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FISHERIES TRAINING INSTITUTE (FTI)
TRAINING NEEDS ASSESSMENT

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Acronyms

CEMASTEA	Center for Mathematics, Science and Technology Education in Africa.
EAC	Eastern Africa Community
FAO	Food and Agriculture Organization (UN)
FTI	Fisheries Training Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NaFIRRI	National Fisheries Resources Research Institute
SON	Source of the Nile fish farm
WAFICOS	Walimi Association of Fish Cooperatives
GI	General Invest
AUDA-NEPAD	African Union Development Agency-NEPAD
ATVET	Agricultural Technical, Vocational Education and Training
GIZ	German International Aid
GFA	The GFA Consulting Group
SWOT	Strength Weakness Opportunity, Threat
SME	Small and Medium Enterprises
TVET	Tertiary Vocational and Education Training
QA	Quality Assurance
DIAA	Diploma in integrated Aquaculture and Agriculture
TA	Technical Adviser / Technical Assistance
LTO	Lead Technical Officer
ToT	Training of Trainers
RAF	Regional Office for Africa
ADG	Assistant Director General
NCHE	National Council of Higher Education ()
TC	Technical Cooperation
AfDB	African development Bank
RAS	Recirculation Aquaculture System
UNU	United Nations University
AV	Audio Visual
MoUs	Memorandum of Understanding
ICT	Information and Communication Technology

Executive Summary

In the wake of the increasing demand for fish nationally, regionally, and globally capture fisheries are becoming more overexploited and depleted in the waters of EAC creating a deficit in the requirements of food for the East African countries that have been depending on Lake Victoria for most of their fish food and livelihoods needs. The alternative to meet the required fish gap is seen in the development of commercial aquaculture, however, the growth of a competitive commercial aquaculture sector is being held back by several common structural constraints, including limited access to commercial networks and vocational skills training. In addition, there are several issues that potentially risk undermining the sector in future; these include managing risks associated with fish diseases, protection of biodiversity and fish farms' uncontrolled spatial distribution and use of natural resources.

The FAO True-Fish project under the SO2 on Skills training undertook a Fisheries Training Institute training needs analysis to provide information that would contribute to solving problems affecting the aquaculture value chain and identify potential target market segments for training services. Therefore, the TNA assessment was conducted to provide information on the capacities of academic staff, design of formal aquaculture syllabus and short training courses. Assessment of skills and delivery capacity of the FTI aquaculture staff including facilities and equipment that facilitate training learning processes was undertaken.

Although several institutions that are involved in aquaculture training in Uganda were consulted the key institution for capacity needs assessment was FTI because of their long experience and strategic positioning as an institute that provides fisheries and aquaculture training for most of the people of Uganda

The methodology: used for making the assessments and developing the curriculum proposal documentation was inclusive in style, drawing on the inputs from a variety of parties that included the public sector institutions; private sector like large scale aquaculture operators and small scale aquaculture operators including individual service providers in the aquaculture sector in Uganda accomplished via internet mail/media and telephone communication due to the problem of Covid19 restrictions and limited time of study. The FTI training capacity assessment and analysis of the current curriculum/syllabus on aquaculture and fisheries, involved reviewing literature of the TVET institutions and the aquaculture and fisheries sector in Uganda and the rest of East Africa; telephone and media-based meetings and interviews with key stakeholders, Private aquaculture operators, and fish processing companies in Uganda. The interviews focused on the current situation and needs and on ideas and plans including what is necessary to achieve these. Annex 2 provides a list of meetings and site visits.

This approach offered a unique opportunity to analyse the Uganda TVET knowledge infrastructure both from multiple perspectives, providing strong insights in what practical and academic knowledge and capacity is required for enhancing economic development while at the same time promoting sustainable use of aquaculture and fishery resources

Preliminary findings from the consulted stakeholders guided the prioritisation of their skills needs for enhancing availability and quality of local skilled workers in aquaculture business operations that will contribute to the development of competitive, gender equitable and sustainable commercial aquaculture to support economic development and sustainable management of natural resources in the Lake Victoria basin.

Results: The TNA for FTI identified that the relationship between the offer of skilled workers by FTI in the last 10 years against those that have been effectively absorbed by the fisheries and aquaculture sector in Uganda is significantly huge. This shows that the current aquaculture and fisheries courses are in demand and are useful for the sector at different levels

The TNA also revealed important content gaps demanded by aquaculture operators from the survey, which includes: Fish Nutrition and Fish Feed formulation at farmer level, Production systems including flexible fish farming systems like using tanks, recirculation systems (RAS), aquaponics and others, Fish diseases and management, Pest and disease control in fish farms, Economics of fish farming/ aquaculture, Data management and analysis and reporting/ Computer, Hatchery management, Fish breeding, Feeding techniques, Cage construction and maintenance, Water quality control and maintenance, Fish handling and processing Technique and Quality control and Quality Assurance

The proposed Aquaculture curriculum content outline was a result of consultations with FTI Academic staff that proposed and guided on the most needed training content and the attendant facilities and equipment, in the validated TNA document. It should be noted that this assignment was conducted at same period with another related study by MAAIF in collaboration with GIZ and had come to almost same issues and so this proposed document has reconciled and streamlined all the vies regarding content and facilities that will be needed. The proposed Aquaculture Curriculum can be customized for different categories of trainees due to the structured Topics that can be selected to build capacity of aquaculture trainees as well as FTI staff via a refresher Training of trainers course for the FTI institute in relevant core disciplines e.g. aquaculture technology (especially cage culture), feeds and nutrition, aquatic animal health, quality control and processing, business studies) and in the pedagogical approach to practical training. To implement such a competency-based aquaculture syllabus it will require the proper supporting facilities and practical equipment which this assessment identified and are also presented in a proposal.

Conclusion/Recommendations: The FTI as the key aquaculture training institute in Uganda is providing services in line with the ever-increasing training needs in the sector and their aquaculture courses are in demand and are useful for passing out graduates that sustain the aquaculture operations, LG technical support, and aquaculture stakeholders at different levels. Therefore, FAO True-Fish Project can rightly engage with FTI as a strong development partner by supporting the FTI aquaculture staff and attendant training facilities in view of enhancing its level of competency as a center for Excellency in aquaculture training.

The design/upgrading of a competence-based aquaculture curriculum must consider at least the important aquaculture content gaps demanded by aquaculture operators from the TNA assessment, which includes: Fish Nutrition and Fish Feed formulation at farmer level, Production systems including flexible fish farming systems like using tanks, recirculation systems (RAS), aquaponics and others, Fish diseases and management, Pest and disease control in fish farms, Economics of fish farming/ aquaculture, Data management and analysis and reporting/ Computer, Hatchery management, Fish breeding, Feeding techniques, Cage construction and maintenance, Water quality control and maintenance, Fish handling and processing Technique and Quality control and Quality Assurance

Proper supporting facilities and practical equipment as identified in the TNA and also presented in a proposal must be secured through the FAO True-Fish project and other donors of government support to ensure smooth implementation of the competence-based aquaculture syllabus.

1.0 Introduction

1.1 Background

Modern, technically sophisticated commercial aquaculture requires skilled workers to manage and operate aquaculture facilities and trained scientists to staff university and government research laboratories. Commercial aquaculture will only compete with agriculture and other sectors of the economy for the services of individuals with desirable skills and experience. The availability of expertise within the East African Countries to address priority commercial aquaculture research needs and barriers remains an open question. The University-based aquaculture programs and Non-degree TVET technical programs emphasizing the practical skills desired for employment at aquaculture production facilities are lacking or very inadequate in EAC countries.

For a long time, Uganda's fish farming that started in the 1940s remained subsistence until as recent as 2006 when it transitioned to commercial aquaculture and believed to have gained momentum. Uganda is now among the top five aquaculture producers in Africa with an average aquaculture annual growth rate of 15%. National aquaculture production capacity comprises of 20,000 aquaculture farmers producing 120,000 tons of fish from 25,000 ponds and 3000 fish cages on mainly Lake Victoria and other lakes in Uganda and contributes to 20% of national total fish productioni. Most farmers are smallholder farmers practicing extensive and semi-intensive pond and cage culture, while farmers run intensive systems and cage culture. The steady growth and increased private sector investment into aquaculture are attributed to the growing local demand and expanding regional markets for fish. Despite such a colorful picture of the promising trend of aquaculture in Uganda presenting abundant opportunities, there are many challenges that are threatening to limit the full potential of the sub-sector. Among the formidable ones is the lagging technical capacity that has not matched the growth pace of the industry, and lack in the nationally harmonized training materials to guide extension workers in providing technical support to the sector's value chain actors. The aquaculture sub-sector in Uganda is served by workers who graduate from non-degree institutions like Fisheries training institute where actual aquaculture technological and practical skills are very limited. The graduates of FTI who have been absorbed by successful aquaculture firms have had to be retrained hands-on to attain the level of competency needed to successfully manage a commercial aquaculture enterprise. Therefore, there is a general trend in deficiency of skilled and experienced workers presenting a constraint in commercial aquaculture development in the country that is endowed with rich water resources and suitable land for aquaculture development. Support is needed for infrastructure and training programs at aquaculture research or production facilities operated by universities like Makerere, Institutions like Fisheries Training Institute, government agencies like NAFIRRI/Kajjansi, or aquaculture private sector businesses.

This report presents the results of the FTI capacity building assessment and curriculum proposal preparation mission for enhancing availability and quality of local skilled workers in aquaculture related businesses to contribute to the development of competitive, gender equitable and sustainable commercial aquaculture to support economic development and sustainable management of natural resources in the Lake Victoria basin. The mission was directed under the overall managerial and administrative leadership of the NAFIRRI FAO RAF ADG, the Project Budget holder and the technical guidance/supervision of the Project Lead Technical Officer (LTO) and the Project Technical Adviser (TA).

1.2 Mission objectives

The FTI capacity building assessment and curriculum proposal preparation mission was carried out by a Fisheries Training consultant who was tasked to:

- To develop a brief analysis of the existing in-country aquaculture training "offer-and-demand" in Uganda (namely: offer; the national officially recognized institutions delivering aquaculture training and entitled to issue valid certificates, demand; to research the existing records (consulting the different available

statistics) of the number of skilled specialists that have been certified by the different recognised institutions in the last ten years)

- To develop an assessment of the aquaculture historic employment status: to research, out of the in the above item identified certified workers, if they have been employed in the aquaculture sector and how many others have found employment in different sectors and quantify it by sector to the extent of possible, in the last 10 years. The goal is to identify the rate or relationship between the offer of skilled workers that have been effectively absorbed by the sector. This rate or index will offer an idea of how the current courses are in demand and if they are useful for the sector, at different levels: artisanal, semi-industrial and industrial).
- To analyse the FTI current aquaculture syllabi (regular courses) and short / specialised courses, not integrated within the regular programme. List of official courses and certificates and a detailed evaluation of the contents and quality of the offered courses.
- To develop an assessment methodology for and to assess the skills and the technical capacity of the teachers, trainers and lecturers or similar active staffs of the FTI, providing training to the aquaculture students
- To assess the FTI facilities and equipment related to current aquaculture trainings delivered.

To identify and assess the needs and gaps of the FTI's aquaculture trainings in relation with the needs of the national aquaculture operators (ponds, tanks, and cages), with special emphasis of those active on freshwater in the Lake Victoria basin (Under Uganda jurisdiction). The information related to the operator's needs, additionally to the expert own knowledge on the subject, will be provided by FAO (from the agreement with FoodTechAfrica).

- To develop a proposal of the outline (not the contents) of a practical aquaculture curriculum for the institution considering its potential further regular syllabi and complementary short courses needed for providing the skills and knowledge demanded by the sector. The proposal will draft just the areas or course titles and outlining the possible indexes but won't enter the contents themselves (subject of a different contract).
- To develop a proposal of the equipment that the Institution needs to purchase and install for properly delivering the proposed curriculum, with the assistance of FoodTechAfrica via FAO/TrueFish.

2.0 Approach

2.1 Methodology

The methodology used for making the assessments and developing the curriculum proposal documentation was inclusive in style, drawing on the inputs from a variety of parties that included the public sector institutions like MAAIF, NARO/NAFFIRI, LG officials; private sector like large scale aquaculture operators and small-scale aquaculture operators including individual service providers in the aquaculture sector in Uganda. Hence the process covered a wide section of stakeholders in Uganda and was largely accomplished via internet mail/media and telephone communication due to the problem of Covid19 restrictions and limited time of study. The key informants were from fisheries training institute, NAFIRRI/Kajjansi, Waficos, SON and other private fish farmers from several districts across all regions of Uganda. The preliminary activities involved an online meeting with the Project Team where the Team leader briefed and reviewed the ToR together with the Consultant to set the ground.

2.1.1 Field Activities

To assess the FTI training capacity and analyse the current curriculum/syllabus on aquaculture and fisheries, the Consultant undertook the following activities:

- a brief literature review of the TVET institutions and the aquaculture and fisheries sector in Uganda and the rest of East Africa was undertaken (see References).
- meetings and interviews (mainly by telephone and internet media) with key stakeholders (FTI, Makerere university, NaFIRRI/Kajjansi, several districts (DFOs), Private aquaculture operators (SON, Ssenya, GI, WAFICOS, freshwater fish farms, hatcheries, feed mills, Fish traders, and fish processing companies) in Uganda.
- Visits to FTI, Makerere University, NaFIRRI/Kajjansi, training centres, fish farms, hatcheries, feed mills, and fish processing companies.

