Objective 2)														
3	Receiving viral RNA HTS data from Macrogen Europe and starting data analysis (Objective 3)														
4	Manuscript writing for Objective 3														
5	Receiving viral DNA HTS data from Macrogen Europe and starting data analysis (Objective 4)														
6	Manuscript writing for Objective 4														
7	Thesis writing and submission														

Table 1-5: Jackson Thomas Mollel(2016-07-00366)

5.1 Popular summary:

Anti-retroviral (ARV's) drugs improve the quality and extend the life span of HIV/AIDS patients. However, challenges such as drug resistance, toxicity, lack of curative effect, limited availability and high cost necessitate the need to explore other anti-HIV agents. Medicinal plants are known to be excellent sources of anti-HIV. This project aims to explore anti-HIV-1, inhibitory properties and cytotoxicity activity of medicinal plants used for treatment and management of HIV/AIDS in Tanzania.

Geographic locations: Kariakoo market in Dar es Salaam, hot spring at Galanos in Tanga, Utete in the coastal region, Kilwa in Lindi, Kisaki and Matombo in Morogoro, Chemka in Arusha, Katesh in Manyara and Kilambo in Kyela district.

The research questions: (i). What are medicinal plants highly traded in Kariakoo market for treatment and management of HIV/AIDS? (ii) What are medicinal plants surrounding the hot springs in Tanzania, which are used for treatment and management of HIV/AIDS? (iii) Does the plant extracts inhibit HIV-1?(iv)Which stage of the HIV-1 life cycle is targeted? (v) What are compounds with anti-HIV-1 inhibitory activity?

5.2 Action plans

		2019		2020											
	Activity details	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	Field visit for collection of medicinal plants which demonstrated a promising antiviral activity														
2	Extraction of crude extracts														
3	Bioassay guided fractionation														
4	Structural elucidation														
5	Time addition assay, yield reduction assay and virucidal assay														
6	To passage the virus in sub-optimal concentration of the active compound to induce\select resistant														

	mutations and sequencing to identify antiviral targets													
7	Viral culture, inoculation of active extracts and observation under the electron microscopy to observe structural effects of active compounds on the virus structure													
8	Bioinformatics analysis and of the mutant virus to identify antiviral targets													
9	Manuscripts preparation and publication													
10	PhD thesis writing													
11	PhD thesis submission and defence													

Table 1-6: Herieth Rhodes Mero (2016-07-00296)

6.1 Popular summary

Cassava is cultivated as a major drought-tolerant staple food crop in Africa, Asia and South America communities. It is highly rich in starch and has multiple commercial applications in various industrial sectors such as pharmaceuticals, cosmetics, biopolymers, textile and biofuels. Even though extensive research work have been conducted in Africa for the past few decades to identify and understand the mechanism by which Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD) hamper cassava production, poverty persist among farmers because scientists have not yet succeeded to control the devastating diseases through breeding of the virus-resistant cassava varieties. Lack of insights on the current genetic diversity patterns and a knowledge gap on genetic resources constituting chloroplast genomes of Tanzanian Cassava land cares and wild cassava relatives are the major constraints to cassava breeding programs in Tanzania. Investigation on the genetics of Tanzanian cassava land cares and wild cassava relatives as well as genomics of cassava chloroplast are the major objectives of this study. Vital genetic information gathered from this study will guide geneticists/ breeders in improving the ongoing cassava breeding and germplasm conservation programs in Tanzania.

Geographic locations: Tanga, Kibaha, Bagamoyo, Ruvuma, Mtwara, Kagera, Mwanza, Pemba, Unguja Mafia, and Tabora.

Research questions:

(i) What is the genetic diversity pattern of Tanzanian cassava in selected farmer preferred land cares and selected cassava wild relatives? (ii) What genetic information can be obtained from chloroplast genome databases of domesticated cassava cultivars and cassava wild relatives in Tanzania for biotechnology applications? (iii) What is the evolution rate of chloroplast genomes between Tanzanian cassava genotypes and wild cassava relatives?

6.2 Action plans

		2019		2020											
	Activity details	Oc- Dec		J	F	M	A	M	J	J L	A	S	O	N	D
1	Whole Genome Sequencing (WGS) of Cassava Brown Streak Viruses (CBSVs) <i>(Objective I)</i>														
2	(i) Time-series sample collection (ii) PCR-AND Sequencing <i>(Objective II)</i>														
3	Bioinformatics analysis of sequence data at SLU, Sweden <i>(Objective I & II)</i>														
4	(i) Time-series samples collections in the screen house (i) Analysis of the collected samples by digital PCR <i>(Objective III)</i>														
5	(ii) Write-up, of the PhD thesis and manuscripts (iii) Thesis Submission														
6	Defence of the PhD thesis														
7	PhD graduation														

Table 1-7: Bernadether T. Rugumisa: (2016-07-00356)**7.1 Popular summary:**

The composition of vaginal microbiome of pregnant women is dominated by *Lactobacillus species*. Vaginal microbiome of pregnant women has a critical role in prevention or facilitation of adverse pregnancy outcomes depending on dominating *Lactobacillus species*. Pregnancy comes with physiological, anatomical, immunological and microbiological changes in a woman's body to support fetal development. Sufficient inter-pregnancy interval is required to allow rebuilding, healing and restoration to normal of maternal body and to reduce the risk of adverse outcomes of a subsequent pregnancy. There is still a gap of knowledge in factors affecting maternal vaginal microbiome patterns and how the patterns prevent or fuel the risk of adverse pregnancy outcomes to both mother and child. The goal of this study is to evaluate how inter-pregnancy interval influences the structure and composition of vaginal microbiome during the first trimester in pregnant women who conceive in less than six months or in at least six months later following abortion, and its subsequent impact on pregnancy outcomes.

Geographic locations: Muhimbili national hospital-Dar es Salaam Tanzania

The research questions: (i)What is the significance of interpregnancy interval following abortion on vaginal microbiome of a subsequent pregnancy?(ii)What type of vaginal microbiome lead to adverse pregnancy outcomes?

Action plans

S/ N	Activity details	2019		2020											
		N ov	D ec	Ja n	F eb	M ar	A pr	M ay	Ju n	J u l	A ug	Se p	O ct	N ov	
1	Data analysis and Manuscript writing (<i>Objective 2</i>)														
2	Data analysis and Manuscript writing (<i>Objective 3</i>)														
3	16S gene sequencing (<i>Objective 1</i>)														
4	Bioinformatics analysis of sequence data and manuscript writing (<i>Objective 1</i>)														

5	PhD thesis writing and submission													
6	PhD thesis defense													

Enclosure 7: Subprogramme Original Budget 2015-2020 (Compiled Summary)

Date: 12 April 2015

Sub Program: Capacity building in interdisciplinary Molecular Biosciences Program

Period: 2015-2020

Tanzanian Institution/Dept: Molecular Biology and Biotechnology

Collaborating Institution/s in Sweden:Uppsala ; Gothenburg , Lund , Swedish Agricultural University

Tanzania	2015/16 SEK	2016/17 SEK	2017/18 SEK	2018/19 SEK	2019/20 SEK	Total SEK
Curriculum development	195,920	-	-	-	-	195,920
Research equipment	3,106,967	-	-	-	-	3,106,967
Maintenance	-	-	8,000	8,000	16,000	32,000
Research consumables	27,000	270,000	135,000	125,000	125,000	682,000
Travel	78,000	65,000	39,000	125,000	26,000	333,000
Field/Lab work	65,840	117,120	68,320	31,040	-	282,320
Student fees	-	127,720	114,860	114,860	114,860	472,300
Student stipends	44,348	245,218	245,218	203,218	218,744	956,746
Conferences	-	34,400	-	136,280	137,600	308,280
Publication costs	-	4,800	-	33,600	33,600	72,000
Travel insurance	4,000	2,000	1,200	2,800	2,400	12,400
Audit	-	-	-	-	-	-
Other costs	63,040	174,680	33,040	129,540	33,040	433,340
Indirect costs	-	-	-	-	-	-
SUB TOTAL 1	3,585,000	1,041,000	645,000	909,000	707,000	6,887,000
Sweden	2015/16 SEK	2016/17 SEK	2017/18 SEK	2018/19 SEK	2019/20 SEK	Total SEK
Supervision	400,000	400,000	400,000	1,650,000	200,000	3,050,000
Curriculum development	-	-	-	-	-	-
Lecturing on courses	-	164,000	54,000	54,000	-	272,000
Other costs	-	-	-	-	-	-
Indirect costs	-	-	-	-	-	-
SUB TOTAL 2	400,000	564,000	454,000	1,704,000	200,000	3,322,000
ISP - student allowance, exchange	2015/16 SEK	2016/17 SEK	2017/18 SEK	2018/19 SEK	2019/20 SEK	Total SEK
SUB TOTAL 3	448,000	346,000	450,000	532,000	242,000	2,018,000
TOTAL SUBTOTAL 1+2+3	2015/16 SEK	2016/17 SEK	2017/18 SEK	2018/19 SEK	2019/20 SEK	Total SEK
	4,433,000	1,951,000	1,549,000	3,145,000	1,149,000	12,227,000
INSTITUTIONAL FEES (10%)	443,300	195,000	1,549,000	315,000	115,000	1,223,000
GRANDTOTAL	4,876,300	2,146,000	3,098,000	3,460,000	1,264,000	13,450,000

MEMORANDUM OF UNDERSTANDINGS:

The Department of Molecular Biology and Biotechnology where IMB sub-programme is hosted through the UDSM management, In the due course of implementing the program activities, apart from the four MoUs signed with our Swedish from Uppsala, SLU, Lund and Gothenburg, two other collaborations have been made and the following MoUs has been signed with the following Institutions:

i) University of Cape Town (UCT) – South Africa

ii) University of Istanbul – Turkey

Both collaborations aim at joint researched on Interdisciplinary molecular Biosciences related issues.

ENGENDERING AGRIBUSINESS ENTREPRENEURSHIP (ENGAGE)

2.11 TITLE OF THE SUBPROGRAMME: Engendering Agribusiness Entrepreneurship (ENGAGE)

PLAN SUB-PROGRAMMES/PROJECTS (July 2020 – June 2021)

Contact information

Cooperating Institution:	Swedish Institution:
University of Dar es Salaam Business School Address: P.O.Box 35046, Dar es Salaam-TANZANIA Contact person: Prof.Lettice Kinunda-Rutashobya Tel: +255 22 2410006 Mob: +255 713323661/+255 755323661 e-mail: letticer@yahoo.com, lettice@udbs.udsm.ac.tz	Swedish University of Agricultural Sciences (SLU), Sweden Address: Box 7012, SE-75007 Uppsala, Sweden Contact person: Linley Chiwona-Karlton; Tel: Phone: +46-18-672757; +46-73-9516424 (cell) e-mail: Linley.chiwona.karlton@slu.se

1. Summary of Achieved Results/Subprogramme Progress

The program is intended to address the need for a gender informed value chain approach when studying agriculture and entrepreneurship. Failure to grasp the bigger picture has led to fragmented agricultural value chains in Tanzania, which points to the need for innovative models and approaches that will ensure inclusive and sustainable rural development. This research programme therefore intends to build research capacity at the University of Dar es salaam Business School as applied to gender and agribusiness entrepreneurship

Hence, the new *postgraduate research training program in Engendering Agribusiness Entrepreneurship – ENGAGE* –that University of Dar es Salaam Business School (UDBS) proposes to establish in collaboration with the Swedish University of Agricultural Sciences (SLU) aims at training the next generation of researchers, whose intended outcome is to increase the quantity and improve the quality of teaching and research outputs at the Business School. ENGAGE will

provide a much-needed national platform for conducting research in gender, agribusiness and entrepreneurship. Over the next five years, the program will train a total of 3 PhD candidates through joint PhD course teaching and supervision, contribute to 5 joint UDBS-SLU publications, support short term staff exchanges, organize 3 thematic workshops, conduct three researches and design and organize a taught PhD program in agribusiness and rural entrepreneurship.

2. General objectives and expected results

The **overall development objective, or goal**, of the ENGAGE program is to contribute to broad-based agricultural growth and inclusive poverty reduction through knowledge-creation in regard to gender and agribusiness entrepreneurship.

The programme specific objectives, or purpose:

- **Specific Objective 1:** To improve the quality of postgraduate programmes
- **Specific Objective 2:** Capacity Building to increase doctoral level trained experts in the area of gender and agribusiness entrepreneurship

Achievement of the above objectives will enhance the research and training capacity at UDBS in the areas of gender and agribusiness entrepreneurship, which, through the publications of UDBS researchers and their engagement in policy dialogues, also will contribute to enhancing the understanding of agricultural value chains in Tanzania from a gender and entrepreneurial perspective.

To achieve the above objective the ENGAGE program will in the next 5 years (2015-2020):

- i) Train 3 PhDs
- ii) Design and implement a new taught PhD level program on Agribusiness and rural entrepreneurship
- iii) Organize 3 thematic workshops on proposal and scientific paper writing for both students and staff,
- iv) Conduct three researches,
- v) Disseminate the research findings through participation in both local and international conferences,
- vi) Conduct and support short term staff exchanges for joint project activities
- viii) Publish at least 5 joint UDBS-SLU publications in the areas of gender and agribusiness

entrepreneurship,

Planned Outputs 2015-2020

- 3 PhD graduates by 2020
- 3 PhD dissertations
- A PhD level curricula programme on agribusiness and rural entrepreneurship designed and is running by 2020
- Short term staff exchanges for PhD supervision and research publications
- 3 thematic workshops organized
- At least 6 scientific papers presented at international conferences
- Minor equipment procured
- 5 papers published in refereed journals

Achieved Results/Progress to be made until June 2020

- h) Three 3 PhD students (one female) (Mesia Ilomo, Merezia Wilson and Mohamed Semkunde) were successfully recruited in 2016. These students, who are jointly supervised by UDBS and SLU are at various levels in terms of progress. Mesia and Merezia are expected to submit their PhD theses in September and December 2020 respectively, while Mohamed will submit his thesis in January 2021. All the candidates are at data analysis, thesis writing, and writing of papers for publication stage.
- i) The ENGAGE sub-programme developed new taught PhD curriculum on Agribusiness and Rural Entrepreneurship in 2017, which was accredited by TCU in December, 2019. The program is part of the taught PhD curriculum in Management which started running in November 2019.
- j) Two PhD level courses on gender in rural entrepreneurship and Science and leadership were successfully delivered to PhD students regionally during this period, leading to a 100% achievement of the milestone.
- k) Minor equipment-5 laptops for PhD candidates and PIs were procured during the 1st year of the project.
- l) 4 papers have been published in refereed international journals; as well as 1 book chapter. Also 9 papers have been presented at international conferences
- m) 2 Policy briefs titled "Rural Entrepreneurship: Promoting gender equitable participation in agri value chains for rural development" were presented to stakeholders conferences in November, 2018 (Dar es Salaam) and November, 2019 (Dodoma).

- n) The ENGAGE sub-program experience has led to some spinoffs. A Sida Funded Regional Programme on Engendering Rural Transformation (ENTRUST) (2019 – 2024), modelled on ENGAGE program has been established at the University of Rwanda – College of Agriculture & Veterinary Medicine in collaboration with SLU. In the next phase the ENGAGE sub-program will work closely with ENTRUST to establish a regional PhD program and a centre of excellence in agribusiness entrepreneurship. Already some of the ENTRUST activities have been planned to be implemented in collaboration with UDBS ENGAGE staff.

3. Target (July 2020 – June 2021)

Targets and Planned Activities from 1st July 2020 to 31st June 2021

19. As mentioned earlier, the 3 PhD students are at different stages toward completing their studies. All 3 students will need more support to enable them complete their studies, and write some articles for publication which is also a condition for them to graduate. They will therefore need to spend more time at SLU, Sweden in order to accomplish the above as proposed below:

- Ms Merezia Wilson will need 4 months from (August to November 2020).
- Mr. Mesia Ilomo, will need 2 months (August to September 2020).
- Mr. Mohamed Semkunde will need 4 months (August to November 2020).

To realize this the students will flight tickets to Sweden and subsistence allowances (stipends). The sub-programme will also need resources for supervision, hence supervision fees to Swedish supervisors.

Justification: The ENGAGE sub program is an interdisciplinary program where students came in with specific backgrounds (Accounting, Finance and Marketing). They needed time to adopt new concepts and new literature in place which bring in new area of expertise in UDBS. New taught PhD program in Management which has just started in UDBS needs trained human resource to run the program. During the period also Merezia got a baby and was on maternity leave for 6 months. Also Mohamed has had challenges with his facing a life threatening illness.

20. 5 supervisors from UDBS will visit SLU, Sweden in August 2020: i) to attend PhD presentation seminars by the candidates, ii) attend a conference in Umea And iii) embark on proposal writing for the next phase of Sida application.

On conference participation in Umea, we have submitted a panel on the theme Engendering Agribusiness, rural transformation and sustainable development to the DevRes2020 conference <https://devres2020.se/abstract>. Students from ENGAGE (3) and ENTRUST (3) at the University of Rwanda as well as the scientists in the programme have all submitted abstracts. It is planned that we will all attend this conference, 5 supervisors from Sweden;

3 supervisors from UDBS; and 2 supervisors from UR.

Budget: To realize this the 5 UDBS supervisors will need flight tickets to Sweden and subsistence allowances (per diems). 5 SLU supervisors will need resources for train travel, accommodation, per diem, and registration fee. 3 UDBS supervisors will need resources for train tickets and registration fee.

21. Three supervisors of PhD students will visit Sweden for 5 days to participate in 90% defence of PhD students Merezia and Mohamed in November 2020. **Budget:** air tickets and per diems
22. All the 5 Swedish Supervisors will be involved in ensuring that the students complete their studies latest February 2021. At least one supervisor and the PI per candidate will travel to Tanzania to attend the PhD defence at UDSM. **Budget:** Air travel and subsistence allowance
23. Three of the peer reviewed publications are planned to be open access. Hence a budget for this purpose will be needed.
24. A Proposal writing and Project Management two weeks Phd Course for the students and staff members will be conducted in February 2021. This is a course that will include an expert on financial project management and control. Due to intensive supervision of the candidates in the end, this course will be designed and offered in the extension phase. It is a new course that takes into account the needs and skills that are required to be effective in proposal writing and project management. **Costs** refer to time required for designing and planning.

TOTAL EXTRA FUNDS BEING REQUESTED

Total extra funds being requested is as follows UDBS/UDSM SEK 699,851, Sweden SEK 1 402 750, and ISP SEK 180 000. Total is SEK 2,282,601.

There is no carryover funds from both the UDBS and SLU

3.1 Programme objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

3.1.1 Planned and the specific activities to be carried out:

- The 3 PhD students will make their last trip to Sweden to complete their thesis write up and write manuscripts for publication in respectable journals- Merezia Wilson (August to November 2020), Mesia Ilomo (August to September, 2020) and Mohamed Semkunde (August to November 2020) .
- All the 3 candidates will attend and present papers at the University of Umea DevRes2020 conference <https://devres2020.se> with the theme Engendering Agribusiness, rural transformation and sustainable development.

Planned publications by Merezia:

1. Journal article 1

Title: The role of spatial context in promoting women rural entrepreneurship

Authors: Merezia Wilson, Lettice K. Rutashobya, Johan Gaddefors, Lemayon Melyoki and Opira Otto

Submission: March, 2020; *Journal of Business Management Review (BMR)*

2. Journal article 2

Title: Women rural entrepreneurship: beyond farming and processing

Authors: Merezia Wilson, Johan Gaddefors, Lettice K. Rutashobya, Opira Otto and Lemayon Melyoki,

Submission: July, 2020; *Journal of Entrepreneurship Theory and Practice (ET&P)*

3. Journal article 3

Title: Re-thinking social norms through women rural entrepreneurship

Authors: Merezia Wilson, Lettice K. Rutashobya, Johan Gaddefors, Opira Otto and Lemayon Melyoki

Submission: January, 2021

Planned publications by Mesia:

1. Mesia Ilomo, Lettice Kinunda Rutashobya, Esther K. Ishengoma, Katarina Pettersson, Johanna Bergman-Lodin, **Doing and undoing gender in the rice business and marketplaces** (for submission to Journal of African Business)
2. Mesia Ilomo, Johanna Bergman-Lodin, Lettice K. Rutashobya, Katarina Pettersson, Esther K. Ishengoma, **Gendered participation in the rice value chain: exploring the how and why** (for submission to Business Management Review)
3. Mesia Ilomo, Katarina Pettersson, Johanna Bergman-Lodin, Lettice K. Rutashobya, Esther K. Ishengoma, **Men doing and undoing gender in women-dominated workplaces** (for submission to Gender in Management: An international Journal)

Planned publications by Mohamed:

1. Mohamed Semkunde^{ab}, Goodluck Charles^a, Elly Tumsifu^a, Johan Gaddefors^b, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Nature and Structures that support Women Producer Groups engaged in rural entrepreneurship. To be submitted to Journal of Business Management Review end April 2020
2. Mohamed Semkunde^{ab}, Johan Gaddefors^b, Goodluck Charles^a, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Similar birds fly together: From self-help to rural entrepreneurship. To be submitted to Journal of Agribusiness in Developing and Emerging Economies or Journal of Entrepreneurship in Emerging Economies
3. Mohamed Semkunde^{ab}, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Navigating group dynamics and stereotypes in women producer groups: Lessons from performing rural enterprises. To be submitted to International Journal of gender and Entrepreneurship

3.1.2 Expected Deliverables

Ms Merezia Wilson will submit PhD thesis in December 2020 and defend thesis in February 2021

Mr. Mesia Ilomo will submit and defend thesis in September and November, 2020 respectively

Mr. Mohamed Semkunde will submit and defend thesis in January and March 2021 respectively

Each candidate in collaboration with supervisors publishes 3 papers making a total of 9.

The new PhD curricula in Agribusiness and rural entrepreneurship will be kick-started during 2020/2021.

3.2 Programme objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

3.2.1 Planned and the specific activities to be carried out:

None

3.2.2 Expected Deliverables

None

3.3. Programme objective 3: Increase the quality and use of research relevant to high priority issues of national development

3.3.1 Planned and the specific activities to be carried out:

A policy brief will be prepared

5 papers presented at conferences

Supervisors prepare joint manuscripts for publications

3.3.2 Expected Deliverables

A policy brief

10 publications

3.4 Programme objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3.4.1 Planned and the specific activities to be carried out:

Three UDBS/UDSM staff to visit Sweden in October 2020 to work on formulation and preparation of application for next phase

Activities

- Meetings with Swedish partners and University of Rwanda ENTRUST project staff
- Writing of proposal

3.3.4 Expected Deliverables are:

- Draft proposal completed

4. Analysis and Justification

It is expected that all 3 candidates will complete their studies by March 2021 given the resources requested and given effective supervision.

It is also expected that the manuscripts planned will be completed during the period and submitted for publication. There may be delays in this area but supervisors will work hand in hand with the students to ensure early completion.

5. Enclosures

- 27. Sub-program **Overall Aggregated Budget**
- 28. Subprogramme Detailed Budget
- 29. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 30. Aggregated Student Progress and Plan (July 2020-June 2021)
- 31. Students Individual Plans and Popular Summary of the Study
- 32. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: Sub-program Overall Aggregated Budget

Date:	1-Jun-20									
Name of Sub program:	ENGAGE									
Fiscal Year:	2020/2021									
Tanzanian Institution/Dept:	UDSM/UDBS									
Collaborating Institution in Sweden:	SLU/Department of Urban and Rural Development									
OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum		0		0		0	-	-	-	-
Research equipment		0		0		0	-	-	-	-
Maintenance		0		0		0	-	-	-	-
Research Consumables		0	10,000	2400000		0	10,000	2,400,000	10,000	2,400,000
Travel		0	350,750	84180000	155,250	37260000	506,000	121,440,000	506,000	121,440,000
Field/Lab work		0		0		0	-	-	-	-
Student fees		0		0		0	-	-	-	-
Student stipends x		0		0		0	-	-	-	-
Coferences		0		0	90,275	21666000	90,275	21,666,000	90,275	21,666,000
Publication costs		0		0	2,300	552000	2,300	552,000	2,300	552,000
Travel insurance		0	10,542	2530000	5,750	1380000	16,292	3,910,000	16,292	3,910,000
Cost related to Research		0		0		0	-	-	-	-
Cost of Training		0		0		0	-	-	-	-
Coordination Cost		0		0		0	-	-	-	-
Others		0		0		0	-	-	-	-
Transfer of Funds to Sweden	0	0	0	0	0	0	-	-	-	-

Bank interest	0	0	0	0	0	0	-	-	-	-
Audit		0		0		0	-	-	-	-
Indirect costs		0	44,555	10693200	30,429	7302960	74,984	17,996,160	74,984	17,996,160
SUB TOTAL	-	-	415,800	99,803,200	284,000	68,161,000	699,900	167,964,200	699,900	167,964,200
Sweden										
Supervision	0	0	422,500	101400000	211,250	50700000	633,750	152,100,000	633,750	152,100,000
Curriculum development	0	0	57,000	13680000	0	0	57,000	13,680,000	57,000	13,680,000
Lecturing on courses	0	0	0	0	379,000	90960000	379,000	90,960,000	379,000	90,960,000
Coordination and project management	0	0	73,000	17520000	24,000	5760000	97,000	23,280,000	97,000	23,280,000
Dissemination and communication	0	0	54,000	12960000	0	0	54,000	12,960,000	54,000	12,960,000
Other costs	0	0	0	0	50,000	12000000	50,000	12,000,000	50,000	12,000,000
Indirect costs	0	0	49,000	11760000	83,000	19920000	132,000	31,680,000	132,000	31,680,000
SUB TOTAL	0	0	655,500	157,320,000	747,250	179,340,000	1,402,750	336,660,000	1,402,750	336,660,000
ISP - student allowances	-	-	90,000	21,600,000	90,000	21,600,000	180,000	43,200,000	180,000	43,200,000
SUB-TOTAL_ISP	-	-	90,000	21,600,000	90,000	21,600,000	180,000	43,200,000	180,000	43,200,000
GRAND TOTAL	-	-	1,161,300	278,723,200	1,121,250	269,101,000	2,282,650	547,824,200	2,282,650	547,824,200

Detailed Budget and Plan

Enclosures 1: ENGAGE (July 2020–June 2021)															
S/N				Source of Fund		2020						2021			Activity Justification
	Planned Activity	Origin of the Activity ¹	Proposed Budget	Original Budget ²	Extra Fund ³	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
		(New/Carried over)	SEK	SEK	SEK										
OB1	Objective 1: To improve the quality of postgraduate programmes														
UDSM PLANS :															
1.8															
Subtotal			0	0	0										
OB2	Objective 2: Capacity Building to increase doctoral level trained experts in the area of gender and agribusiness entrepreneurship														
UDSM PLANS															
2.1	1PhD in the area of Agribusiness, gender and Rural Entrepreneurship. 1 Mesia Ilomo	Carry-Over	26,400		26,400										To stay in Sweden from August to September- Writing two papers and finishing the PhD Monograph
2.2	1PhD in the area of Agribusiness, gender and Rural Entrepreneurship. 2 Mohamed Semkunde	Carry-over	26,400		26,400										To stay in Sweden from August to November, Finishing PhD Monograph ready for submission

2.3	1PhD in the area of Agribusiness, gender and Rural Entrepreneurship. 3 Merezia Wilson	Carry-over	26,400		26,400									To stay in Sweden from August to November, Finishing PhD Monograph ready for submission
2.4	PhD supervision	Carry-over	426,800		426,800									Planned activity for supervisors to attend the 90% PhD presentations in Sweden. Guide the students in their final stages as they accommodate comments received.
2.5	Conference Paper Presentation	Carry-over	90,275		90,275									3 Supervisors and 3 Students to present 3 papers in international conferences in order to enhance the paper for publication in referred journals
	Next Phase Planing &preparation meeting	new	10,000		10,000									As planned

	Publication costs	new	2,300		2,300									Agreed in order to increase readability and dissemination of the findings as per Sweden/SLU requirements, all publications shall be made open access
	Travel Insurance		16,292		16,292									
	Indirect Cost		74,984		74,984									Institutional fee
Subtotal			699,851		699,851									
Sweden														
	Supervision		633,750		633,750									
	Curriculum development		57,000		57,000									
	lecturing on Courses		379,000		379,000									
	Coordination and project management		97,000		97,000									
	Dissemination and Communication		54,000		54,000									

Subtotal			1,220,750	-	1,220,750										
Others															
5.2	Overhead in Sweden	Carried Over	132,000		132,000										
5.3	Other costs	Carried Over	50,000		50,000										
Subtotal			182,000	-	182,000										
	ISP		180,000		180,000										
Grand Total			2,282,600.67	-	2,282,600.67										

Enclosures 5: Sub-programme Results-Based Management Logical Framework for Plan from July 2020 to June 2021

Summary Problem Statement: The program will address the need for a gender informed value chain approach when studying agriculture and entrepreneurship. Failure to grasp the bigger picture has led to fragmented agricultural value chains in Tanzania, which points to the need for innovative models and approaches that will ensure inclusive and *sustainable* rural development. This research programme therefore intends to build research capacity at the University of Dar es salaam Business School as applied to gender and agribusiness entrepreneurship.

Overall Objective: of the ENGAGE program is to contribute to broad-based agricultural growth and inclusive poverty reduction through knowledge-creation in regard to gender and agribusiness entrepreneurship.

Specific Objective 1: To improve the quality of postgraduate programme by introducing a PhD program on gender and agribusiness entrepreneurship and other thematic courses

Specific Objective 2: Capacity Building to increase doctoral level trained experts in the area of gender and agribusiness entrepreneurship

Result Matrix

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas						
3 PhD's trained in the process of research education Doctoral candidates specialized in gender and agribusiness entrepreneurship	2.1 3 PhD students (at least 1 woman) specializing on gender and agribusiness	No. of PhD students Graduating (and at least one female) by 2021	0	All PhD students have completed their PhD studies by 2021	Students have been based in Sweden due to COVID19 though this was planned.	

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
	<p>entrepreneurship graduate by 2021</p> <p>2.2 Increased number of registered doctoral students at UDBS by 2021 at least 33% women</p>					
To continue with a stable environment due to COVID19 for working, students plan to stay on in Sweden until September. They will visit home for 5 months and return to conclude and attend the DEVres conference in June 2021	Students have at least 1-2 manuscripts submitted for publication in peer reviewed journals; Thesis monograph drafts submitted for review and defense	<p>Number of manuscripts submitted/published</p> <p>Number of thesis submitted</p>	0	<p>3 manuscripts Published</p> <p>3 PhD dissertations successfully completed</p>		
1 Course Project Management & Proposal Writing for enhanced external grants	1 Course	Number of courses successfully executed	2	1		
Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines						

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
nil	nil	nil	nil	nil		
Specific Objective 3: Increase the quality and use of research relevant to high priority issues of national development						
Papers Published in peer reviewed journals	3.2 At least 3 papers published in peer reviewed journals, 3 others are submitted and are being reviewed by March 2021.	Number of publications	2 papers published per year	3 published articles, 3 under review		
Paper to focus on impact of COVID19, gender and food security	At least one paper published in a peer-review journal by June 2021	Peer reviewed article	Strengthened Afric wide scientific partnership	1 Paper		
International Conference participation	3.2 5 papers presented at international conferences by March 2021	Number of papers presented		5 papers in conference proceedings		
Policy brief	At least one policy brief prepared	Policy brief document	0	1 policy brief presented at the annual Sida/UDSM research conference		
Specific Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas						

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Proposal for the next phase prepared in collaboration with the UDSM Gender Centre, the College of Agriculture, Current Food Security Sub program and Institute of Development Studies and with Swedish partners and University of Rwanda.	Draft proposal completed by May 2021	Proposal Document and Number of partners established	Current Sida funded University of Rwanda's ENTRUST program where ENGAGE staff will be serving as resource persons	At least 2 meetings organized with Swedish partners and University of Rwanda and local partners by June 2021		
A Scientific panel on Engendering rural transformation and sustainable development accepted at the DEVRES conference June 2021	Scientific Conference panel	Number of abstract, papers submitted and presented in the panel	Number of accepted abstracts	Panel executed and number of participants attended and number of papers presented		
Assumptions for Specific Objective 4: Partners are willing to work with us. This shouldn't be problem however as preliminary discussions have taken place						

Enclosures 4: Aggregated Student Progress and Plan (July 2020-June 2021)

PhD training Name of research student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected / Year of completion	Sandwich PhD Expected / Year of Completion	Progress %	Prel. title of dissertation
PhD students							
1.Merezia Wilson Bambaganya. Reg No. 2016-)7-00259 Email: merezia@udbs.udsm.ac.tz	F	2016	12	September 2020		60%	Rural entrepreneurship in Tanzania: Socio-spatial context and women engagement in agribusiness
2.Mesia Ilomo Research. Reg no: 2015-07-00153 Email: ilomo5@yahoo.com	M	2016	9	December 2020		70%	Gender and participation of women and men in the rice value chain and rice marketplaces in Tanzania
3. Mohamed A. Semkunde.Reg No. 2016-7-00256 Email: moudyvan@gmail.com	M	2016	9	January 2021		60%	Rural Entrepreneurship in women Producer Groups: The case of Rice Producers in Tanzania
MSc. Students							
TOTAL							
	3						

6. Students Individual Plans and Popular Summary of the Study

6.2 Popular Science summary

1. Student Name: Merezia Wilson

Rural entrepreneurship in Tanzania: Socio-spatial context and women engagement in agribusiness.

Researches have portrayed rural women as key players in the agricultural sector, especially in Sub-Saharan Africa. However, the precise process by which these women actually engage in rural agribusiness entrepreneurship is not well understood. There is limited knowledge about practices and processes involved in agribusiness entrepreneurship and the contribution that women make to rural development. This suggests that women's contribution to socioeconomic development is not adequately reported and sufficiently appreciated. The research at hand sought to shed light on rural women's entrepreneurship by investigating the rural context and the processes by which this context influences women engagement in rural entrepreneurship. The research has been guided by three research questions. These are: (i) what are the rural entrepreneurial activities that women are engaged in the agricultural sub-sector? (ii) How does socio-spatial context influence women's engagement in rural entrepreneurship? (iii) How does women's engagement in rural entrepreneurship influence the socio-spatial context?

The research findings show that women engage in a wide range of rural agribusiness entrepreneurial activities well beyond farming and processing. These engagements include organizing women to engage more in agribusiness, overcoming negative societal perceptions on women's engagement in agribusiness, overcoming religious constraints, obtaining permission from husbands, participating in community voluntary environmental conservation activities, place branding and place bridging. Further, findings reveal that these engagements (those besides farming and processing) contribute considerably to social-cultural and spatial transformation with positive implications for overall rural development. Despite the importance of these engagements, they are oftentimes described in passing, and not directly connected to the farming or processing businesses. Instead, they tend to be identified with care for other women and community wellbeing and not with entrepreneurship. It appears that the tendency to study women rural agribusiness entrepreneurship from a single perspective (that is, farming), has led to a narrow view of women engagements, which in turn undermines women's contribution to rural development.

To support development of effective policies and strategies for improving women rural entrepreneurial engagements, a number of socio-spatial enabling and constraining factors have been identified. The enabling factors are resources availability, creative re/combination of resources, embeddedness, place name, (none) governmental interventions, social capital and utilization of local and non-local resources. Constraining factors are lack of ownership and access to resources, rurality (distance and remoteness), lack of power to make decision, negative perception attached to women entrepreneurs, negative religious influence, institutional bureaucracy, lack of sustainable supportive interventions and underdeveloped infrastructure. We

also strongly stress that while traditional physical capital is required and plays a crucial role in agribusiness entrepreneurship, social factors equally influence women rural entrepreneurial engagements and should hence not be neglected.

Finally, this study has revealed the need to effectively communicate the change phenomenon, which is crucial in entrepreneurship research and analyse it from different perspectives. It is important that researchers and policy makers acknowledge the existence of multiple versions of entrepreneurship and learn how they complement or contradict each other. Similarly, there is need to approach entrepreneurship as a societal phenomenon rather than as a purely economic reality and relate it to other spheres of life in order to understand what is going on inside the black box of entrepreneurship.

2. Student Name: Mohamed A. Semkunde

Title: Rural Entrepreneurship in women Producer Groups: The case of Rice Producers in Tanzania

My PhD studies focus on investigating rice producer groups and how specifically, women groups navigate the challenges, barriers, and opportunities in rural entrepreneurship. The studies seek to explain how collective efforts such as self-help groups, formally registered groups, and volunteer groups could facilitate in overcoming gender norms, practices and values in rural entrepreneurship in sub-Saharan Africa.

The studies were conducted in Shinyanga and Kahama Rural districts in Northern Tanzania where rice production is the second most important crop after maize. Both men and women engage in rice production and marketing activities. While men dominate the marketing of rice, women have traditionally been more visible in rice production activities such as planting, weeding and bird scaring. Men have shown more presence during the harvesting period. I have employed a qualitative approach to acquire a deeper understanding of how groups may influence rural entrepreneurship in the rice value chain. Fifty-six interviews, comprising key-informants, in-depth interviews, observations and focus group discussions took place during 2017-2019.

Preliminary results reveal three main findings. Firstly, there are critical moments occurring in the lives of the women that motivate them to seek other women and to come together in groups for solving their problems, specifically those related to income generation and family well-being. Secondly, formation of the groups was not random, but carefully considered issues of inclusion in membership such as, marital status, age, residence and “the good woman behaviour”. A good woman referred to one that was submissive to the husband if she was married. Additionally, a good woman was one that did not misbehave based on the defined community values, such as excessive alcohol consumption or being seen to be a “loose woman”. As such if a woman was single and young, the groups had to make sure that elderly women vetted the individual. Older widowed women were perceived as stable and exhibited behaviour regarded as “good” risk-taking in

entrepreneurial activities. In contrast, a young widowed woman classified as a single woman and could not be accorded the same privileges. Thirdly, by belonging to and being an active member of rice producer groups, women could overcome most of the gender related norms, practices and values. Explicitly, they could access resources such as financial, social capital, market networks, trainings and government support. Interestingly, by belonging to these groups, the women's mobility was not as restricted and travelling to market rice in distant places was acceptable, all in the name of "a good woman". A good woman was one that contributed financially to the well-being of the family and household.

The findings have implications for interventions that promote gender equality and rural entrepreneurship for rural development. Local government policies and development initiatives need to increase their awareness and understanding of how "the good woman behaviour" as well as "the good woman" determines participation in rural entrepreneurship activities. Lastly, the critical moments or events occurring in the lives of the women played an important role in motivating women to seek other women to undertake rural entrepreneurial activities.

3. Student Name: Mesia Ilomo

Gender and participation of women and men in the rice value chain and rice marketplaces in Tanzania

There appear some differences on participation of women and men in the rice crop, which is transforming from food to cash crop. Rice, the third most important food crop in Tanzania after maize and cassava, is increasingly replacing other food crops in consumer baskets in the country. It is the most important food crop in Kyela, the source of the most preferred rice in Tanzania. Through inputs from various stakeholders in Kyela, this study presents the participation of women and men in the rice value chain at task-level. It shows that both women and men participate in farming, where women dominate some tasks such as weeding, threshing, and drying, whereas the men dominate other tasks such as land preparations and chemical applications. The study highlights the way women participation in some tasks such as herbicides applications is underrated because of performing invisible roles, particularly in fetching water. Further, women are found to dominate processing and trading thereby refuting the common narrative that women's involvement in the rice value chain is more or less limited to the farming node, with few women engaging in higher value nodes like processing and trading. The study further shows how the norms, mechanization, personal factors, geography, and increased commercialization of rice seem to influence participation of women and men in the value chain.

The study also highlights the way gender facilitates or constrains participation of women and men in the rice business and marketplaces. It shows men joining the rice business in Kyela, which was originally dominated by women. The study highlights how various processes including interactions, and division of labour at family level and at workplace either facilitate or constrain

women and men participation in the rice business. Marketplace structures and sophistications of rice processing technology seem to favour more men than women. Normative conceptions, which also change as actors interact, further influence the nature of participation and location of business for women and men traders. The observed change in participation, primarily against women, may have negative effect on household welfare as women tend to spend more of their income on household food, health, and education.

This study has both research and policy implications. This research focused on rice, a traditionally female dominated food crop. Using the analytical framework used in this study to study other similar and related crops and markets may lead to results different from this one. At policy level, the study shows the need for detailed task-level analysis for appropriate agricultural interventions. It also highlights the benefits of current government interventions in value addition to rice but also hints some of the possible unintended consequences. The study reiterates the need for gender integration at planning, implementation, and evaluation stage of agricultural projects. Otherwise, intervention for gender equality may ended-up exacerbating gender inequality.

6.2 Detailed student activities and action plan

6.2.1 Merezia Wilson (2016-07-00259)

S/ N	Activity details	2020												2021		
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
1	Working the chapter 5; findings															
2	Working on supervisor's comments on Journal article 1															
3	Writing chapter 6; analysis															
4	Submitting Journal article 1 for publication															
5	Writing chapter 7; discussion															
6	Working on journal article 1 reviewers' comments and re-submit															
7	Update the introductory chapters, (background, literature review, and methodology chapters)															
8	Writing manuscript of journal article 2															
9	Writing chapter8;conclusion and recommendations															
10	Working on supervisors' comments on journal article 2 for submission															
11	Finalizing thesis writing															

	(monograph)														
12	Submitting the intent to submit														
13	writing manuscript for journal article 3														
14	Reviewing and submission of thesis monograph														
15	Preparing for defense														

Note: February – June (stay at Swedish University of Agricultural Sciences (SLU), Sweden)
August – November (Expected days of stay at SLU, Sweden)

Proposed Journal Articles:

4. Journal article 1

Title: The role of spatial context in promoting women rural entrepreneurship

Authors: Merezia Wilson, Lettice K. Rutashobya, Johan Gaddefors, Lemayon Melyoki and Opira Otto

Submission: March, 2020; *Journal of Business Management Review (BMR)*

5. Journal article 2

Title: Women rural entrepreneurship: beyond farming and processing

Authors: Merezia Wilson, Johan Gaddefors, Lettice K. Rutashobya, Opira Otto and Lemayon Melyoki,

Submission: July, 2020; *Journal of Entrepreneurship Theory and Practice (ET&P)*

6. Journal article 3

Title: Re-thinking social norms through women rural entrepreneurship

Authors: Merezia Wilson, Lettice K. Rutashobya, Johan Gaddefors, Opira Otto and Lemayon Melyoki

Submission: January, 2021

Journal: *International journal of Gender and Entrepreneurship*

7. Journal article 4 (project joint papers)

Title: Serial and Portfolio Female Entrepreneurs in Rural Areas: Motivations and Outcomes/Benefits

Journal: *African Journal of Economic and Business Management*

8. Gender and rural entrepreneurship in the digital era

Authors: Lettice, Mesia, Merezia, Mohammed, Linley

Book contribution: submission May 2020

9. Journal article 5 (project joint papers)

Title: How relevant is rural entrepreneurship for industrialization?

Authors: Melyoki, Merezia and Mesi

6.2.2: Mesia Ilomo (2015-07-00153)

		2020												2021
S/ N		Feb *	Mar *	April *	May *	Jun e	Jul y	Aug *	Sept *	Oc t	No v	De c	Jan - Jun	
	Task													
1	Revision of paper 1													
	Submission of Paper 1 to the journal													
2	Thesis write-up													
	Finalize data analysis													
	Write discussion and conclusion chapters													
	Update introduction, literature review, and methodology chapters													
3	Developing paper 2													
	Submit paper 2 to the journal													
4	Intention to submit the thesis													
	Finalize the													

	thesis write-up												
5	Submit the thesis												
6	Developing paper 3												
	Submit paper 3 to the journal												
7	Graduation												

Note: *refers to the months of research stay at Swedish University of Agricultural Sciences (SLU), Sweden February-May 2020 and August to September 2020.

Title of the papers

4. Mesia Ilomo, Lettice Kindunda Rutashobya, Esther K. Ishengoma, Katarina Pettersson, Johanna Bergman-Lodin, **Doing and undoing gender in the rice business and marketplaces** (for submission to Journal of African Business)
5. Mesia Ilomo, Johanna Bergman-Lodin, Lettice K. Rutashobya, Katarina Pettersson, Esther K. Ishengoma, **Gendered participation in the rice value chain: exploring the how and why** (for submission to Business Management Review)
6. Mesia Ilomo, Katarina Pettersson, Johanna Bergman-Lodin, Lettice K. Rutashobya, Esther K. Ishengoma, **Men doing and undoing gender in women-dominated workplaces** (for submission to Gender in Management: An international Journal)

6.2.3 Mohamed A. Semkunde (2016-07-00256)

S/N	Task	2020												2021		
		Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	ch
1	Revision of paper 1															
	Submission of Paper 1 to Business Management Review Journal															
2	Thesis write-up															
	Finalize data analysis															
	Write results and interpretation chapter															
	Write discussion chapter															
	Write Conclusion and implication chapter															

	Update introduction, literature review, and methodology chapters														
	Organizing monograph chapters														
3	Developing paper 2														
	Submit paper 2 to the journal														
4	Intention to submit the thesis														
	Finalize the thesis write-up														
5	Submit the thesis														
6	Developing paper 3														
	Submit paper 3 to the journal														
7	Expected time for PhD defense														

Note: February – May (Five months at SLU, Sweden)

August – November (Four months at SLU, Sweden compiling thesis monograph and manuscripts).

Proposed Manuscripts and Journal Articles

Mohamed Semkunde^{ab}, Goodluck Charles^a, Elly Tumsifu^a, Johan Gaddefors^b, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Nature and Structures that support Women Producer Groups engaged in rural entrepreneurship. To be submitted to *Journal of Business Management Review* end April 2020

Mohamed Semkunde^{ab}, Johan Gaddefors^b, Goodluck Charles^a, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Similar birds fly together: From self-help to rural entrepreneurship. To be submitted to *Journal of Agribusiness in Developing and Emerging Economies* or *Journal of Entrepreneurship in Emerging Economies*

Mohamed Semkunde^{ab}, Lettice Rutashobya^a, Linley Chiwona-Karltun^b. Navigating group dynamics and stereotypes in women producer groups: Lessons from performing rural enterprises. To be submitted to *International Journal of gender and Entrepreneurship*

Note: ^aUniversity of Dar es Salaam Business School (UDBS); ^bSwedish University of Agricultural Sciences (SLU).