The interviews focused on the current situation and needs and on ideas and plans including what is necessary to achieve these. Annex 2 provides a list of meetings and site visits.
The approach involved initial briefing from the TRUEFISH/FAO Project team and desk study of the background information, followed by identification of the stakeholders and follow up appointment arrangements. Structured questionnaires (Annex 5) were prepared and distributed via mail to respondents for assessment of skills and delivery capacity of the FTI aquaculture staff including facilities and equipment that facilitate training learning processes. Fisheries Training Institute as one of the training institutions under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), was established by an Act of Parliament (Uganda) and officially opened on the 23rd of February 1968 (then 45, now 216 students, FTI vision is to be an Institution of professional excellence in fisheries management, training, research and marine safety) as a Regional Institute with a mission to produce competent Fisheries Managers and practitioners and to promote marine safety for sustainable socio-economic development. a full-fledged fisheries and aquaculture training institute with mainly capture fisheries training background but for this training capacity assessment, focus was particularly on aquaculture training, which has gained more attention in the region as a key development area in recent years and considering that it is the target component of interest for the project study.

A capacity assessment (To analyze the FTI current aquaculture syllabi (regular courses) and short / specialized courses that are not integrated within the regular programme; List of official courses and certificates and a detailed evaluation of the contents and quality of the offered courses) of the Institute including SWOT (Annex 4) was conducted with support of the staff, gaps identified on demands and needs from aquaculture operators and suggestions /recommendations made on best proposal for an inclusive curriculum. A structured questionnaire was prepared for the private fish farmers and Local government district fisheries staff to assess the employability, utilization and performance of the aquaculture graduates and interns from FTI and other Institutions (Annex 3). Further Information was collected on aquaculture enterprises around the country to ascertain the depth of aquaculture production in the country.

This approach offered a unique opportunity to analyse the Uganda TVET knowledge infrastructure both from multiple perspectives, providing strong insights in what practical and academic knowledge and capacity is required for enhancing economic development while at the same time promoting sustainable use of aquaculture and fishery resources.

Preliminary findings from the consulted stakeholders guided the prioritisation of their skills needs for enhancing availability and quality of local skilled workers in aquaculture business operations that will contribute to the development of competitive, gender equitable and sustainable commercial aquaculture to support economic development and sustainable management of natural resources in the Lake Victoria basin.

3.0 Results

3.1 Introduction

The outcomes of the FTI training capacity assessment mission presented below support these preliminary findings and further elaborate on them. The findings of the FTI training capacity assessment mission not only include the needs identified by academic and vocational training staff, but position the knowledge and facilities needs also from the perspective of the Uganda private and international fish sector according to the identified producers' needs and demands.

This chapter first discusses the status of Uganda's TVET Institutions technical capacity for fisheries and commercial aquaculture-based education. It then presents the needs in support of the proposed curriculum that will contribute to a sustainable and economically viable aquaculture sector identified by the public sector stakeholders of Uganda, the private sector in Uganda and the foreign aquaculture companies who are interested in doing business with Uganda. This is followed by a discussion of practical knowledge needs and future capacity-building for a sustainable sector.

3.2 Status of Uganda's TVET Institutions technical capacity for fisheries and aquaculture-based education

National officially recognized institutions delivering aquaculture training

There are at least three tertiary institutions that are known to offer tertiary training in aquaculture in Uganda, namely Fisheries Training Institute, Makerere University and Busoga University. iiThese Universities and vocational training centres play an important role in support of developing a sustainable aquaculture and fisheries sector, even though the trainees from these institutions lack the practical skills in large-scale intensive commercial aquaculture as most Ugandan farmers are smallholders. Until recently, the knowledge infrastructure in Uganda has been mainly supply oriented and less demand oriented. In practice, this means that students are not trained to develop the skills and competencies required to foster (sustainable) economic growth in Uganda. In the current university education system, there is a strong focus on theory and knowledge with limited focus on skills and competencies. Field trips and Practical training are included in the curricula, but there is no culture of cooperation with stakeholders such as the Department of Fisheries or private aquaculture companies to ensure effective training delivery. Student internship/industrial training is a common practice among the institutions but has no clear laid out structure that ensures follow up for the intern students and contacts with hosts to ensure desired results. Most university curricula regarding fisheries are similar and embedded in the departments of zoology, having a disciplinary but with no professional specialization. Collaboration between departments within universities to provide interdisciplinary skills training hardly occurs. For the purpose of this report, we shall concentrate on Makerere University and FTI and leave out Busoga University whose aquaculture training capacity is relatively low and less developed and did not form part of the mission.

Makerere University

As Fisheries and Aquaculture education and training continue to attract investments by the national government of Uganda, traditionally non fisheries institutions like, Makerere University have started to offer a 3-year Bachelor of Science in Fisheries and Aquaculture, with an aquaculture component, following a 20 students' intake per year. The syllabus has further been revised and updated putting into consideration MSc Zoology with a fisheries and aquatic sciences with help from the Government of Austria. The university has two aquaculture/Fisheries specialistsiii, but lacks expertise in some areas such as Aquaculture farm engineering and nutrition. The main omission is the lack of practical facilities to provide actual fish farm experience and hands-on learning experience. The university sends students for practical attachments for 2 months, under Memoranda of Understanding (MoU) established with some farms, including Kajjansi Aquaculture Research and Development Centre/NAFIRRI, but this is not properly structured to ensure effective and beneficial learning outcomes due to limitation of logistical facilitation and shorter hands-on learning exposure for students.

That notwithstanding, extensive technical assistance is needed to meet the current demands of commercialization of aquaculture from its traditional position to modern business sense making enterprises like the government established Aquaculture Park(s) and many private aquaculture businesses investors. Of course, for now, the gap in aquaculture best technologies is, and must be filled from overseas where there has been practical experience of successful aquaculture business establishments, although this shouldn't be allowed to continue. Makerere university Department of Zoology is keen to pursue aquaculture training for students and capacity building for selected fish farmers/aquaculture operator but has limited funding and so has been mainly relying on project funding according to the one of the senior aquaculture staff. It is in view of this gap that the FAO-TrueFish project responds to this call for urgent and appropriate national aquaculture-based training to ensure full time aquaculture technicians' availability to also train all new farmers and provide continual technical support. In addition, farmers are required to follow Good Aquaculture Practices to realize best returns in their aquaculture businesses and so need to be trained. For this study, it will suffice to concentrate more on Fisheries Training Institute (FTI) as the focus of the capacity assessment.

The Fisheries Training Institute (FTI)

The Fisheries Training Institute (FTI) which is 2.5 km from Entebbe Municipal is situated at Bugonga point and sits on 7.5 hectares of prime land with 1.5 km shoreline on Lake Victoria at Entebbe, Uganda. The institute was established in June 1968 as a Regional Institute and it still stands so today, with a Vision, to be an Institution of professional excellence in Fisheries Management, Training, Research and Marine Safety, to produce competent Fisheries Managers and Practitioners and promote Marine Safety for sustainable socio-economic development.

The FTI SWOT analysis was conducted (Annex 4) to help identify the institute's internal strengths and weaknesses, along with the external opportunities that are available and the external threats likely to be faced, particularly in relation to business competition. The analysis points out the internal and external factors that are favorable and un-favorable to achieving the strategic objectives, as elaborated in the table in annex 4.

The strategic objective of the institute is to stimulate intellectual and technical growth of students to make them productive members of the community in the fisheries and aquaculture sector; and produce extension workers, craftsmen, technicians, and other skilled manpower to meet the demands of the fisheries industry.

Initially, FTI trained candidates for technical manpower requirement of the fisheries industry, and was meant to provide comprehensive training in fisheries technologies, yacht, and boat building technology at certificate level. However, the institute has since 1995 upgraded to train diploma programmes offering Diplomas and Certificates in Fisheries and Agriculture related courses. These include Diploma & Certificate in Fisheries Management and Technology, Diploma in Integrated Aquaculture and Agriculture, Diploma & Certificate in Boat Building and Marine Mechanics and National Certificate in Agriculture. Since its inauguration, FTI has seen its student enrolment steadily grow from 45 male students to a current 217 who include 73 females after female enrolment picked up along the way. The institute has also developed and reviewed more training programmes, increased staffing to almost full board, as well as developed MoUs with private sector players to support competency-based training. FTI always maintained professional staff strength of about 30, most of them in boat building, and has been rolling out annually an average of 50 to 60 Diploma and 15 Certificate student graduates since 2000.

In 2016 FTI introduced a new Diploma course in Integrated Aquaculture and Agriculture with a strong focus on aquaculture, and integration with agricultural activities like aquaponics system. There were 18 students on the first recruitment (although capacity is 50) all on government scholarship. There are plans to introduce a Certificate course in Aquaculture and agriculture, with greater emphasis on practical skills and competency-based training approach. As it stands now, the Institute has adequate manpower but most of the equipment in the laboratories is either obsolete or not operational and needs to be replaced. FTI also conducts other

non-formal tailor-made trainings for in-service actors, and this is intended to generate income to supplement Government subventions. FTI also offers consultancy services and builds boats for the private sector.

The Fisheries Training Institute is now incorporated into the National Agricultural College, under the Directorate of Training of the Ministry of Agriculture providing an opportunity for a formal pedagogical approach, and integration with other agro-business Topics (business planning, marketing etc.), which are neglected at present. It is accredited by the National Council of Higher Education (NCHE) which ensures quality assurance in delivery of training. The FTI now has a professional staff of 19, all with BSc or higher degrees, and 4 of them being aquaculture lecturers who have 3 MSc degrees and 1 BSc degree in Fisheries and Aquaculture Sciences, plus, several aquaculture-based trainings under a China TC programme (Annex 3, Table 5).

The FTI occupies its own site at Entebbe and is well provided with classrooms and residential accommodation. Over the years, the Institute has grown to a maximum capacity of 300 students although presently have only 150 due to the decline in demand for traditional fisheries courses. In terms of physical aquaculture facilities, there is a small hatchery which is not operational. A previous AfDB project tried to rehabilitate this but failed due to poor initial design. The institute has some training ponds, but they are poorly located and constructed, suffer high seepage rates and are not functional. The FTI has no cages and not offering training in this area.

The courses offered currently at FTI includes a Fisheries Management Technology Diploma (post 18, 2 years can be basis for degree entry) and a corresponding Certificate (O level entry, 2 years). Aquaculture constitutes one of the options within this course.

Three new diplomas have been designed and approved since 2017/18 planning year, of which Integrated Aquaculture and Agriculture (Annex3) is one of them that is in line with this assessment. Others include Boat building and marine mechanics, Food Processing, Safety and QA, and Marine mechanics.

Integrated Aquaculture will budget for an annual intake of 40 scholarships (Government sponsored intake). Others qualified students (up to a total of 60) can pay for themselves (self-sponsored intake) at a cost of about US$ 1,250 including accommodation.

Present strategic direction of TVET Institutions in Uganda

The main strategic direction of all of these institutions is to address the rapidly increasing demand in skilled human resource for the aquaculture sector as indicated by demand that is pushing most of the fisheries related education and training to focus on aquaculture and in line with the Vision 2040 and Uganda national Development plan (II). ivThe fisheries and aquaculture skills training institutions are closely linked to the fisheries administration which has ensured that there has been investment in building the capacity to train new entrants to the aquaculture sector.

Indeed, the selected government Universities (Makerere University Kampala, Busitema University, Busoga University and Gulu University), now see the possibility of offering education in aquaculture disciplines but the capacity for practical training within these institutions varies considerably and is a major concern. Whilst some have reasonable facilities for at least some practical experience, many have nothing, or only very limited facilities. Therefore, as noted from the rapid assessment, all of the institutions mentioned in the foregoing remain substantially focused on less costly and easy-to-apply pond production technologies with none having significant capacity to train in cage culture engineering and techniques, which are the main needs of the expanding aquaculture sector at the moment. Nor is there sufficient emphasis on practical training in water quality monitoring, feeds and nutrition and hatchery management, which are key requirements for a successful aquaculture production enterprise.

Moreover, although these training institutions provide ad hoc attachments to farms as part of the courses, it remains a daunting challenge to ensure that this experience is comprehensive in scope, relevant and effective because of lack of adequate resources to facilitate the whole process and activities involved. Hence, the practical training that is achieved via placements is almost exclusively with pond farming with only a few links interned with cage culture operations e.g., SON in Jinja.

Indeed, as noted from the assessment of the aquaculture operators, and specifically SON, there is a challenge they encounter in getting qualified staff that are hands-on and ready to be deployed to work. They have observed that new graduates coming from Makerere University and related universities require several months of on-the-job training before they can become effective in their work. This is so much in contrast to recruited staff from FTI Certificate and Diploma graduates who tend to display well the hands-on–skills and are very keen to learn and hence put more effort in their job achievements.

Recognizing this deficiency in Higher learning Institutions like Makerere University and others, the providers arrange attachments for their students, with government institutions or private sector operators. Even so, this is often too narrow and insufficient to meet the needs of operators. The deficiency is recognized by the training and educational institutions, who often have well qualified staff, but limited by lack of practical equipment capacity, or their students have no practical facilities for demonstrations and hands on experience like, for example, cage culture, or feed formulation, etc.

Recognizing the need for better skilled personnel several of the larger farmers like SON, Senya fish farm and Yalelo among others (both pond and cage) have commenced training functions, partly as a public good, partly as a means of better serving their customers (for seed and feed) and partly in some cases as direct source of income. They recognize the value in having viable fish farming activities around their hub operation (to whom they can sell seed and feed, provide technical assistance and act as a channel for the marketing of their products).

SON in Jinja, and Senya fish farm in Masaka, among other, all have developed training schemes to some extent ranging from receiving students from fisheries training institutions, to design and offer of short courses. The only weakness about these efforts is that their efforts are not coordinated at all, and are not always effectively resourced, clearly indicating lack of a structured approach to identified training needs like, ensuring that students get exposure to a range of different farming technologies. During this assessment the Production Manager of SON indicated that different aquaculture operators are focused on their business profit maximization interests and on developing their production technologies than engaging in auxiliary costly undertakings, which they think is a government concern as a partner than the aquaculture operators. Hence, each operator prefers to do things in their own way and yet it would be helpful if the government together with aquaculture operators worked out a mechanism of standardizing and structuring the program to ensure that all the actors benefit without pushing the burden of industrial training for interns to aquaculture operators alone without sufficient logistical support leaving learners in a vulnerable position. There is an urgent need for strengthening the relevance of the existing training provision, particular by extending its scope to cage farming, and other more intensive technologies, and addressing gaps in critical areas such as fish nutrition and water quality monitoring.

Establishing public-private sector training capacity for aquaculture skills

There is need to address the aquaculture skills gap by supporting an arrangement that promotes sharing appropriate practical training skills across the region of East Africa by linking the aquaculture training institutions in the region with aquaculture operators who can offer practical training opportunities, which is a basis for this assessment by FAOTRUEFISH project. In collaboration with FAO TrueFish, FTI as a Centre of excellence would arrange and manage structured practical training placements in participating aquaculture enterprises, to ensure that students obtain pedagogically relevant experience across the range of aquaculture

sector activities (e.g., hatchery, cage, pond, RAS technologies, feed mills and feed testing, fish health etc.). Participating aquaculture businesses would be supported to deliver the training (for example with ToT, provision of training materials, equipment, testing kits). This approach would also strengthen their capacity of integrated aquaculture operators (i.e., with hatchery and feed suppliers) to serve their own clients with technology transfer.

This justifies the urgent need for a proper curriculum for FTI that addresses all the present capacity training needs as relates to the fisheries and aquaculture sector as suggested in this FAO TrueFish study.

3.3 Assessment of FTI graduates engaged (employed) in aquaculture business

The goal of assessing the FTI aquaculture historic employment status was to identify the rate or relationship between the offer of skilled workers by FTI in the last 10 years against those that have been effectively absorbed by the fisheries and aquaculture sector in Uganda. This rate or index is to offer an idea of how the current courses are in demand and if they are useful for the sector at different levels: artisanal, semi-industrial and industrial). That is to find a relationship with training institutions numbers graduated in the last 10 years and graduates' employment at National level within the aquaculture/fisheries sector or industry.

Given the wide national scope, limited time and covid19 pandemic situation, a sample of 30 stakeholders were taken from different categories of actual and potential FTI employers that include Local government at district level (10), research institutions (2) and private aquaculture operators (5 SMEs) including 20 certified Aquaculture trainers and service providers (Table 1, 2 and Annex 5B questionnaire) mainly.

3.3.1 Capacity Assessment of FTI Graduates by Employers

1. FTI trained graduates/interns in last decade (10 years) from a few selected aquaculture operators and employers
2. The Source of the Nile (SON) aquaculture farm, Jinja, which is one of the largest private aquaculture operations nationally have employed about 50 graduates in the last 10 years, and usually give consideration for employment to former student interns because they are normally given basic specific training in line with production and operations during internship and deemed to be well equipped to start off well with the work at SON.

Their Intern/industrial training students in-take is in two sets with the January lot being about 8-12 interns, and June intake is about 7-10 students annually. At least a Minimum of about 15 students that are received for industrial training are those from FTI annually.

Currently, the whole production management/supervisory structure of SON consists of 100% FTI graduates, who have since undergone up gradation from Diploma certification to bachelors/master's degrees.

Ssenya Fish Farm, Masaka, one of the prominent private aquaculture establishments in Central/South region of Uganda indicated that they have employed 2 graduates from FTI who have since left, but often received 11 interns in the period of 10 years. These indicated that usually they receive one intern per year.

Serere District Fisheries Office in the Northeastern region of Uganda indicated that they have received a total of Eight (08) FTI trained staff in the last 10 years. However, six (06) of these were employed earlier by Soroti but with the changes resulting into creation of new district was then taken by Serere district and two remained in Soroti district.

Kalangala District, an island district with mainly cage fish farming indicated that they have employed Nine (9) graduates for the last 10 years. All the graduates are actively involved in aquaculture work and majorly in cage farming

Kaberamaido District in the Northeastern noted that they have employed at least four (4) graduates from FTI in line with Local government policy restricting employment of staff to only University graduates as a matter of policy. The FTI Certificate and Diploma graduates had to upgrade to degree level to fit into the Local government employment structure.

3. Percentage of FTI graduates/interns involved directly in aquaculture activities?

For SON, about 75% of the FTI graduates are involved directly in aquaculture activities and, most especially those that have had their internship in the SON farms are always taken up for employment in fish farms. Ssenya Fish Farm have known about 30 FTI graduates outside of their farm, twelve (12) of which are directly employed actively in aquaculture enterprises and the rest upgraded to degree programs.

In Serere district, only 12.5% (i.e., one out of eight) are involved in aquaculture-particularly fish farming, whereas in Kaberamaido district all staff are involved in aquaculture activities, but now with one staff in charge of aquaculture in the district.

4. Strength and weaknesses in performing their work in the field

Source of the Nile (SON) aquaculture farm, Jinja, noted that the Strength for FTI graduates is that they like hands-on work and are more productive/industrious in doing their work. This shows there is a good starting point for engaging the FTI trainees in hands on training needed in aquaculture operations. The Weaknesses highlighted is that the majority lack analytical and management skills and confidence to take up supervisory roles.

- Ssenya Fish Farm, Masaka noted that the Strength for FTI graduates is that they are more than willing to stay and be employed/ volunteer after school than the degree holders. That is, they are keen to learn more on farm and scheme for possible employment than degree holders.
- Ssenya Fish Farm notes that more Weaknesses outweigh the strength as indicated here:
- The curriculum is either shallow or completely lacking in some of what the private sector expects from these: Diseases/ Fish health - usually no basics on this in them.v
- Pond construction - proper pond construction is lacking. What they offer is the usual pond digging demonstrations that are simplistic when taken in view of the changing realities in aquaculture farming.
- General management skills of the day-to-day farm activities are usually scanty in the FTI graduates.
- Hatchery management is usually completely lacking
- Aquaculture laboratory skills - to run the basic lab requirements on-farm (water quality testing, disease identification and control, basic feed quality analysis, etc.). This would fit well if there was a provision for the aquaculture regulations training, possibly.
- The program would be stronger if it were made to be a diploma of its own as Aquaculture without mixing with capture fisheries trainings.
- Then it would include Aquaculture engineering, that is the use of machinery in the sector especially calculated use of a tractor excavator for pond construction, de-silting and repair, kiln design, etc. which can be a diploma of its own too.
- Integrated farming systems - skills are lacking so they do not help the farmer to fully maximize their available resources.
- Water safety and diving - completely lacking yet vital for cage farming and rescue of people during water accidents like drowning at the farms they work and within the community.
- Value addition - they are completely green on the practical here. This will help them easily become self-employed too after school.

- Entrepreneurial skills development - to help them become self-employed so that the sector can have more skilled owners for better production hence better sector performance/ impact.
- In-farm economics - completely lacking yet very vital. They need to help the farmer employing them analyze investment performance and advise on ways to be cost-effective. This will make them more relevant to their employer because if the farmer is making money/ profit, then the employees' relevance is visible.
- Record keeping - lacking but most important if economic analysis/ performance of the enterprise should be done.
- Policies and regulations - lacking yet they would easily be the informants of their employer of the relevant policy issues in the sector to adhere to.
- Generally, FTI graduates' exposure is minimal and also their internship structure is lacking with no follow-up.
-

For Serere District, the DFO indicated that the strength of FTI graduates is in their mobilization skills/extension education to generate interest among community where fish farming was lacking.

The Weaknesses, however, is in their lack of practical experience, Record keeping and Report writing, and Inadequate farmer training abilities

Kalangala District Fisheries Officer noted that FTI graduates' Strength is in having passion for their profession and always eager to learn new things. They are Loyal workers and dependable. The Weaknesses is in having low knowledge in feed formulation

Kaberamaido District Fisheries Officer noted the following Strengths for FTI:

- Upcoming fisheries and aquaculture bill -government policy-that will promote aquaculture.
- Availability of FTI specializing on Fisheries trainings.
- Great potential for aquaculture production.
- Conducive climate for aquaculture production (Many wetlands, e.g., swamps, rivers, lakes.
- Available productions systems e.g., ponds, tanks, fish cages.
- On the other hand, the Weaknesses highlighted include:
- Inadequate skills in production systems, feed formulations techniques, fish breeding- hatchery management skills.
- Limited access to capital for promoting aquaculture.
- Long time negligence by government in promoting fisheries and aquaculture-
- Limited budget allocation for aquaculture production.
- Poor or inadequate fish handling facilities

5. Suggested kind of training needed to help bridge the training gaps

Source of the Nile (SON) aquaculture farm, Jinja suggested the following kind of training needed

- On farm teaching for fish production course units
- Research teaching approach to improve analytical skills
- Introduce some leadership course units
- Learning Models based on 50% field and 50% class need to be promoted
- Organize training Topics that correspond to what is needed by the people/SME's investing in aquaculture.
- PPP: Involve in the training both teachers and experienced practitioners coming from the private sector.
- Also interact with the NaFIRRI /Kajjansi researchers to be integrated in the training Topics, right from working out the Topic content.

Ssenya Fish Farm, Masaka suggested the following measures on training

- Revise FTI curriculum and incorporate the information gaps cited above.vi
- Ensure continuous engagement with the private sector (at least every 3 years) to capture and include new gaps/ interventions sighted in the sector when reviewing and updating the curriculum.
- This is to help graduates keep-pace and remain relevant to the sector. Undertake a review of curriculum in view of the new inclusions impacts say every 5 years period after the beneficiary graduates are in active practice.
- According to Ssenya fish farm Director when one compares Makerere and FTI,
- FTI lacks follow-up on the interns when in the field (field placement). -Even the reports they are required to make at the end of internship, lack the pertinent issues that the supervisor would have asked to truly ascertain the impact of the internship. This could be also because of limited funding to facilitate the interns.vii
- FTI can serve as a skilling sector even for the private sector by organizing short courses for interested stakeholders at the institute during holidays/ in the field (say regional level) during school time. This will help them generate money as they remain relevant to the sector, they serve which is now minimal.

Serere District noted that there is need for more practical (hands on) training preferably on farm attachments

Kalangala District recommended Training in feed formulation for FTI

Kaberamaido District suggested that the Training is needed in areas of --production systems, feed formulations techniques, fish breeding, hatchery management skills and Aquaponics

6. Important subject content and infrastructure/equipment needed in the aquaculture training today if commercialization of aquaculture is to be achieved

Source of the Nile (SON) aquaculture farm, Jinja suggested that it is better to secure Infrastructure/Equipment by:

- Signing MOU with fish farm operatives to offer practical training needs, build hostel in the same farm and training hall. Or
- buy a bus that is supposed to transport students to the farm daily, like the way health institutions do, by training in the hospitals

In terms of Content:

- it should be practical and based on farm teaching approach
- In principle the content should cover all practical operations both for hatcheries and nurseries and also for the grow-out operations.
- It should address the various systems in use (cages, tanks, ponds etc.).
- It should focus more on water management, on health of the fish, and
- on feeding strategies/techniques.
- Construction and maintenance of cages, tanks, and ponds. Etc.
- In addition, review whole curriculum for FTI to meet the growing aquaculture industry needs.
- What is also important is to have a very practical oriented team that designs the training Topics. One should also learn from lessons of successful training units (such as AIT in Bangkok)

Ssenya Fish Farm, Masaka

Content-wise, they need to structure all the above in a more practical approach because theory is not best comprehended by the students.

- Welding machinery for fabrications especially during cage designing
- Comprehensive water testing equipment
- Fishing and protective gear and repairing equipment

- Diving gear especially in view of cage aquaculture
- Demonstration infrastructure and equipment (cater all culture systems and integrations e.g., aquaponics, RAS)
- Mini feed machinery
- Comprehensive laboratory that is fully equipped etc.
- Overall, the performance could be due to the low academic quality of the targeted entrants for cutoff points at entry - entry requirements ("trash in - trash out").

Serere District Fisheries Officer noted that important content should include:

- Fish Feed formulation at farmer level,
- Seasonal fish farming; using tanks and others,
- Pest and disease control in fish farms,
- Aquaponics,
- Economics of fish farming/ aquaculture, and last but not least
- Data management and analysis and reporting

Kalangala District Fisheries Officer suggested the following for content

- Hatchery management
- Feed formulation
- Feeding techniques
- Cage construction and maintenance
- Water quality control and maintenance

Kaberamaido District Fisheries Officer suggested the following for content

- Production systems, feed formulations techniques, fish breeding, hatchery management skills.
- Fish handling
- Modern fish processing Technique.
- Aquaponics
- Fish diseases and management.
- Aquaculture economics.
- Fish Nutrition.
- Fish processing and
- Quality control and Water quality management

3.3.2 FTI graduates who are Professional Service providers and consultants.

Table 1 indicates contacts of FTI graduates who are deployed in Uganda and beyond as service providers providing aquaculture services in different areas. **The mission was able to dig out 20 graduate alumni of FTI that are now well established as service providers making a big contribution to the aquaculture sector in Uganda.** Initially, when aquaculture development was centralised, most of the best graduates used to do internship in Kajjansi ARDC and the few government hatcheries in Uganda where they would eventually be employed as technicians, but with decentralization and recent developments in the aquaculture subsector most FTI Diploma and certificate graduates upgraded to degree programs and more professional positions in the aquaculture sector in Uganda as can be seen in the list. The role they have played in capacity building and promoting aquaculture production in Uganda cannot be underrated given that most of the best aquaculture operations are being sustained by these former FTI graduates.