INNOVATION AND SUSTAINABILITY IN TOURISM

ANNUAL PLAN 2020/2021

TO BE SUBMITTED JOINTLY BY COLLABORATING SUB-PROGRAMME COORDINATORS TO OVERALL COORDINATOR

Project no. 2280 on Innovation and Sustainability in Tourism

Contact information

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Objective and Specific Objectives 2015-2020

The overall objective of the project is to build research capacity through training in order to conduct quality researches that promote innovation and sustainability of tourism resources for inclusive development. More specifically, the project had five objectives:

- SO1: Capacity building in research and training on innovation and sustainability of tourism resources for inclusive development
- SO2: Develop curriculum for Master and PhD degree programmes
- SO3: Enhance linkages and collaboration between universities in one hand and between universities and the industry on the other for outreach programmes
- SO4: Establish the multidisciplinary research center in tourism
- SO5: Strengthen the university's publication record by organizing and participating in both international and local conferences for dissemination of quality research output and conduct short term trainings on scientific writing skills for junior academic members of staff

Specific Objectives and expected deliverables during the extension period July 2020 – June 2021

During the extension period July 2020 to June 2021, the project intends to conclude some of the postponed activities. These include the following:

SO2. Develop curriculum for Master and PhD degree programmes

- Conclude approval of Curriculum on Masters in Tourism and Hospitality Management

SO3: Enhance linkages and collaboration between universities in one hand and between universities and the industry on the other for outreach programmes

- At least four (4) joint publications
- Four (4) UDBS academic staff members spend at least a month at UG for joint scientific writing and/or training
- Five (5) outreach activities in terms of seminars conducted for industry and practitioners (i.e. Training and coaching of tourism and hospitality providers)

SO5: Strengthen the university's publication record by organizing and participating in both international and local conferences for dissemination of quality research output and conduct short term trainings on scientific writing skills for junior academic members of staff

- international conference on sustainable tourism in developing countries (ICST-DC) organised
- Publication of the Book: Tourism and Sustainable Development in Tanzania
- Participation in international Conferences

Other

- Preparation for the next-Sida phase 2021-2026
- Establish regional and international links and cooperation

Enclosure 1: Activities

Activity No.	NAME	DETAILS	TOTAL	SEK	GU,SW (SEK)	TOTAL SEK
1.	Organizing Conference: International Conference on Sustainable Tourism in Developing Countries, Theme: Innovation and Sustainability in Tourism	Organized in collaboration between Department of Marketing and UDSM Centre for Tourism Research; At University of Dar es Salaam, June 2021	25,000,000	93,000		
2.	Publication of the Book: Tourism and Sustainable Development in Tanzania	Dar es Salaam University Press Submitted in November 2019	12,000,000	45,000		
3.	Outreach and dissemination activities by four PhD graduates [Theresia Busagara, Msafiri Njoroge, Patrokil Kanje & Said Suluo]	Coastal, Lakeside, Northern & Southern Zones from February - March 2021	48,000,000	178,000		
4.	Curricula for Masters	Department of Marketing by Dec 2020	10,500,000	39,000		
5.	Participation in international Conferences	September 2020-June 2021	18,000,000	66,000		
6.	2-month Stays at Gothenburg for articles writing by (Theresia, Kanje & Suluo) ¹	April & May 2021	39,000,000	145,000		
	Staff Exchange [Prof. Dev Jani] ²	Return ticket & two months' stipend April & May 2021	13,000,000	48,000		
7.	Preparation for the next-Sida phase 2020-2025 7.1 Sustainable tourism development in the Western/Lakeside of Tanzania –participatory workshops, interviews, and prototypes	University of Dar es Salaam, Gothenburg University, Makerere University & Simon Fraser University Geita, Mwanza & Kagera January -February 2021	72,500,000	268,500		
	7.2 Proposal Development (TZ-SW-CA-UG Research Collaboration 2021-2026)	University of Dar es Salaam, Gothenburg University, Makerere University & Simon Fraser University	30,000,000	110,000		

¹ Budget line will be needed for associated costs at University of Gothenburg

²Overheads' costs at University of Gothenburg will be required

		[Mossberg, L; Anderson, W; Francis, J & Henriksson, K] March to May 2021				
	TOTAL		268,000,000	992,500	414,500	1,407,000

Enclosure 2: Overall Budget

Date: 1st March 2020 Sub Program: Research Management Subprogramme Period: 1st July 2020 to 30th June 2021 Tanzanian Institution/Dept: University of Dar es Salaam OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum	39,000	9360000		0		0	-	-	39,000	9,360,000
Research equipment		0		0		0	-	-	-	-
Maintenance		0		0		0	-	-	-	-
Research Consumables		0		0		0	-	-	-	-
Travel		0		0		0	-	-	-	-
Field/Lab work		0		0		0	-	-	-	-
Student fees		0		0		0	-	-	-	-
Student stipends x		0		0		0	-	-	-	-
Conferences	530,000	127200000		0		0	-	-	530,000	127,200,000
Publication costs	45,000	10800000		0		0	-	-	45,000	10,800,000
Travel insurance		0		0		0	-	-	-	-
Cost related to Research	268,500	64440000	55,000	13200000	55,000	13200000	110,000	26,400,000	378,500	90,840,000
Cost of Training		0		0		0	-	-	-	-
Coordination Cost		0		0		0	-	-	-	-
Others		0		0		0	-	-	-	-
Transfer of Funds to Sweden	0	0	0	0	0	0	-	-	-	-
Bank interest		0		0		0	-	-	-	-
Audit		0		0		0	-	-	-	-
Indirect costs		0		0		0	-	-	-	-
SUB TOTAL	882,500	211,800,000	55,000	13,200,000	55,000	13,200,000	110,000	26,400,000	992,500	238,200,000
Sweden										
Supervision		0		0		0	-	-	-	-
Curriculum development		0		0		0	-	-	-	-
Lecturing on courses		0		0		0	-	-	-	-
Travel Costs		0		0		0	-	-	-	-
Dissemination and communication		0		0		0	-	-	-	-
Other costs		0	207,399	49775760	207,399	49775760	414,798	99,551,520	414,798	99,551,520
Indirect costs		0		0		0	-	-	-	-
SUB TOTAL	0	0	207,399	49,775,760	207,399	49,775,760	414,798	99,551,520	414,798	99,551,520
ISP - student allowances		0		0		0	0	0	0	0
SUB-TOTAL_ISP	-	-	-	-	-	-	-	-	-	-
GRAND TOTAL	882,500	211,800,000	262,399	62,975,760	262,399	62,975,760	524,798	125,951,520	1,407,000	337,751,520

Activity 1: Organizing Conference: International Conference on Sustainable Tourism in Developing Countries

SO5: Strengthen the university's publication record by organizing and participating in both international and local conferences for dissemination of quality research output and conduct short term trainings on scientific writing skills for junior academic members of staff

- Three (3) bi-annual international conferences on sustainable tourism in developing countries (ICST-DC) organized by 2020

This activity was to be done in June 4th and 5th 2020, but it has been postponed due to the COVID-19 pandemic



UNIVERSITY OF DAR ES SALAAM

**The 6th International Conference on Sustainable Tourism in Developing Countries
(ICST-DC 2020)**

Theme: **Innovation and Sustainability in Tourism**

Jointly Organized by:

**Department of Marketing and Centre for Tourism Research of the University of Dar-es-Salaam,
Tanzania and Centre for Tourism of Gothenburg University, Sweden**

Venue: **University Of Dar-es-Salaam, Dar es Salaam, Tanzania**

Date: **4th - 5th June 2021**

Proudly Sponsored by Sida



An Overview of the ICST-DC 2021

The International Conference on Sustainable Tourism in Developing Countries (ICST-DC) is the 6th in a series of successful tourism conferences jointly organized by the Department of Marketing, Centre for Tourism Research of the University of Dar-es-Salaam and Centre for Tourism of Gothenburg University, Sweden.

The conference is held in recognition of the Tourism sector as one of the leading sectors of several developed and developing economies with unlimited potential. ICST-DC was started in 2010 and is being held every other year. For this year, the conference will be held at the **University of Dar es Salaam** from **4th to 5th June 2021**. It will be preceded by a PhD colloquium which is scheduled for **3rd June 2021**. The conference is expected to draw paper presenters and participants from across the globe. Renowned resource persons from the tourism industry and academia will conduct special sessions at the conference. The conference provides a unique convergence of networking, learning, inspiring keynote speeches, discussions, industry-academia conversations, plenary speeches, and workshops along with publication avenues.

Full papers and abstracts should be submitted directly to: icst-dc@udbs.udsm.ac.tz; cc: qusa5@yahoo.com, c.c. yogi_dev@hotmail.com. Submitted full papers will be peer-reviewed to be published in the conference proceedings. Abstracts will be considered for presentation only.

Keynote Speakers



Prof. Catalina Sampol

Catalina Natividad Juaneda Sampol is PhD in Economics by the University of Barcelona. From 1993 she is Chair Professor of Applied Economics at the University of the Balearic Islands (UIB). She has been Dean of the Faculty of Economics and Business, Head of the Department of Applied Economics and Vice-Rector for Internationalization and Cooperation. She has been the Director of the Official Master in Tourism and Environmental Economics and Director of the PhD program in Tourism and Environmental Economics. Her field of teaching and research is in Statistics, Econometrics and Tourism Economics.



Dr. Freddy Manongi

Dr. Manongi (PhD) started his career as wildlife ranger in 1982, moved to become wildlife officer with Anti-Poaching unit of the wildlife department. He then joined the College of African Wildlife Management in Tanzania in 1991 and worked as a tutorial assistant. Between 1991 and 2013, he rose through the ranks from tutorial assistant to Principal of the College. He was appointed Conservator of Ngorongoro Conservation Area Authority in 2013. Between 1999 and 2001, he worked as environmental advisor at the Ministry for Finance and Development Planning with the Government of Botswana. He has vast experiences in aspects of conservation policy and planning.



Prof. Lena Mossberg

Prof. Mossberg (PhD) is professor in marketing, in the School of Business, Economics and Law at Gothenburg University, Sweden and Professor II in innovation and experience economy at Nord University, Norway. She has interests in consumer behaviour and consumption, consumer experiences, service encounters, and destination image. Mossberg has been involved in several international tourism and marketing programs, not least in her capacity as tourism management expert for the UN and the EU. She was the Swedish Co-Principal Investigator (PI) of UDSM-Sida Programme 2009-2014 on Tourism and Sustainable Development Project and the current PI of Project No. 2280 on Innovation and Sustainability in Tourism under UDSM-Sida Programme 2015-2020.



Prof. Dr. Ruhet GENC

Prof. Ruhet Genc is a full-time Professor at Turkish-German University Economics & Administrative Sciences Department. He intends to see all issues from management and strategy point of view. His research interests are Sustainability, Innovation, Gastronomy, Value Creation, Medical Value Tourism, and Tourist Behavior and Quality of Life.

Conference Theme:
“INNOVATION AND SUSTAINABILITY IN TOURISM”

Sub-Themes

Papers may be presented on a range of topics or sub themes focusing on, but not limited to, the following:

- 1. The Sustainability of Natural and Cultural Resources in Tourism for Inclusive Development**
 - Sustainable tourism– challenges, opportunities and other issues facing the sector
 - Natural assets hunting and poaching versus conservation paradoxes
 - Innovation systems, management of natural resources and tourism
- 2. Tourism Resource Efficiency, Social Inclusiveness and Conservation for Economic Growth**
 - Tourism development and growth patterns and processes
 - Determinants of sustainable use of tourism resources
 - Motivation for conservation of natural resources and social inclusiveness/exclusion
 - Gender and tourism
- 3. Innovations and Entrepreneurship in Tourism for Sustainable and Inclusive Development**
 - The sources of innovation in tourism enterprises
 - Entrepreneurship, innovation and inclusive green growth in the tourism sector
 - Business environment, drivers and barriers to innovation and entrepreneurship in tourism
- 4. Community Involvement in the Country's Tourism Planning and Policies**
 - Support structures and public policy frameworks in influencing entrepreneurship and innovation in the tourism sector

Important Dates

- March 15, 2021: Deadline for abstracts
- March 16, 2021: Registration begins
- April 30, 2021: Deadline for Full paper submission
- May 30, 2021: Registration ends
- June 01, 2021: Release of final conference programme

Arranged Tours to Zanzibar Islands

Experience the beauty of Zanzibar Islands. Zanzibar Stone Town was declared a UNESCO World Heritage Site in 2000, due to its unique mixture of Arab, Persian, Indian, and European influence in its architecture and heritage. Zanzibar is a destination well known for sun and sand beach tourism, culture and tradition, history and archaeology, traditional sailing dhows, carved wooden door chests, culinary tourism and scent of clove.

Conference Fees & Optional Costs for Arranged Tours

Category	Rates	Coverage
Conference Participants	\$ 200	Conference materials, refreshments, lunches
Students	\$150	
Arranged Tour to Zanzibar	\$200	Return boat tickets and access to attractions.

Organizing and Scientific Committee

Dr. Omari K. Mbura, University of Dar es Salaam, Tanzania

Prof. Wineaster Anderson, University of Dar es Salaam, Tanzania

Prof. Lena Mossberg, University of Gothenburg, Sweden

Dr. John R. Philemon, University of Dar es Salaam, Tanzania

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Karibu Tanzania

Activity 3: Outreach and dissemination activities by four PhD graduates [Theresia Busagara, Msafiri Njoroge, Patrokil Kanje & Said Suluo]

This is implementation of Specific Objective No. 5 of the Project No. 2208- Innovation and Sustainability in Tourism under the UDSM-Sida Programme 2015-2015on: Five (5) outreach activities in terms of seminars conducted for industry and practitioners (i.e. Training and coaching of tourism and hospitality providers)

This Project empowered four PhDs (Msafiri Njoroge, Patrokil Kanje, Theresia Busagara and Said Suluo) to acquire research capacity and skills on innovation and sustainability in tourism. To exploit the research capacity built, this outreach program aims at enhancing linkages and collaboration between academia and the industry through:

- a) dissemination of research findings to industry stakeholders and obtain practical feedback and
- b) develop policy briefs and a handbook for training of practitioners on sustainable tourism management.

Program Design

The outreach program will involve information sharing workshops and seminars in the five main tourism zones in Tanzania, namely Southern, Northern, Coastal, Western and Lakeside Zone. The program will disseminate research findings in form of policy briefs and solicit feedback from various industry stakeholders. Both private and public stakeholders are expected to participate in the program. In particular, the program will involve leaders of tourism organizations (e.g. hotels managers, representatives of tour operators, and cultural enterprises), officials from local councils, government departments, and tourism-oriented non-governmental organizations. The program will involve about 20 participants in each outreach zone.

Planned Outreach Activities and Implementation Plan

The outreach and dissemination activities are expected to be undertaken between February and March 2021 as illustrated in the matrix below:

	Time Schedule			
	February 2021		March 2021	
Zones	2 nd Week	3 rd Week	1 st Week	2 nd Week
1. Lakeside Zone				
2. Northern Zone				
3. Coastal Zone				
4. Southern Zone				
5. Western Zone				

Msafiri Njoroge

Specifically, the research findings and recommendations to be disseminated reflect on several research questions:

- a) In the hospitality industry, what are the key issues for business to be regarded entrepreneurial?

- b) In the hospitality industry, what does it take for a firm to become sustainable i.e. to attain corporate sustainability?
- c) How can firms' entrepreneurial decision making processes be drivers for business sustainability in the hospitality industry?
- d) How can sustainable benefits be enhanced within the hospitality industry in the destination economy?

Theresia Busagara

This sub-program covers three topics Developing Cultural Tourism Programs/Inclusive tourism development through Cultural Tourism:

- Enhance community engagement in tourism-related activities
 - Provides direct income to rural communities
 - Reduces poverty
- Promotes and preserves local culture
- Diversifies tourism products at destination

Patrokil Kanje

The outreach program is meant to disseminate the findings from the PhD thesis for uptake by private and public sector stakeholders in the tourism sector. The main focus of the study was marketing tourist destinations through social media. The study suggests some important issues to be taken on board by stakeholders in order to exploit social media opportunities to market destination Tanzania. The rationale for this outreach program is therefore to develop action points for the implementation of the recommendations of the study. Thus, a presentation which mainly focuses on the practical and policy implications of the findings will be made to the stakeholders followed by a discussion. The discussion will be guided to yield action points for implementation by both private and public sector stakeholders.

Said Suluo

This sub-program covers three topics that will be presented in the planned workshops:

- i] Corporate sustainability practices undertaken by tourism firms in Tanzania.
- ii] The relationship between corporate sustainability practices and financial performance.
- iii] The design of websites for corporate sustainability communication.

Proposed title: Sustainable Tourism & Innovations for Inclusive Development in Tanzania

Tanzania is among the top ten countries that have abundant natural resources (WEF, 2015), with the contribution from tourism currently estimated at 18% of the country's GDP. Currently, the sector supports over 600,000 direct jobs and 1,337,000 total jobs through direct and indirect linkages, which is equivalent to 12.2% of the nation's total employment³ (MNRT, 2018). By 2028, direct jobs in the tourism sector are expected to have risen to 795,000 (which will constitute 4.0% of total employment). From 2012, tourism has been a leading sector in foreign-exchange earnings and it is the 3rd largest recipient of FDIs after mining and manufacturing (FYDPII). This economic contribution could be elevated even more by using innovative and contextually supportive management approaches and policies. Essentially, more than 25% of Tanzania's land is earmarked as wildlife and natural protected areas.

Given its endowment and having exceptionally rich natural and cultural tourism assets of world heritage status, the tourism sector in Tanzania is an ideal vehicle for propelling growth and poverty reduction. This notwithstanding, however, constraints do exist in the way to a full utilization of the potential of the tourism sector in the country. Over concentration of tourism in few geographical areas and overreliance on a single tourism product threatens not only the physical environment but also the inclusive economic growth. Involvement of local communities in developing the tourism destinations in the underdeveloped geographical sites and products is necessary; and therefore the need for well thought scientific research as means to an end.

In particular, wildlife is so far the dominant tourism product in Tanzania, with wildlife safaris in the northern tourist circuits involving up to 80 percent of all tourists visiting the country. Also there are a significant number of tourism activities in the coastal tourist circuits. That makes the northern and coastal tourist circuits more popular in both applied and scientific research in tourism sciences. The fact that the monotony of a particular tourism product tends to limit repeat visitations over time [the Butler's Tourism Area Life Cycle (TALC) model]; the diversification framework is needed for innovation and sustainability. The TALC model posits that a certain destination begins as relatively unknown and visitors initially come in small numbers due to limited access, facilities and local knowledge (Miller and Gallucci, 2004). As more people discover the destination, both research and practitioners' information spreads about its attractions and the amenities continue to be increased and improved. Tourist arrivals then begin to grow rapidly toward some theoretical carrying capacity, which entail social and environmental limits.

The potential for inclusive tourism development in the coming years is high if the sector is backed with appropriate strategic approaches. To be more specific, developing a viable framework for community involvement and the diversification of the tourism sector geographically and product-wise, with the purpose of ensuring the sustainable tourism development is proposed in the national plans⁴. The proposed theme "*Transformative Research and Innovation for Industrialization and Inclusive Development*" is well in-line with the Government of the United Republic of Tanzania's call to promote geographical and product-wise diversification in the tourism sector for sustainability reasons. The inclusive destination development

³ Ministry of Natural Resources and Tourism (2018). Revised National Tourism Policy. Unpublished

⁴ Ministry of Natural Resources and Tourism (2019). Towards a comprehensive strategy for tourism diversification, growth and development in Tanzania: Quick Win

approach, value chain analysis and sustainable livelihoods analysis are desirable in the underdeveloped tourist circuit such as the lakeside, western and southern tourist circuits.

For example, the overreliance on mining and extractive industries for the past five decades in the lakeside regions, have not been able to offer potential for sustainable legacies and alleviate the extreme poverty. The challenges that natural resource dependent regions face include their remoteness, dominance of single industry, lack of upstream or downstream linkages able to generate viable local economic base as well as threat to culture and social cohesion. Tourism development offers one such avenue for local communities' involvement. Several studies point to the need for more inclusive tourism models of local development in order to create sustainable legacies (e.g. Bakker & Messerli, 2017; Scheyvens & Biddulph 2018; Francis, Henrikson & Anderson, 2020)⁵. Community investments need to take a territorial and inclusive approach to development that ensures individual initiatives are integrated and aligned – this can happen through for example pooling of resources, co-financing, common planning platforms and supply-chain integration systems-centered solutions.

Moreover, in view of the current importance and the growth potential of the tourism sector, the Government puts highest priority on its development as a major economic pillar in the Second Five Year Development Plan (FYDP, 2016-2021). The potential of the tourism sector to the industrial development initiative envisioned in the FYDP 2016-2021 is yet to be tapped. The tourism sector creates demand for industrial products, thus attracting more tourist arrivals (with diverse interests and preferences) will lead to higher demand of output from the manufacturing sector, if handled well⁶. Thus, the sector has great potential for stimulating pro-poor economic growth due to its spill over effects to other sectors of the economy, including manufacturing and agriculture where a majority of Tanzanians are employed.

The proposed cluster therefore intends to develop a viable framework for inclusive tourism development through the diversification of the tourism sector geographically and product-wise, with the purpose of ensuring the sustainable tourism development in Tanzania. The purpose of this cluster would thus be enhancing inclusive tourism development through research in a manner that would inform management strategies and policy aimed at achieving a self-sustaining development in this area. The following research areas complements the already apparent effort by the government of Tanzania to foster development of the tourism sector as articulated in the 2nd FYDP.

Challenges:

- (i) Over 30% of the country's exports are related to extractives yet this is not translating into benefits at the local level
- (ii) Concentration of tourism business and research activities in few geographical areas and overreliance on one tourism product line - wildlife safaris
- (iii) Limited involvement of local communities in the tourism development and destination management in the rural areas

⁵ Francis, J., Henrikson, K, & Anderson, W. (2020). Leveraging the power of tourism for inclusive development and collaborative advantage. Paper presented in Academy of International Business Africa& US Northeast & Special Joint Conference 2020 Facing The Disruptive Forces in Global The Way Forward January 6- 9, 2020 United States International University Business: Africa Chandaria School of Business, Nairobi, Kenya

⁶Anderson, W., Mossberg, L. & Andersson, T (2019). The Nexus of Tourism and Industrialization in Tanzania: Potentials and Challenges. In Anderson, W., Mossberg, L. & Andersson (Eds), *Tourism and Sustainable Development*. Forthcoming

- (iv) Weak local linkages between the tourism sector and other key economic sectors such as agriculture, manufacturing, etc
- (v) Untapped natural and cultural heritage opportunities for tourism;
- (vi) Low innovative and supportive management approaches to tap revenues from tourism;
- (vii) Inadequate recognition of tourist attractions in the least developed tourism areas for socio and economic development

Strategies:

- (i) Support the creation of diversified sustainable legacies in the mining dependence regions
- (ii) Diversify tourism geographically and product-wise in the four tourist zones (i.e. Lakeside, Southern, Western and Coastal tourist circuits)
- (iii) Develop inclusive tourism models for the undeveloped tourist circuits
- (iv) Strengthen local linkages between the tourism sector and other key economic sectors
- (v) Widening the range of people who contribute to decision-making about development of tourism
- (vi) Providing opportunities for new places to be on the tourism map
- (vii) Encouraging learning, exchange and mutually beneficial relationships which promote understanding and respect between 'hosts' and 'guests' in the least developed tourism areas.

Planned activities

SN	Activity, Venue and Timeline	Responsible persons/universities involved	Amount in TZS
1.	Establishing collaborations within the EAC for Ph.D. training to aim for a position as the leading actor for post graduate training (Master and Ph.D.) in East Africa.	College of Business and Management Science, Makerere University, Uganda [Anderson, W. to establish contacts]	-
2.	Establishing collaborations with other universities outside Africa as a multilateral collaborations for capacity building through PhD training	Beddie Business School, Simon Fraser University, Canada [Contacts established, preparation of MoU is underway]	-
3.	Site visitation - Sustainable tourism development in the Western/Lakeside of Tanzania – participatory workshops, interviews, and prototypes [Activity organised by University of Dar es Salaam in Tanzania]	Prof. Wineaster Anderson – University of Dar es Salaam, Tanzania (TAN) [local transport for the PI & participants (local communities), snacks and soft drinks and perdiems] – Geita, Mwanza & Kagera	15,000,000
		Prof. Lena Mossberg, Gothenburg University, Sweden (SWE) [international & local transport and perdiems] – Geita, Mwanza & Kagera	10,000,000
		Kristina Henriksson/June Francis, Simon Fraser University, Canada (CAN) [international & local transport and perdiems] – Geita, Mwanza & Kagera	10,000,000
		Makerere University, Uganda (UGA)	7,500,000

		[international & local transport and perdiems] – Dar es Salaam	
4.	Proposal Development (TZ-SW-CA-UG Research Collaboration 2021-2026) [Activity organised by Gothenburg University in Sweden - international & local transport, Visa, Insurance and perdiems]	University of Dar es Salaam, Gothenburg University & Simon Fraser University [Mossberg, L; Anderson, W; Francis, J & Henriksson, K]	30,000,000

**CONSOLIDATING RESEARCH AND
ANALYTICAL CAPACITY IN FISHERIES AND
AQUACULTURE TECHNOLOGY FOR FOOD
SECURITY, ADAPTING TO CLIMATE CHANGE,
SUSTAINABLE RESOURCE MANAGEMENT AND
INCLUSIVE DEVELOPMENT**

EXTENSION PLAN FOR SUBPROGRAMMES: JUL 2020 – JUN 2021

TITLE OF THE SUBPROGRAMME: MARINE SCIENCES 2015-2020: Consolidating Research and Analytical Capacity in Fisheries and Aquaculture Technology for Food Security, Adapting to Climate Change, Sustainable Resource Management and Inclusive Development.

Contact information

<p>Cooperating Institution: University of Dar es Salaam: Institute of Marine Sciences (IMS), (Cost Centre Tanzania) Department of Aquatic Sciences and Fisheries (DASF) & Department of Botany (BOTANY), TANZANIA.</p>	<p>Swedish Institution: Stockholm University (SU): Department of Ecology, Environment and Plant Sciences (Cost Centre-Sweden) & Department of Physical Geography and Quaternary Geology Swedish University of Agricultural Sciences: Department of Biomedical Sciences and Veterinary Public Health, Department of Animal Breeding and genetics</p>
<p>Addresses: ¹ Institute of Marine Sciences (Cost Centre Tanzania), P. O. Box 668, Zanzibar, Tanzania. Contact Person: Dr. Kyewalyanga, Margareth, S. Director and Coordinator - Tanzania. Tel: 255 (024) 2232128; Mobile: 255 756 504 933 E-mail: mamakevin@gmail.com Contact Person: Dr. Mtolera, Matern, S.P. (Principal Investigator (PI) – Tanzania) Tel: 255 713 045 471 E-mail: mtolera@yahoo.co.uk; mtolera@ims.udsm.ac.tz Contact Person: Dr. Kitula, Rukia – Sub PI Tel: 255 655 230 023 E-mail: rukiakitula@gmail.com ² Department of Aquatic Sciences and Fisheries, P.O. Box 60091, Dar es Salaam Contact Person: Dr. Lugendo, Blandina – Head DASF Tel: E-mail: blandina_lugendo@yahoo.co.uk ³ Department of Botany, P.O.Box 35060, Dar es Salaam. Contact Person: Buriyo, Amelia Tel: 255 713 271 775 e-mail: buriyo@udsm.ac.tz</p>	<p>Adresses: ⁴ Department of Ecology, Environment and Plant Sciences (Cost Centre-Sweden), Stockholm University, Lilla Frescati 106 91 Stockholm, SWEDEN Contact person: Prof. Mats.Björk – (Coordinator Sweden) Tel: +46 702 656561 e-mail: Mats.Bjork@su.se ⁵ Department of Biomedical Sciences and Veterinary Public Health, (SLU), Sweden, Contact person: Dr. Anna Norman Haldén – (Vice Coordinator Sweden) Tel: e-mail: anna.norman-halden@slu.se ⁶ Department of Animal Breeding and genetics (SLU) Contact person: Prof. Dirk Jan de Koning, Principal investigator SLU Tel: e-mail: dj.de-koning@slu.se ⁷Department of Physical Geography and Quaternary Geology, SU Contact person: Ass. Prof. Håkan Berg, Tel: e-mail: hakan.berg@natgeo.su.se</p>

1.0 Summary of Achieved Results/Subprogramme Progress

Aquaculture (farming of aquatic organisms) output in Africa is presently growing faster (6-8%) than any other food-production subsector. The output (1.98 mill. tones) in 2016, for example, accounted for 17-18% of total fish produced (over 11 mill. tones). The contribution (14.2%) from Sub Saharan Africa (SSA), however, could not match its potential. Contribution from Tanzania, for example, is less than 1% (about 0.7%) and 5.3% to Africa and SSA outputs, respectively. It contributed less than 5% of the fisheries output (470,000) with per capita fish consumption (8 kg/year) less than half of the global average (20). Major challenges behind the unimpressive aquaculture growth include inferior seeds and feeds, information and credit inaccessibility. The BMSP 2015-2020 is committed facilitating the Tanzania Fisheries Policy 2015 aimed at doubling the fisheries output by 2025 and triple its contribution to the economy. To that end, the BMSP 2015-2020 intends to assess and generate /recommend technologies/knowledge suitable for, among others:

- (i) Promoting selective breeding programme for tilapia based on growth performance and robustness;
- (ii) Developing high quality low cost feeds and producing high quality seeds;
- (iii) Promoting integrated multi-trophic aquaculture (IMTA) with the view to stabilizing tilapia (inland and marine) and shellfish farming;
- (iv) Promoting sea cucumber farming through artificially hatching sea cucumber and silver pompano for sustained seed production;
- (v) Reducing the impact of climate change on fisheries, mariculture/aquaculture and the associated ecosystems and improve the role of coastal vegetation e.g. seagrass and mangroves in reducing greenhouse gases.

Potential impact of the BMSP by 2025

- (a) Development of a national tilapia breeding program with the view to facilitating the evolution of capacity for having an independent aquaculture industry based on its own supply of fingerlings/seeds.
- (b) Tilapia initiative to stimulate better aquaculture practices for other species such as sea cucumber, silver pompano etc. such that a sustainable fisheries seed production system may be in place.
- (c) Aquaculture for fisheries stock enhancement program to improve overall fisheries output;
- (d) Improved access to fish as a protein source for those most vulnerable to undernutrition, rural employment, reduce urban migration and its impacts while preserving Tanzania's natural inland and marine diversity and resources.

Milestones covered: In an effort to successfully implement measures (i)-(v) the program has so far carried out a number of activities involving partners from the Stockholm University (SU), Swedish University of Agricultural Sciences (SLU) and University of Dar es Salaam (UDSM). These include:

1.1 Capacity Building (Objective 1 and 2)

Human resource development: Out of the planned 14 PhD, 8 MSc and 4 Postdoctoral students planned for recruitment, the Program has recruited 16 PhD instead of 14 PhD with 7 (43.75%) being females. Out of 16 PhD, seven (7) of them have been registered in Swedish counterpart Universities (SLU (3) and SU (4)) and the remainder are registered at UDSM. Of the seven PhD registered in Sweden two are females. With four (4) MSc converted into two (2) PhD, the remaining four (4) MSc and three (3) Postdoctoral students have been recruited for enrolment in 2019/20.

The recruitment has successfully taken into consideration the need to develop capacities in the five (i-v) research areas crucial for promoting both capture fisheries and aquaculture output. One PhD student (Dr. Levinus Leonard (UDSM)) has successfully defended thesis in March 2019. The remainder are expected to defend their theses as follows:

- Two (2) PhD students (Angelina Michael (UDSM) and Francis P. Mmanda (SLU)) will defend their theses by end of June 2020;
- Three (3) PhD students (Olivia John (UDSM), Yusuf A. Yusuf (UDSM) and Batuli Yahya (UDSM)) will submit thesis for examination by June and defend by August 2020.
- Four (4) PhD students (Redempta Athanas (SLU), Christer Simon (SLU), Rashid Ismail (SU) and Mbiru Moses (UDSM)) will defend thesis by October 2020;
- One PhD student (Deogratias Mulokozi) will defend thesis by December 2020;
- Four PhD students (Barnabas Tarimo, John Mapunda, Mwasiti Rashid and Kulwa Mtaki) will defend their theses by March 2021
- One PhD student (Baraka Nyangoko) would need additional time due to health complications

A total of 5 PhD and 8 MSc were adopted from the last phase and all have graduated and secured employments. Of the five (5) PhD one (1) has been employed at UDSM, two (2) at Dodoma University, one (1) each at the Tanzania Fisheries Research Institute and the Department of Environment, Vice President's Office. Three of the eight (8) MSc have been employed by the UDSM, two (2) at SUZA, additional two (2) at the Tanzania Fisheries Research Institute and remaining one (1) proceeding with PHD in the program.

Creation and Review of Postgraduate curricula: All the three developed postgraduate programs (PhD in Applied Marine Sciences (Fisheries and Mariculture) (PhD AMS (FM)) at IMS, MSc in Sustainable Fisheries Management (MSc SUFIM) at IMS and MSc Fisheries and Aquaculture (MSc FA) at DASF) and the two reviewed (PhD in Aquatic Sciences at DASF and MSc in Marine Sciences at IMS) were successfully approved by the UDSM Senate in 2016. However only the reviewed programs have been offered since then. The newly developed programs (PhD AMS (FM) and MSc FA) have been approved in October 2019 and a revised MSc SUFIM has been resubmitted to TCU for approval in March 2020.

Infrastructure development: During the 2015-2020, Sida has allocated a total of SEK 6.6 million to facilitate IMS relocation from Mizingani (Stone Town) as headquarter to Buyu where IMS could realize its transformation dream. IMS aims to transform its three sections namely Marine and Coastal Resources (MCR), Marine Geosciences, Oceanography and Informatics (GOI) and Marine

Technologies and Innovations (MTI) into centres for (i) Marine Biodiversity, Food Security and Livelihood, (ii) Operational Oceanography and Ocean Sciences for Ocean Observations and Disaster Management, and (iii) Marine Technologies and Innovation for Development and Sustainable Utilization of Coastal and Marine Resources and Space.

1.2 Improved Visibility and Academic Reputation (Objective 2, 3&4)

During the period 2015/16-2019/20, the BMSP has published 35 peer reviewed research articles in international journals, contributed over 60 presentations in national/regional/international conferences and won four (4) out of seven (8) collaborative proposals for additional funding (USD 876,000). To facilitate development of a Mariculture Research Centre in Pangani, the UDSM has allocated 400 million for capital improvement and 145 million for acquisition of additional land for expansion of the center. The BMSP is also developing a collaboration program between the UDSM-IMS and Korea Institute of Ocean Sciences and Technology (KIOST; with a budget of USD 7 million) and the Tanzania-Korea Ministries responsible for fisheries' collaboration. Among others, Tanzania will have a fishing port and industrial complex constructed (budget USD 600 million). With regard to partnerships, the Program has managed to develop ten (10) (four national and six international level) partnerships and facilitated development of MoUs with KIOST in 2016, Leibniz Center for Tropical Marine Ecology GmbH (ZMT), Bremen, Germany in 2015 and China Normal University in 2015. In 2019/20 IMS has started a research collaboration with the University of Nha Trang, Vietnam and its MoU is being processed.

A special emphasis in partnership development has aimed at facilitating implementation of the BMSP noble responsibility to develop aquaculture strategy for Tanzania. Towards that end, the Program initiation workshop (held during 3-10 November 2015), agreed that the Program find ways to closely collaborate and establish partnerships with world institutions such as the International Centre for Living Aquatic Resources management (WorldFish; with its headquarters in Malaysia) and Universities in pioneer countries in aquaculture (e.g. China, Malaysia, Vietnam, Philippines, Cambodia and Thailand). Also agreed was that aquaculture lessons learned from them be shared with national stakeholders with the view to establish the way forward for aquaculture development in Tanzania.

1.2.1 International Research Consortium for Tanzania Aquaculture Development

In implementing the initiation workshop recommendations, the BMSP principal investigators and PhD students visited the WorldFish (Malaysia) during 1st-5th Aug 2016. Worldfish is the global hub for tilapia breeding with a vast experience of providing genetically improved fish for different smallholder and integrated systems. The aim of the visit was to experience state-of-the art tilapia breeding and its application in different farming systems. Lessons learned from the visit were presented to 30 scientists representing Tanzanian stakeholders as well as international research organizations met for a 3-day workshop (5th – 8th October 2016) in Zanzibar. The meeting was jointly funded by the BMSP and the Swedish "Agriculture for Food Security 2030" (AgriFoSe) program and organized by the UDSM-IMS in collaboration with the Worldfish Malaysia, and the Swedish University of Agricultural Sciences.

Participation of scientists from Bangor University and Earlham Institute was supported by a BBSRC award from the Global Challenge Research Fund (GCRF). Tanzania was represented by

official/researchers from the Ministries responsible for aquaculture in both the United Republic of Tanzania and the Revolutionary Government of Zanzibar, Commission for Science and Technology (COSTECH), UDSM, Sokoine University of Agriculture (SUA), Tanzania Fisheries Research Institute (TAFIRI), and entrepreneurs.



STAKEHOLDERS WORKSHOP ON TILAPIA AQUACULTURE IN TANZANIA AND THE WAY FORWARD: 5th – 7th October 2016



Closing the Stakeholders Workshop on Tilapia Aquaculture in Tanzania and the Way forward, 5-7 October 2016, by Dr Hassan Mshinda, Director General of COSTECH (Standing in Front Row 3rd from Right).

The main outcomes of the workshop, hereafter referred to the Zanzibar Resolutions (Enclosure 4.2), were a new collaboration, hereafter referred to as research consortium, between the Tanzanian government, industry, international scientists and funders that could help double the production of fish in the country by 2025 and development of a National Aquaculture Research and Development Centre (NARDC). NARDC aims to improve access to nutrient-rich fish resources - especially for women – and to triple the contribution that aquaculture makes to the economy.

1.2.2 Developments since the Zanzibar Resolution

1.2.2.1 Human Resource Development: Nine (9) PhDs have been recruited, four of them for purposes of developing expertise in genetic improvement of tilapia, three in feeds and one in artificial hatching of sea cucumber. The UDSM, SLU and Earlham Institute have been closely collaborating in the training of four (4) students (Presently Dr. Levinus Leonard and PhDs Redempta Athanas, Christer Simon, and Mbiru Moses) in breeding and two (2) students (Kulwa Mtaki and Angelina Michael) in feeds. Among others, the students have received critical PhD courses and hands on training on various research techniques e.g. quantitative genetics in animal breeding, genome analysis, DNA extraction and quantification. Under the IMS-SEAFDEC

(Southeast Asian Fisheries Development Centre) collaboration, a total of three PhD student have received hands on training in the Philippines, one (Yusuf Yusuf) in artificial hatchery of sea cucumbers (October-December 2016) and two (Angelina Michael and Kulwa Mtaki) in production of live fish feeds (phytoplankton and zooplankton) (June-July 2018). To adopt technologies in marine finfish farming, one PhD student (John Mapunda) is presently (November 2019 to March 2020) at the University of Nha Trang, Vietnam studying on the Snubnose Pompano larvae the effect of stocking densities on the cortisol levels and expression of genes related to cortisol, effect of feeding strategies on the expression of genes and enzymes related to feeding etc.

1.2.2.2 Development of marine hatchery: a boost to national and regional fisheries: With technical support of the IMS, the farming of milkfish, mangrove crabs and sand fish (sea cucumber) has been practiced in Tanzania since mid-2000. However the major limitation has been the availability of sufficient seeds. To transform small-holder / community based aquaculture into successful small and medium entrepreneurship, the Government of Zanzibar has developed a state of the art marine multi-species hatchery worth USD 3.2 million. The hatchery has been officially opened on 19 April 2018. The project has been funded by the Korea International Cooperation Agency (KOICA), with the Food and Agriculture Organization (FAO) and the IMS providing technical support. The species produced in the hatchery will be milkfish, mangrove crabs and sand fish. The centre can produce 10,000 fish fry, 75,000 crabs and 55,000 sea cucumber offspring. One of the 16 PhD students in the Program (Yusuf Yusuf) has been attached to this hatchery and so far has produced sea cucumber offspring for distribution to prior trained four villagers.

1.2.2.3 Towards Genetic improvement of Nile and Rufiji tilapia broodstock: To establish important tilapia traits for creating the country's own commercial brood stock, it is crucial to analyze genetics of the various populations before comparing their performance. To that end at least ten populations each of local Nile and Rufiji Tilapia from wild and farm sites in Mwanza, Morogoro, Dar es Salaam and Tanga have been collected, their fin clips collected and its DNA extracted; quantified and its quality assessment done. Library preparation and restricted site associated DNA (RAD) sequencing and RAD Sequence analysis have also been accomplished. Their performance comparison in an 'open garden' experiment that has involved GIFT (to be requested from WorlFish Malasia) have been done in Pangani and Kunduchi. Ongoing analysis will make overall recommendations about what lines/populations are best suited to form the basis of a breeding program for sustainable tilapia aquaculture in Tanzania.

1.2.2.4 UDSM commitment to sustainable aquaculture development: During 2018/19 the UDSM Chancellor, H. E. Dr. Jakaya Mrisho Kikwete had visited the Pangani Mariculture Centre on 29 March 2019 accompanied with the Vice Chancellor of the University of Dar es Salaam, Prof. William A. L. Anangisye, Corporate to Council and Secretary to Council, Dr. S. J. Mwakaje, Director, Office of the VC, Dr. L. Ramadhani and Public Relations Officer, Mr J. Isdory. At the PMC the Chancellor had an opportunity to visit student research activities and the newly acquired land for the expansion of the PMC activities. When addressing IMS staff led by IMS Director, Dr. Margareth Kyewalayanga and their PhD students, the Chancellor congratulated the PMC for its noble research mission aimed at enabling Tanzania increase fisheries outputs. Challenged the PMC to spearhead research for both marine and freshwater fisheries resources so as to enable Tanzania to produce food surplus and thus export a myriad of products to the region and the international market. Research facilities at the PMC include:

- (i) Six aquaculture ponds with pond liners (worth 72.3 mill) useful in the breeding studies; The facility will continue to play central roles in national tilapia breeding program. During the extension period, for example, one post doc will facilitate selection of genetically pure line Nile and Rufiji Tilapias ready for breeding.
- (ii) Three-eight (8) metre diameter plastic ponds to allow for culture of marine aquaculture species. Breeding studies for the Carangids (kole kole) have started in PMC.
- (iii) Additional 128 acres for the PMC expansion. The UDSM has paid a total of 246 million for compensation of the relocated people. Among others the new area will be used to display various aquaculture technologies for research, training and public services and accommodate the planned regional centre of excellence in for Marine Biodiversity and Food Security.
- (iv) Offices, research quarters etc: The UDSM has set aside 400 million for the rehabilitation of the Pangani Mariculture Centre's head office, student dormitory and staff housing. This is to augment the Bilateral Marine Science Program initiative aimed at rehabilitating a laboratory to accommodate fish hatchery activities for 200 million. The Contactor is on site since Dec 2019 for the activity.
- (v) Through the UDSM Tender No: PA/011/G/14 LOT6/2017/2018 dated 26th October 2018, M/S Palray Limited has supplied furniture worth 254,829,333 to Buyu and Pangani.



Research infrastructure developments at Pangani Mariculture Centre: Aquaculture ponds (above) The UDSM Chancellor, H. E. Dr. Jakaya Mrisho Kikwete visiting the Program students John Mapunda (Bottom, Left) Levinus Leonard (Bottom Right)

1.2.2.5 Ministry of Livestock and Fisheries (MLF) commitment to aquaculture development:

The Zanzibar resolution resolved and recommended, among others, that the Government of Tanzania give emphasis to sustainable aquaculture development by developing a National Aquaculture Development Centers. In reiterating the need, the Policy Brief presented in the 2nd Annual Conference of Research and Inclusive Development (Nov 2019) requested the TANZANIA PARLIAMENT to facilitate the development and in March 2020 the Directorate of Aquaculture proposed the “Aquaculture Regulations 2020”; Stakeholders invited to give comments (April 2020). The regulations, among others, proposes the establishment of Aquaculture Development Centres in different parts of Mainland Tanzania to, among others, promote sustainable aquaculture production.

1.2.2.6 Development of SADC-wide collaboration in aquaculture development initiatives: As selective breeding programmes for producing high quality fish seeds is an expensive endeavour, particularly for poor countries, the SADC-WorldFish-FAO platform for Genetics and Biodiversity Management in Aquaculture was established in September 2017 to facilitate sharing of technical know-how on generic improvement for enhanced growth of the indigenous fish species. The 6th Meeting of the SADC Aquaculture working group and the 2nd SADC-WorldFish-FAO-EAC Platform for Genetics and Biodiversity Management in Aquaculture held during 30 April – 03 May 2018 in Lilongwe Malawi have agreed on the use of the FAO framework to guide the use of aquatic genetic resources (AqGR) by creating a harmonized environment for exchange of improved AqGR to improve aquaculture production in the region.

1.2.3 Outputs from Researchers in National Delegations and Assignments

During 2015-2019, IMS and DASF researchers have been represented in 15 delegations, commissions and assignments. The Intergovernmental Oceanographic Commission (IOC) of UNESCO is one of the notable organizations where IMS represents the Government. Outcomes worth mentioning is the planned development of fisheries port and industrial complex in Tanzania. Also notable are advisory roles in conservations initiatives such as Marine Protected Areas (MPAs) which are at the center of integrated ecosystem approach to management of coastal zone.

1.2.3.1 Development of Fisheries Port and Industrial Complex in Tanzania: In fisheries development, the BMSP priorities include finding ways to reduce fisheries post-harvest losses that currently are $\geq 30\%$. When representing the United Republic of Tanzania Government in the IOC of UNESCO in Paris in June 2017, IMS delegation together with its MoU partners from the Korea Institute of Ocean Sciences and Technology visited the Tanzania Ambassador to France where the need for developing fishing port complete with fish processing complex in Tanzania was agreed as one of Tanzania Government priorities. When the BMSP attended the Ministry responsible for Fisheries meeting in Dec 2017, the issue of fishing port was also discussed and the BMSP was requested to facilitate the Tanzania-Korea collaboration in port development. The KIOST delegation visited Tanzania in February 2018 and now the Government of Tanzania and Korea are in the process of making an agreement on development of fishing port complex after Tanzania finalizes the ongoing feasibility study.

1.3 Is Aquaculture Pro-Poor? Evidence of Impacts on Farmers in Tanzania.

Long term beneficiaries of the BMSP technical support include Asha Abdallah Mnengo and Safia

Mohamed (both from the seaweed cluster), Abdallah Amri Mkwamba and Saidi Bakari Milanzi (from Mtwara Association of mariculture entrepreneurs). Their success stories sheds light on how seaweed value addition liberating women and fish farming is a promising driver of coastal economy in Tanzania (see Enclosure 4.4) for details of case studies).

1.3.1 Seaweed value addition liberating women in Tanzania: Seaweed farming in Zanzibar is mostly (more than 80%) an activity of women. Initially seaweed were planted in intertidal knee deep low tide waters but with climate induced seawater warming, deep water farming system is now being popularized by IMS. Seaweed was exported primarily for extracting a polysaccharide known as carrageenan, which is widely used as a stabilizer and thickener in food products (e.g. chocolate milk) pharmaceuticals and cosmetics (e.g. toothpaste). Apart from the nearly three decades of seaweed trade facilitating unprecedented women’s financial independence and the social status that comes with it, seaweed value addition has opened up a local year-round-market for seaweed products.



Asha Abdallah Mnengo (L) from Msimbati village in Mtwara standing in her recently acquired 10 hector cashew nut farm and Safia Mohamed (R) from of Bweleo village, Zanzibar in one of her shops.

Asha and Safia explain that “through production and sale of seaweed value added products, their social positions have significantly changed over the years”. Their seaweed money is now invested in real estate worth over hundreds of million TZS. As accomplished entrepreneurs, both are trainers of fellow fisherfolks in their respective district/regional entrepreneur workshops often organized during farmers’ exhibitions. Safia is now an employer of fellow women as shop keepers in five of her shops.

The late Kwacha, a famous politician in the east coast village of Paje, Zanzibar once bluntly said: “in the past we used to marry women, with seaweed affluence, women are now marrying us”. To highlight women’s financial power, Safia’s husband and two of her boys are driving motorcycles and use fishing boat all purchased by Asha.

1.3.2 Fish farming: the new driver of coastal economy: Animal aquaculture (fish, pearl oyster, sea cucumber etc) is widely held to contribute to poverty reduction in the South East Asia, however robust evidences are limited in Tanzania. This study summerises the status of oyster pearl and milkfish farmers that the IMS has been providing technical support for over a decade now.



Abdallah Amri Mkwamba (L) from Mngoji village, Mtwara explaining his shellfish farming activities in his workshop and Saidi Bakari Milanzi (R) from Namindondi village, Mtwara, standing by his milkfish farm (R).

Abdallah is among pioneers in pearl oyster farming in Mtwara. He explains that unlike milk fish that are farmed in earthen ponds, pearl oysters are grown at least 6 m deep with adults (3 years old) capable of producing good quality half-pearls after 9 months. The growing tourism industry provides a ready, high-end market for the final product. Depending upon the quality of value addition, half-pearls may be sold for USD 10-50, polished shells are sold at USD 5-10 and gold decorated pearls could be sold up to USD 2500, especially in the European/US markets. Met his first foreign buyer in Dar es Salaam international trade fairs of July 2016. Since then he is a never miss in such trade fairs. So far he has sold three consignments of pearl oyster products to a lady in Japan. The Department of Aquaculture, Ministry of Livestock and Fisheries has so far been so helpful in such export businesses. Despite his modest success, has never abandoned milkfish farming he started over a decade ago. Highlighting why milkfish farming never lets you down, his colleague Said explains that early 2018 took a loan of 20 million TZS from the Mtwara District youth development fund for fencing his fish farm. He expects to pay back at the end of the year when his milkfish matures. When asked if that kind of a loan can be managed that way, simply laughed and asked why not? He went on explaining that after the first year you are sure of only reaping profits.

Concluding remarks: Despite some failures for timely implementation of some research activities due to delays in procurement, the nearly five years of the Program have been modestly successful in laying a foundation for sustainable fisheries and aquaculture development in Tanzania. Among others, the Pangani Mariculture Centre of Excellence is emerging, successful relocation of IMS headquarters to Buyu would facilitate its transformation into a center for high level manpower development, problem solving international research collaborations strengthened with developed knowledge and technologies benefiting the poor particularly women. The extension phase is mainly aimed at enabling the remaining 12 PhD, 4MSc and 3 Postdocs finalize their studies. The Program is extremely thankful to Sida for successful facilitation of the activities. It is hopeful that Sida will continue supporting the Program and the new developments for successful poverty reduction, improved food security and sustainable development. The UDSM management is thanked for unwavering support for the development of marine science research capacity.

Budget: In the extension period, the project is planning to spend a total of SEK 3,345,536 (equivalent to Tshs 903,294,740), with the thirteen (13) PhD, three (3) Post doc and four (4) MSc

research activities in Tanzania to spend SEK 1,836,536 (Tshs 495,464,740), PhD student stays in Sweden (ISP allocation) SEK 624,000 (Tshs 168,480,000), Swedish counterparts (supervision) – SEK 750,000 (Tshs 202,500,000) and other student costs in Sweden – SEK 135,000 (Tshs 36,450,000). Out of the requested budget for Tanzania, a total of SEK 1,140,537 (Tshs 307,945,000), over 62% is expected to come from the original budget (mostly last disbursement – SEK 903,500) and the remainder (SEK 696,000) is requested from Sida. Regarding PhD stays in Sweden, out of the requested SEK 624,000 a total of SEK 276,000, over 44% is expected to come from the original budget allocated to ISP. Therefore the Program is requesting a total of SEK 1,929,000 to supplement research costs in Tanzania (SEK 696,000), facilitate supervision (SEK 750,000), a total of twenty three (39) months for PhD additional stay (SEK 624,000), and other costs (audit, minor equipment for PhD students while in Sweden and PhD defence costs) (135,000). It may be noted that extra student stays in Sweden as a result of restricted international travels due the global covid-19 pandemic has added costs of a total of SEK 192,000 (12 months stay for five students).

2. General objectives

The programme's **overall objective** is to increase quality and use of fisheries and aquaculture research produced, including by women, by 2020 for improved food security, climate change adaptation, poverty alleviation, sustainable resource use and inclusive development. To that end, the BMSP 2015-2020 **specific objectives** are meant to mobilise resources and sufficiently engage different stakeholders including fisherfolks in sustaining research outputs, strengthening research collaboration for improved development of fisheries and aquaculture subsectors.

Specific Objective 1: To increase the number of more qualified fisheries and aquaculture research experts.

Specific Objective 2: To increase the academic institutional reputation and level of cooperation of Tanzanian fisheries and aquaculture research

Specific Objective 3: To increase the use of Tanzanian research by policy-makers, private companies, non-governmental organizations, community based organizations and public institutions for improved fisheries and aquaculture outputs

Specific Objective 4: To increase the use of Tanzanian fisheries and aquaculture research internationally and regionally

3. Target (July 2020 – June 2021)

3.1 Programme objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

3.1.1 Planned and the specific activities to be carried out:

- Training of 12 PhD Students to completion
- Training of 4 MSc Students to completion
- Training of 3 Post Doc Students to completion

3.1.2 Expected Deliverables

- 2 PhD theses
- 4 MSc theses
- 3 Post Docs
- 15 Manuscripts developed and submitted to various journals

3.2 Programme objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

3.2.1 Planned and the specific activities to be carried out:

- Mentoring activities to support Post Docs
- Research proposals developed and submitted for alternative funding
- Research papers prepared and submitted for publication
- Research infrastructure is maintained for national and regional state of the art research including selection of genetically pure line Nile and Rufiji Tilapias and breeding

3.2.2 Expected Deliverables

- 3 Post Docs
- At least 10 Journal publications in internationally reputable journals
- Pangani and Kunduchi research centers plays central role in tilapia breeding programme

3.3. Programme objective 3: Increase the quality and use of research relevant to high priority issues of national development

3.3.1 Planned and the specific activities to be carried out:

- Stakeholders workshop held to critically assess progress since the Zanzibar Resolution 2016 and deliberate the way forward in tilapia breeding;
- Partnerships developed;
- Research papers prepared and submitted for publication

3.3.2 Expected Deliverables

- At least 2 policy briefs developed
- At least 15 papers are presented
- A national consensus is reached on the way forward on tilapia breeding e.g. strains to be involved in the planned breeding
- 1 proceeding
- At least 1 partnership developed
- At least 10 papers published

3.4 Programme objective 4: Increase partnerships with local, regional and international

institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3.4.1 Planned and the specific activities to be carried out:

- Research papers prepared and submitted for publication
- Researchers make themselves available for participation in regional and international panes

3.4.2 Expected Deliverables

- At least 10 papers published
- At least 4 researchers participate in international and regional panels; females represented by 50%.

4. Analysis and Justification

Budget: Budget: In the extension period, the project is planning to spend a total of SEK 3,345,536 (equivalent to Tshs 903,294,740), with the thirteen (13) PhD, three (3) Post doc and four (4) MSc research activities in Tanzania to spend SEK 1,836,536 (Tshs 495,464,740), PhD student stays in Sweden (ISP allocation) SEK 624,000 (Tshs 168,480,000), Swedish counterparts (supervision) – SEK 750,000 (Tshs 202,500,000) and other student costs in Sweden – SEK 135,000 (Tshs 36,450,000). Out of the requested budget for Tanzania, a total of SEK 1,140,537 (Tshs 307,945,000), over 62% is expected to come from the original budget (mostly last disbursement – SEK 903,500) and the remainder (SEK 696,000) is requested from Sida. Regarding PhD stays in Sweden, out of the requested SEK 624,000 a total of SEK 276,000, over 44% is expected to come from the original budget allocated to ISP. Therefore the Program is requesting a total of SEK 1,929,000 to supplement research costs in Tanzania (SEK 696,000), facilitate supervision (SEK 750,000), a total of twenty three (39) months for PhD additional stay (SEK 624,000), and other costs (audit, minor equipment for PhD students while in Sweden and PhD defence costs) (135,000).

- (xi) Over sixty percent (64.8%; equivalent to SEK 2,168,478) of the total cost comes from costs for the PhD students to finalise their studies, 17.05% Post-doctoral research, 1.99 MSc research and the remainder (16.16) is for infrastructure maintenance, stakeholders meeting and planning activities for the possible next phase.
- (xii) ***Supported research and infrastructure development makes sense:*** The ongoing phase of BMSP has noble responsibility to develop aquaculture strategy for Tanzania and the 13PhD and 3 Post docs planned to finalize their studies in a year to come would facilitate the assembling of crucial missing pieces in the unimpressive aquaculture development in Tanzania. As the fisheries sector is also at the crossroad of global warming, Tanzania will also be lucky adding crucial experts for measuring implications of some environmental changes on its sustainability. When visiting the IMS during March 2018 & 2019, the UDSM Chancellor, H.E Dr Jakaya Mrisho Kikwete accompanied by the UDSM Vice Chancellor Prof. William Anangisye, was delighted to visit the various PhD student research activities aimed at addressing national fisheries and mariculture issues. Challenged the emerging IMS-Pangani Mariculture Centre of excellence to relentlessly spearhead development of technologies and innovations relevant for Tanzania's vast water resources to sustainably produce food surplus and export a myriad of products to the region and the international market. We are grateful to Sida support for laying a foundation for addressing bottlenecks for Tanzania aquaculture. The potential impact of the BMSP by 2025 include:
 - Tanzania's unique tilapia would increasingly become more valuable as the country's gold but with more people able to experience the benefits more equally.
 - Tilapia initiative to stimulate better aquaculture practices for other species;
 - Tanzania with an independent aquaculture industry based on its own supply of fingerlings/seeds;

- Aquaculture for fisheries stock enhancement program to improve overall fisheries output;
- Improved access to fish as a protein source for those most vulnerable to undernutrition, rural employment, reduce urban migration and its impacts while preserving Tanzania's natural inland and marine diversity and resources.

The human resource would also facilitate further transformation of the UDSM. During the above mentioned visits, the Chancellor also reminded the UDSM on the inverse relationship between poverty and education and its consequences on e.g. the Tanzania's low share of high-technology and medium-high technology exports. Against that background, he reiterated the UDSM commitment to maintain IMS as high level manpower development center dedicated to producing postgraduate human resource. The IMS community is therefore grateful to Sida for facilitating human and infrastructure developments crucial for its relocation to Buyu where IMS would realise its commitment to transform its three sections as earlier shown in section 1.1. The Sida support would go a long way into assisting the UDSM in improving its postgraduate outputs at Buyu.

- (xiii) **Travels:** Mostly PhD students will travel to their respective Swedish universities to take specialized courses and analyse samples/data. Post Doc students will also wish to interact with their Swedish mentors.
- (xiv) **Stakeholders meeting:** The planned stakeholders meeting is meant to inform stakeholders on achievements of the Program, among others, the qualities of the various tilapia strains available for breeding. This is to facilitate an informed national decision on strains that Tanzania could use for Tilapia breeding. The Post docs would go a long way into showing initial outputs from the breeding of the various strains and how proteins from insects could replace fish meal in fish feed.
- (xv) **Impact of global covid-19 pandemic:** In the requested budget for ISP a total of 12 months of stay in Sweden (SEK 192,000) is a result of restricted international travels due the global covid-19 pandemic. Nevertheless, plans are in place for the students to make full use of the stay by analysing their data, developing and publishing their manuscripts.
- (xvi) **Measures to address delays in PhD student research:** The extension has emanated largely from a problem of delayed recruitment and purchases of research equipment and facilities as well as difficulties for students to accomplish relevant courses in the Swedish universities. To address the procurement problems at the geographically separated IMS, the UDSM has granted that IMS use a delegated Tender Board.

Additional measures include the need for future PhDs to mostly register in developed UDSM taught PhD programs but with international supervision.

5. Enclosures

- 33. Subprogramme Activity Implementation Plan (July 2020-June 2021)
- 34. Sub-program **Overall Aggregated Budget**
- 35. Subprogramme Detailed Budget
- 36. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 37. Students Individual Plans and Popular Summary of the Study
- 38. Aggregated Student Progress and Plan (July 2020-June 2021)
- 39. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: Subprogramme: Subprogramme Activity Implementation Plan (July 2020-June 2021)

S/N				Source of Fund		2020						2021			Activity Justification
	Planned Activity	Origin of the Activity ¹ (New/Carried over)	Proposed Budget (SEK)	Original Budget ²	Extra Fund ³	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	
OB1	Objective 1: To increase the number of more qualified fisheries and aquaculture research experts.														
1.1	Training of 13 PhD Students to completion (Tanzania costs)	Carried Over	659,478	395,638	263,840										To facilitate finalization of manuscripts and thesis writing; submission for publication/ examination and thesis defense
	Swedsish costs		885,000		885,000										
1.2	Training of 4 MSc Students to completion	Carried Over	66,667	66.667	-										
1.3	Training of 3 Post Doc Students to completion	Carried Over	570,571	570,571	-										Furthering national efforts in breeding, developing new feeds
1.4															
OB2	Objective 2: To increase the academic institutional reputation and level of cooperation of Tanzanian fisheries and aquaculture research														
2.1	Mentoring activities to support Post Docs	Carried over	-		-										
2.2	Research proposals	Carried over	-	-	-										Improve funding level

	developed and submitted for alternative funding														
2.3	Research papers prepared and submitted for publication	Carried over	55,000	-	55,000										Improves visibility and associated impacts to the UDSM
2.4	Research infrastructure is maintained for national and regional state of the art research	Carried	-	-	-										Improves collaborations, visibility and associated impacts to the UDSM
OB3	<i>Objective 3: To increase the use of Tanzanian research by policy-makers, private companies, non-governmental organizations, community based organizations and public institutions for improved fisheries and aquaculture outputs</i>														
3.1	Stakeholders workshop held to discuss policy issues in the light of the study findings	Carried over	88,500		88,500										To inform achievements so far and develop National consensus on the way forward in fisheries development
3.2	Partnerships developed	Carried over	-	-	-										
3.3	Research papers prepared and submitted for publication	Carried over	55,000	-	55,000										Improves visibility and associated impacts to the UDSM
OB4	<i>Objective 4: To increase the use of Tanzanian fisheries and aquaculture research internationally and regionally</i>														
4.1	Research papers prepared and	Carried over	55,000	-	55,000										Improve visibility and associated

	submitted for publication														impacts to the UDSM
4.2	Researchers make themselves available for participation in regional and international panels	Carried over	-		-										Improve visibility and associated impacts to the UDSM
4.3															

NB: ¹ Please indicate whether the activity was carried over from 2015 approved budget line or it is a new activity.

²Total Original Budget should tally with subprogramme balance expected to remain by July 2020.

³The extra fund connotes amount of money requested from Sida

⁴Attach the Original approved Budget

Enclosures 2: Sub-program Overall Aggregated Budget

Date: 29 February 2020	
Name of Sub program:	MARINE SCIENCE PROGRAM
Fiscal Year:	JULY 2020-June 2021
Tanzanian Institution/Dept:	Tanzanian Institution/Dept: University of Dar es Salaam: Institute of Marine Sciences (IMS), (Cost Centre Tanzania), Department of Aquatic Sciences and Fisheries (DASF) & Department of Botany (BOTANY), TANZANIA.
Collaborating Institution in Sweden:	Collaborating Institution in Sweden: Stockholm University (SU): Department of Ecology, Environment and Plant Sciences (Cost Centre-Sweden) & Department of Physical Geography and Quaternary Geology; Swedish University of Agricultural Sciences: Department of Biomedical Sciences and Veterinary Public Health, Department of Animal Breeding and genetics
Exchange rate: 270	

	Tanzania	Funds expected to be forwarded from previous year (2019/2020)		Allocated funds July-December 2020		Allocated funds January-June 2021		Total allocated funds (July 2020 to June 2021)		Total funds to be executed	
		SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1	Curriculum Development	-	-	-	-	-	-	-	-	-	-
2	Research equipment	49,500	13,365,000	25,000	6,750,000	25,000	6,750,000	50,000	13,500,000	99,500	26,865,000
3	Maintenance	80,000	21,600,000	20,000	5,400,000	20,000	5,400,000	40,000	10,800,000	120,000	32,400,000
4	Research Consumables	86,500	23,355,000	52,840	14,266,800	52,840	14,266,800	105,680	28,533,600	192,180	51,888,600
5	Travel	31,000	8,370,000	49,000	13,230,000	49,000	13,230,000	98,000	26,460,000	129,000	34,830,000
6	Field/Lab work	441,574	119,225,000	24,500	6,615,000	24,500	6,615,000	49,000	13,230,000	490,574	132,455,000
7	Student stipends x	289,000	78,030,000	23,019	6,215,000	23,019	6,215,000	46,037	12,430,000	335,037	90,460,000

8	Student fees	162,963	44,000,000	-	-	-	-	-	-	162,963	44,000,000
9	Conferences	-	-	88,898	24,002,460	88,898	24,002,460	177,796	48,004,920	177,796	48,004,920
10	Publication costs	-	-	27,500	7,425,000	27,500	7,425,000	55,000	14,850,000	55,000	14,850,000
11	Travel insurance	-	-	-	-	-	-	-	-	-	-
12	Cost of Training	-	-	-	-	-	-	-	-	-	-
13	Cost related to research management	-	-	-	-	-	-	-	-	-	-
14	Project Coordination Costs	-	-	-	-	-	-	-	-	-	-
15	Other Cost	-	-	-	-	-	-	-	-	-	-
20	Indirect costs (Institutional Fee)	-	-	37,243	10,055,610	37,243	10,055,610	74,486	20,111,220	74,486	20,111,220
21	Bank interest	-	-	-	-	-	-	-	-	-	-
22	Audit	-	-	-	-	-	-	-	-	-	-
			-		-		-		-	-	-
	SUB-TOTAL TANZANIA	1,140,537	307,945,000	348,000	93,959,870	348,000	93,959,870	696,000	187,919,740	1,836,536	495,864,740
	Sweden										
1	Supervision	-	-	375,000	101,250,000	375,000	101,250,000	750,000	202,500,000	750,000	202,500,000

2	Curriculum Development	-	-	-	-	-	-	-	-	-	-
3	Lecturing on Courses	-	-	-	-	-	-	-	-	-	-
	Travel Costs	-	-	-	-	-	-	-	-	-	-
4	Other costs	-	-	37,500	10,125,000	97,500	26,325,000	135,000	36,450,000	135,000	36,450,000
5	Indirect costs	-	-	-	-	-	-	-	-	-	-
	SUB-TOTAL_SWEDEN	-	-	412,500	111,375,000	472,500	127,575,000	885,000	238,950,000	885,000	238,950,000
7	ISP - student allowances	276,000	74,520,000	254,000	68,580,000	94,000	25,380,000	348,000	93,960,000	624,000	168,480,000
	SUB-TOTAL-ISP	276,000	74,520,000	254,000	68,580,000	94,000	25,380,000	348,000	93,960,000	624,000	168,480,000
	GRAND TOTAL	1,416,537	382,465,000	1,014,500	273,914,870	914,500	246,914,870	1,929,000	520,829,740	3,345,536	903,294,740

Enclosures 3: Subprogramme Detailed Budget

Date: 29 February 2020													
Name of Sub program: MARINE SCIENCE PROGRAM													
Fiscal Year: 2020/2021													
Tanzanian Institution/Dept: University of Dar es Salaam: Institute of Marine Sciences (IMS), (Cost Centre Tanzania), Department of Aquatic Sciences and Fisheries (DASF) & Department of Botany (BOTANY), TANZANIA.													
Collaborating Institution in Sweden: Stockholm University (SU): Department of Ecology, Environment and Plant Sciences (Cost Centre-Sweden) & Department of Physical Geography and Quaternary Geology; Swedish University of Agricultural Sciences: Department of Biomedical Sciences and Veterinary Public Health, Department of Animal Breeding and genetics													
Exchange rate: SEK 1 = TZS 270													
	Tanzania	Unit	Cost/unit	Funds expected to be forwarded from previous year (2019/2020)		Allocated funds July - December 2020		Allocated funds January – June 2021		Total allocated funds (July 2020 to June 2021)		Total funds to be executed	
				SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1	Curriculum Development			-	-	-	-	-	-	-	-	-	-
						-		-		-		-	-
2	Research equipment			49,500	13,365,000	25,000	6,750,000	25,000	6,750,000	50,000	13,500,000	99,500	26,865,000
	1. Equipment									-		-	
	2. Minor equipment			49,500	13,365,000	25,000	6,750,000	25,000	6,750,000	-			
	Various minor equipments: Salinometers, oxygen meters etc				13,365,000		6,750,000		6,750,000				
3	Maintenance			80,000	21,600,000	20,000	5,400,000	20,000	5,400,000	40,000	10,800,000	120,000	32,400,000
	1. Pangani Mariculture Centre: Pumps, hapas, ropes etc.			60,000	16,200,000	10,000	2,700,000	10,000	2,700,000	-			
	2. Kunduchi Aquaculture and Fisheries Centre: Pumps, hapas, ropes etc.			20,000	5,400,000	10,000	2,700,000	10,000	2,700,000	-			

4	Research Consumables			86,500	23,355,000	52,840	14,266,800	52,840	14,266,800	105,680	28,533,600	192,180	51,888,600
	1. Breeding, climate and fish feed studies			73,000	19,710,000	39,340	10,621,800	39,340	10,621,800	-			
	2. Petrol for field trips and litterature			13,500	3,645,000	13,500	3,645,000	13,500	3,645,000	-			
5	Travel			31,000	8,370,000	49,000	13,230,000	49,000	13,230,000	98,000	26,460,000	129,000	34,830,000
	1. PhD students to analyse data and attend important courses in Sweden and elsewhere (6 @ 1.395 mill)					31,000	8,370,000	31,000	8,370,000	-			
	2. Conference attendance (4PhD students @ 1.215 mill)					9,000	2,430,000	9,000	2,430,000	-			
	1. Post Doc students to analyse data and attend important courses in Sweden and elsewhere (3 @ 1.395 mill)			31,000	8,370,000								
	3. Tz senior scientists travel for attending conferences. (At least two: Coordinator, PI @ 2.43 mill)					9,000	2,430,000	9,000	2,430,000	-			
6	Field/Lab work			441,574	119,225,000	24,500	6,615,000	24,500	6,615,000	49,000	13,230,000	310,574	83,855,000
	1. 13PhD; 4MSc (5 with intensive field work @ 16.771 million)			87,574	23,645,000	24,500	6,615,000	24,500	6,615,000	-			
	2. Senior scientists: supervissors									-			

	3. 4Post Docs @ 15.66 mill.			174,000	46,980,000					-			
	4. 3Post docs overseas analysis of samples (in view of ongoing global epidemic, students may not be able to travel to Sweden)			180,000	48,600,000								
7	Student stipends x			289,000	78,030,000	23,019	6,215,000	23,019	6,215,000	46,037	12,430,000	335,037	90,460,000
	1. 15PhD; 4MSc (PhD: 42 months @ 0.7 mill; MSc: 16 months @ 0.6 mill)			144,444	39,000,000					-			
	2. 3Post Docs (27 months @ 1.1 mill)			107,519	29,030,000		-		-	-			
	3. Stationery for 19 students (22 students @ 1.181 mill). Each student to be paid 0.7 mill and the remainder for office costs			37,037	10,000,000		6,215,000		6,215,000	-			
8	Student fees			162,963	44,000,000	-	-	-	-	-	-	162,963	44,000,000
	1. PhD (5 students @ 4.5 mill)			83,333	22,500,000					-		83,333	
	2. 4 MSc (4 students @ 4.5 mill)			66,667	18,000,000					-		66,667	
	3. 3 Post Docs (3 students @ 1.15 mill)			12,963	3,500,000					-		12,963	
9	Conferences			-	-	88,898	24,002,460	88,898	24,002,460	177,796	48,004,920	177,796	48,004,920
	1. Project exist meeting: Meeting the stakeholders	1	23.9 mill			44,250	11,947,500	44,250	11,947,500	88,500	23,895,000	88,500	

	2. Planning workshop	1	23.9 mill			44,648	12,054,960	44,648	12,054,960	89,296	24,109,920	89,296	
10	Publication costs			-	-	27,500	7,425,000	27,500	7,425,000	55,000	14,850,000	55,000	14,850,000
	1. Journal costs						7,425,000		7,425,000	-		-	
11	Travel insurance			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
12	Cost of Training			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
13	Cost related to research management			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
14	Project Coordination Costs			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
15	Other Cost			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
20	Indirect costs (Institutional Fee)			-	-	37,243	10,055,610	37,243	10,055,610	74,486	20,111,220	74,486	20,111,220
	1.....			-		-		-		-		-	-
21	Bank interest			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
22	Audit			-	-	-	-	-	-	-	-	-	-

	1.....			-		-		-		-		-	-
	SUB-TOTAL TANZANIA			1,140,537	307,945,000	348,000	93,959,870	348,000	93,959,870	696,000	187,919,740	1,836,537	495,864,740
	Sweden												
1	Supervision			-	-	375,000	101,250,000	375,000	101,250,000	750,000	202,500,000	750,000	202,500,000
	1. 3PhD to extend for four months	12	20,833	-		125,000	33,750,000	125,000	33,750,000	-		-	
	2. 2PhD to extend for nine months	18	20,833	-		187,500	50,625,000	187,500	50,625,000	-		-	
	3. 1PhD to extend for 6 months	6	20,833	-		62,500	16,875,000	62,500.00	16,875,000	-		-	
2	Curriculum Development			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
3	Lecturing on Courses			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
	Travel Costs			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
4	Other costs			-	-	37,500	10,125,000	97,500	26,325,000	135,000	36,450,000	135,000	36,450,000

	1. Audit			-		12,500	3,375,000	12,500	3,375,000	-		-	
	2. Minor equipment for PhD students while in Sweden			-		25,000	6,750,000	25,000	6,750,000	-		-	
	3. PhD defense cost Department of Physical Geography (SU)			-		-		60,000	16,200,000	-		-	
5	Indirect costs			-	-	-	-	-	-	-	-	-	-
	1.....			-		-		-		-		-	-
	SUB-TOTAL SWEDEN			-	-	412,500	111,375,000	472,500	127,575,000	885,000	238,950,000	885,000	238,950,000
7	ISP - student allowances			276,000	74,520,000	254,000	68,580,000	94,000	25,380,000	348,000	93,960,000	624,000	168,480,000
	1PhD stays 4 month; 1PhD stays 6 months and 1PhD to stay 1 month	11	16,000	144,000	38,880,000			32,000	8,640,000				
	3PhD stays 6, 4 and 6 months respectively.	16	16,000	132,000	35,640,000	62,000	16,740,000	62,000	16,740,000	124,000	33,480,000		
	5PhD overstay due to covid-19 pandemic in Tz (12 months)	12	16,000			192,000	51,840,000						
	SUB-TOTAL-ISP			276,000	74,520,000	254,000	68,580,000	94,000	25,380,000	348,000	93,960,000	624,000	168,480,000
	GRAND TOTAL			1,416,537	382,465,000	1,014,500	273,914,870	914,500	246,914,870	1,929,000	520,829,740	3,345,537	903,294,740

Enclosure 4: Results Matrix for Sub-Programme/Project

Title of Sub-programme: Consolidating Research and Analytical Capacity in Fisheries and Aquaculture Technology for Food Security, Adapting to Climate Change, Sustainable Resource Management and Inclusive Development

(Acronym: Marine Science Programme)

Summary Problem Statement: UDSM with unsustainable research and innovation system for blue fisheries and aquaculture growth

Overall Objective: Increase quality and use of fisheries and aquaculture research produced, including by women, by 2020 for improved food security, climate change adaptation, poverty alleviation, sustainable resource use and inclusive development.

Specific Objective # 1: To increase the number of more qualified fisheries and aquaculture research experts

Specific Objective # 2: To increase the academic institutional reputation and level of cooperation of Tanzanian fisheries and aquaculture research

Specific Objective # 3: To increase the use of Tanzanian research by policy-makers, private companies, non-governmental organizations, community based organizations and public institutions for improved fisheries and aquaculture outputs

Specific Objective # 4: To increase the use of Tanzanian fisheries and aquaculture research internationally and regionally

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
Specific Objective # 1: To increase the number of more qualified fisheries and aquaculture research experts						
1.1 Propose creation of course based PhD program in Applied Marine Sciences	1.1 PhD program is up and running	One new PhD program approved by SENATE & accredited by TCU	None	One (1) taught PhD program accredited		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
1.2 Revise one course based PhD program in Aquatic Sciences with four specialization in Fisheries, Aquaculture, Biological Oceanography, & Limnology	1.2 Reviewed PhD program approved by SENATE and accredited by TCU	Revised PhD program approved by SENATE	The last curriculum review was done in the 2014	Revised one (1) taught PhD program accredited		
1.3 Recruit 16 PhD, MSc and Post Doc students	1.3 Sufficient students apply for PhD, MSc, Post Docs training	Number of students who apply (disaggregated by gender), successfully recruited	16 PhD trained during 2009-2015	A least 10/15 PhD graduated; 7 female		
1.4 Sixteen (16) PhD students complete the training	1.4 PhD students receive their degrees	Number of PhD degrees(disaggregated by gender)	16 PhD complete their training during 2009-2015	At least 10/15 PhD complete the training; 7 female		
1.5 Sixteen 16 PhD graduates apply for positions	1.5 PhD graduates maintain or secure new employment	Percent of PhD graduates maintain or secure new employment(disaggregated by gender)	16 PhD employed during 2009-2015	At least 10/15 PhD complete the training; 7 female		
1.6 Propose creation of two course based MSc programs in Sustainable	1.6 MSc programs are up and running	Two new MSc programs approved by SENATE and accredited by TCU	None	Two (2) taught MSc program accredited		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
Fisheries Management at IMS and Fisheries and Aquaculture at DASF						
1.7 Revise one course based MSc program in Marine Sciences	1.2 Reviewed MSc program approved by SENATE and accredited by TCU	Revised PhD program approved by SENATE accredited by TCU	The last curriculum review was done in the 2014	one (1) taught MSc program revised is accredited		
1.8 Recruit 4 MSc students	1.8 Sufficient students apply for MSc training	Number of students who apply (disaggregated by gender)	34 MSc trained during 2009-2015	4 MSc recruited		
1.9 Four (4) MSc students complete the training	1.9 MSc students receive their degrees	Number of MSc degrees (disaggregated by gender)	34 MSc complete their training during 2009-2015	4 MSc recruited proceeding well with studies		
1.10 Four (4) Post doc positions available	1.10 Researchers occupy post doc positions	Number of post doc researchers(disaggregated by gender)	None	4 Post Docs recruited		
Assumptions for Specific Objective: (1) Marine Science Program remains a preferred destination for graduate students nationally and in the region; (2). IMS and DASF continues to attract and retain highly qualified and trained staff; (3). Transition rates from masters to PhD programs are improved; (4). The government steps up research support to public universities; (5). Stakeholders' sustained interest in research; (6). Timely disbursement of funds for program activities						
Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2018/19	Actual Outcomes Achieved: Results	[Key] Outputs produced in year to obtain Outcome

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
					Observed in year (2018/19)	in 2018/19
Specific Objective # 2: To increase the academic institutional reputation and level of cooperation of Tanzanian fisheries and aquaculture research						
2.1 Proposals for capital improvements, additional equipment, Post doc research, etc. prepared and submitted • Mentoring activities to support post doc researchers • Research proposals developed and submitted for funding	2.1 Increased production of research and applied research in all priority areas; Project funding apart from Sida increased by 5-10% by 2020	Number of research projects that are: a) active b) completed • Number of external grants received (apart from Sida) • Number of national grants received • Funding level	Mean annual research funds (in USD) received during 2009-2015 from projects other than Sida was 443,500 Post docs (None)	Project funding apart from Sida increased by 5-10%		
2.2 Call for research proposals (funds) for research • National funds • International funds	2.2 High quality research projects funded	Number of applications (disaggregated by gender) Number of research projects awarded (disaggregated by gender)	Total applications 20; awards 15 during 2009-2015	5-10 project proposals submitted; 2-5 of them are funded		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
2.3 Research papers prepared and submitted for publication	2.3 Increased number of articles published in peer-reviewed journals and conference proceedings	Number of articles published in: a) International peer-reviewed journals (disaggregated by gender) b) conference proceedings (disaggregated by gender)	60 publications during 2009-2015	5-10 research papers prepared and submitted for publication; 2-5 accepted/published		
2.3 Research papers prepared and submitted for publication	2.4 Improvement in the over-all rating of Tanzanian universities	Change in appearance of Tanzanian universities in rankings				
2.4 Proposals for collaborative research work	2.5 Increase in number of collaborations with national research institutions / networks	Number of collaborative initiatives with national research institutions / networks	3 collaborative initiatives	At least 3 proposals for collaborative research work submitted; at least one accepted for funding		
2.4 Proposals for collaborative research work	2.6 Increase in number of collaborations with international research institutions / networks	Number of collaborative initiatives with international research institutions / networks	3 MoU developed during 2009-2015	At least 1 international/regional collaborative research established		
2.5 New partnership agreements developed with high priority institutions	2.7 Increase in number of partnerships (government authorities, businesses,	• Number of formal partnerships	IMS has formal partnerships with all Government departments dealing	Existing collaborations maintained; at least one new		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
in relevant sectors	etc.)		with environmental, fisheries issues	collaboration established		
2.6 Applications for IPR/patents	2.8 Increase in number of patents received	Number of submitted applications that are successful	None	0 patent applied		
Assumptions for Specific Objective: (2) Continued interest by existing and potential collaborators in fisheries and aquaculture to work with the UDSM; (2). UDSM participating institutions continue maintaining their existing status; (3). The Government timely-release capital development funds for DASFT and IMS buildings						
Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2018/19	Actual Outcomes Achieved: Results Observed in year (2018/19)	[Key] Outputs produced in year to obtain Outcome in 2018/19
Specific Objective # 3: To increase the use of Tanzanian research by policy-makers, private companies, non-governmental organizations, community based organizations and public institutions for improved fisheries and aquaculture outputs						
3.1 Research/policy briefs and papers are prepared and placed on website; Stakeholders workshops held to discuss policy briefs/issues in unimpressive aquaculture development in	3.1 Research briefs and papers are read nationally	Number of downloads of papers Number/types of policy issues emerging from stakeholders workshops	None in aquaculture development	Fishing port issue resolved; National Aquaculture Development Centre activities progressing well		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
Tanzania						
3.2 Research/policy briefs and papers are presented to government officials	3.2 Research briefs and papers are used by government officials to affect changes in policies, laws, regulations, etc.	Extent of use	None in aquaculture development	Fishing port issue resolved; National Aquaculture Development Centre activities progressing well		
3.3 Partnerships developed	3.3 Partners use research results/information/knowledge/papers and skills of researchers in their work	Extent of use/ number of MoU	3 MoU developed during 2009-2015	MoU with KIOST result into one fundable project		
3.4 Researchers engage with communities to identify issues where their skills / research can be useful	3.4 Communities use research results to address local issues	Extent of use/number of communities use	IMS provided technical support to over 1000 villagers during 2009-2015	Communities benefits with ongoing sea cucumber project		
	3.5 Increased use of applied research products / processes (marine & coastal resource conservation techniques, aquaculture seed	Number of products/processes	IMS provided technical support in marine resource value addition; aquaculture during 2009-2015	Communities provided with new researched knowledge and techniques e.g. raising own sea cucumber		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
	production etc.)			fingerlings, spirulina use and benefits, all male tilapia fingerling production etc; media include trade fares, research week etc.		
Assumptions for Specific Objective 3: (1) Continued Sida and other development partners support in business incubation; (2). Interest by innovators and other stakeholders in research uptake; (3). Continued Government and private sector interested in research outputs and uptake						
Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2018/19	Actual Outcomes Achieved: Results Observed in year (2018/19)	[Key] Outputs produced in year to obtain Outcome in 2018/19
Specific Objective # 4: To increase the use of Tanzanian fisheries and aquaculture research internationally and regionally						
4.1 Research papers are prepared for international and regional conferences	4.1 Increased number of papers are presented	Number of papers accepted (disaggregated by gender)	60 papers in 2009-2015	5-10 papers are prepared; 2-5 accepted/published		
4.2 Researchers make themselves available for participation	4.2 Increased exposure of researchers in international and regional panels and meetings	Number of researchers participating in international and regional panels and meetings (disaggregated by gender)	16 researchers (3 women)	At least 2-5 researchers engaged in regional/ international panels		

Types of Outputs	Outcomes (including targets 2020)	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	Actual Outcomes Achieved: Results Observed in year (2019/20)	[Key] Outputs produced in year to obtain Outcome in 2019/20
	4.3 Increased number of researchers in Tanzanian government (advisory Boards), development partners, and business organizations, government appointments, delegations, commissions and assignments	Change in number of researchers on delegations, commissions, assignments (being consulted/working) (disaggregated by gender) (make comparison or trend analysis) Number and types of government appointments, delegations, commissions and assignments	5 researchers (2 women)	At least 5-10 researchers engaged in government advisory boards		
Assumptions for Specific Objective 4: (1) Continued Sida and other development partners support in business incubation; (2). Interest by innovators and other stakeholders in research uptake; (3). Continued Government and private sector interested in research outputs and uptake						

Enclosures 5: Aggregated Student Progress and Plan (July 2020-June 2021)

Name of research student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of Completion	Progress %	Prel. title of dissertation
PhD students							
1. Nyangoko, B.	M	Jan 2017			2020	60%: With social/health difficulties; Through by Dec 2021	See below
2. Mulokozi, D.	M	Oct 2016			2020	70%: Through by December 2020	
3. Kajungiro, R. A.	F	April 2016			2020	75%: To complete by October 2020	
4. Simon, C.	F	June 2016			2020	75%: To complete by October 2020	
5. Yusuf, Y. S.	M	Jan 2016		2020		80%: To complete by Aug 2020	
6. Mmanda, F. P.	M	April 2016			2020	85%: To complete by June 2020	
7. Michael, A.	F	Jan 2016		2020		95%: To complete by June 2020	
8. Tarimo, B.	M	April 2017			2021	65%: To complete by March 2021	
9. Ismail, R. O.	M	Feb 2016			2020	85%: To complete by Oct 2020	
10. John, O.	F	Jan 2016		2020		75%: To complete by Aug 2020	
11. Rashid, M. A.	F	May 2016		2019		60%: To complete by March 2021; Took regional post.	
12. Mbiru, M.	M	Jan 2017		2020		75%: To complete by October 2020	
13. Mapunda John	M	Nov 2017		2021		65%: To complete by March 2021	
14. Yahya, B.M.	F	Nov 2016		2020		80%: To complete by Aug 2020	
15. Mtaki, K	F	Nov 2017		2021		60%: To complete by March 2021;	
MSc. Students							
16. Malesa, F.M.	M	Oct. 2018		2020		80%: To complete by September 2020	See below
17. Mtonga, K.J.	M	Oct 2018		2020		75%: To complete by September 2020	
18. Joseph, V.	M	Oct 2018		2020		80%: To complete by September 2020	
19. Iraba, N. T.	F	Oct 2018		2020		75%: To complete by September 2020	
Total: 22							
Post-Doctoral Students							
20. Leonard, L.	M	2020		2021		To complete by March 2021	See below
20. Soud, S.	M	2020		2021		To complete by March 2021	
21. Rushingisha, G.	M	2020		2021		To complete by March 2021	

Student Research themes, allocated students (PhD and Post Docs) and supervisors

S/N	Selected PhD Student	Sex	Registration (Institution)	Main Supervisors in Tanzania and Sweden	Assistant supervisors in Tanzania & Sweden
<i>Research theme A: Managing Ecosystem Services for Sustainable Wetland Management & Aquaculture Development</i>					
1.	Mr. Baraka P. Nyangoko	M	Dept of Physical Geography, SU	Prof. Håkan Berg Dr. Mwita Mangora	Dr. Mwananhija Shalli Prof. Martin Gullström
<i>Research theme B: Integrated aquaculture systems</i>					
2.	Mr. Deogratias Mulokozi	M	Dept of Physical Geography, SU	Prof. Håkan Berg Prof. Mwita Chacha	Dr. Paul Onyango Prof Törbjorn.Lundh
<i>Research theme C1: Improved broodstock and sustainable fingerling production for tilapia</i>					
3.	Ms. Redempta A. Kajungiro	F	Dept of Animal Breeding and Genetics (SLU)	Prof. Dirk Jan de Koning Dr. Matern Mtolera	Prof. Christos Palaikostas Prof. Chacha Mwita
4	Ms. Christer S. Nyinondi	F	Dept of Animal Breeding and Genetics (SLU)	Prof. Dirk Jan de Koning Dr. Matern Mtolera	Prof. Christos Palaikostas Dr. Aviti Mmochi
5	Mr. Levinus L. Rwehumbiza	M	Institute of Marine Sciences (UDSM)	Prof. Dirk Jan de Koning Dr. Aviti Mmochi	Prof. Phillip Bwathondi Dr. Matern Mtolera
6	Mr. Moses Mbiru	M	Institute of Marine Sciences (UDSM)	Dr. Matern Mtolera Prof. Dirk Jan de Koning	Prof. Christos Palaikostas Dr. Leonard Chauka
<i>Research theme C2A: Improved broodstock and sustainable fingerling production for pompano</i>					
7.	Mr. John Mapunda	M	Institute of Marine Sciences (UDSM)	Dr. Matern Mtolera Dr. Saleh Yahya	
<i>Research theme C2B: Improved broodstock and sustainable fingerling production for Holothurians</i>					
8.	Mr. Yusuf S. Yusuf	M	Institute of Marine Sciences (UDSM)	Dr. Saleh Yahya Prof. Phillip Bwathondi	
<i>Research theme D: High quality low cost fish feed</i>					
9.	Mr. Francis P. Mmanda	M	Dept of Animal Nutrition and Management (SLU)	Prof. Torbjorn.Lundh Dr. Matern Mtolera	Dr. Rukia Kitula
10.	Ms. Angela Michael	F	Institute of Marine Sciences (UDSM)	Dr. Margareth Kyewalyanga Prof. Törbjorn.Lundh	Ass Prof. Charles Lugomela Dr. Matern Mtolera
11	Ms Kulwa Mtaki	F	Institute of Marine Sciences (UDSM)	Dr. Margareth Kyewalyanga Dr. Matern Mtolera	
<i>Research theme E: Ecosystem-based climate change adaptation and response to climate induced episodes</i>					
12.	Mr. Barnabas Tarimo	M	Dept of Ecology, Environment and Plant Sciences (SU)	Prof. Martin Gullström Dr. Saleh Yahya	Prof. Mats Björk Dr Matern Mtolera
13.	Mr. Rashid O. Ismail	M	Dept of Ecology, Environment and Plant Sciences (SU)	Prof. Martin Gullström Ass Prof. Charles Lugomela	Dr. Amelia Buriyo Prof. Mats Björk
14.	Ms. Olivia John	F	Department of Botany (UDSM)	Dr. Amelia Buriyo Prof. Mats Björk	Dr. Yohana Shaghude Prof. Martin Gullström
15	Ms. Batuli M. Yahya	F	Institute of Marine Sciences (UDSM)	Dr. Saleh Yahya	Dr. Aviti J. Mmochi
<i>Research theme F: Establishing climatic trends</i>					
16	Ms. Mwasiti A. Rashid	F	Institute of Marine Sciences (UDSM)	Dr. Yohana W. Shaghude	

<i>S/N</i>	Selected Post Doc Student	Sex	Registration (Institution)	Main Supervisors in Tanzania and Sweden	Assistant supervisors in Tanzania & Sweden
<i>Research theme C1: Improved broodstock and sustainable fingerling production for tilapia</i>					
17	Leonard, L. (Subject to successful PhD defence)	<i>M</i>	<i>Institute of Marine Sciences (UDSM)</i>	Prof. Dirk Jan de Koning Dr. Matern Mtolera	Prof. Phillip Bwathondi
<i>Research theme C2A: Improved broodstock and sustainable fingerling production for pompano</i>					
18	Soud, Salum (Subject to successful PhD defence)	<i>M</i>	<i>Institute of Marine Sciences (UDSM)</i>	Dr. Tamatamah, Rashid Dr. Jiddawi	
<i>Research theme E: Ecosystem-based climate change adaptation and response to climate induced episodes</i>					
19	Dr. Lyimo, Liberatus	<i>M</i>	<i>Institute of Marine Sciences (UDSM)</i>	Prof. Mats Björk Dr. Matern Mtolera	Dr. Buriyo, Amelia Dr. Hamisi Mariam
20	Rushingisha, George (Subject to successful PhD defence)	<i>M</i>	<i>Institute of Marine Sciences (UDSM)</i>	Prof. Mats Björk Dr. Matern Mtolera	Dr. Buriyo, Amelia Dr. Hamisi Mariam

Encluse 6: Students study topic, progress achieved and planned deliverables (July 2020-March 2021)

1. Deogratias Mulokozi:

Title of research project: Integrated aquaculture-agriculture (IAA) systems for diversified food production in Tanzania; **Name of PhD-student:** Deogratias Pius Mulokozi

Popular description: Agriculture sector accounts for more than 25% of the Tanzania economy and employs over 70% of the rural population. Major challenges facing small scale farmers include low and declining productivity partly due to natural resources degradation, limited and uncertain rainfall coupled with poor infrastructure and service support. Given the general inability of small scale Tanzanian crop and fish farmers to purchase pond and farm inputs to sustain even low level systems, efforts should focus on promoting farming system that optimize on-farm resource use efficiency and economic profitability, whereby two or more production systems, at least one of which is fish farming are integrated (integrated agriculture-aquaculture (IAA)). This study aims at identifying and designing the IAA system that can help local farmers to diversify their food production in Tanzania.

The research questions

- a. What is the status quo of pond and integrated aquaculture-agriculture farming in Tanzania?
- b. What is the impact of using vegetable wastes on the fish yield and economic profitability in tilapia-vegetables integrated systems?
- c. What is the impact of fish pond water on vegetable yield and economic profitability in tilapia-vegetable integrated system?
- d. What are the livelihood impacts of integrated aquaculture and agriculture among small holder famers?

Progress overview

Deo is a about to finish his PhD and have published 4 papers of which two or three papers may be used in his thesis, submitted 1 and have another one in advanced manuscript and a final experiment that he currently is ending which we hope can generated a publication. Deo will start two write on his thesis (Kappa) towards the end of the summer and aim to defend his thesis in late 2020 or early 2021.

Activities Feb.-June 2020: Finish final experiment, analyze data and write manuscripts.

Deliverables Feb.-June 2020: One manuscript accepted for publication, another submitted for publication and a third in manus for circulations to supervisors (in addition to three that is already published)

Activities July 2020-June 2021: Visit Norway (final course, 10 hp) and Sweden between June-defence (Januari 2021). Aim to spend 8 months in Norway/Sweden. Revise and publish papers with the target to have 4-5 published papers in his thesis. Start to work on the PhD thesis writing to be submitted in November/December 2020

Deliverables July 2020-June 2021:

Two additional manuscripts accepted for publication

Submit his PhD thesis: November/December 2020

Budget for Deogratias Mulokozi July 2020-March 2021:

Student time 7 months, July to January 2021, travel and allowance for 7 month in Sweden.

Supervision for 7 months. $(250000/12) * 7 = 146\ 000\text{SEK}$ (plus auditing).

PhD-defence-cost 60 000 SEK (requested by the department of Physical Geography that this should be covered by Sida).

PhD Thesis (tentative title): Integrated Aquaculture systems for diversified food production in Tanzania

Publication 1 (published, may tentatively be included): *Spirulina (Arthrospira fusiformis)* as a potential protein source in practical diets for fry mariculture of Rufiji tilapia (*Oreochromis urolepis urolepis*)

Abstract

The effects on growth performance, feed utilization, survival and whole fish body proximate composition of replacing fishmeal (*Rastrineobola argentea*) with a locally available spirulina species (*Arthrospira fusiformis*) as a protein ingredient in the feed of Rufiji tilapia (*Oreochromis urolepis urolepis*) fry was examined. Fishmeal replacement with *A. fusiformis* was carried out at 5%, 15%, 25%, 35% and 100% (S5, S15, S25, S35 and S100), and the effect of the replacement was

compared with the control diet (S0, 0% spirulina). Fish fry were stocked at an average initial weight of 0.57 g at 10 fish per 0.1 m³ and cultured for 60 days using full strength salt water (30-35 ppt). *A. fusiformis* was isolated from Momela Lake in Arusha National Park, Tanzania and propagated using selected culture media. It was observed that fish fry fed spirulina at a 5% fishmeal substitution level diet had better ($p < 0.05$) final weight (8.48), average daily weight gain (0.132), specific growth rate (4.47), feed conversion rate (2.08) and protein efficiency ratio (1.37) compared to the control

fish group. Growth performance in fish fed diet S15 was comparable with the control group ($p > 0.05$). Spirulina supplementation had no effect on fish survival rates and meat quality. It appears that the Momella Lake spirulina may be an appropriate growth-stimulating plant protein when used as a feed additive in Rufiji tilapia mariculture.

Publication 2 (published). Fish farming in Tanzania: the availability and nutritive value of local feed ingredients.

Abstract

An investigative field survey was performed to gather baseline data on locally available feed ingredients and fish farming practices in different regions of Tanzania. More than 80% of

respondents relied on locally available feed ingredients as a major feed supplement for their cultured fish, with maize bran being the most commonly used feed ingredient in all

regions. Crude protein content in most analyzed local feed ingredients was medium-high, while crude fat content was high in some animal and agricultural by-products, and medium-

low in other ingredients. Most respondents were males and the majority of fish farms were owned by individuals. Earthen pond was the most common fish farming system in

all regions except Dar es Salaam. Semi-intensively mixed-sex tilapia monoculture was the dominating fish farming practice. The results of the survey presented provide a good platform

for future development of culture systems and feeding strategies for tilapia in Tanzania.

Publication 3 (published). Rural aquaculture: Assessment of its contribution to household income and farmers' perception in selected districts, Tanzania

Abstract

Rural fish farming is being promoted as a good source of protein and income diversification to fight poverty and inequality. However, its actual contribution to these rural households and

local community at large is little known. Through interviews with 89 farmers' and 6 key informants, we examined the contribution of rural fish farming to local farmers' household income

and investigate farmers' perceptions, opportunities, and constraints towards fish farming in six districts of Tanzania. Results indicated that fish farming contributed on average 13% to household incomes and that it explained 5% of the variation of the household income while 84% of the variation was due to non-fish sources. The majority (79%) of the farmers wanted to continue with fish farming, 9% planned to quit, and 12% had not decided whether to continue or not. Conclusively, much higher aquaculture contribution towards rural development could be obtained if appropriate measures are taken.