Table 1 List of Certified FTI graduate aquaculture service providers and trainers

Name of trainee /company owned by FTI trainees	Contact detail	Area of operation/ District	Comments
Trainers under OwanMwan Aquaculture Limited			
Owani Simon Olok	0772697629	National and East Africa	A founder and executive director of aquaculture service providing firm
George W. Okiror		National	A trainer and research assistant with OMAL
Mabel	0774336650	National	As above
Geoffrey Kisambira	0751745761	Central region	Currently attached to Matugga Fish farm-one of the biggest tilapia hatcheries in Uganda
Atim Marita	0704020020	Central	Same as above
Alex	0700789236	Central region	Founder and director of great harvest service providers
Edith Nankya	0703021162	Central	Currently attached to women fish network
Otage W. Peter	0706134151	National	Founder and director of MAFFE Consult
Joseph Lugolobi	0757632901	Central	Private individual trainer & service provider
Aloysius Mbarushimana	0780481063	Central region	A private individual trainer and service provider
Jackson Onyait	0789411367	Eastern	Private individual trainer & service provider
Asaba Peter	0776634695	Western	Private individual trainer & service provider
Olanya Christopher	0782660499	Northern region	Currently with caritas Uganda as a trainer for a project –Building Skills for Aquaculture Jobs
Kagoya Juliet	0752984409	All over the country	Formerly worked with WAFICOS as extensionist and private trainer
Ben Kiddu	0774955878	Central region	Attached to Gombe district / private trainer
Kityo Godfrey		Kajjansi ARDC	Senior Technician
Masaba Antony		-do-	-Do-
Sam Lemwa	0771460501	West Nile region	Currently attached to a I SEE Fish farm in panyimur in Pakwach / private training.
Odongo Joseph Oumu & Kakuru John Baptist	0702410180 & 07022329148	FTI	The two aquaculture lecturers from FTI who can provide you with more details on former students working as trainers currently.

These very FTI aquaculture graduates serve as links for FTI to the best aquaculture operations where FTI interns are helped to undertake their industrial training (IT) as can be seen in table 2 underpinning the importance of FTI graduates in rolling out aquaculture manpower upon which aquaculture developed in Uganda has thrived to date. With 118 interns that FTI alone is able to send to aquaculture operations annually; it remains the main fountain of potential graduates that can be skilled to serve the burgeoning aquaculture subsector if partnerships are strengthened as FAO True-Fish project intends to achieve. FAO True-Fish project will build on these achievements and potential to further strengthen the capacity of FTI to deliver a competency-based aquaculture training that meets the present skills challenges and regional priorities for aquaculture development. More information about the extent to which aquaculture enterprises nationally, are supported by FTI graduates is presented in a table in annex 6.

Table 2 Partnership Aquaculture Operator organizations where FTI Students go for industrial training (IT) Placement

S/N	Name of Organization	No. of students on IT per year	Contact of Field supervision
	Source of the Nile (SON), Buikwe	20	Mrs. Allen Akusasira, Tel. 0772389851
	AQUA Fish Farm, Buloba, Wakiso	10	Mr. Masiko Richard, Tel. 00782525285
	Yalelo Fish Farm, Jinja	10	Director Daniel Rea, Tel. 0783830196
	Matugga Fish Farm	8	Mr. Owani Simon, Tel.)701041163
	Rock Spring, Tororo	20	Mr. Orukan Sam, Tel. 0776985322
	Novia Fish Farm	6	Director 0755100228
	Kikota Fish Farm, Serere	20	Stephen Tel. 0771828980
	Furdsult fish farm, Buikwe	8	Mr. Oonya Robert, Tel. 0772437424
	Geossy Fish Farm, Tororo	8	Mr. Emanu Joel, Tel. 0770631666
	Rock Spring, Buikwe	8	Mr. Orukan Sam, Tel. 0776985322
	Total	118	

3.4 Analysis of FTI's Current Aquaculture Syllabi/Course study and Content Outline

Among the main issues highlighted with respect to training capacity building for FTI is the curriculum for training fisheries and aquaculture extension workers. Even though the Fisheries Training Institute is the main contributor to the needed manpower in the fisheries and aquaculture sector in Uganda, the training offered has not been as strategic as it should be. This is partly, attributed to the deterioration of infrastructure and limited experience of teaching staff as most of them are increasingly fresh graduates without adequate practical hands-on experience in aquaculture. The traditional model of training for certificate and diploma-based courses with content that is now out of step with the demands of the modern technology in fisheries and aquaculture is no longer sustainable as indicated by respondents from local government and progressive private fish farmers who for a long time have been key employers of FTI graduates. The LG respondents noted that the current Local Government policy on recruitment of staff discourages Certificate and Diploma holder categories and recommends employment of Degrees holders for technical positions at local government level. Moreover, all stakeholders do agree that the two years spent on acquiring a certificate or diploma is outdated and untenable for the present technological pace and demands and prefer a competency-based curriculum focusing more on hands on practical experienceviii. Table 3 below shows various courses offered by FTI including for tailor made courses

Table 3: List of current courses offered at FTI

Category of trainees /Entry requirements	Courses offered
O-Level certificate holders who meet admission requirements	- 2-year Certificate in Fisheries Management & Technologies - 2-year Certificate in Boat Building & Marine Mechanics
A-Level certificate holders who meet admission requirements	- 2-year Diploma in Fisheries Management & Technologies - 2-year Diploma in Integrated Aquaculture & Agriculture - 1-year in-service Diploma in Fisheries Management & Technologies & Boat building & Marine mechanics
- Individual and group fish farmers - Traditional beach boat builders - In-service trainees - Recent male and female school leavers - Out-of-school youths	**Tailor-made courses** in: - Basic site selection and pond construction - Fishpond management - Fish fry production - Fish feed formulation, etc.

3.4.1 FTI current Aquaculture Syllabus

The Directorate of Fisheries Resources in Entebbe embarked on curriculum review taking into account contemporary developments in the management of fisheries. Instead of just focusing almost exclusively on the biology of fisheries as previously was the case, the revised curriculum pays attention to the critical underlying dynamics of co-management and other related areas that match the current sector demands. In essence, the new curriculum strikes a balance between science and social sciences to produce extension officers adequately equipped to deal with the contemporary context of fisheries management. However, the same curriculum has not paid much attention to the changing capacity needs of the aquaculture sector, where technological changes have been very fast and all impacting the development of the sector. The institute has been slow in learning and adapting to such challenges and issues that are to do with aquaculture production systems, including the most prominent cage fish farming that has taken the region 'by fire' and other systems that have been researched and perfected for modern fish farming like the RAS, Aquaponics and other tank fish culture methods. ixThe issues of fish nutrition, feed formula and feeding techniques and fish diseases still pose a big challenge to the desired technical skills balance in the provision of services to aquaculture sub sector by FTI.

The syllabus for the current Diploma in Integrated Aquaculture and Agriculture was analyzed as presented below here in Fig.1. x

Figure 1. Diploma in Integrated Aquaculture and Agriculture (DIAA)

YEAR I, SEMESTER I

COURSE CODE	Course Name	LH	PH	CH	CU
DFC 1101	Communication Skills	15	30	30	2
DFC 1102	Introduction to Computer Applications	15	60	45	3
DFA 1103	Aquatic Biology and Water Quality Management	30	30	45	3
DFA 1104	Basic Aquaculture	45	30	60	4
DFA 1105	Principles of Integrated Farming Systems Management	45	30	60	4
DFA 1106	Principles of Crop Science and Improvement	30	30	45	3
DFT 1107	Food Biochemistry and Human Nutrition	30	30	45	3
DFT 1108	Introduction to Anatomy and Physiology	30	30	45	3
	SEMESTER LOAD				25

YEAR I, SEMESTER II

COURSE CODE	Course Name	LH	PH	CH	CU
DFT 1202	Applied Mathematics	30	30	45	3
DFA 1203	Introduction to Soil Science and Management	30	60	60	4
DFA 1204	Farm tools, Machinery and Mechanisation	30	60	60	4
DFA 1205	Aquaculture Systems Engineering	30	60	60	4
DFA 1206	Crop Husbandry Technologies	30	30	45	3
DFT 1207	Food Microbiology	15	30	30	2
DFA 1208	Principles of Animal Production, Health and Welfare	30	30	45	3
	SEMESTER LOAD				23
DFC 1301	Industrial Training (Recess)	15	120	75	5
DFC 1201	Real-life Project	15	90	60	4

YEAR II, SEMESTER I

COURSE CODE	Course Name	LH	PH	CH	CU
DFC 2101	Business Management and Entrepreneurship	30	30	45	3
DFC 2102	Project Planning and Management	30	30	45	3
DFC 2103	Research Methods and Statistics	30	30	45	3
DFA 2104	Principles of Genetics and Breeding	30	30	45	3
DFA 2105	Feed Production for Livestock and Fish	30	30	45	3
DFA 2106	Principles of Economics, Marketing and Cooperatives	30	30	45	3
DFA 2107	Fish seed Propagation and Hatchery Management	30	60	60	4
DFT 2108	Post- Harvest Handling and Value Addition	30	30	45	3
	SEMESTER LOAD				25

YEAR II, SEMESTER II

COURSE CODE	Course Name	LH	PH	CH	CU
DFC 2201	Rural Sociology and Extension Education	30	30	45	3
DFC 2202	Research Report	15	120	75	5
DFA 2203	Environment Management and Climate change	30	30	45	3

DFA 2204	Aquaculture Farm Management and Practices	30	60	60	4
DFA 2205	Sustainable Land Use Planning and Management	30	30	45	3
DFA 2206	Production of Organic Feed/Food and energy	15	60	45	3
DFA 2207	Food Inspection and Quality Assurance	30	30	45	3
	SEMESTER LOAD				24

Indicates Key Subject areas FTI Syllabus offers which the aquaculture operators say are still wanting and need more enrichment

3.4.2 Analysis of the FTI DIAA Syllabus

The quick capacity assessment findings indicated wide gaps in the kind of content needed by the fish farmers against what FTI offers as seen in the Table 4.

Table 4: Gap analysis of aquaculture skills demanded against what is offered by FTI curriculum

Content demanded by fish farmers in survey:	*Key Subject areas FTI Syllabus offers (Fig. 1)*	Remarks on gaps that FAO True-Fish project can focus on
1. Fish Nutrition.	*Feed Production for Livestock and Fish*	Limited Practical and lack of technical depth
2. Fish Feed formulation at farmer level,	*Feed Production for Livestock and Fish*	Lack knowledge of formulation and rely on theory
3. Production systems, modern fish farming systems; like Fish cages, RAS, tanks	*Aquaculture Systems Engineering*	More Theory with limited demonstrations and hands on practical training
Fish diseases and management.	*Not offered*	Lack technical capacity and the lecturer who can handle it
5. Pest and disease control in fish farms,	*Aquaculture Farm Management and Practices*	Treated under general management and less emphasis taken on the actual risk and mitigation
Aquaponics,	*Not offered*	Still new and no trained staff to handle
7. Economics of fish farming/ aquaculture,	*Principles of Economics, Marketing and Cooperatives*	Need more emphasis on aquaculture systems economic analysis
8. Data management and analysis and reporting/ Computer	*Research Methods and Statistics*	Still not well handled and need more practical enrichment. Modelling techniques and application needed
9. Hatchery management	*Fish seed Propagation and Hatchery Management*	Taught but limited by lack of demonstration facilities.
10. Fish breeding	*Principles of Genetics and Breeding*	More of theory and lacking in practical demonstration
11. Feeding techniques	*Feed Production for Livestock and Fish*	More theory and shallow without practical demonstrations
Cage construction and maintenance	*Not offered*	Completely lacking due to lack of technical capacity and lecturer
13. Water quality control and maintenance	*Aquatic Biology and Water Quality Management*	Need practical and equipment to demonstrate-sampling toolkits
14. Fish handling and processing Technique	*Post- Harvest Handling and Value Addition*	Need to be comprehensive and enhanced with practical demonstrations but lack equipment
15. Quality control and Quality	*Food Inspection and Quality*	This needs to be more focused on the

Assurance	*Assurance*	sector

Important content gaps demanded from the survey by aquaculture operators includes:

- Fish Nutrition and Fish Feed formulation at farmer level,
- Production systems including flexible fish farming systems like using tanks, recirculation systems (RAS), aquaponics and others,
- Fish diseases and management, Pest and disease control in fish farms,
- Economics of fish farming/ aquaculture,
- Data management and analysis and reporting/ Computer,
- Hatchery management,
- Fish breeding,
- Feeding techniques,
- Cage construction and maintenance,
- Water quality control and maintenance,
- Fish handling and processing Technique and Quality control and Quality Assurance (see Table 4).

This contrasts with what the current FTI Diploma in integrated Aquaculture and Agriculture (DIAA) syllabus offers that seemingly looks closer to the demands highlighted by the aquaculture operators during this mission, but with clear gaps that can only be appreciated when you closely examine the content underlying the DIAA syllabus of FTI. The lack of content depth and poor enrichment with case studies, coupled with largely theoretical topics that gives less room for adequate demonstration and practical engagement makes it difficult to deliver and inspire students for implementation in the field to the extent the technical value is not fully realized by the aquaculture operators where the FTI graduates and interns offer services.

Moreover, the DIAA syllabus (Fig.1) seems to be overloaded with many subjects which could have been optional or undertaken under different arrangements making it cumbersome to focus on competencies in specific technical areas urgently needed in the aquaculture sector as noted by the aquaculture operators. Of course, it can be seen that the overloading is intended in its targeting to justify the stretch needed to complete the 2 years, which seems unpopular with the emerging technological era.

There is need to combine some subjects which falls in the same band of skilling and expertise to ensure a well streamlined market-led aquaculture training rather than following the traditional academic focused syllabus. Indeed, it suffices to have a Diploma in aquaculture curriculum with a syllabus that focuses on the commercial aquaculture development and pays detailed attention on providing solutions to the key concerns of the aquaculture operators as was indicated in the survey (Table 4).

It will be necessary for FAO True-Fish project to work with FTI to focus on the gaps identified in the syllabus and streamline the subjects emphasized by aquaculture operators into the DIAA syllabus without changing the syllabus but creating the needed enrichment, specifically for the aquaculture subjects. This can form one of the key discussion points by FAO True-Fish with FTI to find the best fit for the aquaculture training syllabus in view of the gaps identified and based on the strategic actions.