Publication 4 (submitted). An ecological and economical assessment of integrated Amaranth (*Amaranthus hybridus*) and Tilapia (*Oreochromis niloticus*) farming in Dar es Salaam, Tanzania.

Abstract

Organic wastes can be recycled in an ecologically sound way through fish ponds in integrated agriculture and aquaculture systems (IAA). This kind of waste recycling can protect the environment from pollution and improve fish yields. Additionally, IAA provides an opportunity for diversification of the output from two or more existing subsystems leading to higher overall farm economic returns and diversified livelihoods. This study explored the potential application of amaranth wastes as a dietary ingredient for tilapia (*O. niloticus*) in a tilapia-amaranth (*Amaranth hybridus*) integrated systems. Fish were stocked at 8 fingerlings per m² and reared for 183 days using six 7m² concrete ponds. Experimental feed contained 10% (based on the control diet) inclusion of amaranth wastes collected from a nearby vegetable market. The fish experiment involved two treatments; (i) fish fed on a diet supplemented with amaranth wastes, pond water used for irrigating the vegetable, (IAA fish) and (ii) fish fed on a control diet, with no pond water used for irrigating the vegetables (Non-IAA fish). Eighteen 4m² plots were prepared adjacent to the fish ponds for cultivating amaranth, that were irrigated with (i) tap water without fertilization (control vegetables), (ii) water from IAA fish pond, partially fertilized (IAA vegetables) and (iii) vegetable plots irrigated with tap water, fully fertilized (non-IAA vegetables) for 33 days. Amaranth farming was done 90 days after fish stocking. Substitution of 10% amaranth waste in the feed did not compromise the fish growth and yield, but resulted in a superior FCR and PER ($p < 0.05$) compared to the control diet. IAA vegetables had significantly ($p < 0.05$) higher yield than non IAA vegetables for the first harvests, and with comparable yields for the second harvest and for the overall farming cycle ($p > 0.05$). The control group produced significantly lower yield compared with IAA and non IAA plots. The overall net income from tilapia-amaranth integration system was 3.2, 2.3, 2.6 and 1.8 higher than non IAA vegetable, IAA vegetable, non IAA fish and IAA fish systems respectively. The study showed that yield and economic returns for both fish and amaranth can be improved when they are farmed in integration compared to when they are farmed separately. It was also revealed that, use of amaranth wastes can improve the FCR for tilapia, thus reducing feed costs while protecting the environment from pollution.

Publication 5 (in manus). Assessment of pond and integrated aquaculture (IAA) systems in selected districts, Tanzania

Abstract

Integrated agriculture and aquaculture systems (IAA) are well known for their ability to increase the overall farm productivity and profitability. This is through recycling of on-farm resources such as nutrient rich fish pond water and organic remains that would otherwise be considered as wastes. The present study explore the existing and potential IAA systems in Tanzania. It further examin management strategies and their influence on the fish yield and the economic return among IAA ponds and non IAA ponds. The study was conducted through an onsite survey of 129 fish ponds in six district in Tanzania involving 65 and 64 IAA ponds and non IAA ponds respectively. It was revealed that tilapia-vegetables is the most common type of IAA practiced by fish famers. There was a great variation in management practices between IAA and non-IAA ponds. Despite higher fish feed quantity and stocking density in non-IAA ponds, IAA ponds had higher fish yield than non-IAA ponds. IAA ponds had an average fish yield of 2.90 tons/ha, which was

significantly ($p < 0.05$) higher than the fish yield of 1.98 tons/ha found for non IAA ponds. IAA ponds had also 1.54 ($p = 0.05$) and 2.9 ($p = 0.04$) times higher revenue and net profit, respectively, than non-IAA ponds. Additionally, the net return from IAA ponds and integrated crops was significantly higher in an integrated system than when practiced as standalone activities. This study supports the view that IAA farming systems have great potential to improve fish pond production efficiency through an increased recycling of water, nutrients and organic matter. Thus, IAA systems should be strongly promoted among small scale farmer to cover for an increased fish demand and improve food security.

Publication 6 (data still to be analysed). Achieving higher productivity and profitability with less water consumption through tilapia-spinach integrated system in Tanzania

2. Baraka Nyangoko:

Title of research project: Mangroves and community livelihoods in Tanzania; **Name of PhD-student:** Nyangoko, Baraka

Popular description: Mangrove forests in many developing countries including Tanzania continue to face numerous stresses and benefits they provide are likely to be fully degraded within the next 100 years. The main driving factors for the degradation include poverty in rural coastal communities, poor management, pollution and land conversions combined with some natural threats like climate change. Despite recognition of these threats, there is still considerable gap in the understanding of the detailed link between benefits of mangroves and community livelihoods and how communities adapt to the changing benefits from mangroves. This study aims to assess local communities' perception towards dependence on mangrove ecosystem services and adaptation strategies in the Rufiji Delta, Tanzania.

The research questions

- a. How mangrove ecosystem services shape livelihoods of local communities in Rufiji Delta?
- b. What are community perceptions on the status and trends of mangroves ecosystem services in Rufiji Delta?
- c. What are community perceptions on adaptations mechanism in confronting the disturbances of climate change and anthropogenic disturbance on mangrove forests of Rufiji Delta?
- d. What are community perceptions on role of institutions in shaping adaptation strategies to climate change and anthropogenic disturbance of the mangrove forests in Rufiji Delta?

Progress overview

Baraka was admitted to his PhD in May 2017 and has been delayed 9 month due to sick leave, thus he aim is to finish his thesis in late 2021 or early 2022.

Activities Feb.-June 2020: Data analysis, manuscript writing and course work (20 hp) in Sweden until end of April

Deliverables Feb.-June 2020: Two manuscript to be finalized and submitted: one in May and one in June 2020

Activities July 2020-March 2021: Field work in Tanzania for manuscript 3 and 4 (August-September) Data analysis, course work and manuscript writing in Sweden (October-January). 4-5 months. Tentative extra field work in Tanzania (February-March 2021)

Deliverables July 2020-March 2021:

Two manuscript published and two additional manuscript submitted, another manuscript circulated to supervisors for comments.

Activities April 2021-January 2022. (next phase)

Data analysis, publish remaining manuscripts and finalise PhD thesis. 7 months in Sweden

Budget for Baraka Nyangoko July 2020-March 2021:

Student time 4 months, October-January 2021, travel and allowance for 4 month in Sweden.

Supervision for 9 months. $(250000/12) * 9 = 188\ 000\text{SEK}$ (plus auditing).

PhD Thesis (tentative title): Managing Mangrove Ecosystem Services for Livelihoods and Local Adaptations in Tanzania

Publication 1 (manuscript tentatively to be used in thesis). Socio-economic determinants of mangrove exploitation and management in Pangani river estuary, Tanzania.

Abstract

Mangroves in Tanzania are gazetted forest reserves, albeit they continue to be threatened by human pressures and mismanagement. This study explored socio-economic determinants of exploitation patterns and management of mangroves in Pangani River Estuary, using two communities of Bweni and Pangani Magharibi as case study sites. Data were collected through focus group discussions (FGDs), key informant interviews (KIIs), household questionnaire (HHQ) and field observations. Quantitative data were analysed for both descriptive and statistical inferences while qualitative information was subjected to content analysis. Residence time of household, household main occupation, household size and cost of alternative resources to substitute use of mangroves as source of fuel wood were positively correlated with mangrove resource use. The two communities differed in perception on the role of local institutions in management of mangroves. Over 56% of respondents in Bweni agreed that interventions of Beach Management Units (BMUs) enhanced mangrove condition and only about 16% in Pangani Magharibi had similar perception. Overall, more than 50% of respondents were not impressed with effectiveness of state management agencies in implementing conservation measures and sustainable use of mangroves. Loss of coastal fisheries resources was perceived as the major negative impact of mangroves overuse. This study

recommends promotion of feasible alternative livelihood activities especially to fishermen and improved stakeholders' collaborative arrangements for sustainable exploitation and management of mangroves in the area.

Publication 2 (manuscript). Mangroves and Community: Perception of Ecosystem Services and their Determinants in Rufiji Delta, Tanzania

Abstract

Understanding of how local communities perceive and depends on their ecosystems is crucial issue in conservation and decision-making processes to intellectualize functions and services of natural ecosystems. In this study, focus group discussions (FGDs), key informant interviews (KIIs), household questionnaires and direct observation were used to explore how local communities in Rufiji Delta perceive ecosystem services provided by mangroves and factors influencing their perception. Based on disparity in biophysical setting and social systems, six villages named: Mohoro, Mtunda A, Ruaruke Magharibi, Ruma, Mbuchi and Mbera Magharibi were selected as study sites. Quantitative data were analysed for both descriptive and statistical inferences while qualitative information was subjected to content analysis. Eighteen mangrove ecosystem services were identified in the study sites. Among them, provisioning services were the most highly recognized services followed by regulating services, cultural and supporting services. Communities' perception of the relative importance of the ecosystem services provided by mangroves to sustain local livelihoods displayed similarities and differences between the study sites. Poles for building, firewood for cooking, coastal protection and nurse ground for coastal fisheries were perceived as the most important mangroves ecosystem services in the study sites. The mean value for coastal protection services ($F=3.04$, $p=0.03$), firewood (2.34 , $p=0.04$), nursery ground ($F=4.98$, $p=0.024$) and salt production ($F=1.648$, $p=0.018$) differed significantly between the villages. Logit regression model indicated that distance of household to mangroves and residency time were significant predictors of the local communities awareness of all ecosystem services. Gender of household head and being part of management committees also determined local communities' awareness of the provisioning, regulating and cultural services. This finding suggests that the perceptions of ecosystem services are context specific and are much influenced by not only biophysical setting and societal systems but also management strategies undertaken to protect ecosystems. Therefore, in an effort to contribute to the designing of management strategies that allow sustainable protection of ecosystem services, understanding the social systems, conditions and trends of ecosystem services over space and time are importance to minimize potential tradeoff between stakeholder preferences and protection of ecosystem services.

Publication 3 (manuscript). Mangrove Ecosystem Services in the Rufiji Delta, Tanzania: Insight of the Current Status and Future Trends.

Abstract

Approximately 50% of the world's mangrove area have been lost and the decrease is expected to continue in the near future. This loss impairs the flow of ecosystem services and the impacts are often experienced at local levels, especially in developing nations where people often rely directly on natural capital for their livelihoods and wellbeing. This study explored how local communities in the Rufiji Delta perceive the current status and future trend of key mangrove ecosystem services, the reasons for change in ecosystem services and impacts of such changes to livelihoods. Mixed methods of focus group discussions (FGDs), key informant interviews (KIIs), household questionnaires and direct observation were used to collect information in six selected sites: Mohoro, Mtunda A, Ruaruke Magharibi, Ruma, Mbuchi and Mbera Magharibi. Quantitative data were analysed for both descriptive and statistical inferences, while qualitative information was subjected to content analysis. The majority of the surveyed communities (40%) indicated that the current status of mangroves to provide ecosystem services have decreased enormously compared to the last 10 years. Rice farming, illegal harvesting, climate change, population increase, poor management, poverty and salt extraction were identified as main reasons for this change. Most of the communities felt that in the coming 10 years, mangrove ecosystem service (firewood) will increase but other key services such building poles, farm site, climate regulation, coastal protection and natural beauty will continue to decline, mainly due to the construction of Stiegler's Gorge Hydroelectric Power Station and climate change. The perceived impact of firewood shortage ($\chi^2= 13.229$, $p=0.021$) and coastal flooding ($\chi^2= 12.324$, $p=0.031$) on livelihoods differed significantly between the villages. This finding suggests that the status of mangroves and ecosystem services that they provide are much influenced by both socioeconomic practices, management institution, development initiative and climate change. Therefore, securing sustainability of mangroves under different threats require not only proper monitoring of development initiatives but also understanding of diversified adaptive practices undertaken to confront the threats.

Publication 4 (field data to be analysed). Local Perceptions on Climate Change and Ecosystem- based Adaptation in Mangrove Ecosystems of Rufiji Delta, Tanzania

3. Francis Pius Mmunda:

Title of research project: Towards new feedstuffs for cultured Tilapia fish species in Tanzania; **Name of PhD-student:** Francis Pius Mmunda

Popular description: Aquaculture output in Tanzania has more than tripled in the last three years from 3000 mt (2014) to 11,000 mt (2015 & 2016). The growing aquaculture activities have resulted into an increased demands of both artificial/supplementary feeds and seeds and consequently fish feed production plants and fingerlings production units (hatcheries) have increased. Despite of their questionable quality of fish feeds, for example, their market prices are on the increase. This is one of the reasons why small scale farmers rely on locally available feedstuffs to supplement the natural food present in fish ponds. To establish the extent to which such feeds are sufficient for the grown fish and ways to make them adequate, studies to establish their nutritive values are important.

.The research questions

- a. What are the chemical compositions of local feedstuffs used by tilapia fish farmers in Tanzania?
- b. What are the potential nutritive values of selected locally available feed ingredients for Tilapia in Tanzania?
- c. What are the effects of diets formulated with locally available feedstuffs on Tilapia growth performance?
- d. What are the carcass traits of tilapia fish fed with formulated diets using locally available feedstuffs?

Progress overview

Activities Feb.-June 2020: Writing his manuscript and thesis in Sweden, SLU. Finishing coursework. Defending the thesis 12 of June 2020.

Deliverables Feb.-June 2020: Finalizing the last manuscripts and writing the thesis. Dissertation 12 June 2020.

Deliverables February 2020-June 2020:

PhD Thesis: Nutritive value and use of locally available low-cost feed ingredients for Tilapia farming in Tanzania.

Publication 1: Fish farming in Tanzania: the availability and nutritive value of local feed ingredients

Abstract: An investigative field survey was performed to gather baseline data on locally available feed ingredients and fish farming practices in different regions of Tanzania. More than 80% of respondents relied on locally available feed ingredients as a major feed supplement for their cultured fish, with maize bran being the most commonly used feed ingredient in all regions. Crude protein content in most analysed local feed ingredients was medium-high, while crude fat content was high in some animal and agricultural by-products, and medium-low in other ingredients. Most respondents were males and the majority of fish farms were owned by individuals. Earthen pond was the most common fish farming system in all regions except Dar es Salaam. Semi-intensively mixed-sex tilapia monoculture was the dominating fish farming practice. The results of the survey presented provide a good platform for future development of culture systems and feeding strategies for tilapia in Tanzania.

Authors: Francis Pius Mmanda, Deogratias Pius Mulokozi, Jan Erik Lindberg, Anna Norman Haldén⁴, Matern Mtolera, Rukia Kitula, and Torbjörn Lundh

Journal of Applied Aquaculture. <https://doi.org/10.1080/10454438.2019.1708836>

Publication 2: Mineral content in local feed ingredients used by fish farmers in four different regions of Tanzania.

Abstract: This study investigated the content of selected minerals (P, Ca, K, Na, Mg, Fe and I) in local feed ingredients used by tilapia fish farmers in Tanzania. Analyses were performed on 26 local feed ingredients collected at four different geographical locations in Tanzania (Dar es Salaam, Morogoro, Mbeya and Mwanza). The samples were taken randomly from fish farmers, fish feed producers, fingerling producers and animal feed shops or centers near fish farms in each region. The results showed a wide range of mineral concentrations. The highest levels of P was found in fish frames (17.8 g kg⁻¹), of Ca in limestone (107.3 g kg⁻¹), of K in gallant soldier (51.0 g kg⁻¹), of Na in marine shrimp (*Exhippolysmata oplophoroides*) (11.7 g kg⁻¹), of Mg in prawn head waste (4.2 g kg⁻¹), of Fe in azolla (2355 mg kg⁻¹) and of I in soy oil bean cake (447 mg kg⁻¹). The data on mineral content in feed ingredients can be used as a

platform for better-targeted feed formulation to tilapia farming systems. In conclusion, the data suggest that if more than two ingredients are used in the diet, this may be sufficient to meet the mineral requirements of all cultured tilapia species and their hybrids, without inclusion of any mineral premix. Authors: Francis Pius Mmamba, Jan Erik Lindberg, Anna Norman Haldén and Torbjörn Lundh
Western Indian Ocean Journal of Marine Science 18 (2) 1-9

Publication 3: Digestibility of local feed ingredients in tilapia *Oreochromis niloticus* determined by siphoning and stripping. Short summary: Eight locally available protein source ingredients in Tanzania were selected for assessment of apparent digestibility (AD) in tilapia *Oreochromis niloticus* by using siphoning and stripping for faecal collection. The selected protein source ingredients were Lake Victoria sardines (FM), brewery spent yeast (BSY), moringa leaves (ML), fresh water shrimp (FSH), marine shrimp (MSH), cattle blood (CB), duckweed (DW) and fish frames (FF). The AD (%) of dry matter (DM), organic matter (OM) and crude protein (CP) were unaffected ($P>0.782-0.901$) by faecal collection method (*i.e.* siphoning and stripping), with a correlation (r) between the AD of DM, OM and CP determined by siphoning and stripping of 0.99, 0.99 and 0.93, respectively. The AD (%) of DM, OM, CP and gross energy (GE) in the test ingredients differed ($P<0.0001$). The AD (%) of DM and OM was lowest in BSY and DW, followed in increasing order by ML, MSH, FF, FSH and CB. In general, the AD (%) of CP was high ($>76\%$) but with a low value (46%) for DW. The AD (%) of GE was closely correlated ($r=0.96$) to the AD of OM. Authors: Francis Pius Mmamba, Jan Erik Lindberg, Anna Norman Haldén, Matern Mtolera, Rukia Kitula and Torbjörn Lundh.
(Will be submitted to Aquaculture Reports in March 2020)

Publication 4: The effect of diets formulated with locally available feedstuffs on growth performance and carcass traits in Tilapia. Short summary: Growth performance and carcass quality evaluation of the tilapia experiment show that cattle blood meal, fish frames meal, fresh water shrimp meal and brewery spent yeast meal could be an alternative to fish meal in tilapia feed. However, the results showed that the test diets have slightly higher feed conversion ratio (FCR). Despite a higher FCR for, for example, blood meal, it may be more cost-effective for tilapia growers to use blood meal instead of expensive fish meal, which in the long term also contributes to the depletion of wild fish stocks. Authors: Mmamba P.F., Lindberg J. E, Norman Haldén A and Lundh T.

Publication 5: Rural aquaculture: Assessment of its contribution to household income and farmers' perception in selected districts, Tanzania. Abstract: Rural fish farming is being promoted as a good source of protein and income diversification to fight poverty and inequality. However, its actual contribution to these rural households and local community at large is little known. Through interviews with 89 farmers' and 6 key informants, we examined the contribution of rural fish farming to local farmers' household income and investigate farmers' perceptions, opportunities, and constraints towards fish farming in six districts of Tanzania. Results indicated that fish farming contributed on average 13% to household incomes and that it explained 5% of the variation of the household income while 84% of the variation was due to non-fish sources. The majority (79%) of the farmers wanted to continue with fish farming, 9% planned to quit, and 12% had not decided whether to continue or not. Conclusively, much higher aquaculture contribution towards rural development could be obtained if appropriate measures are taken. Authors: Mulokozi D., Mmamba P.F., Onyango P., Lundh T., Tamatamah R. and Berg H. Aquaculture Economics & Management. <https://doi.org/10.1080/13657305.2020.1725687>

This publication is a joint publication with Deo and is not planned to be included in Francis thesis.

Budget for Francis Pius Mmamba July 2020-March 2021:

Cost for publication of the two last manuscripts 20000 SEK

4. Rashid Ismail:

Title of research project: pH dynamics in the tropical shallow lagoon; **Name of PhD-student:** Rashid Omari Ismail

Popular description: During low tide seagrasses are capable of elevating seawater pH within the tropical shallow lagoon and thereby, govern calcification and photosynthesis process in macroalgae. pH increase favour calcification process but hinder photosynthesis in macroalgae. Therefore pH is an important ecological factor that play crucial roles within tropical shallow lagoon and marine system. However, long-term pH dynamics within tropical shallow lagoon is largely unknown. This study therefore will inform on long-term pH dynamics within shallow tropical lagoon (Chwaka) using pH meters set in the field. These meters are capable of recording pH for more than 90 days. pH meter also read temperature, depth, conductivity, PAR (light), salinity and dissolved oxygen. Results from this study will improve our predictive ability regarding the fate of increasing carbondioxide in the marine environments and ocean acidification scenario.

Research questions

- a. What is the long-term change in pH of the tropical shallow lagoon?
- b. How does seagrass photosynthesis influences long term pH dynamics?
- c. How does long term change in pH differ in marine habitats (bare sand, seagrass and calcifying algae)?
- d. How does long term change in pH influences macroalgal calcification and photosynthesis?
- e. How does temperature and dissolved oxygen influences pH dynamics in the tropical lagoon?

Progress overview

Activities Feb.-June 2020: Writing his manuscript and thesis in Sweden, SU. Finishing coursework.

Deliverables Feb.-June 2020: Four finished manuscript included in his thesis that will be submitted in the beginning of June 2020 for approval to go for dissertation.

Activities July 2020-March 2021: Preparation for thesis defence. Disputation end of September 2020.

Deliverables July 2020-March 2021:

PhD Thesis: Balance between Productivity and Calcification in Tropical seagrass beds and its implication for Net Carbon sequestration.

Publication 1: Plant composition and Calcification Modify Air-sea Fluxes of CO₂ in Tropical Seagrass meadow

Short summary: Vegetated coastal ecosystems, such as seagrass meadows, are crucial carbon sinks. In tropical areas, these ecosystems contains large proportion of calcifying organisms, which partly counteracts the sequestration of carbon as the calcification process drives CO₂ from the water to the atmosphere. We investigated the influence of vegetation composition (i.e. seagrass and calcifying macroalgae), environmental parameters and time of day, on the air-water CO₂ flux in field and in controlled mesocosm.

Authors: Rashid O. Ismail, Maria E. Asplund, George Rushingisha, Amelia S. Buriyo, Martin Dahl, Matern S.P. Mtolera, Martin Gullström, Mats Björk.

Publication 2: Land-sea connectivity: effects of mangrove degradation on carbon sequestration in nearby seagrass habitats in north-eastern Madagascar. Short summary: Seagrass meadows constitute important contributors to climate change mitigation through sequestration of carbon dioxide from the atmosphere, creating long-term storage of sedimentary carbon. Although the understanding of strength and variability of sedimentary carbon sequestration and storage is of vital importance to assess coastal carbon dynamics, there is a large uncertainty on how co-existing drivers at local- and landscape scales governing carbon storage in coastal seascape environments. The main aim of this study was to understand effects of mangrove degradation on carbon sequestration in nearby seagrass habitats. Authors: Maria E. Asplund, Rashid Ismail, Martin Gullström, Martin Dahl, Ariane Arias Ortiz, Diana Deyanova, Joao N. Franco, Leah Glass, Linus Hammar, Arielle I. Hoamby, Hans W. Linderholm, Liberatus D. Lyimo, Pere Masque, Diana Perry, Lina M. Rasmusson, Sam Ridgway, Gloria Salgado Gispert and Mats Björk

Publication 3: Coastal blue carbon stocks in Tanzania and Mozambique support for climate adaptation and mitigation actions. Short summary: Globally, there is a general interest in marine ecosystems due to their potential in mitigating climate change. Several marine and coastal ecosystems have the potential to significantly sequester and store organic carbon. Therefore, the development of strategic policy frameworks in order to protect and restore these ecosystems are of outmost importance. This project presents the status of blue carbon habitats in the understudied western Indian Ocean. It provides new data from a comprehensive assessment of blue carbon stocks from coastal habitats (mangroves and seagrass meadows) within and outside existing protected areas of Tanzania and Mozambique. Authors: Martin Gullström, Martin Dahl, Olof Lindén, Francis Vorhies, Sara Forsberg, Rashid O. Ismail and Mats Björk

Publication 4. pH dynamics in Tropical Seagrass meadow: Short summary: Natural changes in pH within seagrass meadows of the Tropical lagoon systems have great influence on the rate of calcification and photosynthesis of calcareous algae associated with seagrasses. Increase of pH due to seagrass CO₂ uptake, influence calcification process positively and have strongest influence on CO₂ fluxes. In this study, we aimed to document the long-term changes of pH within tropical seagrass meadow in relation to biochemical process, other environmental parameters and time of day in order to address clearly the concept of carbon sequestration in tropical seagrass meadows associated with calcifying macroalgae. Authors: Rashid O. Ismail, Maria E. Asplund, Olivia John, Martin Gullström, Martin Dahl and Mats Björk

Publication 5: Organic carbon accretion rate and dating in Tropical Seagrass meadow. Short summary: We conducted a research in Zanzibar Island specifically in mangroves and seagrass areas, collecting sediment samples to determine carbon accretion rate and dating within these areas. Authors: Pere Masque, Chanelle Webster, Rashid Ismail, Martin Gullström, Liberatus D. Lyimo, Gloria Salgado Gispert, Paul Lavery, Mats Björk

Budget for Rashid Ismail July 2020-March 2021:

Student time 4 months, July to October 2020, travel and allowance for one month in Sweden.

Supervision for 4 months. $(250000/12) * 4 = 84000\text{SEK}$ (plus auditing)

5. Olivia John:

Title of research project: The impact of calcareous macroalgae and anthropogenic stress on production and carbon storage in tropical seagrass meadows; **Name of PhD-student:** John Olivia

Popular description: Atmospheric Carbon dioxide levels have been reported to increase and the global average concentration reported in December was 401.62 ppm. This increase is coinciding with increased anthropogenic activities such as burning of fossil fuel, changes in land use and livestock keeping. Natural marine ecosystems such as salt marshes, mangrove and seagrass beds serves as carbon sinks and hence reduce its negative impact in the atmosphere. Seagrass meadows have been reported to store large amount of organic carbon and it store about 10-18% of the total carbon stored in the ocean. Studies have been conducted on the processes influencing carbon sequestration as well as amount of organic carbon stored in the seagrass meadows. However, information on the effect of the presence of calcareous macroalgae and anthropogenic stresses such as increased nutrients and low light intensity on seagrass production linked to carbon storage is lacking. Therefore this study intends to investigate the effect of the presence of calcareous macroalgae and anthropogenic stresses (eutrophication and low light) on seagrass production and carbon storage.

The research questions

- a. What is the effect of calcareous macroalgae on seagrass photosynthesis and growth?
- b. What is the effect of calcareous macroalgae on seagrass biomass and carbon storage?
- c. How does increase seagrass density affect calcareous macroalgae growth and carbonate production?
- d. What is the effect of increased nutrient and low light on seagrass photosynthesis and carbon storage?

Progress overview

Activities Feb.-June 2020: Writing her manuscript and thesis in Dar es Salaam.

Deliverables Feb.-June 2020:

PhD Thesis submitted for evaluation

Three finished manuscript included as chapters in her thesis.

One manuscript submitted to PlosOne:

Publication 1, (submitted and under revision). An experimental assessment of algal calcification as a potential source of atmospheric CO₂. Abstract: Marine vegetated ecosystems such as seagrass meadows are increasingly acknowledged as important carbon sinks based on their ability to capture and store atmospheric carbon dioxide, thereby contributing to climate change mitigation. Most studies on carbon storage in marine ecosystems have focused on organic carbon, leaving inorganic carbon processes such as

calcification unaccounted for, despite of their critical role in the global carbon budget. This is probably because of uncertainties regarding the role of calcification in marine carbon budgets as either atmospheric CO₂ source or sink. Here, we conducted a laboratory experiment to investigate the influence of a calcifying alga (*Corallina officinalis* L.) on seawater carbon content, using a non-calcifying alga (*Ulva lactuca* L.) as a control. In a first part, algae were incubated separately while measuring changes in seawater pH, total alkalinity (TA) and total dissolved inorganic carbon (DIC). The amount of carbon used in photosynthetic uptake and production of CaCO₃ was then calculated. In a second, directly following, part the algae were removed and DIC levels were allowed to equilibrate with air until the pH stabilized and the loss of CO₂ to air was calculated as the difference in total DIC from the start of part one, to the end of the second part. The results showed that *C. officinalis* caused a significant and persistent reduction in total dissolved inorganic carbon (DIC), TA and seawater pH, while no such permanent changes were caused by *U. lactuca*. These findings indicate that calcification can release a significant amount of CO₂ to the atmosphere and thereby possibly counteract the carbon sequestration in marine vegetated ecosystems if this CO₂ is not re-fixed in the system. Our research emphasises the importance of considering algal calcification in future assessments on carbon storage in coastal areas. **Authors: Olivia J. Kalokora, Amelia S. Buriyo, Maria E. Asplund, Martin Gullström^{4, 5}, Matern S.P. Mtolera, Mats Björk.**

Activities July 2020-March 2021:

Preparation, publishing of remaining manuscripts.

Deliverables July 2020-March 2021:

Publication 2: Sediment organic carbon content, plant growth and algal carbonate production is affected by relative cover of seagrass and calcareous macroalgae in tropical seagrass meadows.

Abstract: Seagrass meadows are very important for coastal areas, providing ecological services such as increased biodiversity, coastal water quality, coast line protection, and foraging habitat for a large number of marine species. Since they also capture and store large amounts of atmospheric carbon dioxide in their sediment, they are important carbon sinks contributing to climate change mitigation. In tropical meadows, seagrasses are often inter-mixed with calcareous macroalgae such as *Halimeda* spp. Here the seagrasses and calcareous macroalgae might compete for resources such as nutrients, light and space, but might also have positive feedbacks between species, such as promoting calcification and increase availability of inorganic carbon species. Such interactions are likely to affect primary productivity and thus also the sediment carbon storage capacity of the meadows. In this study, we investigated interspecific interactions between the dominant seagrass *Thalassia hemprichii* and an abundant, rhizophytic calcareous macroalgae, *Halimeda opuntia*, in situ within a mature seagrass community in Chwaka Bay, Zanzibar, Tanzania. Productivity of both the macroalgae and the seagrass were measured over a period of two weeks. Our results showed that increase in relative cover of seagrass reduced both segment and biomass growth while enhancing macroalgae calcification but increase in relative cover of macroalgae reduced seagrass leaf elongation rate but not biomass growth. Furthermore the composition of the vegetation cover had a significant effect on carbon storage in sediments. Plots with macroalgae either monospecific or mixed with seagrass, had a significantly higher sediment carbon storage compared to monospecific plots of seagrass, and unvegetated plots had significantly lower carbon storage than all vegetated plots. **Authors: Kalokora, O. J, Buriyo A. S, Mtolera, M. S. P., Gullström, M., Björk, M.**

Publication 3. pH dynamics in Tropical Seagrass meadow: Short summary: Natural changes in pH within seagrass meadows of the Tropical lagoon systems have great influence on the rate of calcification and photosynthesis of calcareous algae associated with seagrasses. Increase of pH due to seagrass CO₂ uptake, influence calcification process positively and have strongest influence on CO₂ fluxes. In this study, we aimed to document the long-term changes of pH within tropical seagrass meadow in relation to biochemical process, other environmental parameters and time of day in order to address clearly the concept of carbon sequestration in tropical seagrass meadows associated with calcifying macroalgae. Authors: Rashid O. Ismail, Maria E. Asplund, Olivia John, Martin Gullström, Martin Dahl and Mats Björk

Budget for Olivia John July 2020-March 2021:

No funds requested by the Swedish counterpart.

6. Barnabas Tarimo:

Title of research project: Mangrove-seagrass continuum: Linkages to Larval Fish Production, Dispersal and Growth; **Name of PhD-student:** Rashid Tarimo, Barnabas

Popular description: Over the years, coastal communities in developing countries around the world are totally dependent on coastal ecosystem services and goods for food and income. Important coastal ecosystems include coastal vegetation (including seagrass and mangrove ecosystems) which, among others, provide nursery and spawning grounds for fish of commercial and ecological importance. There continued production of fisheries resources is essential for maintaining jobs and food security of the coastal communities. However, sustained productivity of the coastal vegetation is increasingly threatened due to recent increases of human/anthropogenic activities and climate change, which among others accelerate loss of their coverage and health. Such losses may interfere with fisheries recruitment i.e. production, dispersal and growth of fish larvae and thus could lead into declines of fish stocks. This study aims at establishing how the increased degradation of essential coastal vegetation limits fish recruitment process. Field surveys, genetic tools and experimental enclosures will be employed to understand fish larvae production, growth and dispersal as well as a connectivity between coastal habitats and fish recruitment.

Research questions

- a. What are critical coastal habitat conditions for fish recruitment and drivers for fish larvae production in mangroves and seagrass in the study areas?
- b. What are the dispersal potentials of fish larvae in seagrass and mangroves of selected areas of coastal of Tanzania?
- c. Is there any variability in growth of Juvenile Fish in different nearshore habitats (seagrass and mangrove ecosystems)?

Progress overview

Activities Feb.-June 2020: Writing his manuscript and thesis in Sweden, SU. Finishing coursework.

Deliverables Feb.-June 2020: Draft manuscripts.

Activities: July 2020-March 2021:

Finishing data analysis and writing of thesis, finalising manuscripts for publication.

Deliverables July 2020-March 2021:

PhD Thesis: Fish larvae in mangroves-seagrass seascapes in a changing environment

Publication 1: Seasonal distribution of fish larvae and post-larvae in mangrove-seagrass seascapes of Zanzibar (Tanzania). Currently undertaking data analysis and manuscript preparation. To be submitted in January 2020. Authors: Tarimo BA, Winder M, Mtolera MSP and Gullström M.

Publication 2: Food-web linkages with focus on fish larvae, zooplankton and physiochemical variables in nearshore areas of Zanzibar (Tanzania). Currently undertaking data analysis and manuscript preparation. Plan for remaining parts: to finish data analysis by the December 2019, start writing manuscript in January 2020 and submit the manuscript by May 2020. Authors: Tarimo BA, Winder M, Björk M, Mtolera MSP and Gullström M.

Publication 3: Effects of temperature on growth and survival rate of two selected postlarvae of rabbitfish: a mesocosm experimental approach. Currently the field work is undertaken to get fish larvae for the experiment, which will start the 21st of October. Plan for remaining parts: finish data collection from the experimental set-up by December 2019, start data analysis in December 2019 and start writing on a manuscript in January 2020. Submission of manuscript is planned by June 2020. Authors: Tarimo BA, Mtolera MSP, Winder M and Gullström M

Publication 4: Assessment of fish larvae in the food web of productive areas of mangroves and seagrass meadows: a review comparing tropical and temperate environments. Manuscript status: not yet begun. Authors: Tarimo BA, Monika W, Mtolera MSP, Björk M and Gullström M

Budget for Barnabas Tarimo July 2020-March 2021:

Student time 9 months, July to March, travel and allowance for six months in Sweden.

Supervision for 9 months. $(250000/12) * 9 = 188000\text{SEK}$ (plus auditing)

7. Redempta Athanas Kajungiro

Title of research project: Towards a Sustainable Nile Tilapia Breeding Program in Tanzania and the role of local strains; **Name of PhD-student:** Kajungiro, Redempta

Popular description: Aquaculture farmers in Tanzania have difficulties to find their highly cherished seeds from pure line Nile tilapia because of high interbreeding between tilapia species, both in the wild and in cultured environments. Thus unrelated farmed populations look alike. To successfully have genetically improved seeds from the planned breeding program in Tanzania, it is important to identify breeds/populations with sufficient genetic variation. To identify such populations, this study will use a molecular tool (Restriction Associated DNA sequencing (RAD Seq)) to identify tilapia strains and/or species found in Lake Victoria and those in hatcheries and farms found in major aquaculture regions in Tanzania (Mwanza, Dar es Salaam, Mbeya, Kilimajaro, Pwani, Ruvuma), test for their genetic diversity and understand their genetic structures. Other attributes to be analyzed include growth performance, survival rate and Genotype-Environment interactions in two locations (Pangani and Kunduchi).

Research questions

- a. What is the purity and diversity of currently cultured local Tilapia lines in Tanzania?
- b. What are the strains of Nile Tilapia cultured in different hatcheries owned by Tanzanian's government?
- c. What is the performance of local Tilapia strains compared to imported strains?
- d. Does genotype-environment interaction exist between the strains cultured at Kunduchi and Pangani?

Progress overview

Activities February-June 2020

- Analysis of common garden experiment
- Preparation of manuscripts
- Draft of SLU PhD thesis
- Finalize course work at SLU

Deliverables June 2020: Four research manuscripts that will be the basis for the SLU Thesis

Activities July 2020 - March 2021

- Finalize thesis and prepare for PhD defense at SLU in October 2020

Deliverables for June 2020

PhD thesis: Developing the basis of a breeding program for sustainable tilapia aquaculture in Tanzania

Paper 1: Population Structure and Genetic Diversity of Nile Tilapia (*Oreochromis niloticus*) Strains Cultured in Tanzania.

Understanding population structure and genetic diversity within and between local Nile tilapia lines cultured in Tanzania is important for sustainable aquaculture. This study investigated the

genetic structure and diversity amongst seven Nile tilapia populations in Tanzania (Karanga, Igunga, Ruhila, Fisheries Education and Training Agency, Tanzania Fisheries Research Institute, Kunduchi, and Lake Victoria). Double- digest restriction site-associated DNA (ddRAD) libraries were prepared from 140 individual fish (20 per population) and sequenced using an Illumina HiSeq 4000 resulting in the identification of 2,180 informative single nucleotide polymorphisms (SNPs). Pairwise F_{st} values revealed strong genetic differentiation between the closely related populations; FETA, Lake Victoria, and Igunga and those from TAFIRI and Karanga with values ranging between 0.45 – 0.55. Population structure was further evaluated using Bayesian model-based clustering (STRUCTURE) and discriminant analysis of principal components (DAPC). Admixture was detected amongst Karanga, Kunduchi and Ruhila populations. A cross-validation approach (25 % of individual fish from each population was considered of unknown origin) was conducted in order to test the efficiency of the SNP markers to correctly assign individual fish to the population of origin. The cross-validation procedure was repeated 10 times resulting in 77 % of the tested individual fish being allocated to the correct population. Overall our results provide a new database of informative SNP markers for both conservation management and aquaculture activities of Nile tilapia strains in Tanzania. **Published**

Authors: Redempta A Kajungiro, Christos Palaiokostas, Fernando A Lopes Pinto, Aviti J Mmochi, Marten Mtolera, Ross D Houston, Dirk Jan de Koning

Paper 2: Population structure and genetic diversity of native, exotic, and wild strains of Tilapia in Tanzania.

This is a joint paper describing the genetic diversity across all the tested tilapia strains in the project. The paper will have joint first authorship for **Redempta**, Christer, Moses and Levinus.

The analyses for this manuscript have been completed some time ago. The students have the joint task to draft a manuscript which is in progress.

Additional authors: Christos Palaiokostas, Fernando Lopes-Pinto, DJ de Koning from SLU. Ross Houston from Roslin Institute plus supervisors from UDSM.

Paper 3: A common garden comparison of native Nile Tilapia strains in two environments

The paper will describe the results from the common garden experiments in Pangani and Kunduchi. It will show the differences between the different strains in the two environments and explore whether the strains rank differently for growth between the two locations. The outcome of this study is quite important for the decision which lines should be selected as the basis of a breeding program for Nile Tilapia in Tanzania.

Suggested Authors: Redempta Athanas, Mwita Chacha, Matern Mtolera, DJ de Koning and Christos Palaiokostas

Paper 4: Genetic parameters for growth in native Nile tilapia strains in two environments.

This paper is also based on the common garden experiments. Here we will use the family structures to estimate genetic parameters for the measured growth traits. Provided we have sufficient data, we will estimate these parameters separate for Kunduchi and Pagani to test if there is a gene x environment interaction. We can also test if families rank differently between the different environments

Suggested Authors: Suggested Authors: Redempta Athanas, Mwitia Chacha, Matern Mtolera, DJ de Koning and Christos Palaikostas

Budget for Redempta

Student time 4 months, July to October, travel and allowance for one month in Sweden.

Supervision for 4 months. $(250000/12) * 4 = 84000\text{SEK}$ (plus auditing)

8. Christer Simon Nyinondi

Title of research project: Sustainable Tilapia Breeding in Tanzania and the Role of Rufiji Tilapia (*Oreochromis urolepis urolepis*); **Name of PhD-student:** Christer Simon

Popular description: Tilapia may be farmed as mixed or single (mono) sexes. Mono-sex male (all male) cultures are highly cherished for their larger harvest weight and uniform sized fish at harvest. All male tilapia populations may be obtained by visual selection, hormonal sex reversal, hybridization and genetic manipulation. Earlier Bilateral Marine Science Program (BMSP) studies shows crosses of female Nile tilapia with male Rufiji tilapia produces all male hybrid populations. The Rufiji tilapia is also shown to survive and grow better in estuarine water than Nile tilapia while Nile Tilapia does best in the freshwater. The BMSP studies also show that all-male populations resulting from the crosses of the two species resembles Rufiji tilapia in salinity tolerance and Nile tilapia in growth performance. By using a molecular tool (Restriction Associated DNA sequencing (RAD Seq)) this study aims to identify Rufiji tilapia populations with sufficient genetic variation so as to breed a genetically improved Rufiji tilapia for the noble role of producing all male seed populations.

The research questions

- a. How is sex determined in Rufiji tilapia?
- b. Is the sex determination in Rufiji tilapia resembles the blue tilapia?
- c. Is there any genetic correlations between growth performance and other important traits such as disease resistance, stress tolerance and sexual maturation in Rufiji tilapia?
- d. What is the purity and diversity of wild and cultured Rufiji tilapia?
- e. Is it possible to improve important traits in Rufiji tilapia (e.g. growth performance, disease resistance, stress tolerance) by using markers (DNA/RNA variation linked to such traits)

Progress overview

Activities February-June 2020

- Analysis of common garden experiment
- Preparation of manuscripts
- Draft of SLU PhD thesis
- Finalize course work at SLU

Deliverables June 2020: Four research manuscripts that will be the basis for the SLU Thesis

Activities July 2020 - March 2021

- Finalize thesis and prepare for PhD defense at SLU in October 2020

Deliverables for June 2020

PhD thesis: Developing the basis of a breeding program for sustainable Rufiji tilapia aquaculture in Tanzania

Paper 1: Genomic diversity and purity between different populations of Rufiji tilapia cultured in

Tanzania assessed by Restriction site associated DNA (RAD) markers.

This paper measured the population structure and diversity in several strains of Rufiji Tilapia. The analyses for this manuscript have been completed and we are eagerly awaiting the completion of this manuscript. This manuscript should be completed and submitted as a matter of priority. The SLU rules stipulate that at least one manuscript must be accepted for publication before the student can defend their PhD thesis

Proposed Authors: Christer Simon, Christos Palaiokostas, Fernando A Lopes Pinto, Aviti J Mmochi, Matern Mtolera, Ross D Houston, Dirk Jan de Koning

Paper 2: Population structure and genetic diversity of native, exotic, and wild strains of Tilapia in Tanzania.

This is a joint paper describing the genetic diversity across all the tested tilapia strains in the project. The paper will have joint first authorship for Redempta, **Christer**, Moses and Levinus.

The analyses for this manuscript have been completed some time ago. The students have the joint task to draft a manuscript which is in progress.

Additional authors: Christos Palaiokostas, Fernando Lopes-Pinto, DJ de Koning from SLU. Ross Houston from Roslin Institute plus supervisors from UDSM.

Paper 3: A common garden comparison of Rufiji Tilapia strains in two environments

The paper will describe the results from the common garden experiments in Pangani and Kunduchi. It will show the differences between the different strains in the two environments and explore whether the strains rank differently for growth between the two locations. The outcome of this study is quite important for the decision which lines should be selected as the basis of a cross breeding program for Rufiji Tilapia with Nile Tilapia in Tanzania.

Suggested Authors: Christer Simon, Mwita Chacha, Matern Mtolera, DJ de Koning and Christos Palaiokostas

Paper 4: Genetic parameters for growth in Rufiji tilapia strains in two environments.

This paper is also based on the common garden experiments. Here we will use the family structures to estimate genetic parameters for the measured growth traits. Provided we have sufficient data, we will estimate these parameters separate for Kunduchi and Pagani to test if there is a gene x environment interaction. We can also test if families rank differently between the different environments

Suggested Authors: Suggested Authors: Christer Simon, Mwita Chacha, Matern Mtolera, DJ de Koning and Christos Palaiokostas

Budget for Christer

Student time 4 months, July to October, travel and allowance for one month in Sweden (PhD defense, printing and preparing defense).

9. Moses Mbiru

Title of research project: Introduced Nile Tilapia Strains and Their Role in the Tanzania Tilapia Breeding Initiative; Name of PhD-student: Mbiru Moses

Popular description: In anticipation that genetically improved Nile tilapia would revolutionaries Tilapia farm outputs as reported elsewhere, some Tilapia farmers in Tanzania have been permitted to introduce and farm seven such strains (Chitralada, BIG NIN, Red Tilapia/YY-super males and four (4) other unknown strains) since 2007. To date there is limited information on their suitability to Tanzania environment. Studies elsewhere show some differences in growth performances between such strains and/or generations. Moreover, some improved strains were found to be inferior to local strains due to their local adaptation, others have shown differences in genetic correlation under different farming environments due to environmental influence on genotype. By using a molecular tool (Restriction Associated DNA sequencing (RAD Seq)), this study, aims at establishing genetic purity, diversity, growth performances and genotypic response under varying farming environments so as to establish foreign strain's aquaculture potential and usefulness in facilitating the national Tilapia breeding initiative in Tanzania.

The research questions

- a. Is there any significant difference in farm output between the seven foreign introduced strains of Nile Tilapia (Chitralada, Red Tilapia/YY super males, BIG NIN, 4 unknown strains) farmed in similar management systems?
- b. Is there any significant difference in purity and genetic diversity between the different introduced strains of Nile Tilapia (*O. niloticus*) shown in (a) above?
- c. Are there any significant difference in growth performance and survival rates between the introduced strains in (a) and native strains of Nile tilapia (*O. niloticus*) farmed in similar management systems?.
- d. Is there a positive genetic correlation for harvest body weight and survival in brackish and freshwater ponds for all the seven introduced strains in (a)?

Progress overview

Activities February-June 2020

- Analysis of common garden experiment
- Preparation of manuscripts
- Draft of UDSM PhD thesis
- Finalize course work at SLU

Deliverables June 2020: Three research manuscripts that will be the basis for the UDSM Thesis

Activities July 2020 - March 2021

- Draft a fourth manuscript on the overall common garden experiment.
- Finalize thesis and prepare for PhD defense October 2020

Deliverables for June 2020

Paper 1: Characterizing the genetic structure of introduced Nile tilapia (*Oreochromis niloticus*) strains in Tanzania using double digest RAD sequencing.

Tilapia hatcheries in Tanzania rely heavily on importing germplasm. Nevertheless, the genetic structure of the imported stocks is poorly understood. In the current study, the level of genetic diversity and differentiation of eight populations of Nile tilapia (*Oreochromis niloticus*) strains imported in Tanzania was investigated. Four of the studied strains originated from Thailand, three from Uganda, and one from the Netherlands. Double-digest restriction site-associated DNA sequencing (ddRAD-seq) was applied to identify and genotype single nucleotide polymorphisms (SNPs). In total, 2214 SNPs passed all the quality control steps and were utilized for downstream analysis. Mean heterozygosity estimates were higher for the Thailand strains (H_o , 0.23) compared with the strains from Uganda (H_o , 0.12). Low genetic distance was observed amongst populations from the same geographic origin (F_{st} , 0.01–0.04). However, genetic distance between populations from different geographic origins was substantial (F_{st} , 0.24–0.44). Bayesian model-based clustering (STRUCTURE) and discriminant analysis of principal components (DAPC) grouped the studied animals into three distinct clusters. A cross-validation approach (where 25% of animals from each population were considered of unknown origin) was conducted in order to test the efficiency of the SNP dataset for identifying the population of origin. The cross-validation procedure was repeated 10 times resulting in approximately 97% of the tested animals being allocated to the correct geographic population of origin. The breeding history and hatchery practices used to manage these stocks prior and after import appear to be the main factors for the genetic diversity observed in this study. Our study will help inform hatchery stock management and future breeding program designs in Tanzania.

Authors: Mbiru Moses, Matern SP Mtolera, Leonard J Chauka, Fernando A Lopes, Dirk Jan de Koning, Ross D Houston, Christos Palaiokostas

Paper 2: Population structure and genetic diversity of native, exotic, and wild strains of Tilapia in Tanzania.

This is a joint paper describing the genetic diversity across all the tested tilapia strains in the project. The paper will have joint first authorship for Redempta, Christer, **Moses** and Levinus.

The analyses for this manuscript have been completed some time ago. The students have the joint task to draft a manuscript which is in progress.

Additional authors: Christos Palaiokostas, Fernando Lopes-Pinto, DJ de Koning from SLU. Ross Houston from Roslin Institute plus supervisors from UDSM.

Paper 3: A common garden comparison of exotic Nile tilapia strains in two environments

The paper will describe the results from the common garden experiments in Pangani and Kunduchi. It will show the differences between the different strains in the two environments and explore whether the strains rank differently for growth between the two locations. The outcome of this study is quite important for the decision whether exotic lines should be included in a breeding program for Nile Tilapia in Tanzania.

Suggested Authors: Mbiru Moses, Matern SP Mtolera, Leonard J Chauka, Dirk Jan de Koning, Christos Palaiokostas

Deliverables July 2020-March 2021

PhD thesis: Evaluating exotic lines of Nile tilapia as a potential basis of a breeding program for sustainable tilapia aquaculture in Tanzania

Paper 4: Extensive comparison of diverse tilapia strains in a common garden experiment.

This paper would summarize the whole common garden experiment in terms of comparison between all the lines. This manuscript will make overall recommendations about what lines are best suited to form the basis of a breeding program for sustainable tilapia aquaculture in Tanzania. It based on the work of all three students so they should all three be joint authors on this manuscript. Christer and Redempta both have to work on genetic analysis based on their family data. Moses does not have family structures in his data so he could lead the joint manuscript on the overall common garden experiment.

Suggested Authors: Mbiru Moses, Redempta Athanas, Christer Simon, Matern SP Mtolera, Leonard J Chauka, Mwita Chacha, Dirk Jan de Koning, Anna Norman-Haldén, Christos Palaiokostas

Budget for Moses

Student time 4 months, July to October.

10. John Mapunda

Title of research project: Brood-stock maturation, seed production and larviculture of Silver Pompano, *Trachinotus Blochii* (Lucepede, 1801) for mariculture in Tanzania.;

Name of PhD-student: John Mapunda

Popular description: Among the many high value marine finfish in Tanzania that could be farmed, silver pompano is one of the topmost, mainly due to its fast growth, good meat quality and high market demand both in locally and in tourist markets. The Bilateral Marine Science

Program initiatives for its farming in Tanzania have so far studied availability of fingerlings from the wild, cage culture of its juveniles, alternative protein sources for their growth in recirculation tanks, and influence of different water salinities on survival and growth. As silver pompano fingerlings are not readily available at all times, techniques for its breeding and sustained seed production are crucial. Equally important is the management of grow-out operations in earthen ponds that are frequently used in Tanzania. This study is therefore focusing on developing techniques for managing silver pompano broodstock and its sustainable seed production in a hatchery; and best husbandry techniques of silver pompano in traditional and commercial earthen ponds.

The research questions

- What are the effects of maggot and earthworm meals on the spawning performance, egg production, hatching rate, of the silver pompano (*Trachinotus blochii*) broodstock reared in indoor tanks?
- How water temperature and salinities affects the reproductive performance, reproductive gene expression, reproductive hormonal expression of the silver pompano broodstock; and early larvae stages of silver pompano?
- What is the effect of water temperature on the survival and growth rate of silver pompano larvae reared in indoor tanks?
- What is the effect of stocking densities on the growth performance, survival and production of silver pompano fingerlings reared in both traditional and commercial earthen ponds?

Thesis Title

Snubnose pompano (*Trachinotus blochii* (Lacépède, 1801) Larval Production and Growth Performance in Captivity: Some Aspects of Gene Expression, Cortisol Levels, and Digestive Enzymes.

Manuscripts

1. Effect of stocking densities on survival, growth, body contents and cortisol level of pompano larvae (*Trachinotus blochii*)
2. Effect of feeding strategies on survival, growth, body contents, enzymatic activities and expression of genes coding for the appetite, digestion and metabolism of pompano larvae (*Trachinotus blochii*)
3. Effect of salinity on oil globule absorption, gut content, survival, growth, cortisol level and digestive enzymes activities of early pompano larvae (*Trachinotus blochii*)
4. Development patterns of digestive enzymes in pompano larvae (*Trachinotus blochii*)

11. Batuli M Yahya: PhD Student Reg. No: 2016-07-00394

Title of research project: Fish Assemblage Structure in Relation to Habitat Complexity in Seaweed farms and adjacent Seagrass Beds, and Coral Reefs; **Name of PhD-student:** Batuli Yahya

Popular description: Establishing the role of the habitat complexity in relation to fish assemblages within habitats has received particular attention in tropical regions. Habitat structures have been suggested to be a major determinant of the distribution and abundance of fish in many different environments. The presence of coral reefs and seagrasses for shelter has been reported to influence density and distribution of fish communities. Moreover the presence of underwater vegetation, either seagrass or farmed algae, seems to be important for obtaining fish catches in Zanzibar. The proposed study therefore aims at establishing fish assemblages in seaweed farms as introduced/supplementary habitats and compare the status with adjacent natural seagrasses and coral reefs habitats.

The research questions

- a. Does the fish occurrence, diversity and abundance differ in *E. denticulatum* farms compared to adjacent seagrass and coral reefs habitats?
- b. What is the size distribution of fish in *E. denticulatum* farms and adjacent seagrass and coral reef habitats?
- c. What are the trophic dynamics of fish in *E. denticulatum* farms and adjacent seagrass and coral reef habitats?
- d. How do *E. denticulatum* farms, seagrasses and coral reef habitats influence fisheries recruitment?
- e. Is the amount of seaweed related to the abundance, diversity of adult and juvenile fish?

Thesis Title: Fish Assemblage Structure in Relation to habitat Complexity in seaweed farms and adjacent seagrass and coral reef habitats.

Manuscripts

1. Influence of *Eucheuma denticulatum* farms, adjacent seagrass and coral reef habitats on juvenile fish assemblages. Submitted to Coastal Estuarine and Shelf Sciences (current status under review)
2. The trophic dynamics of fish in *Eucheuma denticulatum* farms, adjacent seagrass and coral reef habitats. Submitted to WIOMSA journal (Current status under review).

Expect to submit thesis for examination in June 2020 and finish my studies November 2020.

12. Yussuf Salum Yussuf

Title of research project: Artificial Seed Production of Tropical Sea Cucumber (*Holothuria scabra*) in Tanzania.; **Name of PhD-student:** Yusuf Yusuf

Popular description: Sea cucumbers are highly valued marine resource in Tanzania as source of income for fisherfolk and national export earnings since the 18th century. Processed sea cucumbers are highly demanded in Asian markets as luxury and ideal tonic food item due to their high protein and low fat content and to some are believed to have aphrodisiac, curative and medicinal properties. Its wild resources in Tanzania have, however, been overexploited and its output dwindled in the past decade. Artificial sea cucumber seed production presents an attractive alternative with grown juveniles suitable for wild restocking and artificial farming for wild stock recovery/ conservation and income generation to coastal communities, respectively. The aim of this study is to establish *Holothuria Scabra* natural reproductive pattern, temporal/seasonal changes in reproductive output and develop hatchery method for production its seeds.

The research questions

- a. Is there any significant difference in reproductive output of *H.scabra* at different times/seasons of the year?
- b. Is there any significant difference in reproductive output of *H. scabra* conditioned in flow through and static culture system?
- c. Is there any significant difference in growth performance of *H. scabra* fed with different natural foods (microalgae) and at different ration?
- d. Is there any significant difference in survival rates of *H. scabra* larvae farmed using different stocking densities?

Progress overview

Thesis title: “NATURAL SPAWNING CYCLE AND SEED PRODUCTION OF *HOLOTHURIA SCABRA* (JAEGER 1833)”

List of Manuscript prepared:

- 1) Yussuf S and Saleh A S Yahya (2019) Stocking Density, Growth and Survival Rate of Post-Settled Juveniles of *Holothuria scabra* (Jaeger 1833) Reared in an Ocean-Based Nursery System. The manuscript was submitted to Aquaculture research Journal since December
- 2) Yussuf S and Saleh A S Yahya (2019). Reproductive Biology and Spawning Pattern of *Holothuria scabra* (Jaeger 1833) along the coastal water of Zanzibar, Tanzania (Manuscript)
- 3) Yussuf S and Saleh A S Yahya (2019) Size-Distribution and Length-Weight Relationship of Deep Water Population of *Holothuria scabra* (Jaeger 1833) in Zanzibar, Tanzania. (Manuscript). The manuscript submitted to Western Indian Ocean Marine Sciences Journal
- 4) Yussuf S and Saleh A S Yahya (2019). Setting baselines for large scale hatchery production of high value tropical sea cucumber *Holothuria scabra* (Jaeger 1833) in Zanzibar, Tanzania (Manuscript)

Preliminary title of studies for Post docs and MSc dissertations

Post docs

- 1) Leonard, L.: Genomic Consideration on Farming of Nile and Rufiji Tilapia Hybrids in Brackish Waters, Tanzania
- 2) Soud, S.: Novel Insects Protein-Based Aqua Feeds for Sustainable Aquaculture Production toward Food security and Poverty Alleviation in Tanzania
- 3) Rushingisha, G.: Seagrass carbon sequestration beyond the meadows of the WIO region

MSc

- 4) Malesa, F.M.: Culture of marine plankton as potential larval food for rabbit fish
- 5) Joseph Valeri: Detection and characterization of *Streptococcus* and *Pseudomonas* species and assessment of risk factors facilitating diseases occurrence in cultured Nile tilapia in Pwani and Dar es Salaam Regions, Tanzania.
- 6) Florence, J. P.: Status of aquarium trade of *Cyphotilapia frontosa* from Lake Tanganyika, Tanzania.
- 7) Iraba, N. T.: Survival and growth rate of *Octopus cyanea* in captivity

Enclosure 7: Subprogramme Original Budget 2015-2020

Date	12-Apr-15					
Sub Program	THE MARINE SCIENCE PROGRAMME 2015-2020: Consolidating Research and Analytical Capacity in Fisheries and Aquaculture Technology for Food Security, Adapting to Climate Change, Sustainable Resource Management and Inclusive Development					
Period:	July 2015 - June 2020					
Tanzanian Institutions/Departments:	Institute of Marine Sciences (IMS), Department of Aquatic Sciences and Fisheries (DASF) and Department of Botany (BOTANY) - UNIVERSITY OF DAR ES SALAAM					
Collaborating Institution/s in Sweden:	STOCKHOLM UNIVERSITY (SU)- Department of Ecology, Environment and Plant Sciences (DEEPS); Department of Physical Geography and Quaternary Geology (DPQG) & SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES (SLU)- Swedish Centre for Aquaculture (SCA), Department of Animal Nutrition and Management, Department of Biomedical Sciences and Veterinary Public Health, Department of Animal Breeding and Genetics.					
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Tanzania	SEK	SEK	SEK	SEK	SEK	SEK
Curriculum development	20,000	20,000				40,000
Research equipment & minor equipment	323,000	343,000	334,000	276,000	207,000	1,483,000
Research consumables	7,000	7,000	7,000	7,000	7,000	35,000
Travel	123,000	163,000	149,000	149,000	149,000	733,000
Field/Lab work	1,381,000	1,354,000	1,494,000	937,000	919,000	6,085,000
Student fees	217,000	217,000	158,000	79,000	79,000	750,000
Student stipends	629,000	664,000	665,000	341,000	341,000	2,640,000
Conferences	97,000	97,000	97,000	97,000	97,000	485,000
Publication costs	8,000	8,000	8,000	8,000	8,000	40,000
Travel insurance						0
Audit						0
Other costs						0
Indirect costs						0
SUB TOTAL	2,805,000	2,873,000	2,912,000	1,894,000	1,807,000	12,291,000
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Sweden	SEK	SEK	SEK	SEK	SEK	SEK
Supervision	2,250,000	2,250,000	1,250,000	1,250,000	1,250,000	8,250,000
Curriculum development						0
Lecturing on courses						0
Audit	25,000	25,000	25,000	25,000	25,000	125,000

Other costs: Minor equipment and consumables for Tanzanians while in Sweden	50,000	50,000	50,000	50,000	50,000	250,000
Indirect costs						0
SUB TOTAL	2,325,000	2,325,000	1,325,000	1,325,000	1,325,000	8,625,000

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
ISP - student allowances	SEK	SEK	SEK	SEK	SEK	SEK
SUB TOTAL	432,000	432,000	240,000	240,000	240,000	1,584,000

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
GRAND TOTAL	SEK	SEK	SEK	SEK	SEK	SEK
	5,562,000	5,630,000	4,477,000	3,459,000	3,372,000	22,500,000

➤ **SUSTAINABLE AGRICULTURAL
PRODUCTIVITY, PROCESSING, AND VALUE
CHAIN FOR ENHANCING FOOD SECURITY IN
TANZANIA**

TITLE OF SUBPROGRAMME: FOOD SECURITY 2015-2020:
**Sustainable Agricultural Productivity, Processing, and Value Chain for
Enhancing Food Security in Tanzania**

Contact information

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1. Summary of Achieved Results/Subprogramme Progress

Food Security (FS) is a multifaceted socio-political topic, which scientifically translates into a plethora of interwoven disciplines. Concordantly, to effectively address research capacity in FS, a multidisciplinary network of interactors is required. This proposal aims to develop a broad platform spanning expertise across UDSM colleges (CoET, CoNAS, IRA), and complemented through collaboration with 4 Swedish universities (SLU, Chalmers, LTU, GU). It will educate 3 MSc (only for CoET) and 8 PhD (on sandwich programme) and 3 Post doctoral at a cost of SEK 21,359, 000. Interactions on the platform are facilitated through research, teaching and training, annual FS workshops, and multidisciplinary supervisory, advisory and stakeholder teams. Accordingly, projects are strung together in several benchmark projects, and aim to ‘breed’ a new generation of “globally thinking research specialists“, educated in linking their research across the scientific trajectory from ‘plough to plate’. The consortium addresses core scientific areas in FS, including: plant breeding for resistance and yield;

postharvest technologies, animal husbandry and agroforestry, land use and rights; food processing and product development and peri-urban farming, value-chain and market access. In addition, the consortium provides for lifting sustainable agricultural science at the UDSM into the “omics” era, as this basic science permeates most of today’s food sciences. Beyond technological innovations, this proposal will, by its very structure and throughout its execution, intimately connect with stakeholders and policy makers, and seamlessly transit into the envisioned FS Centre by 2020, the establishment of which is supported by 3 postdocs (local). The results from the programme will be widely disseminated through workshops, conferences and publication in FS debates.

The economy of the United Republic of Tanzania (URT) is predominantly rural-based, with relatively low levels of manufacturing and value addition of the commodities produced. About 75% of the population of the URT is employed in agriculture, but productivity is among the lowest in sub-Saharan Africa (URT, 2013). Rural households are more exposed to food insecurity than urban households where 22% are classified as food insecure compared with 8.3% national average. Smallholder farmers rely on traditional technologies and produce mainly for subsistence (GoT, 2006). Livestock also has not performed well especially for low income families in many parts of the country despite that the annual growth rate is of only 3.3% with 21.3M cattle (Zezza, 2012). To achieve FS there is a need to improve productivity, processing, value addition and commercialize the production systems and these require relevant, committed, and skilled human resource. Although the UDSM has been involved in research since its inception in 1970s, again the researches are discipline biased, fragmented and lack the element of interdisciplinary/multidisciplinarity. The UDSM in collaboration with the Swedish University of Agricultural Sciences (SLU) and Chalmers propose to build research and human resource capacity for integrated agricultural productivity, processing, value addition and access to marketing through promoting agroforestry, peri-urban agriculture, crop breeding, diseases control, dairy farming and environmental management for improved FS. Academic staff from UDSM and other universities in the country will be trained at MSc (3) and PhD (8) levels. Student’s projects will introduce, validate, and promote practices and technologies in communities’ agriculture and livestock keeping. Students shall develop projects aimed at improving agricultural productivity, processing, value addition and market access using appropriate technologies and ICT.

At the end of 2015-2020, the subprogramme is intends to contribute knowledge/technologies for the development of agricultural activities in Tanzania and abroad, in particular:

- (i) Improving people and animal health in combating *Taenia solium* (Pork Tapeworm) infections;
- (ii) Quality assessment of fruits such as avocado and developing technologies for value addition in particular low viscosity banana juice;
- (iii) Adding value to agricultural waste by producing animal feed protein (black soldier larvae);
- (iv) Promoting sustainable use of forest resources and range land management and miombo woodland; and
- (v) Soil management.

Potential impact include sustainable agricultural development and better livelihood for

communities through:

- (i) Improved people and animal health by reducing/eliminating transmission of *Taenia solium*;
- (ii) Production of high quality fruits in particular avocado and production of banana and other fruit juices;
- (iii) Production of animal feed protein from black soldier larvae and other insects;
- (iv) Sustainable use of forest resources and range land management and miombo woodland; and
- (v) Improved soil management for agricultural production.

1.1. Capacity building (objective 1 and 2)

1.1.1. Human capacity development

A total of 8 PhD students were enrolled and registered in Swedish institutions for PhD studies. One Justine Daudi Maganira successfully graduated in April 2020, Ibrahim Juma is expected to graduate in September 2020. The remaining 6 students listed below will continue with their studies in Sweden; they are currently engaged in data analysis, writing of manuscript and publications are expected to graduate by April 2021. However, Student No 4 to 6 have not been able to travel to Sweden Due to COVID-19:

1. Peter R. Ruvuga
2. Nuria Kudra Majaliwa
3. Alice Isibika
4. Matilda Stanslaus Ntiyakunze
5. Lufunyo Lulandala
6. Aneth David Mwakilili

Three (3) MSc students were enrolled at UDSM in the first batch, 6 in the second batch and 1 in the third batch making a total of 10 MSc students. The 2nd and 3rd batches were financed by funds that was to be used for Food Security Centre which was abandoned to limited expertise. **Two (2)** in the first batch students: Gervas Mathayo and Grace Michael graduated in 2018 and 2019, respectively. Martha Chuya froze studies for a year due to health and family matters, she resumed studies in 2019. Martha Chuya, 2nd and 3rd batch students are expected to complete studies between June and October 2020.

Three Postdocs were enrolled by the subprogramme. Two postdocs: Martic Chegele and Liberata Mwita completed their training programme. The third postdoc, Rita Mirondo worked for three months only and quit to join her family in USA. Mirondo's position was later filled by Victor Vicent who is still working on his programme. Vicent was supposed to go to Sweden in April 2020 but his travel has been delayed due to COVID-19.

1.1.2. Creation and Review of Postgraduate curricula:

All two postgraduate (1 PhD and 1MSc) programs developed were successfully approved by the UDSM Senate in 2016 and TCU in Jan 2020. The programmes are expected to be offered from 2020/2021 Academic year.

1.2. Increase research environment and infrastructure (objective 3)

Two major pieces of equipment namely High Performance Liquid Chromatography and UV-VIS Spectrophotometer were received and installed. UDSM community students and staff from College of Engineering Technology, College of Agriculture and Fisheries Technology were trained on how to use the equipment. More equipment namely PCR, Level 2 laminar flow cabinet, freeze dryer, cryogenic freezer have yet to be delivered. A unit for rearing black soldier fly larvae spallation is in progress; space has been allocated by UDSM, drawings completed and budget of structure worked out. Installation to commence in June 2020.



High Performance Liquid Chromatography UV-VIS Spectrophotometer equipment



Training on using of UDSM community on using HPLC

1.3. Increasing visibility of UDSM and Swedish Institutions

Up to May 2020, students and supervisor from the subprogramme have attended 12 conferences on which they presented papers on their work. PhD students and postdocs have published a total of 9; seven (7) PhD students and two (2) by postdocs. One (1) manuscript has been accepted and four (4) are under review. More manuscripts are being drafted.

Concluding remarks: Despite some failures for timely implementation of some research activities due to delays in procurement, the Program have modestly been successful in laying a foundation for sustainable aquaculture development in Tanzania. The Program is extremely thankful to Sida for successful facilitation of the activities. It is hopeful that Sida will continue

supporting the Program and the new developments for successful poverty reduction, improved food security and sustainable development especially in commercialization of technologies/knowledge developed. The UDSM management is thanked for unwavering support for the development of Food Security research capacity.

2. General objectives and expected results

Main Objective

Programme overall objective is to increase sustainable utilization of agricultural and forestry resources, improve productivity along value chain, minimize waste for improved food security.

Specific objectives are:

1. Increase number of teaching staff and research capacity through establishment of postgraduate programmes in food security.
2. Establish food security centre through hosting MSc and PhD taught Programmes in food security.
3. Increase research environment and infrastructure

Output and Impact

1. 8 PhD staff members admitted in Swedish Universities for training in food security related programmes
2. 6 MSc staff registered at UDSM for masters in food security related programmes.
3. 1 PhD and 1 MSc integrated curriculum developed at the University of Dar es Salaam.
4. Improved research capacity through installation of modern technology equipment.
5. Food Security Centre (FSC) established through hosting Masters and PhD programmes in food Security.

3. Target (July 2020 – June 2021)

3.1 Programme objective 1: Increase number of teaching staff and research capacity through establishment of postgraduate programmes in food security.

3.1.1 Planned and the specific activities to be carried out:

- Training of 8 PhD Students to completion
- Training of 3 MSc Students to completion
- Training of 3 Post Doc Students to completion

3.1.2 Expected Deliverables

- 8 PhD theses
- 3 MSc theses
- 3 Post Docs
- 27 Manuscripts developed and submitted to various journals

3.2 Programme objective 2: To establish food security centre through hosting MSc and PhD taught Programmes in food security.

3.2.1 Planned and the specific activities to be carried out:

(objectives changed to)

- Training of 7 MSc Students to completion

3.2.2 Expected Deliverables

- 7 MSc theses
- 3 Manuscripts developed and submitted to various journals

3.3 Increase research environment and infrastructure.

3.3.1 Planned and the specific activities to be carried out:

- Procurement of at least 3 state of the art equipment

3.3.2 Expected Deliverables

- 3 state of the art equipment

Programme objective 4: Increase the quality and use of research relevant to high priority issues of national development

3.4.1 Planned and the specific activities to be carried out:

- Stakeholders workshop held to discuss policy issues in the light of the study findings
- Partnerships developed
- Research papers prepared and submitted for publication

3.4.2 Expected Deliverables

- At least 4 policy briefs developed
- At least 16 papers are presented
- 1 proceeding
- At least 1 partnership developed
- At least 16 papers published

4. Analysis and Justification

Budget: In the extension period, the project is planning to spend a total of SEK 3,625,700 (equivalent to Tshs 906,435,000) of which SEK 2,721,400 is carried forward and SEK 1,012,300 is being requested from Sida. Part of the funds amounting to SEK 1,140,000 is required for stipend for 6 students and one (1) postdoc in Sweden up to March 2021 and SEK 841,000 is required for supervisory cost in Sweden and cost for Swedish partners to attend planning workshop for Sida 2020-2025. The remaining part amounting to SEK 1,614,700 will be used complete procurement, dissemination and joint publication of project results, support of students to conferences, maintenance of equipment and supporting two (2) MSc students to complete their studies. The funds to support PhD students has been reallocated from equipment and consumables and some is being requested from Sida.

1. Approximately 55.6% of total cost is required for students cost in Sweden; of which 31.5% will go to students and postdoc stipend and 24.1% is supervisory cost (including cost of Swedish supervisors to attend planning workshop for Sida 2020-2025).
2. About 8.9% will be used for completing procurement and maintenance of equipment. Due to COVID -19, procurement stalled; with improving situation, the process of procuring remaining equipment should be completed. These equipment are very much required for high quality scientific output of results.
3. About 4.5% will be used for genomic analysis of samples for one PhD student Aneth Mwakiliki and one MSc student Mercy Kobelo. The process stalled due to COVID -19, but should resume in near future.
4. About 10.4% is required for joint dissemination and publication workshop, special workshop and training to disseminate results for combating pig tapeworm in central Tanzania, as well as Tanzanian participation in the planning workshop for Sida 2020-2025.
5. About 6.7% is required for Tanzanian supervisor to travel to Sweden to attend student viva and increase linkage with Swedish supervisors.
6. About 11.2% is required for both students and supervisors to attend conferences.

5. Enclosures

- 40. Subprogramme Activity Implementation Plan (July 2020-June 2021)
- 41. Sub-program **Overall Aggregated Budget**
- 42. Subprogramme Detailed Budget
- 43. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 44. Aggregated Student Progress and Plan (July 2020-June 2021)
- 45. Students Individual Plans and Popular Summary of the Study
- 46. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: Subprogramme: Subprogramme Activity Implementation Plan (July 2020-June 2021)

S/N				Source of Fund		2020						2021			Activity Justification
	Planned Activity	Origin of the Activity ¹ (New/Carried over)	Proposed Budget (SEK)	Original Budget ² (SEK)	Extra Fund ³ (SEK)	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	
OB 1	Objective 1: To Increase number of teaching staff and research capacity through establishment of postgraduate programmes in food security.														
1.1	Training of remaining 6 PhD Students	New & Carried Over	1,080,000	576,000	432,000										Funds required for stay in Sweden
1.2	Postdoc cost in Sweden	Carried Over	60,000	60,000											Funds required for stay in Sweden
1.3	Attending conferences	Carried Over	403,520	403,520											Funds required for attending conference before completion of studies
1.4	Tanzanian supervisors visit Sweden for viva	Carried Over	243,530	243,530											Cost of Travel for supervisors to attend student viva
1.5	Joint publication and dissemination and training	Carried Over	374,841	374,841											Funds required for joint publication and linkages

1.6	Procurement & Maintenance of Equipment	Carried Over	321,000	321,000											Funds required for minor maintenance of equipment
1.7	Genomic Analysis	Carried Over	161,538	161,538											Genomic analysis abroad and procurement on minor chemicals
1.8	Student supervision cost in Sweden	New & Carried Over	750,000	375,000	375,000										Supervisory cost in Sweden
1.9	Sids 2020-2025 Planning meeting	New		196,280	196,280										Funds required for both Tanzanians and Swedish partners to attend workshop
OB 2	<i>Objective 2: To establish food security centre through hosting MSc and PhD taught Programmes in food security</i>														
2.1	Training of remaining 2 MSc Students	Carried Over	2,800	2,800											Funds required for thesis production
2.2															
OB 3	<i>Objective 3: To Develop 1 PhD and 1 MSc integrated curriculum and approved at the University of Dar es Salaam and TCU</i>														
3.1															
3.2															

NB: ¹ Please indicate whether the activity was carried over from 2015 approved budget line or it is a new activity.

²Total Original Budget should tally with subprogramme balance expected to remain by July 2020.

³The extra fund connotes amount of money requested from Sida

⁴Attach the Original approved Budget

Enclosures 2: Sub-program Overall Aggregated Budget

Date:	9th March 2020									
Sub Program:	Food Security									
Period:	Period: 1st July 2020 to 30th June 2021									
Tanzanian Institution/Dept:	University of Dar es Salaam/IRA, CoET, CoNAS, CoAF									
OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum	-	-	-	0	-	0	-	-	-	-
Research equipment	321,000	77,040,000	-	0	-	0	-	-	321,000	77,040,000
Maintenance	-	-	-	0	-	0	-	-	-	-
Research Consumables	161,538	38,769,231	-	0	-	0	-	-	161,538	38,769,231
Travel	243,530	58,447,200	-	0	-	0	-	-	243,530	58,447,200
Field/Lab work	-	-	-	0	-	0	-	-	-	-
Student fees	-	-	-	0	-	0	-	-	-	-
Student stipends x	14,800	3,552,000	30,000	7200000	30,000	7200000	60,000	14,400,000	74,800	17,952,000
Coferences	403,520	96,844,800	-	0	-	0	-	-	403,520	96,844,800
Publication costs	374,841	89,961,920	-	0	-	0	-	-	374,841	89,961,920
Travel insurance	11,200	2,688,000	-	0	-	0	-	-	11,200	2,688,000
Cost related to Research	0	-	0	0	0	0	-	-	-	-
Cost of Training	0	-	0	0	0	0	-	-	-	-
Coordination Cost	0	-	0	0	0	0	-	-	-	-
Other costs	0	-	37,640	9033600	37,640	9033600	75,280	18,067,200	75,280	18,067,200
Transfer of Funds to Sweden	1,043,000	250,320,000	0	0	0	0	-	-	1,043,000	250,320,000
Bank interest	0	-	0	0	0	0	-	-	-	-
Audit		-		0		0	-	-	-	-
Indirect costs		-	8,118	1948320	8,118	1948320	16,236	3,896,640	16,236	3,896,640
SUB TOTAL	2,573,400	617,623,200	75,800	18,181,900	75,800	18,181,900	151,500	36,363,800	2,724,900	653,987,000
Sweden										
Supervision		-	248,000	59,520,000	248,000	59,520,000	496,000	119,040,000	496,000	119,040,000
Curriculum development	0	-		-	0	-	-	-	-	-
Lecturing on courses	0	-		-		-	-	-	-	-
Travel Costs	0	-		-	0	-	-	-	-	-
Dissemination and communication		-		-		-	-	-	-	-
Other costs		-		-		-	-	-	-	-
Indirect costs		-		-		-	-	-	-	-
SUB TOTAL	-	-	248,000	59,520,000	248,000	59,520,000	496,000	119,040,000	496,000	119,040,000
ISP - student allowances		-	216,000	51,840,000	216000	51,840,000	432,000	103,680,000	432,000	103,680,000
SUB-TOTAL_ISP	-	-	216,000	51,840,000	216,000	51,840,000	432,000	103,680,000	432,000	103,680,000
GRAND TOTAL	2,573,400	617,623,200	539,800	129,541,900	539,800	129,541,900	1,079,500	259,083,800	3,652,900	876,707,000

Enclosures 3: Subprogramme Detailed Budget

Date:	27th May 2020
Name of Sub program:	Food Security
Fiscal Year:	Jul 2020 - Mar 2021
Tanzanian Institution/Dept:	University of Dar es Salaam/IRA, CoET, CoNAS,
Collaborating Institution in Sweden:	CoAF
Exchange rate:	SLU, Chalmers, LTU, GU
	250

OBS! Major budget items should be the same for all. The budget details may differ.

		Unit	Cost/unit	Funds expeted to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total funds allocated		Total funds to be executed	
				No.	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1.	Tanzania Curriculum development												
1.													
2.	Research equipment												
1	Retreat to develop/refine curriculum (3 units, each 4 people for 5 days)	60	480										
2	Identification of curriculum requirements for three units (teaching materials, laboratory needs) and harmonisation of curriculum (Visit to Sweden)												
3	Air ticket - three people	3	15000										
4	Subsistence allowance, three people, 7 days	21	2,940										
5	Local transport	3	1800										
6	Stakeholder consultations												

7	Transport (5000 km)	5000	4.8										
8	Per diem (8 persons, 12 days)	96	480										
9	Two Stakeholders workshop, 80 people	80	400										
	SUB-TOTAL												
	Research equipment	QTY	Price (SEK)										
1	Laptop (CoET)	3	7,700										
2	Two dimensions electrophoresis equipment (CoET)	1	21,000										
3	UV spectrophotometer (CoET)	1	70,000							-	-	-	-
4	Kjeldak nitrogen analyser (CoET)	1	70,000							-	-	-	-
5	Gel separation columns (CoET)	4	2,800										
6	HPLC (CoET)	1	315,000										
7	Small scale extruder (CoET)	1	105,000										
8	Microscope (CoET)	1	35,000										
9	Colour spectrum meter (CoET)	1	175,000	175,000	43,750,000					-	-	175,000	43,750,000
10	Cryogenic Freezer	1	70,000							-	-		
11	Freeze dryer	1	77,000							-	-		
12	GIPs (IRA)	2	1,600										
13	Laptop (IRA)	5	7,700										
14	A3 color printer for GIS Lab (IRA)	1	30,000	30,000	7,500,000					-	-	30,000	7,500,000
15	Digital Camera (IRA)	2	4,200									-	-
16	Lidar datasets (3D models) (IRA)	1	19,200									-	-
17	Diameter calliper (IRA)	2	2,000									-	-
18	Diameter tape (IRA)	4	800									-	-
19	Suunto hypsometer (IRA)	2	2,400									-	-
20	GPS (IRA)	2	2,800									-	-

21	Chainsaw (IRA)	1	4,400									-	-
22	Hoes (IRA)	2	600									-	-
23	Axe (IRA)	2	320									-	-
24	Projector	1	16,000	16,000	4,000,000					-	-	16,000	4,000,000
25	PCR, thermocycler (CoNAS)	1	70,000		-					-	-		-
26	Laptop (CoNAS)	4	7,700										
27	Ultra (-80 oC) freezer (CoNAS)	1	70,000										
28	Level II cell culture hood (CoNAS)	1	84,000										
29	Water jacket CO2 Incubator (CoNAS)	1	105,000										
30	Laminar flow cabinet (CoNAS)	1	100,000	100,000	25,000,000							100,000	25,000,000
31	Structure for larvae rearing (CoET)	1	140,000										
32	Micropipettes	10	1,750										
33	Power stabilizer	10	1,400										
34	Glassware and small items												
35	Miscellaneous												
36	Maintenance (3%)									-	-	-	-
	SUB-TOTAL			321,000	80,250,000	-	-	-	-	-	-	321,000	80,250,000
	Research Consumables												
1	Banana including transport (CoET)	1	32,308										
2	Sephadex separation beads (CoET)	1	35,538										
3	Moringa powder, flour, etc. (CoET)		-										
4	Analytical kits for vitamins, protein molecular size, flavours etc. (CoET)	11	6,462										
5	Other Chemicals, reagents (CoET & CoNAS)		-										

6	Disposables (gloves, bags, tissues, 4 YRS) (CoET)	4	6,462										
7	Map production (IRA)	6	9,231	-	-								
8	AO gross paper (IRA)	20	558		-								
9	Plotter cartridge (IRA)	24	738		-								
10	Spot image (verification) (IRA)	1	11,815	-									
11	Elders imagine software (IRA)	1	35,077	-									
12	Remote sensing data (IRA)		-	-									
13	Culturing chemicals, nutrients, reagents and kits (CoNAS)	1	39,692		-								
14	Microbiology lab disposables, 4 yrs (CoNAS)	3	23,077		-								
15	Metagenomics analysis (CoNAS & CoET)	2	161,538	161,538	40,384,615				-	-	-	161,538	40,384,615
16	Field material, plots, plants etc. (CoNAS)	4	23,077		-								
17	Modeling Software (one for each unit)	3	14,215		-					-	-		
	SUB-TOTAL			161,538	40,384,615	-	-	-	-	-	-	161,538	40,384,615
	Travel	QTY	RATE (SEK)										
1	Supervisor travel to Sweden to visit students (once)												
2	Air ticket	7	15,000	105,000	26,250,000			-	-		-	105,000	26,250,000
3	Subsistence allowance, seven days	7	17,640	123,480	30,870,000			-	-	-	-	123,480	30,870,000
4	Local travel in Tanzania and Sweden	7	1,800	12,600	3,150,000			-	-	-	-	12,600	3,150,000
5	Visa	7	350	2,450	612,500			-	-	-	-	2,450	612,500
	SUB-TOTAL			243,530	60,882,500	-	-	-	-	-	-	243,530	60,882,500
	Field/Lab work	Mileage or days	RATE (SEK)										
	1.IRA												
1	Transportation	10000	4.8										

2	Field subsistence allowance: Supervisor (3 people)	28	480										
3	Field subsistence allowance: Student (3 people)	120	400										
4	Field subsistence allowance: Driver (3 people)	120	320										
5	Field hired Labour												
6	Chemical analysis for soils and plants												
	2. CoNAS												
1	Transportation	10000	4.8										
2	Field subsistence allowance: Supervisor (3 people)	30	480										
3	Field subsistence allowance: Student (3 people)	108	400										
4	Field subsistence allowance: Driver (3 people)	108	320										
	3. CoET												
1	Transportation	8000	4.8										
2	Air ticket (5 persons)		2400										
3	Transport to and from Airport, 2 trips (5 persons)		800										
4	Field subsistence allowance: Supervisor (2 persons)	25	480										
5	Field subsistence allowance: Student (4 persons)	25	400										
6	Field subsistence allowance: Driver (4 persons)	25	320										
	SUB-TOTAL			-	-	-	-	-	-	-	-	-	-
	Student allowances/ISP (35 +6 months)	6	18,000	648,000	162,000,000	108,000	27,000,000	324,000	81,000,000	432,000	108,000,000	1,080,000	270,000,000

	Postdoc cost in Sweden, 3 months		20,000	60,000	15,000,000			-		-	-	60,000	15,000,000
	TRANSFER TO SWEDEN (TOTAL)			708,000	177,000,000								
	1. MSc Tuition fee, 2 years each												
	SUB-TOTAL - STUDENT FEE					-	-	-	-	-	-	-	-
	Student stipends	#	RATE (SEK)					-		-	-		
1	PhD (sandwich) cost in Tanzania (stipend)	8	28,800										
2	PhD Student's cost (stationery & book allowance, 2 years)	8	3,380										
3	Travel cost for PhD students: air ticket	8	15,000										
4	Travel cost for PhD students: local transport	8	1,800										
5	Master Student's cost (stipend, 3 months 2 students)	2	24,000	12,000	3,000,000					-	-	12,000	3,000,000
6	Master Student's cost (stationery & book allowance, 2 years)	3	3,380										
7	Thesis production (Master)	2	1,400	2,800	700,000			-		-	-	2,800	700,000
	SUB-TOTAL			14,800	3,700,000	-	-	-	-	-	-	14,800	3,700,000
	Coferences (2 conferences, 4 students, 4 supervisors)	QTY	RATE (SEK)										
1	Conference registration	8	7,000	56,000	14,000,000					-	-	56,000	14,000,000
2	Travel to conference - Air ticket	8	15,000	120,000	30,000,000					-	-	120,000	30,000,000
3	Subsistence allowance - Supervisors (4 days)	8	2,940	94,080	23,520,000					-	-	94,080	23,520,000
4	Subsistence allowance - Student (4 days)	8	2,520	80,640	20,160,000					-	-	80,640	20,160,000
5	Local Travel in Tanzania and abroad	8	1,800	28,800	7,200,000					-	-	28,800	7,200,000
6	Visa	8	3000	24,000	6,000,000					-	-	24,000	6,000,000

		SUB-TOTAL			403,520	100,880,000	-	-	-	-	-	-	403,520	100,880,000
		Publication costs/Dissemination workshops	QTY	RATE (SEK)		14,411,429								
1		Literature cost of journal articles (2 subscriptions per year, for 5 years)	15	8750										-
2		Brochure, one per student, 250 pages	11	2200	16,133	4,033,333							16,133	4,033,333
3		Video preparations, one for each PhD student	8	8000	42,667	10,666,667							42,667	10,666,667
4		Posters, one per student	11	892	6,541	1,635,333							6,541	1,635,333
5		Manuscript publishing cost, one for each MSc student, 2 manuscripts per PhD students	19	600	30,000	7,500,000							30,000	7,500,000
		Dissemination workshop (60 people)	50	4,050	202,500	50,625,000							202,500	50,625,000
		Sensitisation workshop and training on combating Taenia Solium (Pork Tapeworm) Infection and Cysticercosis in Central Tanzania	35	2,200	77,000	19,250,000							77,000	19,250,000
		SUB-TOTAL			374,841	93,710,333	-	-	-	-	-	-	374,841	93,710,333
		Travel insurance	QTY	RATE (SEK)										
1		Supervisor travel to sweden for curriculum development	8	700		-	-	-	-	-	-	-	-	-
2		Supervisor travel to sweden to visit students	16	700										
3		5 students, 5 supervisors, travels to 1 conferences, 7 SUPERVISORS VISITS	16	700	11,200	2,800,000	-	-	-	-	-	-	11,200	2,800,000
		SUB-TOTAL			11,200	2,800,000	-	-	-	-	-	-	11,200	2,800,000
		Other costs												
1		Post doctoral allowance, 3 persons for 1 years	3	18,000										

2	Travel cost for Post doctoral: air tickets	3	15,000										
3	Travel cost for Post doctoral: local travel	3	1,800										
	Postdock stay in sweden 3 for 3 months	9	18,000										
4	Tex tbooks: 5 copies for 10 courses per unit	150	1,050										
5	Establishing Food Security centre of excellency												
6	Equipment												
7	Consumables												
8	Annual Planning meeting in Tanzania												
9	Conference package, 2 days	30	400										
10	Transport per diem	22	480										
11	Transport allowance	22	400										
	Workshop for Sida 2020-2025 (Tanzania)												
	Workshop preparation logistics travel to Arusha							10,080	2,520,000	10,080	2,520,000	10,080	2,520,000
	Logistics + ticket local	5	2,000					10,000	2,500,000	10,000	2,500,000	10,000	2,500,000
	VENUE FOR WORKSHOP, 3 DAYS, 30 people	90	160					14,400	3,600,000	14,400	3,600,000	14,400	3,600,000
	Ticket for local staff	20	1,440					28,800	7,200,000	28,800	7,200,000	28,800	7,200,000
	Subsistence allowance	20	480					9,600	2,400,000	9,600	2,400,000	9,600	2,400,000
	Local travel and communication	20	120					2,400	600,000	2,400	600,000	2,400	600,000
	SUB-TOTAL			-	-	-	-	75,280	18,820,000	75,280	18,820,000	75,280	18,820,000
	Audit												
	Indirect costs												
	SUB TOTAL			2,238,400	559,607,400	108,000	27,000,000	399,300	99,820,000	507,300	126,820,000	2,745,700	686,427,400
	Sweden												
		QTY	RATE (SEK)										

	Supervision	6	62,500	375,000	93,750,000			375,000	93,750,000	375,000	93,750,000	750,000	187,500,000
	Curriculum development												
	Swedish professors (3) to visit UDSM to attend curriculum review meeting and advise on infrastructure	3	25,000							-			
	Lecturing on courses									-			
	1. Exchange of Personnel (3 Swedish professors to teach at UDSM, 3 trips each)	9	25,000							-			
	2. Per diem for each professor, 10 days, 9 module	90	400							-			
	Swedish participation in the Sida 2020-2025 Planning workshop	5	15,000					75,000	18,750,000	75,000	18,750,000	75,000	18,750,000
	Visa, Hotel, logistics and subsistence allowance for 5 new members for 5 days for the workshop	5	9,200					46,000	11,500,000	46,000	11,500,000	46,000	11,500,000
	Other costs			-	-					-			
	1. Coordination cost 12% of supervision			-	-					-			
	Indirect costs			-	-					-			
	SUB TOTAL			375,000	93,750,000	-	-	496,000	124,000,000	496,000	124,000,000	871,000	217,750,000
	GRAND TOTAL			Funds expeted to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total		Total funds to be executed	
				SEK	(TZS)	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
				2,613,400	653,357,400	108,000	27,000,000	895,300	223,820,000	3,616,700	904,177,400	3,616,700	904,177,400

Budget description/justification (write the explanation/justification for the costs/purchases you have outlined in the budget)

1. Research equipment

- Equipment whose procurement were initiated but stalled due to COVID-19 will be procured in the extension period
- Some of the funds for equipment have been reallocated for supervisory cost in Sweden and to ISP for students stipend in Sweden during extension period

2. Maintenance of equipment

Some of the funds will be need for equipment maintenance during extension period

3. Research consumables

- Two MSc Students (Martha Chuya and Mercy Kobelo) and One PhD student (Aneth Mwakilili) could not complete their laboratory work, especially DNA analysis which is done in South Africa. Funds have been allocated for the activities
- Some of the funds for consumables has been reallocated for supervisory cost in Sweden and to ISP for students stipend in Sweden during extension period

4. Supervision cost in Sweden

- SEK 750,000 carried forward from equipment and consumables has been allocated for supervisory cost in Sweden from Sep-Dec 2020, (June - Sep 2020 is a no cost extension)
- The subproject requests for SEK 375,000 to cover supervisory cost in Sweden from Dec to June 2021

5. ISP Student Stipend

- A total of SEK 1,140,000 is required for stipend for 6 students up to March 2021 and one postdoc. Of which:
- SEK 708,000 has been has been reallocated from equipment and consumables for students and postdoc up to December 2020
- SEK 324,000 is being requested from Sida for 6 students from Jan-March 2021
- SEK 108,000 is being requested from Sida for 2 students (Maganira and Ibrahim)who extended due to COVID -19

6. Request for new allocation

- The subprogramme is requesting for new disbursement for the sum of SEK 807,000, of which: • • •
- SEK 375,000 for supervisory cost in Sweden from Jan - March 2021 •
- SEK 108,000 for Two students who extended studies from May-July due to COVID -19
- SEK 324,000 for ISP stipend for 6 students from Jan-March 2021

Enclosures 4: Results Based Management (RBM) Matrix (July 2020-June 2021)

Types of Outputs	Outcomes (including targets)	Performance Indicator of Outcome	Baseline (if established)	Annual outcome target for 2019/2020	Actual Outcomes Achieved: Results Observed in year (2020/21)	Key Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 1: Increase number of teaching staff and research capacity in food security through establishment of postgraduate programmes						
PhD curricula in food security developed	At least one PhD curriculum in food security developed and accredited by TCU by 2020	Approved PhD curriculum in food security	0 PhD programmes in food security in 2015	1 Taught PhD Programme Accredited by TCU	1 taught PhD programme approved by TCU	1 taught PhD Programme approved by TCU to be used for teaching in 2020/2021 Academic year
MSc curricula in food security developed	At least one MSc curriculum in food security developed and accredited by TCU by 2020	Approved MSc curriculum in food security	0 MSc programmes in food security in 2015	1 Taught MSc Programme Accredited by TCU	1 taught MSc programme approved TCU	1 taught MSc Programme approved by TCU to be used for teaching in 2020/2021 Academic year
Increased number of PhD registered in food security at least 30% are women	At least 8 staff recruited in PhD food security by 2018.	Number of academic staff registered in PhD	0 registered students in PhD (food security) in 2015	8 PhD students registered in Swedish Institutions	2 PhD students graduated by July 2020	<ul style="list-style-type: none"> 6 PhD students graduated by April 2021. Four (50%) of the of the students are women
Increased number of MSc registered in food security at least 30% are women	At least 3 staff recruited in MSc food security by 2018.	Number of academic staff registered in MSc	0 registered students in MSc (food security) in 2015	10 MSc students registered at UDSM	<ul style="list-style-type: none"> 8 MSc students graduated by July 2020 	<ul style="list-style-type: none"> 8 more MSc students graduated by Oct 2020 Six 60% of MSc students are women
Research environment	At least five (5) food	Number and	About 2 state of	Five (5) food	Five (5) food	Food security equipment purchased and used for

Types of Outputs	Outcomes (including targets)	Performance Indicator of Outcome	Baseline (if established)	Annual outcome target for 2019/2020	Actual Outcomes Achieved: Results Observed in year (2020/21)	Key Outputs produced in year to obtain Outcome in 2020/2021
and infrastructure: state of the art equipment procured	security equipment purchased and commissioned by 2018	types of equipment procured and commissioned	the art equipment in participating units in 2017	security equipment purchased and commissioned	security equipment purchased and commissioned	More equipment procured and received and used for research & teaching activities by October 2020,,
	Assumptions: All enrolled students will graduate Equipment maintained in good condition					
	Specific Objective 2: Establish food security centre for MSc and PhD taught Programmes in food security.					
Food security centre established	At least six (6) MSc students recruited in food security training by 2018	Number of Masters students in food security	0 staff recruited in Masters (food security) in 2015	Seven (7) MSc students recruited in food security training at UDSM	Seven (7) MSc complete training	Seven (8) MSc students graduated
	3 Postdoc recruited in food security	Number of postdoc in food security	0 postdoc in food security 2015	Three (3) postdoc completed training in food security UDSM	Two (2) postdoc completed training in food security UDSM	One (1) more postdoc completed training in food security training at UDSM by March 2021
	Assumptions ➤ All enrolled postdoc will complete contract terms					

Enclosures 5: Aggregated Student Progress and Plan (July 2020-June 2021)

PhD training Name of research student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of Completion	Progress %	Prel. title of dissertation
PhD students							
Ibrahim Juma	M	2016	29		Sept 2020	95%	Promotion of horticultural productivity for food nutrition and income generation; A case of avocado in Tanzania
Peter R. Ruvuga	M	2016	26	NA	March 2021	80%	Rangeland management practices for intensification of livestock production in miombo woodlands
Nuria Kudra Majaliwa	F	2016	28	NA	March 2021	85%	Potential role of protein-tannin interaction on banana Juice Extraction
Matilda Stanslaus Ntiyakunze	F	2016	30	NA	March 2021	80%	Forest Dependency in Tanzania: Analysis of household's heterogeneity, household's revealed energy choices, links etween forests and food security.
Lufunyo Lulandala	M	2016	29	NA	March 2021	80%	The influence of tree vegetation cover, land use and soil characteristics on underground water recharge
Aneth David Mwakilili	F	2016	32	NA	March 2021	75%	Microbiome analysis of push-pull companion plants in plant growth and protection
Alice Isibika	F	2016	33.5	NA	March 2021	75%	Larvae composing of Food industrial waste with focus on banana wastes for production of animal feed protein
MSc. students							
Martha Chuya	F	2016	NA	2020	NA	75%	Drying and characterization of banana juice spent pulp
Mercy Kobelo	F	2019	NA	2020	NA	80%	Improvement of Local Brew, A Case Study of Rubisi Local Brew in Kagera, Tanzania
Total: 9							

Enclosures 6: Students Individual Plans and Popular Summary of the Study

PhD Students

Table 1- 1: Detailed student activities and action plan for: **Ibrahim Juma Vuga**, 860205 – P198. SLU

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	Data collection for the animal feeding experiment (Obj. 5) Final thesis report writing													
2.	Nailing and preparation of final doctoral thesis defence													
3.	Final doctoral thesis defence and graduation													

Table 1- 1: Detailed student activities and action plan for: **Lufunyo Lulandala**, 19860414 – T955. SLU

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	Finalizing manuscript one for submission to Journal of Land degradation and development,													
2.	Completing data analysis and writing manuscript two													
3.	Final data collection for manuscripts three and four													
4.	Data analysis for manuscript three and four													
5.	Writing manuscript three													
6.	Finalizing manuscript three													

7.	Writing the last manuscript (manuscript four)													
8.	Finalizing manuscript four													
9.	Final Ph. D seminar													
10.	Thesis report writing including all the chapters													
11.	Finalising thesis report writing and submission													
12.	Preparation for defence													
13.	Defence													

Table 1- 2: Detailed student activities and action plan for: Peter R. Ruvuga, 89015 – T538 (Swedish University of Agricultural Sciences, SLU)

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	Data collection for the animal feeding experiment (Obj. 5)													
2.	Data analysis for carrying capacity study and feeding trial experiment (Obj 2, 4, 5, 6)													
3.	Prepare manuscripts on the carrying capacity study and feeding experiment													
4.	Attending international conference on rangeland management													
5.	Publish final manuscripts in the peer reviewed journals													
6.	Final thesis report writing													
7.	Nailing and preparation of final doctoral thesis defence													

8.	Final doctoral thesis defence and graduation													
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Table 1- 3: Detailed student activities and action plan for Alice Isibika, Registration No.2016.3.2.2-1093, Swedish university of Agricultural Sciences

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	Data Collection in food industries mapping organic solid waste													
2.	Discussing the manuscript two and submitting to the journal													
3.	Writing and discussing manuscript three and submitting to the journal													
4.	Data entry and analysis of Industrial study													
5.	Writing and discussing manuscript four and submitting to the journal													
6.	Taking Courses													
7.	Thesis report writing including all the chapters													
8.	Finalising thesis report writing (monograph) and submission													
9.	Submission													
10.	Graduation													

Table 1- 4: Detailed student activities and action plan for: Aneth David Mwakilili, 901118-T535, Swedish University of Agricultural Sciences (SLU)

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	- Greenhouse experiments in Sweden - Push-pull plots maintenance at UDSM for objective 4													
2.	- Manuscript writing for objective 1 and submission for publication - DNA sequencing and analysis for objective 4													
3.	- Manuscript writing and submission for publication for objective 2 - Data analysis for objective 3 (greenhouse experiments) and manuscript writing													
4.	Writing kappa and compiling thesis chapters													
5.	Thesis submission													
6.	Manuscript writing for objective 4 and submission for publication													
7.	Thesis defence													

Table 1- 5: Detailed student activities and action plan for:(*Nuria Majaliwa, Registration No.800521-C183, Chalmers University of Technology*)

S/N	Activity details	2020										2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.	Finalising analysis for 3 rd manuscript (amino acid analysis)													

2.	Data analysis for 3 rd manuscript Manuscript writing (Paper 3)													
3.	Experimental analysis for 4 th manuscript													
4.	Data analysing data for 4 th manuscript													
5.	Manuscript writing (Paper 4)													
6.	Thesis writing													
7.	Finalising thesis report writing													
8.	Thesis submission (Internal committee evaluation)													
9.	Thesis submission (Opponent)													
10.	Defence (Thesis)													

Table 1- 6: Detailed student activities and action plan for: (*Matilda Stanslaus Ntiyakunze, Registration No. 870244-T408 and Luleå tekniska universitet*)

S/N	Activity details	2020											2021		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
1.	Data cleaning														
2.	Data analysis for the 4 th manuscript														
3.	Finalising a manuscript for submission in the journal of Forestry Economics														
4.	Revising the manuscripts.														
5.	Taking two courses in Sweden and attending an International Conference														
6.	LTU economics PhD student workshop						X								
7.	Taking one course in Sweden														
8.	Finalizing manuscripts and taking two														

	additional courses in Sweden													
9.	Pre-defence thesis seminar								X					
10.	Finalizing the manuscripts and writing the cover pages.									X	X	X		
11.	Submission												X	
12.	PhD defence													X

Master students

Table 2.1 Student activities and action plan for: Miss. Mercy Honory Kobelo, 2018-06-01913 at the University of Dar es salaam.