3.5 FTI Aquaculture Department Staff assessment for skills and technical Capacity

Structured questionnaires were purposely administered to all the five-aquaculture staff/lecturers of FTI to gauge their technical capacity - skills and challenges they face in delivering the training to the aquaculture students. The findings are presented in Annex 3, Table 5 and summarized in table 4 as indicated here.
There are 3 lecturers with relevant MSc degree, 2 lecturers with BSc degree and are all trained in fisheries and aquaculture related studies, with additional short-term trainings in China in aquaculture courses. The two BSc holders had Fish breeding courses in China, and one staff had international training in Leadership and Management at UNU.

In spite of the adequate training depicted by the lecturers, they noted a number of challenges that they encounter in training their students. These include:

- Inadequate training equipment and lack of enough Facilities to deliver Practical based training
- Less attention paid on Practical based training due to limited equipment and lack of funds for procuring practical equipment and material requirements
- Lack of necessary practical and technical textbooks and unreliable internet provision
- Lack of demonstration facilities to match the number of trainees who have increased beyond the originally planned institute capacity
- From the assessment the FTI staff suggested possible intervention that can help them improve their capabilities as trainers to improve their training delivery, which include:
- Need for short refresher training courses to upgrade their studies in the areas of market demand
- Provisions for aquaculture training resources, textbooks and free internet
- Standard technical teaching guides, up to date with changing technology with relevant aquaculture equipment
- Need for training materials and tools like projectors to facilitate delivery of lessons in classrooms.

In addition, recommendations were made in relation to training delivery methods, which include:

1. Support for hands-on training for aquaculture skills (practical) development
2. Practical skills be enhanced in the aquaculture training to compliment the theory
3. Technical training should emphasize the learner centered teaching approach
4. Need more teaching aids like Power Point projector to enhance audio-visual demonstrations and learning for students.
5. Laboratory equipment is needed for aquaculture technology demonstrations
6. Develop a competence-based curriculum and enhance competence-based education and training
7. Writing research, publishing research papers, studies on Oceanography
8. Promote exchange programs in partnership arrangements between TVET institutions and private sector to help enhance hands-on skills
9. Need reliable partnerships with aquaculture operators (stock firms), international technical fisheries Institutions, funding research institutions
10. Partnering with Aquaculture Research Institutions like NAFIRRI/Kajjansi Research and Development Center
11. Need for support in some training programmes and Partnering with Fish farmers as well

Table 7 Summary of Training Skills Capacity Assessment and gaps for FTI aquaculture staff

Skills Assessment	Capacity Needs as indicated by lecturers of FTI	Very important capacity needs gaps for current FTI aquaculture staff
Challenges in Training students	- Inadequate training equipment - Lack of enough Facilities to deliver practical - Less attention paid on practical due to limited equipment for and lack of funds for procuring practical requirements - Lack of necessary textbooks and unreliable internet - Lack demonstration facilities to match the number of trainees	- Practical Training session and feedback, - Preparing the training, - Training delivery, - Presentation skills, - Training & Responsibility – Ownership & Commitment, - Listening - The core skill, - Influencing and Inspiring, - Designing sessions and the course with creativity, - Methods of training
Any Intervention	- Need frequent refresher course trainings - Need short refresher training courses to upgrade their studies - Provision of aquaculture training resources, textbooks and free internet	

	- Need clear technical teaching guides, up to date with changing technology with relevant aquaculture equipment - Need training materials and tools like projectors	-Discussions, Role play, - Appreciation and Gratitude as a vital tool
Recommendation in training Methods	- Need hands-on training for skills (practical) - Practical be enhanced to compliment the theory - Technical training with emphasis on Learner centered teaching approach - Need more teaching aids like Power Point projector to enhance audio-visual demonstrations and learning. - Laboratory equipment needed for aquaculture technology demonstrations	
Training Partnership:	- Exchange programs in partnership with sister institutions and private sector to enhance hands-on skills - Need reliable partnerships - Need reliable partnerships with stock firms, international technical fisheries Institutions, funding research institutions - Partnering with Aquaculture Research Institutions like NAFIRRI/Kajjansi Research and Development Center - Partnering with Fish farmers as well - Need support in some training programmes	
Other suggestion:	- Develop a competence-based curriculum and enhance competence-based education and training - Writing research, publishing research papers, studies on Oceanography - Exchange programs partnership with sister institutions and private sector to help enhance hands-on skills	

Recommendation for type of skills development needed for FTI training staff (Lecturers) to meet the demands of the aquaculture sector in Uganda are reflected in the prioritized content in the curriculum as in table 5 below.

FTI training staff (Lecturers) need to develop technical competence in the commercial aquaculture production systems, fish feed, and fish seed. Key content that can be included in the curriculum include: Designing production, feed and aquaculture systems and appropriate seed production technologies adapted for Ugandan fish farmers; training in aquaculture for farmers, students and professionals; Assessment of environmental issues and developing mitigation measure for production systems in aquaculture; Setting up demonstration farms, identifying, testing and adopting appropriate technologies; Aquaculture enterprise development both at farm and sectoral development levels; Fish health management - diagnostics and clinical services. As indicated in Table 8 below.

Table 8: Prioritized Content to be included in the Curriculum for FTI Diploma Aquaculture Students training

Strategic capacity development actions as identified in TNA		
Intensity of need for implementation of chosen capacity needs content for curriculum (Please indicate High, Medium, Low) Note: it is expected that no more than 3-4 elements would be implemented at High intensity		Give an indication of how chosen capacity needs content will be implemented. (FTI and FAO-TrueFish to review all the needs identified and agree on the optimal curriculum that will be enriched with new suggested content as below.)
Aquaculture Biology and	High	Applied Biology of Commercial Aquaculture Species:

Production Systems:		Tilapia and Catfish, Trout, and Carp, Physiological Systems and Applied Biology Respiratory and Re-circulatory systems; Digestive and Endocrine systems; Nerve, Skeletal and muscle systems. Different Production systems and their operations. This is foundational and needs to be backed by upgraded Aquaculture biology resources and knowledge of production systems to acquaint learners with the knowledge of aquaculture commercial fish Biology and preparation of production systems
Fish feed:	High	Key content to focus on include Nutrition and Feeding of Aquaculture Species; Nutritional requirements; live feeds; Formulation and manufacturing of artificial feed; Feed management: Application and Monitoring. This is very essential for the aquaculture development which takes about 60 % of Aquaculture production requirements. So, the need to build capacity of learners in this aspect is very significant
Fish seed:	High	The intervention should promote capacity of quality seed production knowledge and skills which is low. Can do this by including in the curriculum content on appropriate seed production technologies adapted for Ugandan fish farmers
Water quality parameters Monitoring and Management of water quality:	High	Capacity building needed in Assessment of water quality and environmental issues and developing mitigation measures for production systems in aquaculture
Aquaculture enterprise development both at farm and sectoral development levels;	Medium	Setting up demonstration farms, identifying, testing and adopting appropriate technologies;
Processing and Product Development:	Medium	Processing, storage & Quality control Product development, Fish preservation and marketing,
Fish health management - diagnostics and clinical services:	Medium	Disease recognition and identification; Disease treatment and prevention; Common diseases of fish and shellfish

3.6 Assessment of the FTI facilities and equipment

Assessment Findings and Gaps

There are identified concerns about the FTI, particularly in respect to the FTI facilities and equipment related to current aquaculture trainings delivered.

- The FTI campus owns land of over 7.5 hectares and conveniently has a 1.5km shoreline along Lake Victoria that makes it convenient to invest in cage fish farming training for the students and in-service aquaculture operators,
- The institute has a conducive learning environment with recreational facilities like a sports ground with changing rooms, washrooms and a secure perimeter fence.
- It also has three student hostels with a total capacity of 250 resident students, 16 staff housing.
- There are adequate lecture rooms and hostels for students with a big main dining hall, main administration block, and an aquarium and fish hatchery.
- There is also a 60-seater library, fully stocked computer laboratory, one net shed, a Chorkor oven (kiln) – a newly acquired modern fish processing equipment. The Institute has an active website

- There are two workshops – a marine engineering workshop and a boat building yard unique to FTI and uses fiber glass technology in boat construction with highly experienced and specialized staff.
- A police post and marine and fish protection unit are also on the site.
- However, there are some notable challenges that exist with these resources. For example,
- There is limited accommodation for female students and staff and so more accommodation facilities are proposed in the FTI strategy.
- The students lack transport to take them around for study visits and purchase of a convenient bus is proposed.

Aquaculture based facilities/services that need immediate funding include:

i. Aquaculture equipment are much needed for practical demonstrations and training, among others and they include equipment for culture systems of (a) liner pond; (b) earthen pond; (c) recirculating aquaculture systems; (d) cage culture (e) circular concrete tanks (f) collapsible PVC tank.
ii. There are some facilities that are not functional at all like the fish hatchery, which needs complete overhaul and refurbishment.
iii. Other supporting Infrastructure like - girls' hostel
iv. Maintenance of lab equipment and provision of practical materials
v. Support for intern student attachments and their capacity building

The key challenge is the chronic lack of adequate funding to replenish the facilities and ensure upgraded operations. This means there is need to prioritize to ensure the very essential facilities can be provided by the project as indicated in Table 9 below.

1. Additional aquaculture facilities needing immediate attention that have been identified in the FTI list of requirements include the renovation of lab requiring civil and electrical works, Equipment such as Wet Lab Computer and Hatchery, and Learning materials like text books for aquaculture, integrated aquaculture and agriculture, fish processing technology and fishing and gear technology, and ICT & internet.
2. Mechanical workshop can be equipped for cage culture engineering training support.

Statement of the Principal of FTI

"…our training may not be sufficient in some respects such as fish nutrition and fish feed formulation, aquaculture/fish genetics and breeding as well as fish health. However, our urgent need is to address the challenge of inadequate supporting materials /equipment and facilities for Practical. Equipment and materials, facilities required for better training needed more detailed focus. For instance, we need pilot feed manufacturing plant, equipped feed/nutrition analysis laboratory, functional hatchery, functional microbiology laboratory, fish disease and parasites diagnostic laboratory, simple genetics laboratory, fish cage production workshop, tools for aquaculture engineering, chemical reagents. Once these are in place, they should indeed be run and managed under a business model for sustainability.

FTI should devise means of organizing regular stakeholder's symposium to show case or exhibit what we are doing for publicity and to overcome assumptions among the employers of its graduates.
Regular training of staff for capacity enhancement is a highly welcome as proposed by the consultant but we propose that the consultant should visit FTI and also organized 1or 2 days' consultative workshop with stakeholders for a clear and true training needs assessment of the institute in delivering aquaculture training."

Table 9. Prioritized facilities and equipment needed for effective training of the FTI Diploma aquaculture Training

Strategic capacity development actions as identified in FTI TNA		
Intensity of need for implementation of chosen capacity needs for facilities and equipment (Please indicate High, Medium, Low) Note: it is expected that no more than 3-4 elements would be implemented at High intensity		Give an indication of how chosen facilities and equipment capacity needs will be implemented. (FTI and FAO-True Fish to review all the needs identified and agree on the optimal facilities and equipment that are essential.)
Pilot feed manufacturing plant, equipped feed/nutrition analysis laboratory,	High	Proximate analysis of content of food nutrient proportion in the feeds is needed for analysis of feeds so as to ensure proper nutrition
Functional hatchery,	High	Is needed for demonstrations of successful establishment of a seed production unit, which is indeed essential.
Functional microbiology laboratory,	medium	Laboratory equipment needed for aquaculture technology demonstrations. Equipment such as Wet Lab Computer and Hatchery are all essential for hands-on operations of aquaculture production unit. The project can make further assessment from FTI to find a win-win situation on how best to implement this
Fish disease and parasites diagnostic laboratory,	Medium	
Simple genetics laboratory,	Medium	
Fish cage production workshop,	High	Mechanical workshop can be equipped for cage culture engineering training support. Cages are the main aquaculture production system currently and demand for cage engineering skills is high and will be good to explore more how facilities can be established at FTI, which already has some starting point.
Tools for aquaculture Production Systems engineering,	High	All equipment for production systems is needed, which will include aquaponics, RAS, Tanks, cages, ponds establishment equipment
Chemical reagents	Medium	Yes, needed in tests and can be in relation to the demonstrations in the training
Teaching aids and equipment like Power Point projector	High	This is to enhance audio-visual demonstrations and learning.
Learning materials like textbooks for aquaculture,	medium	Integrated aquaculture and agriculture, fish processing technology and fishing and gear technology, and ICT & internet.

4.0 Proposal (Outline without Content) of a Competence-Based aquaculture curriculum for FTI

4.1 Introduction

In line with the requirement of the ToR for this assignment a proposal was to be developed for a practical aquaculture curriculum for the Fisheries Training Institute. The curriculum has been developed to enrich the regular DIAA syllabus with complementary short courses needed for providing the skills and knowledge demanded by the aquaculture sub- sector. The proposal is a product of the foregoing assessments for the technical capacity of the TVET institutions with particular focus on FTI as a key fisheries and aquaculture TVET in Uganda. It derives from a performance assessment of FTI graduates in the field, capacity assessment of the FTI and its aquaculture staff including the current DIAA curriculum review and analysis that were undertaken in view to streamlining the aquaculture syllabus that meets the present training needs for aquaculture development by aquaculture operators. This also derives from the gaps in the training capacity of FTI and the information on functional review of FTI graduates gathered from the aquaculture operators and the LG employers of the graduates rolled out from FTI for the last 10 years.

4.2 Proposed competence-based aquaculture curriculum for FTI

The Proposal suggests a revision and upgrade of the FTI DIAA syllabus following the given outlined content in the next section 4.3 that addresses the needs identified in the training needs analysis, and it accounts for greater inclusion of practical training, business management subjects, sustainable aquaculture practices and technologies, and it is intended to ensure not only a national but also a regionally consistent approach between other TVET institutions.