S/N	Activity details	2019		2020										
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	Conducting experiments on DNA extraction through handling of biological sample training													
2	Collection of samples from Kagera region for DNA extraction and analysis of fermentation parameters													
3	DNA extraction of Rubisi and water samples at the MMB laboratories for objective 1													
4	Shipment of samples to South Africa for DNA sequencing													
5	Experiment and analysis of samples for fermentation parameters using HPLC for objective 2													
6	Report writing (initial thesis report development) for objective 1 and 2													

8	Fermentation optimization Experiments and analysis according to design of experiments for objective 2													
11	Experiments and analysis on maturation of banana beer and conduction of sensory analysis for objective 3													
12	Thesis report writing including all the chapters													

Table 2- 2: Detailed student activities and action plan for: MARTHA CHUYA 2016-06-02511 UNIVERSITY OF DAR ES SALAAM

S/N	Activity details	2019		2020										
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1.	Unfreezing and Registration													
2.	Preparation of samples and conducting experiment (Drying banana Spent Pulp)													
3.	Conducting experiment(Drying Banana Spent pulp) and analysing data													
4.	Experiment (characterization of banana spent pulp) and analysis of Data													
5.	Mineral and Vitamin analysis of banana spent Pulp													
6.	Thesis writing (initial thesis report development)													
7.	Thesis writing													
8.	Thesis writing and Submission													
9.	VIVA													

Enclosures 6: Subprogramme Original Budget 2015-2020 (Compiled Summary)

Date:	08-Apr-15
Sub program	Sustainable agricultural productivity, processing, and value chain for enhancing food security in Tanzania
Pperiod	2015-2020
Tanzania Institution/Dept.	University of Dar es Salaam/IRA, COET, CONAS
Collaboration Institutions in Sweden	SLU Chalmers
OBS! All Major Budget Items Should be the same for all	

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Tanzania	SEK	SEK	SEK	SEK	SEK	SEK
Curriculum Development	245,700	-	-	-	-	245,700
Research Equipment	677,300	680,100	142,000	-	-	1,499,400
Research Consumables	93,400	383,900	300,600	240,400	120,500	1,138,800
Travel	-	-	92,800	92,800	91,000	276,600
Field/Lab work	-	335,500	335,500	285,500	-	956,500
Student Fee	0	25,500	51,000	25,500	0	102,000
Student Stipends	120,000	280,900	324,800	282,300	120,000	1,128,000
Conferences	-	-	490,600	490,600	490,600	1,471,800
Publication Cost	26,300	26,300	62,700	62,700	62,700	240,700
Travel Insurance	5,600	0	11,200	11,200	11,000	39,000
Other Costs	56,000	249,000	971,800	936,700	54,000	2,267,500
Institutional Fee	146,700	237,800	334,000	291,300	114,200	1,124,000
Indirect costs						0
SUB TOTAL	1,371,000	2,219,000	3,117,000	2,719,000	1,064,000	10,490,000

Sweden	2015/16	2016/17	2017/18	2018/19	2019/20	Total
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	SEK	SEK	SEK	SEK	SEK	SEK
Suervision	1,000,000	2,000,000	2,000,000	2,000,000	1,000,000	8,000,000
Curriculum Development	75,000	-	-	-	-	75,000
Lecturing on Courses	75,000	75,000	75,000	-	-	225,000
Other Costs	-	-	-	-	-	0
Indirect costs						0
SUB TOTAL	1,150,000	2,075,000	2,075,000	2,000,000	1,000,000	8,300,000

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
ISP - Student allowance	SEK	SEK	SEK	SEK	SEK	SEK
SUB TOTAL	320,000	640,000	640,000	640,000	320,000	2,560,000

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
GRAND TOTAL	2,841,000	4,934,000	5,832,000	5,359,000	2,384,000	21,350,000

SMART GRID CAPACITY DEVELOPMENT AND ENHANCEMENT IN TANZANIA

2.11 iGRID: Smart Grid Capacity Development and Enhancement in Tanzania

Contact information

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1. Summary of Achieved Results/Subprogramme Progress

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 network (smart grid) in order to improve delivery efficiency and to optimize operational costs in the electrical power system in Tanzania. The project uses the triangulation of training, research and innovation to generate a new breed of graduates that focuses on societal needs, relevance and in providing innovative solutions that invokes critical thinking. Smart grid realization has multiple dimensions which have to be addressed simultaneously to ensure success. It includes addressing communication challenges and its related attributes, addressing security concerns linked to 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 area forms an essential part of smart grid research. The project is using challenge driven education (CDE) methodology to solve real life challenges of our main stakeholder (the user), national utility company TANESCO. The project is glad to have modest success in the following:

1.1 Capacity Building

The project has established new taught PhD and MSc (*in Computer and IT Systems Engineering*) programs based on Challenge Driven Education (CDE) paradigm approved by the senate of the

University of Dar es Salaam and accredited by Tanzania Commission for Universities (TCU). The project has been a success by attracting the highest number of PhD and MSc students in the College of Information and Communication Technologies (CoICT) for a single programme. The project recruited 11 local PhD, 2 Sandwich PhD students, 1 international PhD student and 19 MSc students. These programs have transformed the capacity building processes at the UDSM in solving real life problems and connecting innovation and entrepreneurship in individual training programs while building trust of industry that academia can use research to solve technical and scientific research their challenges. The capacity building is based on co-creation with various national and international stakeholders.

1.2 Scientific Orientation

For quality assurance of the educational programs, the project has systematically studied the programs with scientific methods and published results extensively at international educational oriented peer reviewed conferences and journals for quality control feedback.

Publications in peer review conferences and journals have also been done. This has resulted into increased international cooperation with Sweden, UK, Saudi Arabia and Finland.

1.3 Collaborative Aspects at Local Level

The project has been able to construct multidisciplinary teams with different backgrounds of individuals. These teams also include external experts working together with our research teams. The project has succeeded in creating trust with the national utility company TANESCO leading to signing MoU and allocation of the pilot site for testing our prototypes on a live network. This will result in co-creation and co-learning in order to find new and innovative solutions to the problems.

1.4 Collaborative Aspect at International Level

A number of new international collaborative projects have been established based on IGRID project. The purpose of these is to provide sustainability and recognition of the quality of our work technically and scientifically.

- STINT project with KTH for faculty development and increasing innovation and entrepreneurship.
- ERASMUS+ project for faculty and PhD students exchange program with KTH being available to individuals even outside project.
- Active collaboration with Kassim University in the Kingdom of Saudi Arabia.
- MoU with Fudan University in Shanghai China which increases the number of researches in photovoltaic systems.
- Active cooperation in educational assessment and innovational processes with the University of Turku Finland.
- Research cooperation with Brunell University in UK.

1.5 Practical Achievements

The project has also achieved in the following practical areas:

- Out of 15 PhD students (5 Female), two have finished writing their dissertation awaiting examination bound to graduate May 2020. Five PhD students are finalizing their dissertation documents expecting to finish November 2020. The remaining PhD students will graduate May 2021. The status of the recruited 19 MSc students (6 Female) is that one female graduated November 2019, two students will graduate May 2020.

- 4 active local collaborators (TANESCO, Ministry of Energy, Rural Energy Agency and EWURA)
- There are about 25 reviewed journal articles and 40 reviewed conference articles.
- 6 Postdocs trained on CDE and state of the art research (50% Female)
- Developed prototypes and demonstrations.
- Has held 10 external stakeholders' workshops and 3 faculty development workshops.
- Weekly project meetings through internet between UDSM and KTH project teams
- Project was rated 1st award winner during the 5th UDSM research exhibitions at college level and 2nd overall winner at the University level.
- Best papers award and invitations to submit for special issues journals based on our conference presentations.
- Invitation to be reviewers for special issues on the areas of our specialty.
- Provision of the PILOT site by the utility company for PhD students to test and verify their prototypes in live network.

2. General objectives and expected results

The overall objective of the iGRID project is to facilitate efficient and effective management of electrical power system network to minimize power cuts, improve power system overall efficiency and productivity and hence optimize energy costs by ensuring that there will be capable and competent researchers that can monitor, analyse and evaluate effectively electrical power system management enhancement issues in a smart and intelligent electrical power system. It is also envisaged that such human resource shall be capable of providing rational innovative solutions. This can be realized through two specific objectives as follows.

Specific Objective 1: Capacity development including incorporating innovation and entrepreneurship through revised MSc, develop MSc and develop PhD curricula.

Specific Objective 2: Increase the local power systems reliability by exploring research opportunities in different aspects of smart grid to address local power system challenges and utilizing products and services to support smart grid implementation, to foster development of new business, entrepreneurs and smart grid policy for societal development

3. Target (July 2020 –June2021)

3.1 Programme objective 1: Capacity development including incorporating innovation and entrepreneurship through revised MSc, develop MSc and develop PhD curricula

3.1.1 *Planned and the specific activities to be carried out:*

- Extending training of local PhD students
- Coordinate local PhD students' activities
- Extend PostDoc training of Ms Hellen Maziku up to August 2020

3.1.2 *Expected Deliverables*

- Increased number of graduating PhD students
- Increased pool of trained supervisors

- Increased volume of publications

3.2 Programme objective 2: To Increase the local power systems reliability by exploring research opportunities in different aspects of smart grid to address local power system challenges and utilizing products and services to support smart grid implementation, to foster development of new business, entrepreneurs and smart grid policy for societal development

3.2.1 *Planned and the specific activities to be carried out:*

- Involve the PhD sandwich students into operationalization of the Pilot Site
- Products and services dissemination workshops
- Sustainability workshops
- Next phase proposal discussion and write up

3.2.2 *Expected Deliverables*

- Operationalization of Pilot Site
- Smart grid products and services
- New supporting project proposals for sustainability
- Next phase proposal

4. Analysis and Justification

4.1 Summary of Budget for the period of five years:

This sub-programme is budgeted **SEK 12,932,500** (excluding institutional fee) and **SEK 13,750,400** including the institutional fee for the period of five years; with 2,452,050 for 2015/2016, 2,782,570 for 2016/2017, 3,388,380 for 2017/2018, 3,098,220 for 2018/2019 and 1,211,280 for 2019/2020. The amount of each was distributed as follows:

Institution/Year	2015/16	2016/17	2017/18	2018/19	2019/20	Total (SEK)
UDSM	1,590,900	1,705,020	2,351,980	2,061,820	889,180	8,598,900
Sweden	861,150	1,077,550	1,036,400	1,036,400	322,100	4,333,600
Total	2,452,050	2,782,570	3,388,380	3,098,220	1,211,280	12,932,500

This sub-programme at UDSM in five years will receive **SEK 8,598,900 (excluding institutional fee)** and by June 2020 it expected **1,403,000 SEK** to be carried over. The carried over amount will be made of Research equipment **1,000,000 SEK**, Research consumables **150,000 SEK**, Students stipend **153,000 SEK** and conferences **100,000 SEK**.

4.2 Extending Training of local PhD Students

Out of the 8 SIDA funded local PhD students, 5 have positive progress and expects to complete training by November 2020. The rest will finish their studies by May 2021. To accommodate for these changes, therefore, Local PhD research students will extend their training from July 2020 to March 2021. Also, there is need to accommodate additional costs beyond for those that shall graduate. The budget per student includes:

- i Tuition fees for academic year 2020/21. The budget will be 178,000 SEK for eight (8) local PhD students. New academic year starts late October or early November.
- ii A subsistence grants of 17,000 SEK per six months at a rate of 2,900 SEK per month to cater for subsistence allowance.
- iii During extension PhD student will be supported to attend one conference 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.
- iv Consumables: 10,000 SEK lump sum for papers printers, literature, etc
- v Minor equipment to support research work 6,000 SEK per student

4.3 PostDoc Training

There will be one female PostDoc students (Ms Hellen Maziku) who will finish her training August 2020. The delay has resulted from studies freezing due to maternity leave taken immediately after recruitment. However, her budgeted activities will not be affected, hence, not included into the extension period budget.

4.4 PhD Training in Sweden

Two (2) PhD students will be supported to spend two months (September - October 2020) in Sweden. These students did not visit Sweden for special courses like their peers (Mr. Yona Andegelile and Ms Hadija Mbembati). The budget for PhD students visiting Sweden is 56,000 SEK per candidate that includes:

- i A travel allocation of 10,000 SEK per program to KTH
- ii A subsistence grants of 36,000 SEK per program to cater for the two-month subsistence allowance for PhD students in Sweden at a rate of 18,000 SEK per month
- iii 10,000 SEK bench fees per trainee

Two (2) sandwich PhD students (Ms Diana Rwegasira and Mr Aron Kondoro) will visit Sweden for their PhD defense. They will be accompanied by their Tanzanian supervisors (2) during defense. Hence, therefore, the following costs will be incurred:

- i Travel of 40,000 SEK for four (4) people @ 10,000 SEK each
- ii Allowance for supervisors (2) of 40,000 SEK @ 20,000 SEK each for five (5) days.

4.5 Coordination and Supervision Costs

UDSM supervisor for PhD students will visit Sweden once for 4 days: Ticket 10,000 SEK, allowance 3,000 per day i.e. 22,000 SEK per visit. This will be 44,000 SEK for two supervisors.

Similar costs would be incurred for three (3) researchers visiting Sweden for next Phase SIDA funding phase (2021-2026) discussion and preparation of proposal. In retrospect two (2) researchers from Sweden will visit Tanzania for similar talks to finalize and submission of the proposal document.

It is also intended that during the visit of the Sweden partners to Tanzania, sustainability workshops will be done to secure funds from other agencies with the collaboration of Swedish partners. Workshop will cost 25,000 SEK in Tanzania; venue, facilities, refreshments, and travel costs: day workshop package per person@335, transport 300 per person, consumables (photocopying, printing, binding, stationary) 50 per person; 30 people internal stakeholders and 50 people external stakeholders.

4.6 Operationalization of Pilot Site

This will include training of technical staff at TANESCO and our new research students on using and maintaining the PILOT site for further research studies under the project with collaboration of

TANESCO. It is taken as consumables at 50,000 SEK.

4.7 Products and Services Dissemination Workshops

Two workshops will be done in the extended period. The costs will be flat @ 25,000 SEK which includes venue, facilities, refreshments, and travel costs: day workshop package per person@335, transport 300 per person, consumables (photocopying, printing, binding, stationary) 50 per person; 30 people internal stakeholders and 50 people external stakeholders.

4.8 Rationale for the Extension of Programme Duration

The iGRID project has had outstanding success in training PhD and MSc students on computer and IT Systems Engineering through challenge driven education (CDE) methodology to create trust with industry the capacity to use USDM academia to solve their technical and scientific challenges. The engagement of stakeholders from TANESCO, Ministry of Energy, the energy sector regulator EWURA and Rural Energy Agency has resulted into successful workshops leading to signing MoU with TANESCO and TANESCO availing for research their network. However, there have been challenges on long procurement processes for items that have already been ordered by iGRID, female students freezing studies for maternity leave (Ms Hadija Mbembati, Ms Diana Rwegasira), one researcher had issues with employer, delays in initial take off of the project and of researchers at UDSM starting their work (i.e. due one year to prepare curriculum and attending coursework for one year), dynamics in the identification of the pilot site which resulted from the government changing its policy on rural electrification which focused on grid connection and not isolated minigrids. These factors are responsible for the carryover amount expected to be in UDSM accounts after June 30th 2020.

Total extra fund being requested is as follows **UDSM 816,480 SEK, KTH 430,000 SEK and ISP 80,000 SEK**. Total is **1,326,480 SEK**. Carryover fund at **UDSM is 1,403,000 SEK**, which is made of Research equipment 1,000,000 SEK, Research consumables 150,000 SEK, Students stipends 153,000 SEK and conferences 100,000 SEK.

Note:

(a) Procurement

Items have already been ordered and orders are being processed. Items will need to be paid when delivered. iGRID has no control of the institution procurement process which has to follow procurement regulations.

(b) Consumables

Funds need to be available to meet thesis and other research consumables because researchers could not implement planned activities due to delays in research take-off.

(c) Student Stipend

Funds were withheld for students who were not making very good progress in particular quarter. The students will have to be paid when their efforts are satisfactory.

(d) Publications

There are conferences that students will have to present their papers accepted before the end of June 2020 but will be held after end of June 2020 and there are those that conferences have been pushed forward because of the COVID-19 outbreak. This is for quality assurance of local PhD students.

5. Enclosures

- 47. Subprogramme Activity Implementation Plan (July 2020-June 2021)
- 48. Sub-program **Overall Aggregated Budget**
- 49. Subprogramme Detailed Budget
- 50. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 51. Aggregated Student Progress and Plan (July 2020-June 2021)
- 52. Students Individual Plans and Popular Summary of the Study
- 53. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: iGRID: Subprogramme Activity Implementation Plan (July 2020-June 2021)

Enclosures IV/ICM/ET/Sup programming/ICM/ET															
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															students on their research tasks.
1.4	Air travel PhD students to Sweden (2)	Carried over	40,000	40,000	0										Air travel for PhD (2) students to Sweden (Mr. Yona Andegelile, Ms Hadija Mbembati)
1.5	Air travel sandwich PhD students to Sweden for defense				20,000										Air travel for sandwich PhD students to defend their work
1.6	Air travel Swedish supervisors to Tanzania (2)	Carried over	20,000		20,000										Prof Hannu and Dr. Amleset will visit Tanzania for supervision and next phase discussion.
1.7	Air travel Tanzanian supervisors (2) to Sweden – PhD defense of sandwich PhD students				20,000										Air travel for supervisors to visit Sweden during PhD defence
1.8	Allowance to supervisors (2) visiting Sweden for PhD defense				40,0 00										Supervisors allowances.
1.9	PhD students (8) fees in the academic year 2020/21				178,000										Tuition fees for PhD students in the academic year 2020/21.
1.10	PhD students (8) stipend for six months (July 2020-Dec 2020)	Carried over	153,000	153,000	0										Stipend for the nine (9) PhD students.

1.11	PhD publication costs	Carried over	332,000	100,000	232,000										There will be massive data analysis from pilot site, hence , therefore dissemination costs through publications.
1.12	Travel insurance	Carried over	8,000	8,000	0										Insurance costs for travelers.
1.13	Next phase discussion in Tanzania	Carried over	44,000		44,000										Per Diem for Prof Hannu and Dr. Amleset while in Tanzania for supervision and next phase discussion.
1.14	Retreat for PhD students to accelerate their training completion	Carried over	100,000		100,000										Retreat for PhD students to finish their studies.
1.15	Sustainability workshop	Carried over	25,000		25,000										Workshop to sustain the project
1.16	Institutional fee (12%)				66,120										
SWEDEN PLANS															
1.17	PhD Students supervision costs	Carried over	100,000		100,000										Supervision costs of students (Mr. Yona Andegelile, Ms Hadija Mbembati) while in Sweden
1.18	Lecturing courses for PhD students in Sweden	Carried over	50,000		50,000										Lecturers costs for preparing and deliverance of

															lecture materials for students in Sweden.
1.19	Bench fee for students at KTH	Carried over	40,000		40,000										Bench fees for PhD students while in Sweden
1.20	Project coordination costs	Carried over	240,000		240,000										Project coordination costs at KTH
1.21	Stipend for PhD students (2) while at KTH	Carried over	80,000		80,000										Stipend for two (2) PhD students while in Sweden for two months.
	SUB TOTAL		2,330,520	1,342,000	1,276,480										
OB2	Objective 2: To increase the local power systems reliability by exploring research opportunities in different aspects of smart grid to address local power system challenges and utilizing products and services to support smart grid implementation, to foster development of new business, entrepreneurs and smart grid policy for societal development guidelines														
UDSM PLANS															
2.1	Operationalization of Pilot Site	Carried over	61,000	61,000	0										Operationalization costs of the pilot site.
2.2	Products and services dissemination workshops (2)	Carried over	50,000		50,000										Dissemination of products and services workshop costs
	SUB TOTAL		110,000	61,000	50,000										
	GRAND TOTAL		2,440,520	1,403,000	1,326,480										

NB: ¹ Please indicate whether the activity was carried over from 2015 approved budget line or it is a new activity.

²Total Original Budget should tally with subprogramme balance expected to remain by July 2020.

³The extra fund connotes amount of money requested from Sida

⁴Attach the Original approved Budget

Enclosures 2: Sub-program Overall Aggregated Budget

Date: 18 February 2020 Sub Program: IGRID Period: July 2020 - June 2021 Tanzanian Institution/Dept: CoICT/UDSM OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum	0	0	0		0	0	-	-	-	-
Research equipment	1,000,000	270000000	0	0	0	0	-	-	1,000,000	240,000,000
Maintenance	0	0	0	0	0	0	-	-	-	-
Research Consumables	150,000	40500000	0	0	0	0	-	-	150,000	36,000,000
Travel	0	0	30,000	7,200,000	30,000	7,200,000	60,000	14,400,000	60,000	14,400,000
Field work (Pilot site Operationalization and dissemination workshops)	0	0	0	-	0	-	-	-	-	-
Student fees	0	0	89,000	21,360,000	0	21,360,000	178,000	42,720,000	178,000	42,720,000
Student stipends PhD	153,000	41310000	0	-	0	-	-	-	153,000	36,720,000
Conferences			25,000	6,000,000	25000	6,000,000	50,000	12,000,000	50,000	12,000,000
Publication costs	100,000	270000000	116,000	27,840,000	116000	27,840,000	232,000	55,680,000	332,000	79,680,000
Travel insurance	0	0	0	-	0	-	-	-	-	-
Cost related to Research	0	0	104,500	25,080,000	104500	25,080,000	209,000	50,160,000	209,000	50,160,000
Cost of Training	0	0		-	0	-	-	-	-	-
Coordination Cost	0	0		-	0	-	-	-	-	-
Other costs	0			-	-	-	-	-	-	-
Transfer of Funds to Sweden	0	0		-	0	-	-	-	-	-
Bank interest	0	0		-	0	-	-	-	-	-
Audit	0	0		-	0	-	-	-	-	-
Institutional fee (12%)		0	43,740	10,497,600	43,740	10,497,600	87,480	20,995,200	87,480	20,995,200
SUB TOTAL	1,403,000	378,810,000	408,200	97,977,600	319,200	97,977,600	816,500	195,955,200	2,219,500	532,675,200
Sweden										
Supervision of PhD (4) in Sweden			50,000	12,000,000	50,000	12,000,000	100,000	24,000,000	100,000	24,000,000
Curriculum development			-	-	-	-	-	-	-	-
Lecturing on courses			25,000	6,000,000	25,000	6,000,000	50,000	12,000,000	50,000	12,000,000
Travel Costs			-	-	-	-	-	-	-	-
Dissemination and communication			-	-	-	-	-	-	-	-
Bench Fee			20,000	4,800,000	20,000	4,800,000	40,000	9,600,000	40,000	9,600,000
Indirect costs			120,000	28,800,000	120,000	28,800,000	240,000	57,600,000	240,000	57,600,000
SUB-TOTAL_SWEDEN	-	-	215,000	51,600,000	215,000	51,600,000	430,000	103,200,000	430,000	103,200,000
ISP - student allowances			40,000	43,200,000	40,000	9,600,000	80,000	52,800,000	80,000	52,800,000
SUB-TOTAL_ISP	-	-	40,000	9,600,000	40,000	9,600,000	80,000	52,800,000	80,000	52,800,000
GRAND TOTAL	1,403,000	378,810,000	663,200	159,177,600	574,200	159,177,600	1,326,500	351,955,200	2,729,500	688,675,200

Enclosures 3: Subprogramme Detailed Budget

Date: 11 June2020 Name of Sub program: iGRID Fiscal Year: July 2020 - June 2021 Tanzanian Institution/Dept: CoICT/UDSM Collaborating Institution in Sweden: School of Electrical Engineering and Computer Systems(EECS) KTH Exchange rate: 1 SEK = 270 Tsh													
<i>OBS! Major budget items should be the same for all. The budget details may differ.</i>													
		Unit	Cost/unit	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total funds allocated		Total funds to be executed	
		No.	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1.	Tanzania												
	Curriculum development												
	1. None					-	-						
2.	Research equipment			1,000,000	270,000,000							1,000,000	270,000,000
	1. Research equipment					-	-						
3.	Maintenance						-						
	1. None					-	-						
4.	Research Consumables												
	1. Document preparation, printing costs, papers, literature etc for PhD students	9	2,700,000	76,000	20,520,000	90,000	24,300,000			-	-	76,000	20,520,000

5.	2. Minor equipment support PhD	4	1,350,000	74,000	19,980,000	74,000	19,980,000			-	-	74,000	19,980,000
	Travel												
	1. Air travel sandwich PhD students (2) to Sweden for defence	2	2,700,000	-	-	20,000	5,400,000			20,000	5,400,000	20,000	5,400,000
	2. Air travel Swedish Supervisors to Tanzania	2	2,700,000			20,000	5,400,000			20,000	5,400,000	20,000	5,400,000
	3. Air travel Supervisors to Sweden (2)	2	2,700,000	-	-	20,000	5,400,000			20,000	5,400,000	20,000	5,400,000
6.	Field/Lab work						-			-	-	-	-
	Pilot site work allowance for PhD (9)	-	-	-	-	-	-			-	-	-	-
	Student fees (8-PhD)					178,000	48,060,000			178,000	48,060,000	178,000	48,060,000
7.	Student stipends (8-PhD)	13	3,177,692	153,000	41,310,000	-	-			-	-	153,000	41,310,000
8.	Conferences						-			-	-	-	-
	1. PhD students' conference costs	-	-	-	-	-	-			-	-	-	-
	Publication costs						-			-	-	-	-
9.													

10.	1.Publications of PhD students	13	4,818,462	100,000	27,000,000	232,000	62,640,000			232,000	62,640,000	332,000	89,640,000
	Travel insurance		-	-	-	-	-			-	-	-	-
	Other costs						-			-	-	-	-
	1. Products and services dissemination workshops (2)	50	270,000			50,000	13,500,000			50,000	13,500,000	50,000	13,500,000
	2. Next phase discussion in Tanzania	2	5,940,000			44,000	11,880,000			44,000	11,880,000	44,000	11,880,000
	3. Sustainability workshop	50	135,000			25,000	6,750,000			25,000	6,750,000	25,000	6,750,000
	4. Retreat for PhD students to speed up their training completion	20	1,350,000			100,000	27,000,000			100,000	27,000,000	100,000	27,000,000
	Allowance for supervisors visiting Sweden for PhD defence of sandwich students	2	5,400,000			40,000	10,800,000			40,000	10,800,000	40,000	10,800,000
	Audit					-	-			-	-	-	-
	Indirect costs						-			-	-	-	
13.	1. None					-							
	Institutional fee (12%)					87,480	23,619,600			87,480	23,619,600	87,480	23,619,600
	SUB TOTAL			1,403,000	351,810,000	816,480	220,449,600			816,480	220,449,600	2,219,480	599,259,600

		Unit	Cost/unit	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
		No.	SEK	SEK	TZS	SEK	TZS	SEK	TZS
	Sweden								
1.	Supervision of PhD students (4) while in Sweden			100,000	27,000,000			100,000	33,750,000
2.	Curriculum development				-			-	-
	1. None			-	-			-	-
3.	Lecturing on courses				-			-	-
	1. PhD students (4) attending courses at KTH			50,000	13,500,000			50,000	22,140,000
4.	Other costs				-			-	-
	1. Bench fee for students at KTH			40,000	10,800,000			40,000	10,800,000
	2. Coordination cost KTH			240,000	64,800,000			240,000	64,800,000
5.	ISP				-			-	-
	1. Stipend for PhD (4) for two months in Sweden			80,000	21,600,000			80,000	21,600,000
	SUB TOTAL			510,000	137,700,000			510,000	137,700,000

GRAND TOTAL	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
	SEK	TZS	SEK	TZS	SEK	TZS
	1,326,480	358,149,600			2,729,480	736,959,600

Budget description/justification

1. Curriculum development

There will be no activity on curriculum development during extension period.

2. Research equipment

Major research equipment are currently being purchased using the budgeted allocations of 2015-2020. No major major equipment acquisition will be done during the extension period.

3. Maintenance of equipment

It is assumed that recently acquired equipment will still be on warranty period. Hence, no maintenance budgeted for extension period.

4. Research consumables

There will be research consumables totaling 164,000SEK on document preparations, printing, secretarial services, operationalization of pilot sites and replacement of failed sensors.

5. Stipend for PhD Students

During extension period, PhD students will be paid stipend, also they must pay tuition fee and study extension fee for those who will exceed their targeted dates of graduation.

Enclosure 4: Results Based Management Logical Framework for Extension Period July 2020 –June 2021 iGRID

Types of Outputs	Outcomes (including targets)	Performance Indicator of Outcome	Baseline (if established)	Extension Outcome Targets for July 2020-June 2021	Actual Outcomes Achieved: Results Observed in period (July 2020-June 2021)	[Key] Outputs produced in the extension to obtain Outcome in July 2020 –June 2021
Specific Objective 1: Capacity development including incorporating innovation and entrepreneurship in revised MSc, develop new MSc and develop new PhD curricula						
Trained nine (9) local PhD students in Computer and IT Systems Engineering	1.1 Nine (4) local PhD students graduate by November 2021	Number of PhD graduates	Sida funded PhD students (9).	Nine (9) local PhD dissertations documents examined and approved by directorate of post graduate studies.	Nine (9) PhD local students trained.	Nine (9) PhD local students graduated.
Trained four (4) PhD students in Computer and IT Systems Engineering in Sweden	1.2 Four (4) PhD students trained at KTH by June 2021	Number of courses successfully taken and completed by visiting local PhD students at KTH	Sida funded PhD students at KTH	Four (4) PhD reports submitted to the department on extra studies at KTH.	Four (4) PhD local students trained at KTH	Four (4) PhD reports produced on KTH training.
20 publications in refereed journals and conferences between July 2020 and June 2021	1.3 Enhance dissemination of research and innovation outputs publications	Number of publications in conferences and journals	Sida-funded (0)	At least ten (20) publications accepted for presentation/publication	Number of accepted submissions.	Number of publications in referred journal.

Types of Outputs	Outcomes (including targets)	Performance Indicator of Outcome	Baseline (if established)	Extension Outcome Targets for July 2020-June 2021	Actual Outcomes Achieved: Results Observed in period (July 2020-June 2021)	[Key] Outputs produced in the extension to obtain Outcome in July 2020 –June2021
Assumption: <ul style="list-style-type: none"> ➤ The pilot site is fully equipped by July 2020. 						
Specific Objective 2: Increase the local power systems reliability by explore research opportunities in different aspects of smart grid to address local power system challenges by utilizing products and services to support smart grid implementation, to foster development of new business, entrepreneurs and smart grid policy for societal development.						
Pilot site operationalization by 2021	2.1 Fully equipped and working pilot site	Number of operational pilot site	Sida-funded	Number of prototypes submitted for testing into pilot site	Number of prototypes tested into the pilot site	Number of prototypes accepted for patents and mass production.
Hold two (2) dissemination workshops per year with stakeholders	2.2 Collaboration with stakeholders strengthened	Number of meetings held	Sida-funded	Stakeholders accept and participate in four consultative (2) workshops.	Number of participants in the meetings	Number of social services offered in the meetings.
At least 3 Smart grid business opportunities addressing local power system challenges by 2021	2.3 Proposal for new business opportunities in strategic areas that constitute to smart grid to enhance Power System Reliability	Number of business opportunity created	Existing products in power industry	Number of business opportunities addressed during meeting	Number of business opportunities accepted by the main client TANESCO	Number of business opportunities taking off
Hold next phase and sustainability workshops	2.4 Sustainability proposals presented	Number of strategies	Existing research activities in	Number of ideas presented and discussed	Number of funded proposals written and submitted to funding	Accepted funded proposals

Types of Outputs	Outcomes (including targets)	Performance Indicator of Outcome	Baseline (if established)	Extension Outcome Targets for July 2020-June 2021	Actual Outcomes Achieved: Results Observed in period (July 2020-June 2021)	[Key] Outputs produced in the extension to obtain Outcome in July 2020 –June2021
		discussed and agreed upon.	the project		agencies.	
Assumptions: <ul style="list-style-type: none"> Assumptions for Specific Objective # 2. Cooperation from the stakeholders, and the availability of facilities, equipment and human resources 						

Enclosures 5: Aggregated Student Progress and Plan (July 2020-June 2021)

PhD training Name of research student:	(M/ F)	Year training <u>started</u>	Training in Sweden (no. months)	<u>Local PhD</u> Expected/ Year of completion	<u>Sandwich PhD</u> Expected/ Year of Completion	<u>Progress %</u>	<u>Title of Dissertation</u>
Mr Daudi Mnyaghwalu	M	2016	2	Nov 2020		75	Optimal Sensor Network and Faults Classifications Algorithms for Automatic Faults Clearance in the Secondary Electrical Power Distribution Network
Ms Rukia Mwifunyi	F	2016	2	May 2020		85	Automation of Fault Localization, Isolation and Service Restoration to Improve Reliability in Electrical Secondary Distribution Network
Mr. Godfrey Chugulu	M	2016	2	Nov 2020		70	A Smart Grid Communication Architecture for Enhancing Automatic Faults Detection and Clearance in Tanzania Electrical Power Secondary Distribution Network
Mr. Yona Andegelile	M	2016	2	Nov 2020		75	Cost Effective Resilient Communication System for Fault detection and Clearance Automation in Secondary Distribution Power Grid
Mr. Shamte Kawambwa	M	2016	2	Nov 2020		75	Coordination of Distributed Energy Resources for Enhancing Fault Clearance and Service Restoration in Electrical Power Distribution Network
Mr. Gilbert Gilbert	M	2016	2	Nov 2020		70	Integrated Computing Framework for Automatic Fault Clearance in Tanzania Electrical Power Grid
Ms. Hadija Mbembati	F	2016	0	Nov 2021		40	Preparing proposal after maternity
Mr. Ally Bitebo	M	2016	2	Nov 2021		50	A framework for Securing Communication Network for Fault Management in Secondary Electrical Power Distribution Network
Mr. David Makota	M	2016	0	Nov 2021		40	Big Data Approaches for Intelligent Fault Management in Tanzania Electrical Power Secondary Distribution Network
Mr. Bakiri Hussein	M	2016	0	Nov 2021		50	Load demand Forecasting mechanism to enhance effective power management in Secondary Electric Distribution Network for Fault Clearance.
Mr. Aron Kondoro	M	2016	22		May 2020	95	Enhancing Security in Distributed Internet-of-Things Based Communication System for Agent Driven Smart Micro-grid
Ms. Diana Rwegasira	F	2016	22		May 2020	95	Agent Based System for Improved Control and Monitoring of a solar driven DC micro grid

Ms. Amleset Kelati	F	2016	22		May 2020	90	IoT based sensors, embedded and microcontrollers for monitoring Smart systems
Ms. Mwajua Shiraz	F	2017	6	May 2020		50	Working on CDE challenge.
Mr. Ramadhani Maulid	M	2017	0	May 2020		50	
Mr. Fanuel Hume	M	2017	0	Nov 2020		40	
Mr. Stephan Mgaya	M	2017	6	Nov 2020		40	
Mr. Mkupete Mkupete	M	2017	6	Nov 2020		40	
Mr. Salim Yahya	M	2016	6	May 2020		95	Wireless Sensor Network for enhancing power consumption visibility in secondary electrical distribution network
Ms. Lucina Lawi	F	2016	0	May 2020		95	Big Data visualizer for consumption data within the secondary distribution network of the electrical grid.
Mr. Bernard Sengo	M	2016	0	Nov 2020		40	Big data analytics for power consumption visibility in electrical power secondary distribution network
Mr. Amani Msomba	M	2016	0	Nov 2020		40	Development of a communication Network and Gateway for consumption monitoring in secondary distribution of electrical grid
Mr. Harold Chipphanha	M	2016	0	May 2020		95	Big data database design for system to enhance power consumption visibility in the secondary electrical distribution network
Total: 23							

**DEVELOPMENT OF AFFORDABLE ADSORBENT
SYSTEMS FOR ARSENIC AND FLUORIDE
REMOVAL IN DRINKING WATER SOURCES IN
TANZANIA (DAFWAT)**

PLAN SUB-PROGRAMMES/PROJECTS (July 2020 - June 2021)

TITLE OF THE SUBPROGRAMME

DEVELOPMENT OF AFFORDABLE ADSORBENT SYSTEMS FOR ARSENIC AND FLUORIDE REMOVAL IN DRINKING WATER SOURCES IN TANZANIA (DAFWAT)

Contact information

Cooperating Institution:	Swedish Institution:
Department of Water Resources Engineering, University of Dar es salaam (UDSM)	Department of Sustainable Development, Environmental Science and Technology, KTH Royal Institute of Technology
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1. Summary of Achieved Results/Sub-programme Progress

The general objective of DAFWAT program is to build research capacity and training skills to support development of affordable low-cost technology in removing Fluoride and Arsenic from drinking water sources using locally available materials in Tanzania. It will lead to:

- Understanding the drinking water quality and occurrence of fluoride in the Rift Valley and volcanic mountains and Arsenic around Lake Victoria drinking water sources and the associated health effects.
- Understanding and evaluate different scientific conceptual frameworks to explore sorption performances of different locally available adsorbents namely activated alumina, Fe-oxides, magnesite, bauxite and clays as well as gypsum for arsenic and fluoride removal with improved sorption capacity on a laboratory scale.
- Design and test field application for the developed technology for effective removal of fluoride and arsenic from natural waters of varying quality parameters.
- Design and facilitate stakeholder workshops that enable interaction with water supply practitioners (including government ministries, local communities, service providers both public and private, NGO's and CBO's) to enhance research capacity, raise awareness and implementation of this technology in rural areas.
- Enhance the capacity of water quality laboratory through installation of modern laboratory equipment and training laboratory technicians to operate them

- f) Establish a regional taught PhD Program in Hydrology and Geochemical modeling to up-scale the DAFWAT training and research in the region.
- g) Write peer-reviewed articles that incorporate an inter-disciplinary scope to apply to academics outside the Water Resources Engineering, Ministry of Water, Local Government Authorities including policy makers at the Ministry of Health and Social Welfare.
- h) Present research results, orally and through posters, in inter-disciplinary academic and scientific forums within Africa and beyond.
- i) Enhance teaching; through having PhD students act as teaching assistants to postgraduate training at WRE, to expose them to teaching, grading and facilitating seminars.
- j) Improve the quality and quantity of article writing by organizing and participating in writing workshops and co-author articles by senior and junior staff from within the DAFWAT program team. Students will also be responsible for organizing and facilitating student-to student peer-reviewing processes when they are writing manuscripts to be ready for submission to academic journals.
- k) Seek synergies with other capacity building programs, first within the WRE department itself as well as with other programs, as a way to build networks, enhance learning and share resources.
- l) Reach out to the wider public, through government ministries, NGO's and CBO's via non-scientific writing and presentations through social media and participation in and organizing of workshops and forums in Tanzania to highlight the work of the DAFWAT program to link to new stakeholders and networks. The outreach workshop at the end of the 5- year program is one such outlet to show other academic institutions and the public what kind of research and education is being conducted at the university of Dar es Salaam (UDSM)

In summary, the research capacity training will:

- Strengthen the research capacity at WRE department UDSM through training of staff.
- Strengthen the water quality laboratory research and consultancy capacity at WRE department through installation of modern equipment and technician training.
- Create a number of PhD graduates in hydrology and geochemical modeling at UDSM,
- Develop low cost defluoridation technology to be used in rural areas
- Develop a pilot plant in collaboration with Arusha Urban Water and Sewerage Authority (AUWSA) for defluoridization of groundwater.
- Increase training and research collaboration with other stakeholders outside academia to increase actionable knowledge on defluoridation by the research group at UDSM and Water Supply authorities outside academia,
- Increase research output at UDSM,
- Increase partnership projects with other international research institutions
- Increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (KTH).

Progress made until June 2020

- o) Four PhD students were recruited and registered in 2016 at KTH Royal Institute of Technology under sandwich mode. One lady Fina Lesafi dropped out after one year due to social family issues and was later replaced by Vivian Kimambo who was registered in January 2017. The students are expected to complete their studies by June 2021.
- p) Seven Masters Students have benefited from the project. Five under full scholarship and 2 partial scholarship by providing research support. Two have completed their studies and graduated. The other five students are expected to complete by November 2020.
- q) The sub-programme developed new taught PhD curriculum in Hydrology and Geochemical Modeling which was approved by Senate in 2017 and was accredited by TCU in December 2019. We expect it to be running by September, 2020
- r) A modern state of art analytical laboratory has been set up at the Department of Water Resources Engineering. Modern equipment installed other equipment have not arrived yet but it is expected that they shall be installed by October 2020.
- s) A methodology for Arsenic and Fluoride removal using locally available adsorbents (Magnesite, Bauxite and Gypsum) at laboratory scale have been developed. This will be further upscaled and tested at industrial scale.
- t) Published 4 peer reviewed Journals, 2 more papers have been accepted for publication, 4 journal papers are under internal review. We have achieved to have conference proceedings papers. 2 policy briefs have been presented. These peer-reviewed articles incorporate an inter-disciplinary scope to apply to academics outside the Water Resources Engineering, Ministry of Water, Local Government Authorities including policy makers at the Ministry of Health and Social Welfare.
- u) Present research results, orally and through posters, in inter-disciplinary academic and scientific forums within Africa and internationally (USA, India, China, Vietnam and Europe)
- v) Improve the quality and quantity of article writing by participating in writing workshops and co-author articles by senior and junior staff from within the DAFWAT program team. Students were also responsible for organizing and facilitating student-to student peer-reviewing processes when they were writing manuscripts to be ready for submission to academic journals.
- w) Reach out to the wider public, through government ministries, NGO's and CBO's via non-scientific writing (2-policy briefs) and presentations through social media and participation in organizing of workshops and forums in Tanzania to highlight the work of the DAFWAT program.
- x) We have created collaboration with International Research institutions. We have now linked with Japanese Universities and our new proposal may be funded by JICA.
- y) We have also participated in the Research week exhibitions at UDSM and attended the Research conference and exhibitions in Dodoma for government officials.

Summary of Budget for the period of five years:

This sub-programme was allocated SEK 16,000,000 for the period of five years with 4,817,000 for 2015/2016, 3,020,000 for 2016/2017, 3,213,000 for 2017/2018, 2,801,000 for 2018/2019 and 2,144,000 for 2019/2020. The amount of each was distributed as follows:

Sub program: DAFWAT UHR Identification Number 2235-2014.

Institution/ Year	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total (in SEK)
UDSM	3,386,000	1,618,000	1,831,000	1,451,000	794,000	9,080,000
SWEDEN	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	5,000,000
ISP	384,000	384,000	384,000	384,000	384,000	1,920,000
Total	4,817,000	3,021,000	3,213,000	2,801,000	2,144,000	16,000,000

This sub-programme at UDSM in five years received SEK **16,000,000** and by June 2020 will have SEK **2,144,000** as balance to be carried forward for the period July 2020 to June 2021.