The proposed curriculum has provision for flexibility to cater for shorter tailor made courses that can be customized for different categories of trainees due to the structured Topics that can be selected to build capacity of FTI staff via a Training of trainers for the FTI institute in relevant core disciplines e.g. aquaculture technology (especially cage culture), feeds and nutrition, aquatic animal health, quality control and processing, business studies) and in the pedagogical approach to practical training. The proposed curriculum will be developed and supported further to deliver pilot implementation by other TVET institutions of short, tailored training courses/Topics, for instance trainings for aquaculture trainers (fish farmers, extension workers, freelance trainers/consultants) on fish nutrition and feeds, fish health related issues (disease management practices, fish movements, etc.), water quality monitoring. This can include courses benefitting aquaculture operators who agree to work with the TVET institutions for partnership hands on skilling and facilitate the training placements. It can also include trainings of outreach aquaculture operators (with hatchery, “aquashops” - local suppliers of aquaculture inputs and technical advice - and feed production/ distribution activities) who demonstrate willingness and capacity to extend training services to their commercial clients under the supervision of TVET institutions. Such operators shall also be supplied with limited aquaculture field equipment kits and training materials.

4.3 The proposed outline of the curriculum structure

Duration of the proposed curriculum programme shall be four semesters distributed in a period of two years. Each semester consists of a minimum of 85 working days, including examination, distributed over 17 weeks each of 5 working days.

YEAR ONE - Semester 1

No.	Course code	Course Title	TH	PH	CH	Credits
	DAF -1101	<u>Limnology</u> **Aim:** To introduce the students to basic concepts of limnology and Aquatic Biology **Objectives:** 1. To familiarize the students with the freshwater and marine environment as the habitat of fish, 2. To acquaint the students with the processes taking place in the water 3. To introduce the students to the major instruments for measuring various water parameters 4. To develop awareness among the students on marine and inland resources and the need for their conservation. **Course Content outline** Topic 1: Definition and scope of Limnology, Topic 2: Structure and types of inland waters; lakes, rivers, streams. Topic 3: Sea and lake formation, Topic 4: Pond parameters, structure of pond communities, phytoplankton, zooplankton benthos, Topic 5: Flow of matter and energy interactions, effects of pond fertilization and liming Topic 6: Biomass and primary productivity	45	30	45	4
	DAF -1102	<u>Introduction to Computer Science, Communication and Information Technology</u> **Aim:** To expose the students to basic computer science, communication and information technology concepts and applications. **Objectives:** Ensure students acquire knowledge and skills in disk operating system, Microsoft windows, windows based word processing programmes, windows based spread sheet etc., Introduction to statistics and statistical packages.	30	30	45	3
	DAF -1103	<u>Introduction to Aquaculture</u> **Aim:** To expose the students to Concepts of aquaculture and general characteristics of fishes, and shell fishes, possibilities and prospects of aquaculture as a science, aquaculture practices and management **Objectives:** Ensure active student participation in activities connected with basic aquaculture practices and be	45	30	60	4

		able to: differentiate Aquaculture from fisheries which deal with the catching, processing, and selling of fish and other seafood taken from natural environments. To understand research similarities and differences between aquaculture and fisheries, and to compare and contrasts between aquaculture and agriculture. To acquire understanding about role of Aquaculture & Our Changing Planet, and about Overcoming Challenges Provide basic understanding of biological, chemical and environmental concepts pertaining to aquatic environment. Acquaint students with various fisheries and aquaculture institutions and their activities. **Course Content outline (Each Topic 6 Hrs.)** Topic 1: Introduction to prospects of aquaculture as a science, aquaculture practices and management Topic 2: The role of Aquaculture & Our Changing Planet, and about Overcoming the Challenges Topic 3: Freshwater and marine fish farming Topic 4: Water quality parameters Monitoring and Management of water quality Topic 5: Aquaculture for stable environment Topic 6: Fisheries and Aquaculture governance				
		<u>Principles of Hatchery Technology for Aquatic Organisms</u> **Aim:** To impart a basic knowledge on the operation of commercial hatcheries. **Objectives:** 1. To understand the current methodology and various techniques of commercial seed production including larval food production. 2. To develop basic knowledge on the spawning, larval rearing and feeding of the commercially important species 3. To demonstrate competency in Hatchery Management **Course Content outline (Each Topic 9 Hrs.)** Topic 1: Tilapia Hatchery Topic 2: Tilapia Production System Topic 3: Seed Production of other Fishes Topic 4: Seed Production of Crayfish Topic 5: Live Feeds - Algal production, replacement diets of live algae, rotifers, cladocerans, copepods, Artemia. Culture of Fresh water zooplankton, larval	30	60	60	4

		food premises and additives. Feeding regimes for larvae, post larvae, fry and fingerlings. Topic 6: Hatchery Management - Planning for hatchery construction, site selection essential components of a hatchery. Topic 7: Requirements of brood fish and brood fishponds, hapas, hatchery design and layout, operation and hygiene.				
5.	DAF -1104	<u>Water quality management and Soil Quality Parameters</u> **Aim:** To learn effective soil and water quality management practices **Objective:** To facilitate the students in decision-making process in regard to soil and water quality monitoring: soil and water quality standards; soil and water quality monitoring and management.	30	30	45	3
6.	DAF -1105	<u>Fish Biochemistry and Nutrition I</u> **Aim:** To acquaint students with basic Principles of biochemistry and nutrition **Objectives:** To know the definition and role of biochemistry – a study of the substances and chemical processes which occur in living organisms. To know the role Biochemistry plays in identification of the substances, studying of their structure, and in determining how they are synthesized and degraded in organisms, and elucidating their role in the functioning of the organism. To get an overview of the general principles of fish nutrition as they relate to aquaculture; and understand a critical role nutrition plays in intensive aquaculture in influencing production costs, fish growth, health and waste production **Course Content outline:** ic 1: The Principle of biochemistry deals with the structures and functions of cellular components such as proteins, carbohydrates, lipids, nucleic acids and other biomolecules and their synthesis and degradation. ic 2: To understand how biological molecules give rise to the processes that occur within living cells which in turn relates greatly to the study and understanding of whole organisms ic 3: Principles of fish nutrition: - aquaculture production as a major industry in many countries, with potential sustained growth as the demand for fisheries products increases and the supply from natural sources decreases.	30	30	45	3

		ic 4: To develop competencies in the knowledge of a species' nutritional requirements so as to meet those requirements with balanced diet formulations and appropriate feeding practices and ensure cost-effective diets, ic 5: Major nutrient groups - Energy-yielding nutrients, Proteins, carbohydrates and lipids as distinct nutrient groups that the body metabolizes to produce the energy it needs for numerous physiological processes and physical activities. ic 6: Notes on Proteins and amino acids, Lipids, Micronutrients –Minerals, Vitamins, Digestion and metabolism. Intermediary metabolism, Nutrient and energy utilization. <u>Fish Biochemistry and Nutrition Practical I</u> : Preparation of chemical solutions, buffers and reagents. Estimation of glucose and protein in fish tissues. Extraction and estimation of total lipids from fish tissue.				
7	DAF -1106	Rural innovation and sociology	30		45	2
			Total			23

YEAR ONE - Semester 2

No.	Course code	Course Title	TH	PH	CH	Credits
8	DAF -1201	Management of aquaculture facilities	30	60	60	4
9.	DAF -1202	**The Fisheries and Aquaculture Institutional structure and governance** **Aim:** To acquaint student with knowledge of the key institutions involved in aquaculture and the roles played in governance and sustainable production. Uganda Constitution, Fisheries and Aquaculture Act and Policy, Government Strategic programmes and sustainable Environment. Decentralization and service provision The importance and aims of best management practices in Aquaculture The importance of BMPs in aquaculture is driven by: a) The need for aquaculture to be in compliance to legislative obligations, b) The need for resource protection and conservation, c) The need for resource use to be equitable, responsible and sustainable, d) The need for the aquaculture sector to become recognized as environmentally responsible and sustainable, e) The need for the aquaculture sector to provide independent norms and standards by which it can be held accountable, and f) The need for the sector to illustrate adequate environmental due diligence.	30		30	2
10.	DAF -1203	**Principles of Genetics and Fish Breeding** **Aim:** To provide basic idea of fish heredity and genetics, recent advances in biotechnology and biostatistics relevant to aquaculture **Objectives:** 1. To provide basic idea about the principles of genetics and depict the hereditary mechanism in cultured species 2. To acquaint with the state-of-the-art techniques in biotechnology as applied to aquaculture industry. **Course Content outline (Each Topic 9 Hrs.)** Topic 1: Basic Genetics. Topic 2: Selection and Hybridization Topic 3: Aquaculture Biotechnology Topic 4: Marine Biotechnology Topic 5: Basic Statistics	30	30	45	3

		Topic 6: Statistical Tests				
11.	DAF -1204	Research methods & Basic statistics	30		30	2
	DAF -1205	<u>Fish Biochemistry and Nutrition II</u> **Aim:** To learn about the Principles of Biochemistry and gain an understanding into Feed ingredients, formulation and manufacture **Objectives:** To gain an understanding about the Principles of Biochemistry and major biomolecules in foods and their important functions. **Course Content outline** Topic 1: Feed Ingredients, Feed formulation and Feed manufacturing Topic 2: Feeding practices, Natural foods Topic 3: Feeding schedules based on water temperature and/or fish size, Feeding to apparent satiation Topic 4: Feeding frequency and distribution, Medicated feeds **Fish Biochemistry and Nutrition II Practical** Aim: Applications of paper chromatography, thin layer chromatography, ion exchange chromatography. Principles of electrophoresis. Estimation and separation of proteins by electrophoresis; Determination of saponification and iodine values. Determination of lipase activity. Gel filtration. Preparation of tissue homogenate and organelle isolation.	15	30	30	2
	DAF -1206	**Fishery Microbiology and Fishery Byproducts** **Aim:** To develop basic understanding about microbiology with special reference to fish culture environment for better management of the culture ponds and the products. **Objectives:** To know different types of microorganisms associated with fish and shellfish spoilage. To learn the growth and survival of microorganisms in food. To develop understanding about the microbiology of culture pond To understand the role of microbes in nutrient cycling in a pond To create awareness about the health significant bacteria in culture pond To develop understanding about perishability of seafood and the importance of better time/ temperature management of aquaculture produce **Learning Outcomes** 1. Student can know microorganisms associated with aquatic environment and fish and their role in	30	30	45	3

		spoilage of fish. 2. Student can learn food spoilage microorganism and their growth in food. **Course Content outline (Each Topic 9 Hrs.)** Topic 1: Introduction Topic 2: Aquatic Microbiology Topic 3: Aquaculture Microbiology Topic 4: Fish Microbiology Topic 5: Fishery By-Products Topic 6: Value Added Products				
	DAF -1207	Processing and Product Development Processing, storage & Quality control Product development, Fish marketing,	30	30	45	3
	DAF -1208	Real life project	-	90	45	4
			Total			**23**
		Industrial Training (Recess)	15	90	45	3

YEAR TWO - Semester 1

No.	Course code	Title			Hr./week	Credits
	DAF -2101	<u>Applied Biology of Aquaculture Species</u> **Aim:** To impart an in-depth knowledge on the biology of aquatic organisms used in aquaculture practices. **Objectives:** Introduce the students to general characteristics of Aquaculture Species: Tilapia, Catfish, Carp, and Trout. To study the physiology of feeding, digestion, growth, reproduction in fishes. **Course Content outline (Each Topic 6 Hrs.)** Topic 1: General Characteristics of Fishes in aquaculture practices. Topic 2: Physiological Systems and Applied Biology Topic 3: Respiratory and Recirculatory systems. Topic 4: Digestive and Endocrine systems. Topic 5: Nerve, Skeletal and muscle systems. <u>Practical: Biology of Fishes</u> **Aim:** To have a working knowledge of the general aspects of fish and shellfish biology **Objective:** To describe the anatomical features of the fin fish and shell fishes, to study the growth, feeding and reproductive physiology of these groups with a view to understand the life cycle of the fin fish and shellfish species.	30	30	45	3
	DAF -2102	<u>Fish Breeding and Applied Endocrinology</u> **Aim:** To impart theoretical knowledge necessary for the breeding and rearing of aquatic organisms. **Objectives:** To understand the endocrine regulation taking place in fishes and shellfishes during reproduction Principles and methods in aquaculture of freshwater organisms, ecology of reproduction, brood stock selection and management, management of ante spawning and spawning units. Gonadotropin and Gonadal changes in natural fish breeding, applied endocrinology homoplastic and heteroplastic hypophysation use of steroids, gonadotropins or their analogues in induced fish spawning. Breeding substrates, stripping, wet and dry fertilization hatchability larval and post larvae management, fry rearing. Aquaculture of planktonic fish food, raising of fingerlings up to marketable sized fish.	30	60	60	4

	DAF -2103	**Feed Formulation and Analysis** **Aims:** To manage feed and feeding in aquaculture farms To learn the feeding physiology, feed composition **Objectives:** To provide a basic understanding about fish nutrition, feeding physiology, nutritional requirements, feed composition, formulation of nutritionally balanced feed, production and use of live feed for optimal production. **Course Content Outline** Principles of Feed formulation, Effects of protein intake on metabolizable and net energy values of fish diets, Nutritional requirements of fish, and feeding strategies/techniques Feed stuffs and their digest abilities conventional and nonconventional protein sources in practical fish diets. Manufacturing of fish feeds, Additives in fish fees. Effects of processing on stability of heat labile nutrients, quality control in fish feeds.	30	60	60	4
	DAF -2104	**Aquaculture Production Systems engineering** Aim: Introducing to students Aquacultural engineering as a multidisciplinary field of engineering and that aims to solve technical problems associated with farming aquatic vertebrates, invertebrates, and algae. **Objectives:** To equip students on Common aquaculture systems requiring optimization and engineering including sea cages, ponds, aquaponics and recirculating systems. **Course Content outline (Each Topic 6 Hrs.)** Topic 1: Evolution of fish culture, history of Aquaculture in Uganda, status of Aquaculture, potential of Aquaculture and prospects. Fish as a group, fish as a commodity. Ecology of fish production tank culture; glass, concrete, plastic, aquaponics, pond, dam and cage cultures. Reservoirs reticulated and open water systems. Associated problems of aquaculture production. Topic 2: Aquaculture Systems Topic 3: Design and Management Topic 4: Site selection & System design; Pond management Topic 5: Farm Engineering Topic 6: Farm Design and Equipment	15	90	60	4