Planned Activities from 1st July 2020 to 30th June 2021

25. This sub-programme has 4 PhD students on sandwich mode but fully registered at KTH-Sweden. The four PhD students are at different stages toward completing their classroom studies, research and publications.
26. During the extension the sub-programme will provide to student's travel to Sweden and subsistence allowances. The estimated stay during extension period at UDSM is about 3 months and the remaining 9 months the students will be at KTH-Sweden
27. The Swedish supervisors' will be paid their supervision allowance during the extension period.
28. Two UDSM supervisors of PhD students will visit Sweden twice for 7 days to participate in seminar and PhD defence presentations by the PhD students.
29. One-week local retreat to synergise all water related SIDA supported projects in the department to develop one strong proposal for next phase SIDA project call.
30. Two staff members will visit Sweden in summer for 14 days for preparation of proposal writing for the next phase of SIDA project application.
31. One field work will be conducted by students and staff during extension period to ascertain impact of seasonal changes on ground water.
32. Training of staff and technicians on operation and maintenance of the new installed lab equipment
33. Improving the lab. Environment to meet the conditions of the manufacturers of the equipment

34. Two staff members from KTH-Sweden will visit Tanzania to participate in the construction of the prototype defluoridation plant in Arusha and lecture in the new taught PhD programme.
35. Organise 3-day seminar for students on how to fast track completion of their studies.
36. The subproject will organise a stake holders meeting in Arusha and Geita to sensitize the members on the impacts of drinking the Arsenic or fluoride contaminated water.

Total extra fund being requested is as follows UDSM1, 739,465, Sweden SEK 562,500 SEK 1,257,840 and ISP SEK 384,000 Total is **SEK**. Carryover fund is SEK 150,000 and extra fund requested is **SEK 1,453,876**

2. General objectives and expected results

The overall objective of the UDSM-SIDA programme is to generate sufficient analytical capacity and research-based knowledge and technological innovations with appropriate and immediate valuable outcomes to relevant stakeholders (policy makers, industry, civil society etc.) in addressing the problem of poverty and promoting sustainable and inclusive development. In that spirit, the UDSM research and training during 2015-2020 was guided by its Vision 2061 to be “A leading centre of intellectual wealth spearheading the quest for sustainable and inclusive development”. Taking into consideration the various achievements from earlier support from Sida and other development partners, the research and training had the following specific objectives:

- (v) To increase postgraduate curricula and the extent of research training for development in key strategic and priority areas (i.e. Food Security and Agriculture, Tourism, Agribusiness, Integrated Sanitation Management, Marine Sciences, Molecular Biosciences, Mathematics in higher learning education and Smart Grid).
- (vi) To improve research environment (that includes equipment and infrastructure, regulations, policies and guidelines).
- (vii) To increase the quality and use of research
- (viii) To Increase partnership with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3. Target (July 2020 –June2021)

3.1 Programme objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas.

3.1.1 Planned and the specific activities to be carried out:

- To ensure that all PhD and MSc registered students complete their studies by May 2021.
- The PhD programme in Hydrology and Geochemical modeling will be kicked off by admitting the first batch of at least five students by October 2020

- Consolidation and finalizing laboratory and outreach installations of the prototype defluoridation plant in Arusha. Specifically, we will finalize design and installation of the plant. (Pumps, motor, pipes cables and control panels).

3.1.2 Expected Deliverables

- A prototype defluoridation plant using local materials running in Arusha.
- A taught Phd class of Hydrology and Geochemical Modeling in place.
- Four Phd students' complete studies and graduate by March 2021.
- Support Masters students to graduate by November,2020

3.2 Programme objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

3.2.1 Planned and the specific activities to be carried out:

- A state-of-the-art water analytical laboratory equipment installation to be continued after June, 2020
- Accrediting the new state of art laboratory with the regulatory institutions such as ERB by June 2021

3.2.2 Expected Deliverables

- A well-furnished analytical laboratory in place and operational
- The analytical laboratory registered with ERB

3.3. Programme objective 3: Increase the quality and use of research relevant to high priority issues of national development

3.3.1 Planned and the specific activities to be carried out:

- A tailored training for technicians to operate and run and maintain the new equipment in the laboratory.
- Design and hold 2stakeholder's workshops on the water quality problems related to the contaminants (Fluoride and Arsenic) from geogenic and anthropogenic sources in Tarime and Arusha for Arsenic and fluoride respectively
- Involve government ministries, local communities, service providers both public and private, NGO's and CBO's to, raise awareness and implementation of the innovated technology in rural areas.
- Preparation of policy brief and create awareness for adoption by Ministry of Water, Parliament, NGO and technology investors.

3.3.2 Expected Deliverables

- Four technicians trained on how to operate and run the new equipment in the laboratory
- A stake holders meeting held in Arusha and Tarime to sensitize the problems of drinking water with excessive Fluoride or Arsenic.
- Policy briefs developed for safe drinking water free from Arsenic and Fluoride

3.4 Programme objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

3.4.1 Planned and the specific activities to be carried out:

- Follow up the MoU with Arusha UWSA on the installation of a prototype defluoridation plant for demonstration of the new technology
- Follow up with the Japanese Universities for a detection mechanism based on Metalloid.
- Finalization of the patenting of the innovation as well as obtaining the permits to use the materials for treating drinking water (toxicity considerations)
- Design and construction of the defluoridation prototype plant

3.4.2 Expected Deliverables

- Signing of a MoU with Arusha UWSA on the application of the new technology of defluoridation on their drinking boreholes water
- A prototype defluoridation plant constructed and ready for demonstration of the water treatment technology

4. Analysis and Justification

During the extension period starting from July 2020 to June 2021 the following activities will be carried out to support activities started in previous year 2019/2020

1) Training of the 4 PhD and Masters candidates

The four PhD students (Julien Ijumana, Regina Irunde, Fanuel Ligate and Vivian Kimambo) will finalize the classroom attendance and data analysis at KTH and UDSM then start writing the theses and final paper publications to be submitted to peer reviewed Journals. Student Regina Irunde may have to carry out some laboratory analysis work at UDSM laboratory during the period. The PhD students are expected to graduate by May 2021. During extension period the students shall need three months stay in Dar es Salaam and Nine months in KTH Sweden.

No,	Name of Students	Expected Graduation Date
1	Julien Ijumana	March, 2021
2	Regina Irunde	April, 2021
3	Fanuel Ligate	April, 2021
4	Vivian Kimambo	May, 2021
5	All 5 MSc students	November, 2020

The students were expected to stay in Sweden for 24 months and in Tanzania 24 Months. They have utilized a total of 79 months stay in Sweden, with a carry over of 17 months @ SEK 16,000 =SEK272,000. Two students who were in Sweden have been paid additional SEK 2,000 for 10 months from September 2019 to June 2020 = SEK 40, 000. Amount Carried forward for ISP (Student allowances is 242,000. Within One-year extension the students will spend 3 months in UDSM and 9 Months in KTH-SWEDEN. Total required stipends in SWEDEN is SEK 18,000x 4studentsx 9 months minus amount carried forward (SEK 232,000= SEK 416,000. At UDSM 3 months with additional one month to take risks for COVID 19 in case of longer stay at UDSM SEK 40,000 is required for 4 months at UDSM.

2) Organize three-day seminar for PhD students to support their fast tracking their PhD studies

A total of 4 Phd students and 3 supervisors shall attend a workshop for 5 days that will help students to speed up their research complete their research work. The Cost will involve hiring seminar room, transport and per diems for attendees. SEK 4,000 is required. This was not planned in the budget.

This was not planned in the budget.

3) Organize one-week retreat to synergize all SIDA supported water related sub-programmes to develop one strong proposal for next phase of SIDA project.

Two DAFWAT PI and CO-PI to attend a workshop organized in collaboration with SUSTAIN and WATER RESOURCES sub-projects to initiate proposal concepts and merge the three subprograms into one project. The Cost will involve hiring seminar room, transport and per diems

for attendees, this will also involve PhD students who are planning for a postdoc in next phase. SEK 6,000 is required. This was not planned in the budget.

4) Preparation of proposal for next phase of SIDA project.

Two DAFWAT PI and CO-PI shall visit SWEDEN in collaboration with SUSTAIN and WATER RESOURCES to initiate proposal concepts and write a comprehensive proposal for next SIDA call. The Cost will involve, transport, insurance and per diems for 2 staff, this will involve also PhD students who are planning for a postdoc, most of them will be in Sweden. SEK 150,000 is required. This was not planned in the budget.

5) Procurement, installation and testing laboratory equipment

Most of the laboratory equipment was ordered during the previous year 2019/20. However, due to the virus CORONA, most of the delivery will be delayed eg. the Programmable furnace, XRD Machine, XRF Machine, Total organic carbon analyzer and the grinding ball mill machines will be received and installed during the extension period. Payment of Clearing and forwarding charges, port charges, some money has been allocated for rehabilitation of the laboratories for new equipments. Training of laboratory technicians. The field prototype defluoridation plant will be installed and tested in Arusha during the extension period. All LCs are expected to be paid by end of June 2020. It costs are included in this category. Additional of SEK 12,000 is requested for maintenance of Furnace and Ball mill laboratories rooms. These laboratories shall require 3 phase electricity supply and repair of rooms for placement of these two equipments. These were not considered during planning phase.

6) Taught PhD program establishment

The Taught PhD Programme in Hydrology and Geochemical modeling will take off during the extension period. It is expected that first batch of students will be admitted by September 2020.

7) Participation in local and international scientific conferences by DAFWAT staff and students

It is expected that the staff and students will be able to attend one international conference each to publicize the research findings. The International arsenic Conference was to be held in Netherlands in June 2020 and the Waternet Annual symposium was to be held in October 2020. These conferences were postponed to 2021. The students and staff will to present their papers.

8) Stake holders' workshop to be held in Tarime and Arusha

It is anticipated to hold one workshop to disseminate the technology and sensitize people on the problems of drinking water with high Fluoride or Arsenic content.

5. Enclosures

- 54. Subprogramme Activity Implementation Plan (July 2020-June 2021)
- 55. Sub-program **Overall Aggregated Budget**
- 56. Subprogramme Detailed Budget
- 57. Results Based Management (RBM) Matrix (July 2020-June 2021)
- 58. Aggregated Student Progress and Plan (July 2020-June 2021)
- 59. Students Individual Plans and Popular Summary of the Study
- 60. Subprogramme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: Subprogramme: Subprogramme Activity Implementation Plan (July 2020-June 2021)

S/N				Source of Fund		(End month) 2020						(End month) 2021			Activity Justificati on
	Planned Activity	Origin of the Activity ¹ (New/Carriedover)	Proposed Budget	Original Budget ²	Extra Fund ³	Jul	Aug	Sept	Oct	Nov	Dec	Feb	Apr	June	
OB1	Objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas														
1.1	Training 4 PhD students														Supports output
1.2	Taught PhD trainings														Supports output
1.3	Prototype plant installation														Supports output
1.4															
OB2	Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines														
2.1	Laboratory equipment installation														Supports key output
2.2	Training of technicians														Supports output
2.3	Accreditation of laboratory														Supports output
OB3	Objective 3:Increase the quality and use of research relevant to high priority issues of national development														
3.1	Publishing papers in ISI Journals														Key output
3.2	Stakeholders meeting														Key output
3.3	Policy briefs														Key output

2.4	Attending Conferences														
OB4	<i>Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas</i>														
4.1	Proposal writing for next phase														
4.2	Patenting research findings														
4.3	MOU with AUSA														
4.4	Design of Industrial prototype														
4.6															

⁴Attach the Original approved Budget

Period: 1st July 2020 to 30th June 2021

Tanzanian Institution/Dept: DEPT. of WATER reSOURCES-UNIVERSITY OF DAR ES SALAAM

OBS Student allowances should be under ISP

Tanzania	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		
	SEK	TZS	SEK	TZS	SEK	TZS	
Curriculum	0	0					
Research equipment	88000	21120000					
Maintenance	20000	4800000	60,000	14400000	60,000	14400000	
Research Consumables	30,000	7200000		0			
Travel	205000	49200000		0			
Field/Lab work	190,000	45600000	30,000	7200000	30,000	7200000	
Student fees	0	0					
Student stipends x	20,000	4800000					
Coferences	175000	42000000					
Publication costs	30000	7200000					
Travel insurance	5000	1200000					
Cost related to Research	0	0	0	0	0	0	
Cost of Training	0	0	0	0	0	0	
Coordination Cost	0	0	0	0	0	0	
Other costs	0	0	0	0	0	0	
Transfer of Funds to Sweden	0	0	0	0	0	0	
Bank interest	0	0	0	0	0	0	
Audit	0	0	0	0	0	0	
Indirect costs	0	0	48,500	11640000	48,500	11640000	
SUB TOTAL	763,000	183,120,000	138,500	33,240,000	138,500	33,240,000	
Sweden							
Supervision			175,000	42,000,000	175,000	42,000,000	
Curriculum development							
Lecturing on courses							
Travel Costs							
Dissemination and communication							
Other costs							
Indirect costs							
SUB-TOTAL_SWEDEN	-	-	175,000	42,000,000	175,000	42,000,000	
ISP - student allowances	387,000	92,880,000	130,500	31320000	130,500	31320000	
SUB-TOTAL_ISP	387,000	92,880,000	130,500	31,320,000	130,500	31,320,000	
GRAND TOTAL	1,150,000	276,000,000	444,000	106,560,000	444,000	106,560,000	1

Name of Sub program: DAFWAT

Fiscal Year: 2020/2021

Tanzanian Institution/Dept: Department of Water Resources Engineering, University of Dar es Salaam

Collaborating Institution in Sweden: KTH-Royal Institute of Technology, SWEDEN

Exchange rate: 1SEK = TSH 245

OBS! Major budget items should be the same for all. The budget details may differ.

		Unit	Cost/unit	Funds expected to be forwarded from previous year		Allocated funds July-December 2020		Allocated funds June 2021	
		No.	TZS	SEK	TZS	SEK	TZS	SEK	TZS
1.	Tanzania Curriculum development								
	1.								
2.	Research equipment								
	1.Equipments and laboratory maintainance			88,000	21,560,000	6,000	1,470,000	6,000	1,470,000
	2.....								
3.	Maintenance								
	1. Reseachequipmtent spare parts, maintainance and maintainance contracts costs		Lumpsum	20,000	4,900,000	60,000	14,700,000	60,000	14,700,000
4.	Research Consumables								
	Chemicals, printer cartrigages, papers,		lumpsum	30,000	7,350,000	0	0	0	

5.	laboratory consumables								
6.	Travel								
	Travel airtickets, perdiem etc for researchers and students		lumpsum	205,000	50,225,000	80,000	19,600,000	80,000	19,600,000
7.	Field/Lab work								
	Fuel, perdiem, fieldstaff allowances, and external laboratory costs		lumpsum	190,000	46,550,000	30,000	7,350,000	30,000	7,350,000
8.	Student allowances/ISP								
	Student allowance stay at KTH in sweden		lumpsum	232,000	56,840,000	208,000	50,960,000	208,000	50,960,000
9.	Student fees x								
10.	Student stipends x								
	4 PhD Students stipends at UDSM		lumpsum	20,000	4,900,000	10,000	2,450,000	10,000	2,450,000
10.	Conferences								
	Travel air ticket, perdiem, conference material preparation		lumpsum	175,000		0	0	0	
10.	Publication costs								

	publication fees		lumpsum	50,000	7,350,000	0	0	0	
11.	Travel insurance								
	Travel insurance for staff and student during travel to confrances and to KTH-Sweden		lumpsum	5,000	1,225,000	0	0	0	
12.	Other costs								
	1.								
	2.								
13.	Audit								
14.	Indirect costs								
	Institution fees and other costs		lumpsum			48,500	11,882,500	48,500	11,882,500
	SUB TOTAL			995,000	200,900,000	442,500	108,412,500	442,500	108,412,500

1.	Sweden Supervision	Unit	Cost/unit	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total	
		No.	SEK	SEK	TZS	SEK	TZS	SEK	TZS
	1.Staff at KTH for supervision role			175,000	42,875,000	175,000	42,875,000	350,000	85,750,000
2.	Curriculum development								
	1.								
	2....								
3.	Lecturing on courses								
	1.Lecturing on courses costs for								

4.	2.								
	Other costs								
	1.....								
	2....								
	5. Indirect costs								
	1.								
	2.								
	SUB TOTAL			175,000	42,875,000	175,000	42,875,000	350,000	85,75
	GRAND TOTAL	Allocated funds July-December 2020		Allocated funds Jan-June 2021		Total			
		SEK	TZS	SEK	TZS	SEK	TZS		
		617,500	151,287,500	617,500	151,287,500	1,235,000	302,575,000		

Enclosures 4: Result Based Matrix for Sub-Programme

Summary Problem Statement:

DAFWAT is a scientific and training program aiming at strengthening the research capacity at UDSM and access to safe drinking water free from excess fluoride and arsenic in priority areas in THE Rift valley zones in Tanzania. Access to affordable technology in reducing high fluoride and arsenic levels in drinking water is a priority goal for sustainable development. Occurrence of elevated concentration of fluoride and arsenic in the drinking water supply sources in Tanzania has caused a serious medical problem with widespread prevalence of dental and skeletal fluorosis. Fluorosis caused by ingestion of drinking water with elevated fluoride concentration has been reported from several parts of the Tanzania, especially in the Great Rift Valley and volcanic mountains areas. The region around Lake Victoria is characterized by elevated arsenic concentrations and long-term exposure from drinking water sources are manifested as skin cancers such as skin keratosis gangrene among the population. Studies related to drinking water quality are extremely important for developing appropriate low-cost technologies for drinking water treatment. This proposal for research training partnership envisages to build research capacity to understand the underpinning mechanisms for the water quality problems related to the contaminants from geogenic and anthropogenic sources and to develop appropriate innovative tools for evaluation and assessment of the risks related to the drinking water quality in the rift valley ground waters, as well as to build capacity to design and develop water treatment technologies through pilot and then full scale applications for safe drinking water supply to the affected population. Another important spin off from this research training partnership is to develop a high-quality laboratory infrastructure for long term drinking water quality monitoring in Tanzania

Overall Objective (2015-2020):

The general objective of DAFWAT sub-programme is to build research capacity and training skills to support development of affordable low-cost technology in removing fluoride and arsenic from drinking water sources using locally available materials in Tanzania. To address the general objective, the DAFWAT 2015-2020 specific objectives are meant to create awareness to stakeholders (policy makers, rural community, NGO's, and scientific community) on prevailing burden to rural communities drinking naturally contaminated water in northern Tanzania.

Specific objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

Specific Objective 3: Increase the quality and use of research relevant to high priority issues of national development

Specific Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas

Result Matrix

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
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Specific Objective 1: To increase postgraduate curricula and the extent of research training for development applied in key strategic priority areas

Trained 4 PhD Graduates from studies	1.1 Four PhD students on sandwich mode graduate by June 2021	Number of PhD graduates	Four PhD students supported by Sida	Four PhD students defended their theses		
Taught PhD running by 2021	Five PhD students registered by September 2021	Number of registered PhD student in Taught PhD course	Zero currently registered by 2019	Five privately registered PhD students		
Prototype defluoridization plant in Arusha installed	Prototype is running and treating water	Number of Prototype installed	Zero currently installed	Design completed and materials procured		

Assumptions for Specific Objective 1:

- All letter of credits for equipment are paid before June 2020
- All laboratory equipment's installed on time
- PhD candidates for new taught PhD secure funds/scholarships for studies
- Equipment's (ball mill and furnace arrive on time to facilitate preparation of natural materials for the prototype plant

Risks

- Delays of arrival of equipment
- COVID 19 pandemic restriction of movement may delay research activities

Mitigation measures

- Use of other laboratories where possible
- Extension of project duration
- Inclusion of Prototype plant in next phase SIDA project

Specific Objective 2: To improve research environment by increasing the utilization of equipment and infrastructure, and conformance to regulations, policies and guidelines

Installation of remaining laboratory equipments	Seven new equipment's installed in the laboratory	Number of equipment installed	Two installed equipment's	Five new instruments installed		
Training of laboratory technicians	Five trainings done for all new laboratory equipments	Number of staffs trained and number of training organised	Number of staff and training	Three training conducted		
Accreditation of laboratory	New laboratory accredited by ERB	Number of accreditations	Number of accreditations in place	Accreditation Certificate by ERB		

Assumptions for Specific Objective 1:

- All letter of credits for equipment are paid before June 2020
- All laboratory equipment's installed on time
- Equipment's (ball mill and furnace arrive on time to facilitate preparation of natural materials for the prototype plant

Risks

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
<ul style="list-style-type: none"> Delays of arrival of equipment COVID 19 pandemic restriction of movement may delay research activities Mitigation measures <ul style="list-style-type: none"> Use of other laboratories where possible Extension of project duration 						
Specific Objective 3: Increase the quality and use of research relevant to high priority issues of national development						
Papers Published in peer reviewed journals	At least 6 papers published in peer reviewed journals by March 2021.	Number of publications	3 papers published per year	Conference organised and one postdoc awarded		
Stakeholders meeting Organized	Two stakeholders meeting organized in Geita and Arusha	Number of stakeholders meeting	Stakeholders meetings	Two stakeholders meeting organised by March 2021		
Policy briefs for drinking water quality	One policy brief prepared	Number of policy briefs prepared	One policy brief	One policy brief submitted to Ministry of Water		
Assumptions for Specific Objective 1: <ul style="list-style-type: none"> PhD candidates willing to write papers Equipment's for research are running Results are adequate for dissemination Risks <ul style="list-style-type: none"> Lack of commitment by PhD students to do research COVID 19 pandemic restriction of movement may delay research activities Mitigation measures <ul style="list-style-type: none"> Motivation and monitoring progress of students Support from PI so as the students to finish studies 						
Specific Objective 4: Increase partnerships with local, regional and international institutions/organizations for knowledge generation, sharing and utilization of research in high priority areas						
Proposal writing for the next phase	3.1 Draft proposal prepared by March 2021	Number of partners established	Available networks	Organized at least three meetings with Swedish partners by March 2021		
Patenting research findings	Patenting details compiled	Number of patents developed	Available research findings	Organised and patent completed by March 2021		
MOU with Arusha urban Water Supply Authority	MOU signed for Pilot plant Construction	Number of MOUs	Available MOU	MOU signed by 2021		

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Design of industrial prototype	Design report	Number of designs guideline	Design guideline	Design guideline for defluoridization plant		
Assumptions for Specific Objective 1: <ul style="list-style-type: none"> • SIDA willing to continue support of research activities at UDSM • External partners willing to join hands in doing research • Results are adequate for dissemination Risks <ul style="list-style-type: none"> • Lack of commitment by PhD students to do research • COVID 19 pandemic restriction of movement may delay research activities Mitigation measures <ul style="list-style-type: none"> • Motivation and monitoring progress of students • Support from PI so as the students to finish studies 						

PhD training Name of research student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of Completion	Progress %	Prel. title of dissertation
PhD students							
1. Vivian Kimambo	F	2016	30		2021	50%	Fluoride Removal with Improved Sorption Process for Groundwater Sources
2. Regina Irunde	F	2017	30		2021	60%	Adsorptive removal of arsenic from drinking water sources in Geita and Mara, Tanzania using local available materials.
3. Ijumana Julien Magezi	M	2016	30		2021	75%	Hydrogeological controls on spatial variability of geogenic contaminants in drinking water resources
4. Fanuel Ligat	M	2016	30		2021	65%	Arsenic and Fluoride Contamination in the Groundwater Resources of Tanzanian Rift Valley: Source, Mobilization and Impacts on Drinking Water Quality
MSc. students							
OkokoKossam	M	2017		2019		98%	Defluoridation of Contaminated Drinking Water using Raw and Calcinated Gypsum. The Case of USARiver, Arusha Region, Northern Tanzania
Peter Andrew	M	2018		2019		98%	Efficiency of Activated Moringa OlifeiraSeeds on

							Removing Fluoride in Drinking Water in Tanzania
Abdalla Mohammed	M	2018		2019		98%	
Agnes Fataki	F	2018		2019		98%	Assessment of Fluoride removal in groundwater using Magnesite
Brenda Anthony Mndolwa	M			2018		100 %	Optimal composite composition of natural adsorbents for removal of fluoride and arsenic from drinking water
Dennis Dismas	F	2017		2019		90%	Adsorptive removal of arsenic and fluoride using local adsorbents from drinking water sources: Case of Magnesite and Magnetite
Bernard Rugayi	M	2017		2019		100 %	Adsorptive removal of arsenic and fluoride using local adsorbents from drinking water sources: Caser of Magnesite and Bauxite
Total:							

Enclosure 6: Students Individual Plans and Popular Summary of the Study

Enclosure 6.1: Ms. Vivian Kimambo action plan and popular summery

Student Name:	Vivian Kimambo
Registration No.:	851212-T362
Registered at:	KTH Royal Institute of Technology
Award:	PhD in Land and Water Resources Engineering
Scholarship Contract Period with UDSM:	1/1/2017 – 31/12/2020
Title of PhD Thesis: Fluoride Removal with Improved Sorption Process for Groundwater Sources	
Main Objective: The overall objective of this study is to develop simple and cost-effective method for removing fluoride in groundwater sources using locally available materials	
Specific objectives: <ol style="list-style-type: none"> Determination of chemical and mineralogical compositions of raw and calcined bauxite, magnesite and gypsum Determination of optimum conditions and suitable models to explain fluoride removal using calcined bauxite, magnesite and gypsum Determination of sorption isotherms for fluoride removal using calcined bauxite, magnesite and gypsum Determination of adsorption capacities of calcined bauxite, magnesite and gypsum for fluoride removal from groundwater 	
Popular Summary:	
<p>Drinking groundwater with high concentration of fluoride is potentially the greatest sources of fluoride in the human. Fluoride removal in water is still a problem in developing countries because excellent methods for fluoride removal such as ion exchange resins and membrane method are expensive and limit application in the country like Tanzania. The studies of using cheap locally available adsorbents like bauxite, magnesite and gypsum for fluoride removal showed low fluoride removal efficiency; hence further studies are needed to improve the performance of these adsorbents.</p>	

Activity schedule													
No	Activity description	2020						2021					
		7	8	9	10	11	12	1	2	3	4	5	6
1	Attending Phd coursework lectures												
	1.1: Research Communication I 4.5 credits												
	1.2: Minerals in soils and sediments and their X-ray identification and quantification 5.0 credits												
	1.3: Research Ethics 2.0 credits												
	1.4: Research Communication II 3.0 credits												
	1.5: Land and Water Engineering, Issues, Case and Field Studies 4.5 credits												
	1.6: Environmental Geochemistry and Ecotechnology 7.5 credits												
	1.7: Writing Popular Science publication 1.5												

	credits													
2	Presenting and attending seminars													
	2.2 Seminar 2													
	2.3 Seminar 3													
3	Publications manuscripts preparation, review, submission													
	3.2: Manuscript 2													
	3.3: Manuscript 3													
	3.4: Manuscript 4													
4	Presentation and attending conferences													
	4.1: 8 th international congress and exhibition on arsenic in the environment to be held in Netherlands from 15 th – 18 th June, 2020													
	4.2: 2 nd International Conference on Dental 2020 to be held in Prague, Czech Republic from 21 st – 22 nd September, 2020													
	4.3: 35 th Conference of the International Society for Fluoride Researcher in Tehran, Iran from 8 th – 9 th November, 2020													
5	Field data collection and analysis													
	Field work 1													
	Field work 2													
6	Laboratory analysis													
	Inhouse													
	External													
7	Thesis compilation and writing													
8	Thesis submission and review													
9	Thesis revising and submission													
1	PhD defense													

Enclosure 6.2: Ms. Regina Irunde action plan and popular summery

Student Name:					Regina Irunde									
Registration No.:		820828-5703												
Registered at:		KTH												
Award:		PhD in Land and Water Resources Engineering												
Scholarship Contract Period with UDSM:		1 st May 2016 to 30 th May 2020												
Title of PhD Thesis: Adsorptive removal of arsenic from drinking water sources in Geita and Mara, Tanzania using local available materials.														
Main Objective: The overall objective of this study is to develop simple and cost-effective method for removing Arsenic in groundwater sources using locally available materials														
Specific objectives:														
<ul style="list-style-type: none"> v. Determination of chemical and mineralogical compositions of raw and calcined bauxite, magnesite and gypsum and how it affects adsorptive capacity for Arsenic vi. Determination of optimum conditions and suitable models to explain Arsenic removal using calcined bauxite, magnesite and gypsum vii. Determination of sorption isotherms for Arsenic removal using calcined bauxite, magnesite and gypsum or combination of materials viii. Determination of adsorption capacities of calcined bauxite, magnesite and gypsum for Arsenic removal from groundwater 														
Popular Summery														
<p>Arsenic is a toxic element which occurs in natural waters as Arsenic three or Arsenic five. Tanzania has recently reported to have high levels of arsenic ranges from 10ppb -300ppb especially in gold mining areas of Geita and Mara. The aim of this study is to prepare and use local available materials such as bauxite, bone char, magnesite, wood char, iron ores and natural zeolites which will be packed as filters to remove arsenic from water. Experimental studies on performance of the local material filters will be done in the water Laboratory and one pilot filter plant which will be built in the field at Matongo village, Mara region Tanzania by 2020.</p>														
		Activity schedule												
S/n	Activity description	2020						2021						
1	Attending Phd coursework lectures	7	8	9	10	11	12	1	2	3	4	5	63	
	1.1: FAE 3006													
	1.2: FAE 3007													
	1.3: FAE 3008													
	1.4: FAL 3509													
2	Presenting and attending seminars													
	2.1 Seminar 1													
	2.2 Seminar 2													
	2.3 Seminar 3													

3	Publications manuscripts preparation, review, submission												
	3.1: Manuscript 1												
	3.2: Manuscript 2												
	3.3: Manuscript 3												
	3.4: Manuscript 4												
4	Presentation and attending conferences												
	4.1: Conference 1 As2020 Arsenic in the environment												
	4.2: Conference 2 Name and dates												
	4.3: Conference 3 Name and dates												
5	Field data collection and analysis												
	Field work 1												
	Field work 2												
6	Laboratory analysis												
	Inhouse												
	External												
7	Thesis compilation and writing												
8	Thesis submission												
9	PhD defense												

Enclosure 6.3: Mr. Fanuel Ligate action plan and popular summery

Student Name:	Fanuel Josephat Ligate
Registration No.:	850530-6152
Registered at:	KTH Royal Institute of Technology
Award:	PhD in Land and Water Resources Engineering
Scholarship Contract Period with UDSM:	48 Months (ending 30 th April 2020)
Tittle of PhD Thesis: Arsenic and Fluoride Contamination in the Groundwater Resources of Tanzanian Rift Valley: Source, Mobilization andImpacts on Drinking Water Quality	
Main Objective: To characterize, assess and model drinking water quality with focus on As, F ⁻ and other inorganic contaminants of geogenic origin in the East African-Great Rift Valley region of Tanzania.	
Specific objectives: <ol style="list-style-type: none"> Identify the chemical constituents of groundwater and surface water and their effects on drinking water quality. Predict the mechanism of release of arsenic and fluoride from the bearing rocks into water sources using geochemical models Investigate the effect of seasonal variation on concentrations of geogenic As and F⁻ in groundwater and surface water. Investigate the geochemical relationship between As, F⁻ and other inorganic constituents in groundwater Identify the minerals responsible for the buffering of pH and the potential leaching of As, F⁻ and other selected trace elements 	
Popular Summery	
<p>Groundwater is the major source of drinking water and other household uses in most urban and rural areas along the East African-Great Rift Valley (EA-GRV) region of Tanzania. Most of the people in the region are facing challenges with safe drinking water supply associated with both quantity and quality as well as poor sanitation. Groundwater reservoirs that serve as source of water for human consumption are underexploited and the hydrogeochemical characteristics of groundwater and controls on the water quality are poorly understood and documented. In particular, the quality of groundwater with regard to arsenic (As) and fluoride (F) along with other geogenic contaminants is inadequately investigated. In some studies, which have been published so far with regard to As and F problem, conventional methods of characterization and analysis were used. The EA-GRV is characterized by the cratons which are formed by a series of neo-archean granitic, gneissic, migmatitic and volcanic rocks. The geological settings and rock types are responsible for the availability and control of naturally occurring potential contaminants such as As and F in groundwater in different areas within the region. In the northern Tanzania region of the EA-GRV, As is associated with gold mining activities (artisanal and large scale) which exposes sulfide minerals such as arsenopyrites (FeAsS), enargite (Cu₃AsS₄) and tennantite (Cu₁₂As₄S₁₃) from the deep underground parent rocks. Oxidation of arsenopyrite minerals is hypothesized to be responsible for the dissolution and release of arsenic into groundwater. On the other hand F is originating from fluoride-rich minerals such as fluorite (CaF₂) and fluorapatite (Ca₅(PO₄)₃F) which are associated with granite and acidic volcanic rocks which are the dominant rock types in the region. Due to complexity of groundwater environment around the EA-GRV, there is a need to understand the geochemical characteristics arsenic and fluoride, their relation with other inorganic constituents and the mechanism of As and F release from the source rock materials and the</p>	

possible influence of other chemical constituents to the chemistry of As and F in water. Currently the Tanzania Bureau of Standards (TBS) is developing new standards (not published) aimed at lowering the permissible limit of concentration from 50µg/L to 10µg/L and from 4 to 1.5 mg/L for As and F respectively. This means more research is needed to re-establish the status of As and F problems in the EA-GRV region where groundwater is known to be contaminated with various geogenic pollutants. Despite the great attention from researchers, government institutions, as well as the public awareness towards F (and recently As) problem in the affected areas, so far there is no viable, efficient and sustainable technologies which are commercially available in large scale for remediation of these contaminants. The adoption of an effective remediation technology is dependent on the overall hydrochemical attributes of the contaminated water sources under natural conditions. Literature review indicates that there is a significant gap in understanding of the overall groundwater quality in the study area. The information on hydrogeochemistry of As, F and other geogenic contaminants, their mobility and fate in the groundwater aquifers and the surface water supply sources is relatively scanty.

Activity schedule

No		2020						2021					
	Month	7	8	9	10	11	12	1	2	3	4	5	6
S/No	Activity description												
1.	Attending PhD coursework lectures												
	1.1: FAE3006												
	1.2: FAE3007												
	1.3: FAE3008												
	1.4: AE3014												
2.	Presenting and attending seminars												
	2.1 Seminar 1: NA												
	2.2 Seminar 2												
	2.3 Seminar 3												
	PhD defense												
3.	Publications manuscripts preparation, review, submission												
	3.1: Manuscript 1												
	3.2: Manuscript 2												
	3.3: Manuscript 4												
	3.4: Manuscript 4												
4.	Presentation and attending conferences												
	4.1: Conference 1: 8 th International congress and exhibition on arsenic in the environment June 15-18, 2020 Netherlands												
5.	Field data collection and analysis												
	Field work 1												
	Field work 2												

6.	Laboratory analysis												
	Inhouse												
	External												
7.	Thesis compilation and writing												
8.	Thesis submission												
9.	PhD defense												

Enclosure 6.4: Mr. Julien Ijumlana Magezi action plan and popular summery

Student Name:	JULIAN IJUMULANA MAGEZI
Registration No.:	790408-T275
Registered at:	KTH Royal Institute of Technology
Award:	PhD in Land and Water Resources Engineering
Scholarship Contract Period with UDSM:	48 Months (ending 30 th April 2020)
Title of PhD Thesis: Hydrogeological controls on spatial variability of geogenic contaminants in drinking water resources	
Main Objective: Spatial modeling of hydrogeological controls on spatial variability of arsenic and fluoride in drinking water sources in the Gold Mining areas and Great Rift Valley Regions and volcanic areas of Tanzania	
Specific objectives: <ol style="list-style-type: none"> To study spatial variability of geogenic contaminants in drinking water sources and quantify probable human health effects associated with drinking arsenic and fluoride-rich water in the study area. To establish a causal relationship between the pollution hotspots and the influencing factors of arsenic and fluoride concentration levels in drinking water sources To study spatio-temporal variation of geogenic contaminants in drinking water sources and predict the future probable health burden associated with drinking arsenic and fluoride-rich water To develop a conceptual hydrogeological model for assessing geogenic contaminants mobilization in groundwater system using GIS 	
Popular Summery	
<p>Adequate, safe and accessible water is an important aspect to human health worldwide. Groundwater has been recognized as a major sustainable source of drinking water based on its quality and quantity aspect in the continually changing environmental conditions. However, occurrence of identified potential toxic elements such as arsenic and fluoride in aquatic environment puts millions of people under severe health risk (Bundschuh et al., 2017; Vithanage & Bhattacharya, 2015). Their occurrence is geogenic in the earth's crust and the concentration levels vary from place to place depending on geologic settings of a region and other</p>	

anthropogenic activities. The occurrence of fluoride in surface and groundwater resources has been associated with volcanic activities, presence of thermal waters especially those with high pH, gases emitted from earth's crust, granitic rocks and gneissic rocks (Malago, Makoba, & Muzuka, 2017). In contrast, the occurrence of arsenic in African water resources has been associated with natural and anthropogenic causes. Anthropogenic causes include mining activities, fossil fuel processing, incineration of municipal and industrial wastes and geogenic causes include presence of sulphide ores associated with other metals like Cu, Pb, Ag and Au (Ahoulé, Lalanne, Mendret, Brosillon, & Maïga, 2015). The release of arsenic and fluoride is a result of interaction between geologic units and water under natural hydrogeological conditions. Several factors may influence spatial variability of concentration levels including water table depth, climatic conditions and pumping (Alfredo, Lawler, & Katz, 2014; Grobler, 1988; Yahia, Abdellah, & Abdel Magid, 2015). Similarly, the natural terrain may influence the variability in contamination levels. Flat grounds with approximately 0% slope are likely to have higher concentration values compared to gently sloping grounds because of long contact time of water and fluoride and arsenic bearing minerals. Therefore, the topography of an area may influence elevated concentrations in combination with other factors.

Supply of adequate quality drinking water requires local detailed information on hydrogeologic characteristics of water bearing rocks (aquifers) and hydrogeochemical composition of groundwater within an area. This study employs several spatial statistical techniques and GIS tools to investigate hydrogeological controls on spatial variability of arsenic and fluoride concentration levels in drinking water sources in Tanzania. Based on past studies on fluoride and arsenic occurrence, the study area will be divided into four zones, namely, part of Lake zone (LZ: Geita, Mwanza, Simiyu and Mara region), Northern zone (NZ: Arusha, Manyara and Kilimanjaro region), Western zone (WZ: Shinyanga region) and Central zone (CZ: Singida region)-figure 1. The study zones were selected based on varying climatic conditions, topography and lithostratigraphic formations which are major influencing factors in natural contamination of drinking water sources.

Problem statement and motivation Groundwater contamination is becoming a global agenda due to its implied human health risk. Recently, geogenic contaminants such as arsenic and fluoride exceeding international guidelines of 0.01 and 1.5 mg/L respectively and associated health burden have been reported in many countries of the world. Although arsenic has been reported to be a real phenomenon in Tanzania particularly in Lake zone drinking water sources, little is known about its spatial extent of occurrence, mobilization and distribution. Past studies have indicated occurrence of elevated arsenic levels around Geita and Mara Gold mining areas in Lake Victoria Basin (Bowell, Warren, Minjera, & Kimaro, 1995; Kassenga & Mato, 2008). Like in many arsenic affected regions of the world, occurrence, mobilization and distribution of arsenic levels in the environment may be varying from place to place but forming spatial patterns important to be known by drinking water supply authorities to avoid future health problems.

Despite fluoride related health problems are rampant in some parts of Tanzania, recent reviews have indicated higher levels to occur in both surface and groundwater resources in Great Rift Valley Regions particularly Arusha, Kilimanjaro and Manyara (Malago et al., 2017). Like in other regions of the world, the occurrence of fluoride in elevated amounts is attributed to a number factors including volcanic activities, presence of thermal waters especially those with high pH, gases emitted from earth's crust, granitic rocks and gneissic rocks (Malago et al., 2017). Based on toxicity of geogenic contaminants to human health, national and international governments have set standards and guidelines to avoid future human health risk. While the World Health Organization (WHO) recommends drinking water with maximum permissible value of 0.01 and 1.5 mg/L for arsenic and fluoride respectively, the Tanzania Bureau of

Standards (TBS) recommends 0.05 and 4.0 mg/L for arsenic and fluoride respectively. Different recommendations depend on diverse alternative sources of safe water. Due to lack of alternative sources in the semi-arid regions including Great Rift Valley areas has forced such recommendations although health problems remain. Since the magnitude of possible health problem related to drinking arsenic and fluoride-rich water is increasing worldwide, it is important to study spatial variability and distribution of arsenic and fluoride occurrence in many verticals. The aim of this study is to model the hydrogeological controls on occurrence, distribution and variation of fluoride and arsenic in drinking water sources of Tanzania using spatial statistics and GIS mapping tools.

Activity Schedule

		2020						2021					
	Month	7	8	9	10	11	12	1	2	3	4	5	6
S/No	Activity description												
1.	Attending Phd coursework lectures												
	1.1: FAK3137												
	1.2: FAE3007												
	1.3: FAE3006												
	1.4: FAE3006												
2.	Presenting and attending seminars												
	2.1 First PhD Seminar												
	2.2 Mid-term Seminar												
	2.3 Final PhD Seminar												
3.	Publications manuscripts preparation, review, submission												
	3.1: Manuscript 1												
	3.2: Manuscript 2												
	3.3: Manuscript 3												
	3.4: Manuscript 4												
4.	Presentation and attending conferences												
	4.1: 36th International Geological Congress, Delhi, India, 2-8 March 2020												
	4.2: The 8th International Congress & Exhibition on Arsenic in the Environment (As2020), Wageningen, The Netherlands												
	4.3: GSA Annual Meeting & Exhibition, Montreal, Canada												
5.	Field data collection and analysis												
	Field work 1												
	Field work 2												

6.	Laboratory analysis													
	Inhouse													
	External													
7.	Thesis compilation and writing													
8.	Thesis submission													
9.	PhD defense													

Enclosure 7: Subprogramme Original Budget 2015-2020 (Compiled Summary)

Date: 8th April 2015 Sub Program Period: 2015 to 2020 Tanzanian Institution/Dept: UDSM-Dept of WATER RESOURCES ENGINEERING Dept. of Sustainable Development, Environmental Science and Collaborating Institution/s in Sweden: Technology KTH- Science and Technology						
OBS! All major budget items should be the same for all.						
	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Tanzania	SEK	SEK	SEK	SEK	SEK	SEK
Curriculum development	80,000	0	0	0	0	80,000.00
Research equipment	1,870,000	150,000	170,000	50,000	0	2,240,000.00
Research consumables	553,000	659,000	779,000	584,000	160,000	2,735,000.00
Travel	63,000	63,000	75,000	75,000	69,000	345,000.00
Field/Lab work	290,000	359,000	359,000	362,000	281,000	1,651,000.00
Student fees	0	0	0	0	0	-
Student stipends	60,000	60,000	60,000	60,000	60,000	300,000.00
Conferences	22,600	55,000	55,000	55,000	55,000	242,600.00
Publication costs	1,000	57,000	77,000	59,000	58,000	252,000.00
Travel insurance	18,000	20,000	20,000	20,000	20,000	98,000.00
Audit	0	0	0	0	0	-
Other costs	75,000	40,000	40,000	35,000	10,000	200,000.00
Indirect costs (Institutional)	353,400	155,000	196,000	151,000	81,000	936,400.00
SUB TOTAL	3,386,000	1,618,000	1,831,000	1,451,000	794,000	9,080,000

	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Sweden	SEK	SEK	SEK	SEK	SEK	SEK
Supervision	700,000	700,000	700,000	700,000	700,000	3,500,000
Curriculum development	0	0	0	0	0	0
Lecturing on courses	100,000	100,000	100,000	100,000	100,000	500,000
Other costs	200,000	200,000	200,000	200,000	200,000	1,000,000
Indirect costs						0
SUB TOTAL	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	5,000,000

ISP - student allowances	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
SUB TOTAL	384,000	384,000	384,000	384,000	384,000	1,920,000

GRAND TOTAL	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
	4,817,000	3,021,000	3,213,000	2,801,000	2,144,000	16,000,000

.

SUSTAINABLE SANITATION IN THEORY AND ACTION (SUSTAIN) SUB-PROGRAMME

SUSTAINABLE SANITATION IN THEORY AND ACTION (SUSTAIN) SUB-PROGRAMME (JULY 2020 –June 2021)

Contact information

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1. Summary of Achieved Results/Sub-programme Progress

SUSTAIN is a multi and interdisciplinary capacity building program aimed at strengthening the research capacity in postgraduate integrated sanitation management (ISM) at the Department of Water Resources Engineering (WRE) of University of Dar es Salaam through a collaborative partnership and exchange of teaching staff from Lund University Centre for Sustainability Studies (LUCSUS). For the period of five years from 2015 to 2020, SUSTAIN program planned to generate knowledge and give training-skills to postgraduate students and staff to understand and apply conceptual frameworks that explore the interactions between, and implications of, multiple drivers and pressures on sustainable sanitation in the Water and Sanitation (WATSAN) context of Tanzania today, including, but not limited to: rural and urban challenges and priorities. Water and sanitation needs and challenges; technological developments, adoption of and funding for various systems and technologies; designing and building systems that are adapted to future disasters and climate change; integrated water and sanitation systems with synergies for food security, energy production etc. By proceeding from a Sustainability Science approach the SUSTAIN program attempted to generate *actionable knowledge*, that takes into account *both the environmental aspects* and boundaries inherent in the water and waste cycle and the differing *societal values and political interests* of the users of these systems to come up with sustainable solutions to the problems faced. The SUSTAIN program had further attempts to highlight and emphasize the potential *value*, rather than waste, that sanitation and rainwater harvesting, in particular, can generate for Tanzania's future development. Ultimately the SUSTAIN training program fosters a new generation of sanitation managers and academics with a multi and interdisciplinary understanding, skills and tools to advance the implementation of sustainable sanitation in Tanzania.

For the period of five years SUSTAIN programme aimed to achieve five objectives: -

- Specific Objective 1:** To strengthen the multi-disciplinary scope of postgraduate training in integrated sanitation management at the Department of Water Resources Engineering at University of Dar es Salaam
- Specific Objective 2:** To increase the number of PhD graduates in integrated sanitation management in Tanzania at the Department of Water Resources Engineering at University of Dar es Salaam
- Specific Objective 3:** To increase training and research collaboration with sanitation stakeholders outside academia to increase actionable knowledge in ISM between researchers at UDSM and sanitation practitioner outside academia.
- Specific Objective 4:** To increase research output in ISM at UDSM

Specific Objective 5: To increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).

Summary of achievements and progress

Several notable achievements have been made on execution of programme under the set goals: - The curriculum for the taught PhD in Integrated Sanitation Management has been developed and submitted to Tanzania Commission of Universities (TCU) for approval. Meanwhile the taught Masters programme in Integrated Sanitation Management (MISM) is running whereby eight (8) master's students were supported of whom 6 have graduated and 2 are on dissertation stage. The programme has attained 100% achievement in enrolment of PhD students following enrollment of 4 PhD students in Integrated Sanitation Management (PhD ISM). All four are on data collection and writing and submission of manuscripts. Other achievements are on increasing research outputs where Four (4) papers have been published in Peer Review Journal and presented in National and International conferences. More publications are expected following continuing submission of manuscript to Journals. with regard to collaboration with sanitation practitioners outside academia, SUSTAIN has signed MoU with BORDA (a Dar es Salaam based German International NGO). Other collaborative efforts include that of Ministry of Water where SUSTAIN participated in development of Design Manual for the Ministry as well as being part of developing the structure and functions of Rural Water Supply and Sanitation Agency (RUWASA). Across the border, SUSTAIN is collaborating with IWA on non-sewered sanitation and Makerere University to deliver a Master in Sanitation that has been transferred from Delft, IHE. Despite achievement, the programme encountered and still encounter implementation challenges that include: The emerged demand to include engineering aspects in student research, late disbursement of research funds and lengthy procurement process that delays delivery of laboratory and field works. Consequently, students could not accomplish data collection and writing of thesis in time. It is for this reason that the programme requests for extension of execution of programme for a period of nine (9) months to be able to accomplish the remaining activities.