		Topic 7: Various systems used in aquaculture production in Uganda (Hatcheries, open farming systems, Recirculating Aquaculture Systems (RAS), land-based production systems, aquaponics, biofloc, Integrated Multi-Trophic Aquaculture (IMTA), cages, tanks, ponds etc.). Topic 8: Construction and maintenance of cages, tanks, and ponds.				
	DAF -2105	<u>Fish disease (Pathology) and Fish Health Management</u> **Aim:** To equip the students for the health management in aquaculture farms and to provide a basic understanding of various types of diseases encountered in aquaculture and also to provide understanding on the principles of aquaculture engineering. **Objectives:** To understand the various types of diseases among the cultivable fishes, to learn and apply methods of control and precaution of diseases. Disease recognition and identification; Disease treatment and prevention; Common diseases of fish and shellfish To understand the tools for diagnosis, and disease management strategies available today. To understand the role of environment as an important player in infectious diseases. **Course Content outline (Each Topic 6 Hrs.)** Topic 1: Protozoan Diseases and Bacterial Diseases Topic 2: Fungal Diseases and Viral Diseases Topic 3: Nutritional deficiency & Immunology Topic 4: Health Management: water management and health of the fish,	15	30	30	2
	DAF -2106	<u>Fish Preservation Techniques and Value Addition</u> **Aim:** To provide an understanding of value addition and its importance in fish processing to start an enterprise. **Objectives:** 1. To outline different fish-based value added products. To give an understanding of post-harvest handling 2. To provide an overview of various methods involved in post-harvest 3. To briefly describe various processes involved in fish and shellfish value addition 4. To study various byproducts originating from fishes and their importance. 5. To impart knowledge about the storage and	30	30	45	3

		marketing of fishery products				
			Total			20

YEAR TWO - Semester 2

No.	Course code	Title			Hr./week	Credits
	DAF -2201	Fish Processing Technology, Product Development and Quality Control **Aim:** To provide a basic idea about the post-harvest technology of fish and fish products., Processing, storage & Quality control Product development, Fish marketing, **Objectives:** **To empower students with present day technologies involved in fish processing and to provide a firm understanding on the various quality requirements in seafood industry.** 1. To give an understanding of post- harvest handling 2. To provide an overview of various methods involved in post-harvest including Processing and Product Development 3. To impart knowledge about the storage and marketing of fish and fish products **Course Content outline (Each Topic 9 Hrs.)** Topic 1: Introduction Topic 2: Freezing and Canning Topic 3: Drying, Salting, Smoking and Freeze-drying Topic 4: Fish Inspection and Quality Control Topic 5: Quality Assurance (Competent Authority role) Topic 6: Packing, Cold Storage and Export of Fishery Products	15	60	45	3
	DAF -2202	Aquaculture Economics and Business Planning **Aim:** To know the economic analysis of various fishing, farming and processing activities. Objectives: 1. To have an idea of basic economic principles 2. Understanding the principles of business 3. To know more about fisheries cooperatives **Course Content outline (Each Topic 6 Hrs.)** Topic 1: Introduction Topic 2: Basics of Business Topic 3: Marketing and Economic Analysis Topic 4: Aquaculture Economics Topic 5: Aquaculture Business enterprises development and management	30	30	45	3
	DAF -2203	Extension Methods Aim: To Examine extension methods; nature and classification and selection and use of appropriate methods in implementing extension programmes. And give an overview of (audio-) visual aids their role and use in	15	30	30	2

		extension work, including practical training on producing good visual aids. **Objectives:** To enable students, understand extension and education as essential dimensions of extension work and build their capacity to facilitate extension teaching/learning events in different extension situations **Course Content outline:** Topic 1: Concept of (human) communication and the communication process Topic 2: Extension and education (teaching/learning) as fundamental and interlinked dimensions of extension work Topic 3: Designing and delivering effective extension messages to relevant extension audiences Topic 4: Selecting and using appropriate extension methods and/ or techniques and devices. Topic 5: The role of visual aids in extension teaching/learning situations Topic 6: Participatory Rural Appraisal (PRA) methods in extension work. Topic 7: Gender issues, rural sociology and Tourism as part of extension methods. Topic 8: Workshop and conference organization				
	DAF -2204	**Fish inspection and quality assurance** Care of fish catch, Post-harvest practices, bad handling, Hygiene of personnel, organoleptic tests, microbial tests, types and mechanisms of fish spoilage; autolytic bacterial, rancidity, control of post-harvest losses. Processing Technology and Quality control. Biochemical composition of fish and proximate analysis. Principles of separation and identification of food components by chromatographic, spectroscopic and immunochemical methods. Refrigeration, drying, salting, curing, fermentation, smoking, canning and irradiation. Quantitative physic/chemistry of harvesting, processing, storing, packaging and marketing aquatic foods. Quality control and assurance in fish processing. Total quality management ISO	30	30	45	3

		9000, value-added fish products and by-products utilization. Solving problems of man and energy transfer with regard to processes and to change in important food components. Use of computer process control involving basic food engineering principles.				
	DAF -2205	Research report	15	90	60	4
	DAF -2206	Real life Project Work	-	90	45	3
			Total			18

5.0 Proposal of the equipment FTI needs for properly delivering the aquaculture curriculum

The proposal of the equipment that the Institution needs to purchase and install for properly delivering the proposed curriculum, with the assistance of FoodTechAfrica via FAO/TrueFish is in line with the proposed curriculum in chapter 4. It follows the assessment of FTI staff on the training methods capacity and challenges encountered in delivering aquaculture curriculum to the students.

The assessment of facilities and equipment at the Fisheries Training Institute in Uganda indicated that there is inadequate facilities and equipment for practical training, with the most obvious being the total lack of training capacity in any aspect of cage culture, which is the fastest growing segment of the national and regional industry. Therefore, it is notably important to extend practical training to cage construction and cage culture management if FTI as a key fisheries and aquaculture training institution is to have any impact on development.

The chronic and deplorable state of aquaculture training bedeviled by lack of facilities and equipment at FTI is tied to underfunding and inability to attract investment and transform into a business-like profitable organization. The government only provides funds for salaries and maintenance with some small student grant, which cannot cater for the required modern technology equipment and learning materials for the institute. The funds generated by private student intake and off-the-cuff training courses paid for by participants, or production and sale of semi-commercial inputs (fry and feed); revenues are absorbed by the treasury account, so there is no significant cross-finance. Therefore, the institutions need to develop, supported by the TrueFish project a business plan for covering gaps in funding

There are other gaps that were identified in educational provision to students by staff and need also to be filled and these include:

- improved practical demonstration/pilot facilities (feed production, hatcheries, ponds, cages, presentation and processing)
- upgraded laboratories and measurement equipment (for testing feeds, water quality parameters)
- improved educational resources (computers, AV facilities, internet, libraries)
- improved physical facilities (classrooms, hostels)
- revised and updated syllabi (technical as well as business subjects)
- upgrading and modernizing the capacities of staff
- The government of Uganda need to co/finance with project for refurbishment and upgrading of facilities for Fisheries Training Institute by covering the public works and major capital items, and the project to provide ancillary equipment such as field-testing kits, laboratory equipment for feed analysis and specialized aquaculture equipment where this is directly required for training.

6.0 Conclusion

The TNA for FTI identified that the relationship between the offer of skilled workers by FTI in the last 10 years against those that have been effectively absorbed by the fisheries and aquaculture sector in Uganda is significantly huge. This shows that the current aquaculture and fisheries courses are in demand and are useful for the sector at different levels. With a sample of stakeholders/respondents taken from different categories of actual and potential FTI graduates' employers due to Covid19 constraint, the large scale private aquaculture operators like SON has 100% all graduates from FTI in its service, and research institutions like Kajjansi ARDC/NAFFIRI proved to be the main employers followed by local government administrations across Uganda, then NGOs and small scale fish farmers respectively.

The TNA also revealed important content gaps demanded by aquaculture operators from the survey, which includes: Fish Nutrition and Fish Feed formulation at farmer level, Production systems including flexible fish farming systems like using tanks, recirculation systems (RAS), aquaponics and others, Fish diseases and management, Pest and disease control in fish farms, Economics of fish farming/ aquaculture, Data management and analysis and reporting/ Computer, Hatchery management, Fish breeding, Feeding techniques, Cage construction and maintenance, Water quality control and maintenance, Fish handling and processing Technique and Quality control and Quality Assurance

A tentative Aquaculture curriculum content outline is proposed to ensure flexibility in the design and to cater for academic FTI DIAA syllabus and shorter tailor-made courses that are competence focused. The new Aquaculture Curriculum can be customized for different categories of trainees due to the structured Topics that can be selected to build capacity of aquaculture trainees as well as FTI staff via a refresher Training of trainer's course for the FTI institute in relevant core disciplines e.g. aquaculture technology (especially cage culture), feeds and nutrition, aquatic animal health, quality control and processing, business studies) and in the pedagogical approach to practical training.

To implement such a competency-based aquaculture syllabus it will require the proper supporting facilities and practical equipment which this assessment identified and are also presented in a proposal.

The Consultant learnt during final draft report review that in 2020, a parallel TNA for FTI had been undertaken by the support of MAAIF in partnership with AUDA-NEPAD, ATVET, GIZ and GFA to develop a Diploma in Aquaculture (Fish Farming) Curriculum that is tailored towards competence-based training in a bid to improve the knowledge and skills. Fortunately, this Curriculum agrees closely with the finding of the TNA for FTI undertaken by the FAO True-Fish Consultant and has already been approved by MAAIF (Annex 7).

7.0 Recommendations

1. The FTI is the key aquaculture training institute in Uganda providing services in line with the ever-increasing training needs in the sector and their aquaculture courses are in demand and are useful for passing out graduates that sustain the aquaculture operations, LG technical support, and aquaculture stakeholders at different levels. Therefore, FAO True-Fish Project can rightly engage with FTI as a strong development partner by supporting the FTI aquaculture staff and attendant training facilities in view of enhancing its level of competency as a center for Excellency in aquaculture training.
2. A competence-based aquaculture curriculum must be designed or upgraded in line with the outlined curriculum content to cater for the needs of aquaculture stakeholders that were identified in the TNA to boost aquaculture production and development in Uganda. These important aquaculture content gaps demanded by aquaculture operators from the survey includes: Fish Nutrition and Fish Feed formulation at farmer level, Production systems including flexible fish farming systems like using tanks, recirculation systems (RAS), aquaponics and others, Fish diseases and management, Pest and disease control in fish farms, Economics of fish farming/ aquaculture, Data management and analysis and reporting/ Computer, Hatchery management, Fish breeding, Feeding techniques, Cage construction and maintenance, Water quality control and maintenance, Fish handling and processing Technique and Quality control and Quality Assurance
3. Proper supporting facilities and practical equipment as identified in the TNA and also presented in a proposal must be secured through the FAO True-Fish project and other donors of government support to ensure smooth implementation of the competence-based aquaculture syllabus.
4. Since FTI has already been assisted by GIZ et al to comprehensively produce Competence-based curricula for Certificate and Diploma in Aquaculture with possible modular short courses, which has been approved in 2020 by the Ministry of Agriculture, Animal Industries and Fisheries and pending implementation, there should be no further need to design a new curriculum with support of FAO True Fish Project. Instead, the FAO project should support the implementation and provision of aquaculture training facilities.
5. The Consultant after reviewing all the recently approved FTI competence-based aquaculture curriculum/ syllabi in view of the curriculum outline suggested in the report of FTI TNA and consultations with the FTI senior management and found it very compatible with the needs of the aquaculture subsector in Uganda, do hereby recommend to adopt the already approved curriculum, which will be presented separately as annex 7 volumes for your reference.

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- MAAIF. 2020. Aquaculture Training Manual for Extension Agents in Uganda. Ministry of Agriculture, Animal Industry and Fisheries; P.O Box 102, Entebbe Plot 16-18, Lugard Avenue, Entebbe-Uganda; Email: www.agriculture.go.ug; Website: info@agriculture.go.ug; Tel: +256 41 4320004
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ANNEXES

Annex 1 Terms of Reference

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Terms of Reference for National Project Personnel

Minimum number of years of relevant experience required: 1 year; 5 years; 12+years

Name:	Mr Paul Namisi		
Job Title:	National Aquaculture Training Specialist		
Division/Department:	FAO RAF / FAO Uganda		
Programme/Project Number:	GCP/RAF/519/EC		
Duty Station:	Entebbe, Uganda and home based		
Expected Start Date of Assignment:	Asap in Feb 2021	**Duration:**	20 working days
Reports to: **Name:**	Jose Parajua	**Title:**	TrueFish Chief Technical Adviser

GENERAL DESCRIPTION OF TASK(S) AND OBJECTIVES TO BE ACHIEVED

The project *"EU-EAC True Fish Farming Story in Lake Victoria Basin (*TrueFish*)"* is to contribute to the development of competitive, gender equitable and sustainable commercial aquaculture in order to support economic development and sustainable management of natural resources in the Lake Victoria basin. The specific objectives are to improve access to commercial networks for aquaculture-related businesses, increase availability of skilled workers, thereby addressing two of the most important limiting factors for the development of aquaculture, as well as to improve sustainability by mitigating risks related to aquatic animal health conditions and biodiversity. The project covers the following components: Component 1. Business (access to commercial networks), Component 2. Skills (availability and quality of local skilled workers in aquaculture related businesses) and Component 3. Sustainability (sustainable and bio-secure regional aquaculture production systems).