2. General objectives and expected results

For the period between July 2020 to June 2021 the project aims to accomplish specific objectives 2, 3, 4 and 5 i.e. **Specific Objective 4** of increasing research output in ISM at UDSM and **Specific Objective 5** of increasing staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).

3. Targets (July 2020 –June 2021)

Specific objective number 1 (Previous Specific Objective 4): To increase research output in ISM at UDSM

- ✓ Supervision of 4 PhD and 2 Masters students to accomplish data collection and thesis writing
- ✓ Preparation 10 research articles: Two (2) by MISM and eight (8) by PhD students to be publication into peer reviewed journal to fulfil requirements for graduation recently issued by TCUC
- ✓ Conduct two weeks training on technical and academic writing skills
- ✓ Conduct working session to prepare plan for the next phase
- ✓ Conduct two weeks training to enhance students technical and academic writing skill
- ✓ Conduct two weeks training on advanced statistics and data analysis
- ✓ Conduct stakeholders meeting to disseminate research findings under the programme and provide technical support to national sanitation stakeholder on development of roll out plan for the key findings.

Specific Objective 2: To increase training and research collaboration with sanitation stakeholders outside academia to increase actionable knowledge in ISM between researchers at UDSM and sanitation practitioner outside academia.

Specific objective number 3 (Specific Objective 5): To increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).

- ✓ A 12-day knowledge exchange to LUCSUS for 1 WRE staff during January and March, 2021
- ✓ A 3-month studentship at LUCSUS for 4 research based PhDs in ISM from UDSM during January and March 2021
- ✓ Visiting lecturer from LUCSUS to supervise, visit field sites and laboratory work conducted by the MSc students and PhD candidates

Specific Objective 3: To increase training and research collaboration with sanitation stakeholders outside academia to increase actionable knowledge in ISM between researchers at UDSM and sanitation practitioner outside academia.

In the requested extension period, we plan to conduct sanitation stakeholders' workshop with the aim of disseminating the research results.

4. Analysis and justification

The programme proposes a 3 months' studentship at LUCSUS for the PhD students to get exposed more sustainability science, academic resources and adequate time to analyze data, prepare and submit papers to peer review journals. Furthermore, one of the unique feature of SUSTAIN programme is fostering actionable knowledge that bridge the gap between theory and action. In this regards the programme plans to hold national stakeholders workshop to disseminate research findings to decision and policy makers as a way to raise awareness on possible ways to improve WATSAN in the country. In general, the planned targets and activities are likely to be achieved because the PhD students have received much of the required field funds and laboratory equipment.

5. Risk analysis (Mitigation and adaptation measures)

One of the foreseen risk during the course of implementation of the programme between July 2020 and March 2021, is the persistence of travel restrictions between Tanzania and Sweden because of the COVID 19 pandemic. The anticipated travel restrictions may pose the challenge on execution of the budget particularly on student's stipend. In the budget, funds for stipend for the period of January to March 2021 have been allotted in the Sweden side. Should the students fail to travel because of restrictions, the programme from Tanzania side will run short of funds for payment of student stipend. The challenge however, can be addressed through transferring of funds from Sweden to UDSM to facilitate the payment. Furthermore, should student fail to travel, the programme will organize several writing retreats to create conducive environment to students for effective writing of Thesis and manuscripts.

6. Enclosures

61. Sub-programme Activity Implementation Plan (July 2020-June 2021)
62. Sub-program **Overall Aggregated Budget**
63. Sub-programme Detailed Budget
64. Results Based Management (RBM) Matrix (July 2020-June 2021)
65. Aggregated Student Progress and Plan (July 2020-June 2021)
66. Students Individual Plans and Popular Summary of the Study
67. Sub-programme Original Budget 2015-2020 (Compiled Summary)

Enclosures 1: Sub-programme Activity Implementation Plan (July 2020-June 2021)

S/N	Planned Activity	Origin of the Activity ¹ (New/Carried over)	Proposed Budget	Source of Fund		2020						2021			Activity Justification
				Original Budget ²	Extra Fund ³	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	
OB1	Objective 1: To increase research output in ISM at UDSM														
1.1	Supervision of 4 PhD students to accomplish data collection and thesis writing	Carried Over													
1.2	Preparation 10 research articles: Two (2) by MISM and eight (8) by PhD students to be publication into peer reviewed journal to fulfil requirements for graduation recently issued by TCU	Carried over	-												
1.3	Conduct two weeks training to enhance students technical and academic writing skill	New													
1.4	Conduct working session to prepare plan for the next phase	New													
1.5	Conduct two weeks training on advanced statistics and general data analysis	New													
1.6	Conduct stakeholders meeting to disseminate research findings under the programme and provide	Carried over													

	technical support to national sanitation stakeholder on development of roll out plan for the key findings													
OB2	Objective 2: To increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).													
2.1	Visiting lecturer from LUCSUS to supervise, visit field sites and laboratory work conducted by the MSc students and PhD candidates	Carried over												
2.2	A 3-month studentship at LUCSUS for 2 research-based PhDs in ISM from UDSM during January and March 2021	Carried over												Include: Air fare for 4 students,
2.3	A 12-day knowledge exchange to LUCSUS for 1 WRE staff during April- June, 2020 and January March, 2021	Carried over												Include daily subsistence allowance and airfare for 1 supervisor-PI

NB: ¹ Please indicate whether the activity was carried over from 2015 approved budget line or it is a new activity.

²Total Original Budget should tally with subprogramme balance expected to remain by July 2020.

³The extra fund connotes amount of money requested from Sida

⁴Attach the Original approved Budget

Enclosures 2: Sub-program Overall Aggregated Budget

Date: 02 March, 2020 Sub Program:Sustainable Sanitation in Theory and Action (SUSTAIN) Period: 1st July 2020 to 30th June 2021 Tanzanian Institution/Dept: Tanzanian Institution/Dept: Water Resources Engineering Collaborating Institution in Sweden:Lund Unversity Centre for Sustainability Studies Exchange rate: 270										
OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from preivous year		Allocated funds July-December 2020		Allocated funds Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum		0	-	0	0	0	-	-	-	-
Research equipment		0	-	0	0	0	-	-	-	-
Maintenance		0	20,833.3	5000000	20,833	5000000	41,667	10,000,000	41,667	10,000,000
Research Consumables		0	-	0	0	0	-	-	-	-
Travel	36300	8712000	83,958.3	20,150,000	83,958	20150000	167,917	40,300,000.00	204,217	49,012,000
Field/Lab work		0	54,166.7	13,000,000	54,167	13000000	108,333	26,000,000.00	108,333	26,000,000
Student fees		0	1,875.0	450,000	1,875	450000	3,750	900,000.00	3,750	900,000
Student stipends		0	30,000.0	7,200,000	30,000	7200000	60,000	14,400,000.00	60,000	14,400,000
Coferences		0	52,541.7	12,610,000	52,542	12610000	105,083	25,220,000.00	105,083	25,220,000
Publication costs		0	41,666.7	10,000,000	41,667	10000000	83,333	20,000,000.00	83,333	20,000,000
Travel insurance		0	-	0	0	0	-	-	-	-
Cost related to Research		0	97,437.5	23385000	97,438	23385000	194,875	46,770,000	194,875	46,770,000
Cost of Training		0	121,666.7	29200000	121,667	29200000	243,333	58,400,000	243,333	58,400,000
Coordination Cost		0	-	0	0	0	-	-	-	-
Other costs		0	-	0	0	0	-	-	-	-
Transfer of Funds to Sweden		0	-	0	0	0	-	-	-	-
Bank interest		0	-	0	0	0	-	-	-	-
Audit		0	-	0	0	0	-	-	-	-
Indirect costs		0	60,498.0	14519520	60,498	14519520	120,996	29,039,040	120,996	29,039,040
SUB TOTAL	36,300	8,712,000	564,644	135,514,520	564,644	135,514,520	1,129,288	271,029,040	1,166,000	279,741,040
Sweden										
Supervision		0		0		0	-	-	-	-
Curriculum development		0		0		0	-	-	-	-
Lecturing on courses		0		0		0	-	-	-	-
Travel Costs		0		0		0	-	-	-	-
Dissemination and communication		0		0		0	-	-	-	-
Other costs		0		0		0	-	-	-	-
Indirect costs		0		0		0	-	-	-	-
SUB-TOTAL_SWEDEN	-	-	-	-	-	-	-	-	-	-
ISP - student allowances	216,000	51840000	54000	12960000	54,000	12960000	108,000	25,920,000	324,000	77,760,000
SUB-TOTAL_ISP	216,000	51,840,000	54,000	12,960,000	54,000	12,960,000	108,000	25,920,000	324,000	77,760,000
GRAND TOTAL	252,300	60,552,000	618,644	148,474,520	618,644	148,474,520	1,237,288	296,949,040	1,490,000	357,501,040

Title of Sub-programme SUSTAIN Sustainable Sanitation in Theory and Action Annual Plan July 2020 – June 2021

Date First Prepared: 04th March, 2020

Summary of Problem Statement: INADEQUATE CAPACITY FOR SUSTAINABLE SANITATION MANAGEMENT

Specific objective number 1 (Previous Specific Objective 4): To increase research output in ISM at UDSM

- ✓ Supervision of 4 PhD and 2 Masters students to accomplish data collection and thesis writing
- ✓ Preparation 10 research articles: Two (2) by MISM and eight (8) by PhD students to be publication into peer reviewed journal to fulfil requirements for graduation recently issued by TCU Conduct two weeks training on technical and academic writing skills
- ✓ Conduct working session to prepare plan for the next phase
- ✓ Conduct two weeks training to enhance students technical and academic writing skill
- ✓ Conduct two weeks training on advanced statistics and data analysis
- ✓ Conduct stakeholders meeting to disseminate research findings under the programme and provide technical support to national sanitation stakeholder on development of roll out plan for the key findings.

Specific objective number 2 (Specific Objective 5): To increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).

- ✓ A 12-day knowledge exchange to LUCSUS for 1 WRE staff during January and March, 2021
- ✓ A 3-month studentship at LUCSUS for 4 research based PhDs in ISM from UDSM during January and March 2021
- ✓ Visiting lecturer from LUCSUS to supervise, visit field sites and laboratory work conducted by the MSc students and PhD candidates

Types of Outputs	Outcomes (including targets) by June 2021	Performance Indicator(s) of Outcome	Baseline (if established)	Annual Outcome Targets for 2021	Actual Outcomes Achieved: Results Observed in year (2020/2021)	[Key] Outputs produced in year to obtain Outcome In2020/2021
Specific Objective 1: To increase research output in ISM at UDSM						
Supervision of 4 PhD and 2 Masters students on accomplish data collection and thesis writing	4 PhDs and 2 MISM supervised on data collection and thesis writing	Number of PhDs and Masters students supervised		4 PhDs and 2 Masters accomplished thesis writing		
Preparation and development of research articles by MISM and PhD students to be submitted for publication into peer reviewed journal. PhD student will publish at least two (2) articles and one for each MISM students to fulfil requirements for graduation recently issued by TCU	8 articles published 4 PhDs and 2 manuscripts developed by 2 Masters	Number articles published and manuscripts developed		8 articles published and 2 manuscripts developed		

Organize training sessions to enhance students capacity on statistics, data analysis and academic writing skills	4 PhD students participated in training on statistics, data analysis and academic writing	Number training the 4 students have participated		4 PhD students attended 2 training session on statistics and academic writing		
Conduct students and supervisors writing retreat to accelerate publishing rate	4 PhD student and 4 supervisors participated in retreat	Number of completed manuscripts		8		
Conduct stakeholder meeting to disseminate research findings under the programme and provide technical support to national sanitation stakeholder on development of roll out plan for the key findings.	Research findings disseminated to stakeholders	Number of stakeholders attended the workshop Number of presentations made		Stakeholder informed of the programme key research findings		
Specific Objective 5: To increase staff and student mobility to enable knowledge exchange between Tanzania (UDSM - Water Resources Engineering) and Sweden (Lund University Centre for Sustainability Studies).						
PhD studentship in Sweden	A 3-month studentship at LUCSUS for 2 research based PhDs in ISM from UDSM during January and March 2021	Number of months spent in Sweden/PhD		3 months/PhD		

Visiting researcher from UDSMto Sweden	A 10-day knowledge exchange to LUCSUS for 1 WRE staff during January to March, 2021	Number days WRE staff visited Sweden		1 visit		
Visiting lecturer from LUCSUS to Tanzania	At least 3 visit per year	Number of visits to Tanzania by LUCSUS staff	Zero visits in previous SIDA supported phase	3 visits		

Enclosure 5: Aggregated Student Progress and Plan (July 2020-June 2021)

PhD training Name of research student, registration number and email address	Sex (M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of completion	Progress %	Title of Thesis
1. Seleman Amour (2016-07-00282)	M	Oct 2016	Lund University, 6months	March, 2021		60%	Framework for desludging and transport of Faecal Sludge
2. Isabela Thomas Mkude (2016-07-00283)	F	Oct 2016	Lund University, 6months	March, 2021		60%	Framework for Resource Recovery and Reuse from Faecal Sludge
3. Mary Kayombo (2017-07-00207)	F	Oct 2017	Lund University, 4months	March, 2021		40%	Potential uses of high rate Algal ponds for Biological treatment of wastewater and resource recovery, Case study of Dar es Salaam
4. Douglas Benjamin (2017-07-00205)	F	Oct 2017	Lund University, 4months	March, 2021		40%	Local conditioners performance in treatment of faecal sludge from on-site sanitation from Agricultural use in the Dar es Salaam
Total: 4							
MSc training Name of student/registration number and email address	(M/F)	Year training started	Expected/ Year of completion	Name of Super visors		Progress %	Title of dissertation
5. TenendeNuntwale (2017-06-01965)	F	Dec 2017	Completed June 2019	Prof. Aloyce Mayo, Dr. Richard Kimwaga, Dr. Sara		100%	An exploratory study on social cultural norms and religious beliefs around menstrual hygiene management in Tanzania. A case study of

				Gabrielsson			Moshi district
6. Mwamlima Petro (2017-06-01968)	M	Dec 2017	Completed June 2019	Prof.Aloyce Mayo, Dr. Richard Kimwaga, Dr. Sara Gabrielsson		100%	Potential use of faecal sludge char briquettes as a source of cooking energy in Dar es salaam Tanzania
7. SwaiJackline Lucas (2017-06-01969)	F	Dec 2017	December, 2020	Prof.Aloyce Mayo, Dr. Richard Kimwaga, Dr. Sara Gabrielsson		90%	Assessment of menstrual waste management in secondary school of Ilala district of Dar es Salaam
8. Marco Suzan (2017-06-01943)	F	Dec 2017	December, 2020	Prof.Aloyce Mayo, Dr. Richard Kimwaga, Dr. Sara Gabrielsson		90%	Assessment of biodegradation of human placenta in an anaerobic digester at Mwananyamala Hospital Dar es salaam

Enclosure 6: Popular Summary of each of research project by SUSTAIN four (4) PhD and 4 Masters Students

SIDA-SUSTAIN PROJECT

Integrated Sanitation Management PhD and Masters Students' projects popular summary 2018/2019

Name of the PhD student	Amour Seleman
Registration number	2016-07-00284
Title of research project	Development of technology selection framework for Faecal Desludging and Transportation in Unplanned Urban Settlements

Description of the project

Desludging and transportation are key steps in management of faecal sludge (FS) accumulating in non- sewerred sanitation facilities in unplanned urban settlements (UUS). However, in most UUS desludging and transportation practices have been poorly performed risking human health and environment. The use of proper technology for desludging and transportation improve desludging and transportation (FS). However, planners and decision makers grapples with the tools for selection of most appropriate technology options for desludging and transportation. This study aim to generate a better understanding of factors determining safe desludging and transportation of FS as a critical step in faecal sludge management (FSM) for subsequent development of a framework for selection of technology to achieve optimum desludging and transportation of FS in UUS. The study uses combination of qualitative and quantitative methods under sustainable sanitation framework in analysis of complex dynamics around desludging and transportation.

Research questions

1. What are the underlying factors for the desludging and transportation situation in unplanned urban settlements in DSM
2. What factors determining household's preference of containment and desludging technology
3. What potential and constrains does FS transfer stations have in desludging and transportation of FS in study area
4. What framework is suitable for selection of technological options for faecal desludging and transportation in unplanned urban settlements

Data for the analysis of objective number one and two have been collected while collection of data for the remaining objectives is ongoing

- 2 Name of the PhD student **Isabela Thomas Mkude**
- Registration number **2016-07-00283**
- Title of research project **Development of a community level framework for safe reuse and resources recovery of faecal sludge in urban unplanned settlements of Dar Es Salaam, Tanzania**

Description of the project

The rapid population increase in Dar es Salaam City that increases excreta generation (Carr-hill, 2017), major inconsistencies in coverage and unequal access to proper sanitation in urban areas (UNICEF, 2015) are alarming situations to the city's planning initiatives. About 80% of Dar es Salaam City population with more than 5 million people, live in unplanned settlements while on-site sanitation is the predominant option (Kasala, 2016). 57% of faecal sludge produced in Dar es Salaam ending up in the environment without treatment (Brandes et al., 2015; VPO-ENVIRONMENT, 2013), while it can be collected and converted to valuable products potential for community use. Current, there is no formal guidelines or directives at National level that specifically used for safe FS reuse and resource recovery in Tanzania to be implemented at local community levels. This study therefore; using multi-disciplinary methods, designed to develop strategies that will be used as a basis of effective planning, targeting and prioritizing safe FS reuse and resource recovery options

Research questions

1. What are the current FS management practices with particular focus on FS re-use and resources recovery in selected unplanned settlements of Dar es salaam?
2. To what extent the resources; Nutrients and Energy from FS could be recovered and what are the barriers throughout the FSM service chain in unplanned settlements of Dar es Salaam?
3. How can FS reuse and resource recovery impact health and environmental to the selected unplanned communities in settlements of Dar es Salaam?
4. How can FS reuse and resource recovery impact socio-economic of the consumers and handlers in the selected communities in unplanned settlements of Dar es Salaam?
5. What are essential features for community level strategies that can be used for safe FS re-use and resource recovery in unplanned settlements of Dar es Salaam?

- 3 Name of the PhD student **Mary Kayombo**
- Registration number **2017-07-00207**
- Title of research project **Assessment of the potential uses of high rate Algal ponds for Biological treatment of wastewater and Resource recovery, Case study of Dar es Salaam.**

Description of the project

Water Stabilization Ponds (WSP) in Tanzania notably Dar es Salaam city indicates that problems exist within pond systems including failure and/ or poor conditions such as odor problems and undesirable effluent quality which call for the scheme of upgrading (Hayati et al., 2013). Another potential problem of waste stabilization ponds is the high concentration of insoluble organic material, most notably cells of algae. Unfortunately, stabilization ponds in Tanzania face numerous problems including: improper operation and maintenance, incorrect hydraulic regime applied to the system, incorrect design approach because of poor understanding of the basic biochemical processes involved. This study therefore, is designed to use the adoption of high rate photosynthetic ponds, as a partial solution to this problem which have evolved from conventional oxidation ponds and could play an important role in the treatment of organic wastewaters in Sunbelt communities requiring tertiary treatment

Research questions

1. What are the dominant biochemical mechanisms involved in high rate ponds?
2. How can nutrients removal in high rate ponds be transformed and optimized?
3. How can the mortality of faecal bacteria be optimized in high rate ponds?
4. What kind of resource recovery can be opted?

- 4 Name of the PhD student **Doglas Benjamin**
- Registration number **2017-07-00205**
- Title of research project **Investigation of local conditioners performance in treatment of faecal sludge from on-site sanitation for Agricultural use in the Dar es Salaam.**

Description of the project

Faecal sludge from onsite sanitation systems is rich in nutrients and organic matter constituents which contribute to replenishing the humus layer and soil nutrients reservoir (Fred et al., 2014). The partially treated faecal sludge from onsite sanitation systems can further be treated by either conventional or natural conditioners (Kalogo, 2001). Inorganic chemicals and cationic polymers are reported to be effective for the improvements of treatment of sludge, however little knowledge and documentation on the physical-chemical of by products (solids/sludge and percolated water) and its potential use particularly for agricultural use. This study, hence designed to fill scientific gap on the potential use of conditioners for the treatment purposes of faecal sludge that need to be used for agricultural purposes.

Research questions

- What are the physical, chemical and biological characteristics of faecal sludge from onsite sanitation systems, physical-chemical characteristics of *Moringa Oleifera* and *Jatropha Curca* and under consideration influence to the parameters of faecal sludge?
- What is the effect of dosing *Moringa Oleifera* and *Jatropha Curca* in the treatment of faecal sludge from onsite sanitation and their difference in treatment performances?
- What are the physico-chemical parameters of the mixture of *Moringa Oleifera* and *Jatropha Curca*, the effects of dosing the mixture in the treatment of faecal sludge and the difference in treatment performance between the mixed conditioners and individual ones?

MISM

1 Name of the MSc student	Susan Marco
Registration number	2017-06-01943
Title of research project	Assessment of biodegradation of human placenta in an anaerobic digester

Description of the project

Tanzania is the sixth most populous country in Africa after Nigeria, Ethiopia, Democratic Republic of Congo (DRC), South Africa and Egypt. Tanzania's population is likely to grow

from 46.3 million in 2013 to 59.4 million in 2021. Present statistical data from population and housing census show that the country grows by 1.6 million people every year, indicating a doubling of the population every two decades. The contributing factors to this high population growth are linked to; high fertility rates, people's preference to have many children, poverty, culture, religious beliefs and low level of using modern family planning methods (NBS, 2018). The presence of motivating factors for having many children in Tanzania, suggests an increase in volumes of human placenta waste in both urban and rural settings. Currently, this waste is not valued as a viable resource due to lack of adequate treatment technologies. The incineration of human placenta waste is linked to air pollution, economical losses and health hazards to the people who are exposed to the facility (Hyland, 1993; Senatore, 1994; Park and Jeong, 2001; Bdouret *al.*, 2006). This study will attempt to fill this gap by assessing the feasibility of biodegradation of human placenta in an anaerobic digester at Mwananyamala hospital in Dar es Salaam

Research questions

1. How far can human placenta be biodegraded from anaerobic digester?
2. What are the qualities and quantities of biogas produced after biodegradation of human placenta from anaerobic digester?
3. What are the economic, environmental and social benefits of treating human placenta through anaerobic technology

2	Name of the MSc student	Jackline Lucas Swai
	Registration number	2017-06-01969
	Title of research project	Assessment of menstrual waste management in secondary schools of Ilala District in Dar es salaam Region

Description of the project

Menstrual Hygiene Management (MHM) for schoolgirls in low-income countries (LICs) is a 'long-neglected issue' (Sommer and Sahin, 2013). MHM has only recently reached international agencies' agendas for research, programming, and policy. Ineffective MHM has reportedly been associated with girls' absenteeism from school, due to unavailability of absorbent materials, lack of facilities for changing and washing, fear of leakage and odour, or discomfort (Sommer and Sahin, 2013). Monitoring and Evaluation done by Femme International demonstrate that school girls are less able to participate at school and other social

and religious activities during menstruation (Rubli, 2018). In Tanzania there are 10,905,117 women at reproductive age of 15-49 years (National Bureau of Statistics, 2013) and 70% of the girls/ women prefer to use disposable pads (SNV, 2014). Also, an average woman throws away 125 to 150 kgs of tampons, pads and applicators in her lifetime (Baradwaj and Patkar, 2004). The rapid increase in secondary school enrolment since Secondary Education Development Program (SEDP) in 2004, which aimed to enroll all those who passed primary education examination has put a heavy burden on existing infrastructure particularly WASH facilities (SNV/Water Aid/UNICEF, 2011). While school girls spend a significant amount of time in and around their schools and this includes when menstruating. The state and requirements of menstrual waste disposal in secondary schools in Ilala District is not clearly known. It is therefore relevant to investigate the current state of menstrual hygiene management and disposal among secondary schools with the view of improving it.

Research questions

1. How much of the disposable menstrual pads is being generated per in the selected schools, in Dar es Salaam and what is the estimate generation in the future?
2. How and where do school-girls collect, store and dispose of their menstrual waste?
3. What types of disposal facilities and waste management technologies and practices are currently used in the selected schools and what are the advantages and disadvantages of each?
4. What are the alternative technologies and practices of improving menstrual waste management that can be both socially, economically and environmentally viable?

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LINKING PUBLIC-PRIVATE PARTNERSHIP TO SECURE SUSTAINABLE WATER RESOURCES MANAGEMENT IN THE KILOMBERO-RIVER BASIN

PLAN SUB-PROGRAMMES/PROJECTS (July 2020 - June 2021)

LINKING PUBLIC-PRIVATE PARTNERSHIP TO SECURE SUSTAINABLE WATER RESOURCES MANAGEMENT IN THE KILOMBERO-RIVER BASIN

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1. Executive summary of sub-programme/project

Wetland ecosystems are land use development ‘hotspots’ that have a number of parallel functions related to human nutrition, wildlife habitat, and social-economic production that must be considered in concert to ensure sustainable management. Recently, Tanzania, under the policy of *Kilimo Kwanza*, launched an initiative known as the Southern Agricultural Corridor of Tanzania (SAGCOT), which was initiated at the World Economic Forum (WEF) Africa Summit 2010. This is an inclusive, multi-stakeholder partnership, which aims at rapidly developing the region’s agricultural potential through large- and small-scale irrigation and water use schemes. It is supported by various stakeholders including the Government of Tanzania (GoT), farmers, agri-business, and companies from across the private sector. The Southern highlands zone has been identified as the potential area for the implementation of SAGCOT. While SAGCOT cannot be expected to change the national preparedness, investors and implementers are expected to make plans and be ready to work with others to contribute to improved readiness. This can only be achieved through a clear implementation framework involving public-private partnerships since the implementation of the SAGCOT initiative places considerable demands on water resources since they permeate all aspects of agriculture and other ecosystem services. This project aims at collaborating across ongoing initiatives in an effort to establish sustainable water resources management options and mechanisms firmly founded in state-of-the-science understanding for implementing public-private partnerships for the sustainable development of the *Kilimo Kwanza* policy in Tanzania. The broad question addressed by this research is therefore; *how can the natural resources and their associated biodiversity be managed to provide goods and services equitably and sustainably to the people?*

2. General objectives and expected results 2015-2020

The **overall objective** of the training and capacity building program is the generation of sufficient analytical capacity and research-based knowledge with appropriate and immediate valuable outcomes to relevant stakeholders (e.g., policy makers, industry, civil society) for addressing problems of poverty and promoting sustainable and inclusive development.

This study explores the potential for public-private partnership in relation to agriculture and water resources management in selected SAGCOT clusters in Tanzania. This project focuses on understanding the impact of land management strategies and investments on land within the Kilombero Valley of central Tanzania as a representative case study. The project also investigates the current water resources conditions in Kilombero Valley using state-of-the-science hydrologic modelling to determine how water interacts with the landscape so as to quantify the available water resources. These quantifications are the cornerstone from which to explore links between regional livelihood and ecosystem services thereby making it possible to structure appropriate science-based governance and policy.

The specific objectives of the project are:

1. To increase the number and quality of persons doing research applied to landscape changes at various scales and the related impacts on hydrology and water resources in Tanzania
2. To increase the use of quality research produced in connection to sustainable water resources management in Tanzania
3. To increase the capacity and utilization of specialized research techniques through South-North collaboration

The partnership strengthens the cooperation between UDSM and the Swedish counterparts to share skills and expertise. Particularly, UDSM is expected to benefit by its involvement in the partnership by learning new research methods, specifically in the areas of remote sensing of land use change, biodiversity quantification and ecosystem service assessment, and tracer hydrology.

In order to achieve the research objectives, the sub-programme is divided into three work packages:

Work Package 1: Linking landscape changes across spatial scales and hydrological processes

Work Package 2: Assessment of trade-offs between ecosystem services under gradients of land and water use

Work Package 3: Development of Policy and management strategy framework for Public-Private Partnership and optimized water allocation in the Kilombero river basin

Title: Assessment of Water Resources in the Tanzania's Kilombero Valley

PhD student: William Clement Senkondo

Project description

Southern Agriculture Corridor of Tanzania (SAGCOT) is an inclusive, multi-stakeholder partnership, which aims at rapidly developing the region's agricultural potential through large and small scale irrigation schemes. Kilombero Valley (KV) has been identified as one of the potential areas for the implementation of SAGCOT's plans. Implementation of these plans, places a considerable demand on water resources which in turn affect its sustainability. However, information on how implementation of SAGCOT plans, affect the water resources is still lacking. This research aims to explore the likely implications of implementing SAGCOT plans on the water resources of the KV. Outputs from this research can be used by the Tanzanian Government and other stakeholders to sustainably manage water resources in the KV.

Objectives:

The main objective of this research is to assess the water resources in the Tanzania's Kilombero Valley (KV). Specifically: (1) To estimate local and regional scales' aquifer transmissivity in the KV; (2) To map evapotranspiration (ET) in the KV; (3) To develop, calibrate and validate the Soil and Water Resources Assessment Tool (SWAT) model; and (4) To analyze the impacts of different water use scenarios on the water resources of the KV using the calibrated SWAT model.

Research Questions:

This research aims to answer the following questions: (1) What are the local and regional scales' estimates of aquifer transmissivity (T) in the KV? (2) How do these T estimates compare? (3) Which land use/cover consumes more water in the Kilombero Valley? (4) Is the SWAT model suitable for KV? (5) What are the water use scenarios in the KV? (6) What are the impacts of different water use scenarios on the water resources of the KV?

Title: Irrigating social differences? Inclusive, Pro-Poor Growth and Social Differentiation in Smallholder's Irrigation Investments in Kilombero River Valley in Tanzania

PhD Student: Victor Mbande

Popular Description

Southern Agriculture Growth Corridor of Tanzania (SAGCOT) initiative is focused on expanding agricultural productivity and improving smallholders' livelihood through investments in form of Public-Private Partnerships aimed at commercialization of agriculture and irrigation. These investments are focused on among other things, the construction and expansion of both small scale and large scale irrigation schemes. Plans in expanding irrigated are proposed where large scale private (and public) investment through patient capital in outgrowers schemes are seen as crucial in linking the smallholders into commercial value chains. Despite the fact that SAGCOT is not fully operational in Kilombero, what is prevailing in Kilombero in the current context is distinct from what is proposed by SAGCOT as relatively small scale irrigation schemes that are managed by smallholders are either constructed or improved by either the government or/and donors despite several initial plans to expand large scale irrigation in the area.

Aim: This study predates out-growers' model suggested by SAGCOT in agriculture and irrigation in Kilombero valley in Tanzania with an aim of understanding inclusive, pro-poor growth and social differentiation process among smallholder irrigation farmers in Kilombero valley. The study further aim to highlight the historical trends in large scale and small scale irrigation investments (and plans)in

Kilombero and their role in accumulation and social differentiation among small holders. The focus on social differentiation in irrigation agriculture acknowledge the role of the process in agricultural dynamics. However there is a need to understand how these processes could be inclusive and pro-poor in terms of what groups of smallholders emerge, what are the roles of these different smallholders in these processes and how do they gain or lose from the process?

Research questions

- i. What is the historical nature of investment in irrigation in Kilombero?
- ii. How are the dynamics in irrigation agriculture in Kilombero influencing social differentiation among smallholder farmers?
- iii. To what extent are the policies and investments in irrigation in Kilombero inclusive and pro-poor?
- iv. What are the trade-offs and relationships between large scale and small scale irrigation investments in Kilombero?

Title of the research project: Potential of Kilombero Wetland: Conserving for Carbon Stocks, Biodiversity and Climate Change Mitigation

PhD Student name: Edmond Alavaisha

A popular description of the project

Wetlands are estimated to occupy 6% of the world's land surface in Tanzania and about 10% used for agriculture. Altering natural and semi-natural vegetation to agriculture is currently the most significant land use change at Kilombero Valley. This leads to changes in soil and water quality and increased CO₂ emission. An expansion of urban areas and croplands in recent decades, complemented by large increases in water and fertilizer consumption, has led to considerable loss of biodiversity. As a result, facing the challenge of managing trade-offs between immediate human needs and maintaining the capacity of the biosphere to provide goods and services in the long term. Therefore, with these impact already noticed and further expansion of agriculture, the study aimed to assess the trade-off ecosystem services in the Kilombero valley.

Research Questions

This project aimed to address the following questions: (i) does soil organic-carbon, total nitrogen and total phosphorous varies among different farming management and crops? (ii) Does the expansion of crop field and developed irrigation canals affect the health of steams (using biotic index)? (iii) Does ecosystem services change with land use and (iv) what are the trade-off ecosystem services in different farming management?

Progress to be made until June 2020

- z) Three M.Sc. students were recruited at the University of Dar es Salaam in the academic year 2015/2016 and all graduated in 2017
- aa) Three 3 PhD students sandwich mode were recruited in Sweden 2016. One student defended his thesis on 29th April 2020 and two students will finalize the thesis write up in June 2020 but the final examination is planned for November 2020.
- bb) Three postdoctoral fellowships were awarded. One postdoc completed his research in 2019. The other two postdocs were not able to register due to some challenges.

- cc) Developed short course content on trace hydrology, remote sensing and GIS application and conducted the training in 2018/2019

Summary of Budget for the period of five years:

The sub-programme received a total of SEK 7,900,000 for the period of five years as summarized in Table 1 below.

Institution/Year	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Total (SEK)
UDSM	821,500	881,600	602,000	222,700	146,200	2,674,000
SWEDEN	750,000	750,000	750,000	750,000	750,000	3,750,000
ISP	396,000	396,000	396,000	288,000	-	1,476,000
Total	1,967,500	2,027,600	1,748,000	1,260,700	896,200	7,900,000

Planned Activities from 1st July 2020 to 31st March 2021

The sub-programme has only 3 PhD students on sandwich mode as follows:

- 1) Mr. William Senkondo – registered at the Stockholm University (SU), successfully defended his thesis on 29th April 2020 and therefore no extension is required. The student is expected to attend the conferment of doctoral degrees in September 2020 at SU. The detailed action plan for the student is as shown in Table 2.

Table 2: Detailed student activities and action plan for William Senkondo (19820708-9056)

SN	Activity details	2019		2020								
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	Drafting manuscript titled ‘Using satellite-based evapotranspiration estimates to constrain hydrological model in the heterogeneous and data-limited Tanzania’s Kilombero Valley, East Africa’											
2	Writing a comprehensive summary (‘kappa’) of PhD thesis											
3	Defending PhD dissertation											
4	Attending the conferment of doctoral degrees											

- 2) Mr. Edmund Alavaisha – registered at SU and expected to finalize writing of the thesis in June 2020 and the final defence of thesis is scheduled to be in September 2020 as

shown in Table 3.

Table 3: *Activities and action plan for Edmond Alavaisha*

Component / Task	2019		2020								
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Field work for paper IV											
Data analysis paper IV											
Writing paper III and IV											
Paper IV and Kappa writing											
Finalizing dissertation and submission of paper III and IV											
Defence											

- 3) Mr. Victor Mbande – registered at SU and expected to finalize writing of the thesis in June 2020 and the final defence of thesis is scheduled to be in September 2020 as shown in Table 4.

Table 4: *Detailed student activities and action plan for Victor Mbande (19850407-6855)*

SN	Activity details	2019		2020										
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	Drafting 2 manuscripts													
2	Review and submit 3 paper already in progress													
3	Writing a comprehensive summary ('kappa') of PhD for the Departmental final seminar presentation in													

	March													
4	Final seminar													
5	Work on comments from the final seminar and submit remaining papers and Final Kappa													
6	Defending PhD dissertation													

37. Three staff will visit Sweden in October/November 2020 for preparation of proposal writing for the next phase of Sida application.

38. One supervisor of PhD student will visit Sweden for 5 days to participate in defence of PhD students.

3. Target (July 2020 – March 2021)

3.1 Specific objective 1: To increase the number and quality of persons doing research that is applied to landscape changes at various scales and the related impacts on hydrology and water resources in Tanzania

3.3.5 Planned and the specific activities to be carried out are:

- Two PhD students (Mr. Edmund Alavaisha and Mr. Victor Mbande) will submit the thesis for examination in June 2020 but the final defence for Alavaisha is planned to be in September 2020 and for Victor Mbande the final defence will be in November/December 2020. The third PhD candidate will do the final defence in April 2020 but the degree award ceremony will be held in September 2020.

3.1.2 Expected Deliverables are:

- All three PhD students will graduate by December 2020
- At least three papers will be published in Peer-review Journals

Specific Objective 2: To increase *the use of* quality research produced in sustainable water resources management in Tanzania

3.2 *Planned and the specific activities to be carried out*

- Journal articles drafting by MSc, PhD and postdoc in collaboration with the supervisors
- Stakeholders workshop organized to disseminate the results to key stakeholders

3.3.2 *Expected Deliverables are*

- Workshop proceedings prepared
- Publication in a peer reviewed journal

3.4 Specific objective 3: To increase the capacity and utilization of specialized research techniques through South-North collaboration

3.4.1 *Planned activities to conducted*

Joint meetings on the preparation of application for next phase

- Various meetings with partners
- Drafting the proposal for phase 2

3.4.2 *Expected Deliverables are:*

- Draft of a proposal prepared

4. Analysis and Justification

4.1 Budget justifications

The sub-program would like to appreciate Sida support which enabled successful facilitation of the activities. It is hopeful that Sida will continue supporting the sub-program and the new developments for sustainable water resources management in the country. The UDSM management is thanked for unwavering support for the development of marine science research capacity.

Budget: In the extension period, the project is planning to spend a total of **SEK 228,800** (equivalent to Tshs 54,912,000). One PhD student is expected to travel to Sweden for the PhD award in September 2020 and two (2) PhD students are expected to complete the analysis of data by June 2020. The requested fund covers travel cost to Sweden to defend thesis and for the award of degree by the one PhD student who will be defending the thesis in April 2020, estimated total cost of SEK 51,000, student allowance for three months in Tanzania, SEK 15,000 (Tshs. 3,600,000/-). The cost at ISP is only the one month allowance for the two PhD students defending thesis is September and November 2020, which is estimated to be SEK 36,0000 (Tshs. 9,000,000/-).

Publication and dissemination costs amounting to SEK 141,800, which includes working

sessions for developing journal articles, local conference on water resources management in collaboration with SUSTAIN and DAFWAT and proposal development for phase 2.

From the total fund of SEK 228,800 (Tshs. 54,012,000/-) expected to be spent during the extension period, SEK 174,100 (Tshs. 41,784,000/-) is expected to be carried forward and SEK 54,700 (Tshs. 13,128,000/-) is requested from Sida since this is the new activity - planning meeting for phase 2.

4.2 Risks and actions for mitigation of the risks

Risk	Level	Remedial action	Responsibility
PhD students not graduating on time	Low	Monitor their progress monthly	Sub-programme coordinators, and Swedish Coordinator
Failure to hold stakeholders' workshop because of COVID-19 pandemic	Medium	The situation will be monitored and alternative means of dissemination will be put in place	Sub-programme coordinators
Failure to prepare good proposal for the next phase	Low	Begin preparation as early as possible	Sub-programme coordinators
Not publishing on time	Low	Monitor the progress	Sub-programme coordinator, Supervisors & Swedish coordinator

5. Enclosures

Enclosures 1: Subprogramme: Water Resources Management Implementation Plan (July 2020-March 2021)

Enclosures 1: Water Resources Management Activity Implementation Plan (July 2020-March 2021)															
S/N				Source of Fund		2020						2021			Activity Justification
	Planned Activity	Origin of the Activity ¹	Proposed Budget	Original Budget ²	Extra Fund ³	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
		(New/Carried over)	SEK	SEK	SEK										
OB1	Objective 1: To increase the number and quality of persons doing research that is applied to landscape changes at various scales and the related impacts on hydrology and water resources in Tanzania														
UDSM PLANS:															
1.1	Air tickets for 3 PhD students to Sweden to attend final defence and degree award	Carried Over	36,000	36,000	0										Mr. Alavaisha will defend thesis in September 2020 and Mr. Mbande in November 2020. Mr. Senkondo will be attending degree award in September 2020

1.2	Stipend for the 2-PhD students (Victor Mbande and Edmund Alavaisha)	Carried over	15,000	15,000	0										Stipend for extra three months before defence in September/November
Subtotal			51,000	51,000	0										
ISP PLANS															
1.6	Stipends for Alavaisha and Victor Mbande to spend 1 month in Sweden to defend thesis in December 2020	Carried Over	36,000	36,000	0										The funds at ISP for the 2-postdocs (Dr. Madaka and Dr. Subira) was not fully utilized. It can be used to cover the students
Subtotal			36,000	36,000	-										
Subtotal			36,000	36,000	0										
OB2	Objective 2: To increase the use of quality research produced in sustainable water resources management in Tanzania														
UDSM PLANS															
2.1	Working session for drafting journal articles	Carried over	25,000	25,000	0										Drafting journal articles supervisors, PhD and post-doc candidates

2.1	Stakeholders workshop on water resources management	Carried Over	55,000	55,000	0										Joint workshop in collaboration with SUSTAIN and DAFWAT - planned to be held in Dodoma
Subtotal			80,000	80,000	0										
OB3	Objective 3: To increase the capacity and utilization of specialized research techniques through South-North collaboration														
UDSM PLANS															
3.1	Preparation of phase 2-sida proposal	New	61,800	7100	54,700										In this phase we expect to have additional collaborators - TMA and Bolin Climate centre at SU
Subtotal			61,800	7100	54,700										
ISP PLANS															
Grand Total			228,800	174,100	54,700										

Enclosures 2: Sub-program Overall Aggregated Budget

Overall Budget per budget item										
Date:										
Overall Program:										
Period:										
Tanzanian Institution/Dept: Water Resources Engineering/Institute of Resource Assessment (IRA)										
Collaborating Institution/s in Sweden: Stockholm University										
Exchange rate: 250										
OBS! All major budget items should be the same for all.										
Tanzania	Funds expected to be forwarded from previous year		July-December 2020		Jan-March 2021		Total allocated funds		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum development							-	-	-	-
Research equipment							-	-	-	-
Maintenance							-	-	-	-
Research consumables							-	-	-	-
Travel	36,000	8,640,000					-	-	36,000	8,640,000
Field/Lab work	0	0					-	-	-	-
Student fees	0	0					-	-	-	-
Student stipends	15,000	3,600,000					-	-	15,000	3,600,000
Conferences									-	-
Publication costs	87,100	20,904,000	27,350	6,564,000	27,350	6,564,000	54,700	13,128,000	141,800	34,032,000
Travel insurance	0	0	0	0	0	0	-	-	-	-
Cost related to Research										-
Cost of Training	0	0	0	0	0	0	-	-	-	-
Coordination Cost	0	0	0	0	0	0	-	-	-	-
Other costs	0	0	0	0	0	0	-	-	-	-
Transfer of Funds to Sweden	0	0	0	0	0	0	-	-	-	-
Bank interest	0	0	0	0	0	0	-	-	-	-
Audit							-	-	-	-
Indirect costs							6,564	-	6,564	-
SUB TOTAL	138,100	33,144,000	27,400	6,564,000	27,400	6,564,000	61,300	13,128,000	199,400	46,272,000
Sweden										
Supervision							-	-	-	-
Curriculum development							-	-	-	-
Lecturing on courses							-	-	-	-
Travel Costs							-	-	-	-
Dissemination and communication							-	-	-	-
Other costs							-	-	-	-
Indirect costs							-	-	-	-
SUB-TOTAL_SWEDEN	-	-	-	-	-	-	-	-	-	-
ISP - student allowances	36,000	8,640,000							36,000	8,640,000
SUB-TOTAL_ISP	36,000	8,640,000	-	-	-	-	-	-	36,000	8,640,000
GRAND TOTAL	174,100	41,784,000	27,400	6,564,000	27,400	6,564,000	61,300	13,128,000	235,400	54,912,000

Enclosures 3: Aggregated Student Progress and Plan (July 2020-March 2021)

PhD training	(M/F)	YEAR TRAINING STARTED	TRAINING IN SWEDEN (NO. MONTHS)	LOCAL PHD EXPECTED/ YEAR OF COMPLETION	SANDWICH PHD EXPECTED/ YEAR OF COMPLETION	PROGRESS %	PREL. TITLE OF DISSERTATION
Name of research student:							
1) William Senkondo	M	2016	6	Steve Lyon/Joel Nobert	2020	100%	Assessment of Water Resources in Tanzania's Kilombero Valley
2) Edmond Alavaisha	M	2016	6	Regina	2020	98%	Assessment of trade-offs between ecosystem services under gradients of land and water use
3) Victor Mbande	M	2016	6		2020	95%	Development of Policy and management strategy framework for public-private partnership and optimized water allocation in the Kilombero river basin
MSc training	SEX (M/F)	YEAR TRAINING STARTED	MSC EXPECTED/ YEAR OF COMPLETION	NAME OF SUPERVISORS		PROGRESS %	TITLE OF DISSERTATION

Name of student: 1.Ghanima Chanzi	F	2015	2017	Joel Nobert		100%	Assessment of Water Availability and Uses in The Kilombero Basin Using SWAT and WEAP Models
2.Batenga Mary-Rose	F	2015	2017	Noah Pauline		100%	Vulnerability of Rural Livelihoods to Multiple Stressors in Kilombero Valley, Tanzania
3.Samwel Daudi Nyasani Total:3	M	2015	2017	Madaka Tumbo		100%	Drivers and Land use/cover change: Implication on sustainable natural resources management: The case of Kilombero Valley, Tanzania.

4) Enclosures 4:Sub-programmeResults-Based Management Logical Framework for Plan from July 2020 to March 2021

Summary Problem Statement:

In many places ecosystems are already under pressure due to population increases; increasing demand for land and timber; and competition among water needs for farming, hydropower, municipalities, ecosystems, irrigation and investments in the agricultural sector (Foley *et al.* 2011). The implementation of the *Kilimo Kwanza* policy will add another stressor to the existing national natural resources management challenges thus increasing vulnerabilities. The **central question** underlying this proposal is: how can natural resources and their associated biodiversity be managed to provide goods and services equitably and sustainably to people? This applies particularly to freshwater resources (rivers, lakes and

wetlands) in Tanzania that are often vulnerable to over-exploitation on a first-come-first-served basis. Traditional resource-sharing strategies rapidly collapse as populations grow beyond the carrying capacity of the resources (MEA, 2005). Economic pressures (irrigation and industry, demand for timber) exacerbate the over-exploitation. Many rivers, particularly in the drier regions, stop flowing during dry seasons (often due to upstream obstruction) leading to local and regional water use conflicts. The identified SAGCOT clusters have exhibited a high demand for water and already demonstrate risk for serious conflicts over water. Given this situation, can the large-scale agriculture that requires large-scale irrigation schemes (as suggested in the SAGCOT initiative) be feasible given the sensitivity of ecosystems and projected global (and regional) environmental changes?

Overall Objective (2015-2020):

Specific Objective 1: To increase the number and quality of persons doing research that is applied to landscape changes at various scales and the related impacts on hydrology and water resources in Tanzania

Specific Objective 2: To increase *the use of* quality research produced in sustainable water resources management in Tanzania

Specific Objective 3: To increase the capacity and utilization of specialized research techniques through South-North collaboration

Result Based Matrix

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
Specific Objective 1: To increase the number and quality of persons doing research that is applied to landscape changes at various scales and the related impacts on hydrology and water resources in Tanzania						
Trained 3 PhD Graduates in Water Resources Management	Three PhD students on sandwich mode graduate by June 2021	Number of PhD graduates	Three PhD students supported by Sida	3 PhD students defended their theses in Sweden		
Specific Objective 2: To increase <i>the use of</i> quality research produced in sustainable water resources management in Tanzania						
High quality research Faculty mentoring Publication guide-lines Articles submitted for publication	At least 3 paper published in peer reviewed journals by September 2020.	Number of publications	2 papers published per year	3 papers published by September 2020		

Types of Outputs	Outcomes (including targets) 2021	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2020/2021	Actual Outcomes Achieved: Results Observed in year 2020/2021	[Key] Outputs produced in year to obtain Outcome in 2020/2021
1 -Scientific paper in conference attended	Increase of staff presenting scholarly papers in conference proceedings by November 2020	Number invitations to publish in the conference proceedings papers presented at the conference	Conference proceedings	One scientific conference attended		
Specific Objective 3: To increase the capacity and utilization of specialized research techniques through South-North collaboration						
Proposal writing for the next phase	3.1 Draft proposal prepared by March 2021	Number of partners established	Available networks	Organized at least two meetings with Swedish partners by March 2021		