The Fisheries Training Institute (FTI) located at Entebbe, Uganda, was established in June 1966 as Regional Institute and it still stands so today, with a Vision of to be an Institution of professional excellence in Fisheries Management, Training, Research and Marine Safety, in order to produce competent Fisheries Managers and Practitioners and promote Marine Safety for sustainable socio-economic development. Among its Objective the Institute stimulates intellectual, and technical growth of students in order to make them productive member of the community in the Fisheries Sector; and produce crafts men, technician and other skilled manpower to meet the demands of the Fisheries Industry. The FTI offers Diplomas and Certificates in Fisheries and Agriculture related courses, like: Diploma & Certificate in Fisheries Management and Technology, Diploma in Integrated Aquaculture and Agriculture, Diploma & Certificate in Boat Building and Marine Mechanics and National Certificate in Agriculture

Under the Result Area 2.1: Upgraded practical training delivery by formal training institutions of the Component 2, Skills, and under the overall managerial and administrative leadership of the FAO RAF ADG, the Project Budget holder and the technical guidance/supervision of the Project Lead Technical Officer (LTO) and the Project Technical Adviser (TA), the incumbent will carry out the following:

To develop a brief analysis of the existing in-country aquaculture training “offer-and-demand” in Uganda (namely: offer;

the national officially recognised institutions delivering aquaculture training and entitled to issue valid certificates, demand; to research the existing records (consulting the different available statistics) of the number of skilled specialists that have been certified by the different recognised institutions in the last ten years)
To develop an assessment of the aquaculture historic employment status: to research, out of the in the above item identified certified workers, if they have been employed in the aquaculture sector and how many others have found employment in different sectors and quantify it by sector to the extent of possible, in the last 10 years. The goal is to identify the rate or relationship between the offer of skilled workers that have been effectively absorbed by the sector. This rate or index will offer an idea of how the current courses are in demand and if they are useful for the sector, at different levels: artisanal, semi-industrial and industrial).
To analyse the FTI current aquaculture syllabi (regular courses) and short / specialised courses, not integrated within the regular programme. List of official courses and certificates and a detailed evaluation of the contents and quality of the offered courses.
To develop an assessment methodology for and to assess the skills and the technical capacity of the teachers, trainers and lecturers or similar active staffs of the FTI, providing training to the aquaculture students
To assess the FTI facilities and equipment related to current aquaculture trainings delivered.
To identify and assess the needs and gaps of the FTI's aquaculture trainings in relation with the needs of the national aquaculture operators (ponds, tanks and cages), with special emphasis of those active on freshwater in the Lake Victoria basin (Under Uganda jurisdiction). The information related to the operator's needs, additionally to the expert own knowledge on the subject, will be provided by FAO (from the agreement with FoodTechAfrica).
To develop a proposal of the outline (not the contents) of a practical aquaculture curriculum for the institution considering its potential further regular syllabi and complementary short courses needed for providing the skills and knowledge demanded by the sector. The proposal will draft just the areas or course titles and outlining the possible indexes but won't enter into the contents themselves (subject of a different contract).
To develop a proposal of the equipment that the Institution needs to purchase and install for properly delivering the proposed curriculum, with the assistance of FoodTechAfrica via FAO/TrueFish.

KEY PERFORMANCE INDICATORS

Expected Outputs:

Output	Deadline
Report detailing all and each of the above tasks	By the end of the assignment
A proposal of updated institutional curriculum	By the end of the assignment
A proposal of equipment for updating the institution's facilities.	By the end of the assignment

Minimum Qualifications

Advanced university degree in fisheries or marine sciences or natural resources management, aquaculture, or related field.
At least 5 years of experience in aquaculture capacity development / training.
Collaboration or Evaluation of Aquaculture Training Centres in the East African region is a strong asset.
Fluency in written and spoken English.
Fluency in MS Office.

Preferred Qualifications

Relevant degree
Experience working in aquaculture or aquaculture training in Uganda or the region
Relevant experience with UN agencies, especially FAO.

Selection Criteria

Experience in aquaculture related tasks as per described above.

Annex 2 List of People contacted

GreenfieldsPhilip BorelFish farmer & processor, 0752 764 764, iil@infocom.co.uk
Waficos Elisabeth Ssempebwa Chair Womens Fish Network 0772 467445 bettyssempebwa@yahoo.com
Private Sector Foundation Uganda Daniel Ojiambo, Business Advisor Fisheries 0789555984 dojiambo@cedpmgf.go.ug (Former FTI student)
Pakwach District Fisheries Office Olwoya Michael, DFO 0773363313 /Jimmy Berocan FO and Aquaculture
Mukono District William Isebaidu, Asst DFO0750581807
Makerere University Dept ZoologyGodfrey Kawooya Kubiriza, Lecturer0751902498 kubirizag@gmail.com
Sabra & Sons Fish farm Jamal Sabra, Managing Director ISM 0751770066 sabra.jamal@gmail.com; & Feed mill Abbas Sabra Managing Director S&S 0777585858 sabraandsons@gmail.com
Kajjansi Aquaculture Research Station Anthony Masaba, Technican 0712598661 masatony2014@gmail.com (Former FTI student)
Sunfish Farms Ltd Digo Tugumisirize, Owner & Manager 0772462776 digo.tugumisirize@gmail.com
IG Invest: Feed mill Jinja Ivan Kharchenko, Production Manager 0793 966011
NaFIRRI Jinja Dr. Winnie Nkalubo, Director of Research 0772518324, ataabum@yahoo.com
Jinja Fish Farmers Association JFFA Michael Walugada, JFFA, Patron JFFA 0772553329, fmwalugada@gmail.com
SON Source of the Nile Robert Osinde, General Manager SON 0756879720, 0772207216 rosinde@lakeharvest.com
IG Invest: Fish farm & feed mill, Jinja Victor Piskunovych, CEO's Assistant/Commercial Director 0794162697 pva@iginvestug.com
Mwena Aquaparks site, Kalangala Jackson Baguma, District Fishing Officer, 0772565628 0772 565628 baguma_jackson@yahoo.com
Ssenya Fish Farms Pauline Nakyewa, Managing Director, owner 0772646408 0753646408 ssenyafishfarms@gmail.com
DRF MAAIF Aquaculture Andrew Alio, Assistant Commissioner, Aquaculture Management 0772 567189 0701 567189 andrewalio@gmail.com
Fish Farm Eng Omar Wadda, Owner 0772 372797 bnkowadda2000@yahoo.com
Umoja Fish Farm Mrs Jocelyne Rugunda, Owner 0752 429 922
Aquafarm fish farm, Buloba; Fry Producer Dr. Justus Rutayisire, Owner 0772501227 jruta@infocom.co.ug
Fisheries Training Institute Ms Gertrude Abalo, Principal 0772681269 gabalo54@gmail.com
Unifood - Jinja Mr Satish Production manager 0758226003 quality.jinja@alphaafrica.com, sathishsathish239@gmail.com
Jinja Fish Farmers Association Mr Andrew Musana, General secretary 0776277733 bamusana@gmail.com, jinjafishfarmers@gmail.com
Serere District Fisheries Office Mr. John Achibu, District Fisheries Officer 07151698033 achibuekwilu@yahoo.com, achibuecea@gmail.com
Kabemaraido District Fisheries Office Mr Joseph Agaja, DFO 0775004193, joshagaja@gmail.com
Amolatar District Fisheries Office Mr Anthony Otunga, DFO 0754327369 otungaanthony@yahoo.com
Buikwe District Fisheries Office Mr James Katali, DFO 0772587760 katalijames@yahoo.com
Manjola Fish Piggery & Poultry Project Kitgum, John Okeny Owona, Chairman Tel: 0702356866/0772903291 /0772405974/0772357605 Email: john.okeny@y.com

Katabi Fish Farm	Herbert Kabyemera Kasigwa	Tel-077669916
Kukundakwe Owen	Fish farms in western uganda	Tel. 778782486

Annex3 FTI Current Diploma in Integrated Aquaculture and Agriculture

Table 5 FTI Aquaculture Department Staff assessment for skills and technical Capacity

Name	Designation/ years	Education level/Challenges/Intervention needed/partnerships	Pedagogical Training Need level
Juliet Zalwango	Lecturer/ 2 yrs	Postgraduate, MSc Maritime Affairs, University of Sweden Awarded 2020 -Has MS Office computer skills ***Trained for*** career development and alignment with subject ***Challenges Training students***: Lack of necessary textbooks and unreliable internet ***Any Intervention:*** Refresher training, provision of training resources, textbooks and internet ***Recommendation in training Methods:*** Technical training with emphasis on Learner centered teaching approach ***Training Partnership:*** Partnering with Aquaculture Research Institutions like NAFIRRI/Kajjansi Research and Development Center Partnering with Fish farmers as well	-Considers Practical training session & feedback as **a very important training need,** and the following as **important:** Presentation skills, Great Leadership Skills, Project management, Training & Responsibility - Ownership & Commitment, Listening - The core skill, Influencing and Inspiring, Shift from unhealthy patterns to inner greatness, Emotional Freedom Technique to liberate potential, Designing sessions and the course with creativity, Methods of training - Discussions, Role play, Appreciation and Gratitude as a vital tool
Kakuru John Baptist	Asst Lecturer/ Technician 19 years	BSc Degree Computer & good typing skills - Have access to computer lab but NO internet - Had Aquaculture international trainings twice in China. - Capacity building training with ADB/MAAIF - Aquaculture training with FISH Project To improve hands-on experience & knowledge ***Challenges Training students***: Lack Facilities to match the number of trainees ***Any Intervention:*** Need training materials ***Recommendation in training Methods***, Demonstrations & Practical Enhancement ***Training Partnership:*** Need support in some training programmes	Considers Practical training session & feedback plus Training & Responsibility - Ownership & Commitment, as a **very important training need**, and the rest of the following as important: Training delivery, Presentation skills, Great Leadership Skills, Listening - The core skill, Methods of training - Discussions, Role play, Appreciation and Gratitude as a vital tool
Kaganzi Seth	Lecturer/ 5 years	Has BSc Degree No access to computer and internet Had Fish breeding training in China in 2017 -Training opportunity for him ***Challenges Training students***: Lack of enough Facilities to deliver practical ***Any Intervention:*** Need short refresher training	-Considers Practical training session & feedback plus Designing sessions and the course with creativity as **a very important training need**, and the following as important: Preparing the training, Training delivery, Presentation skills,

		courses, further upgrade studies ***Recommendation in training Methods:*** Practical be Enhancement and should go with theory ***Training Partnership:*** Need reliable partnerships	Listening - The core skill, Influencing and Inspiring, Principles of adult learning, Shift from unhealthy patterns to inner greatness, Emotional Freedom Technique to liberate potential.
Mujuni Edmund	Lecturer/ 4 yrs	MSc. Fisheries Biology MS computer and typing skills Has access to computer and internet Had a Short course on Sustainable Land Management by MAAIF –Extension Dept. 2020. -To acquire practical skills on land management n Knowledge on integrated farming ***Challenges Training students***: Less attention on practical, Limited equipment for practical, lack of funds for practical ***Any Intervention:*** Need more training and teaching guides, Update with technology equipment/tools like projectors ***Recommendation in training Methods:*** Need more teaching aids, projector for film demonstration. Laboratory for different disciplines like aquaculture, gear and technology ***Training Partnership:*** Need reliable partnerships with stock firms, international technical fisheries Institutions, funding research institutions Other: Writing research, publishing research papers, studies on Oceanography	Considered as **Very important training need**: Preparing the training, Training delivery, Practical Training session and feedback, Shift from unhealthy patterns to inner greatness, Methods of training - Discussions, Role play, Appreciation and Gratitude as a vital tool, and the following are **important**: Presentation skills, Training & Responsibility - Ownership & Commitment, Listening - The core skill, Great Leadership Skills, Influencing and Inspiring, Designing sessions and the course with creativity, Shift from unhealthy patterns to inner greatness, Law of Attraction to empower the trainers, Appreciation and Gratitude as a vital tool
Oumo Joseph	Lecturer/ 10 yrs	MSc degree Has access to computer but no internet Had international training in Leadership and Management at UNU in 2016 Training expectation: better management skills for training institutes, good leadership is a basis for achieving quality training ***Challenges Training students***: Inadequate training equipment ***Any Intervention:*** Frequently consider refresher course training ***Recommendation in training Methods:*** Need more of hands-on training for skills (practical) ***Training Partnership:*** Exchange programs partnership with sister institutions and private sector to help enhance hands-on skills **Others**: develop a competence-based curriculum and enhancement of competence based education and training	Considered as **Very important training need**: Preparing the training, Training delivery, Practical Training session and feedback, Presentation skills, Training & Responsibility - Ownership & Commitment, Listening - The core skill, Influencing and Inspiring, Designing sessions and the course with creativity, Methods of training - Discussions, Role play, Appreciation and Gratitude as a vital tool, and the following are **important**: Great Leadership Skills, Conflict Handling, Project management, Principles of adult Learning, Shift from unhealthy patterns to inner greatness, Law of Attraction to empower the trainers, Emotional Freedom Technique to liberate potential

ANNEX 4. FTI SWOT ANALYSIS

Table 5 FTI's strengths, weaknesses, opportunities and threats

Strengths	Weaknesses
The only fisheries training institution in the country with proximity to the lake offering training in fisheries programmes Flexible training programmes/courses tailored to the needs of the farmers and fishing community Newly acquired modern fish processing equipment A boat building and marine engineering workshop unique to FTI Use of fiber glass technology in boat construction Highly experienced and specialised staff Own land of over 7.5 hectares Presence of staff accommodation facilities Fully stocked computer lab Adequate lecture rooms and hostels for students An active institute website	Low FTI visibility in the countryside Lack of modern equipment in the boat building and marine engineering department Inadequate library facilities, space, reference books and e-library services Fewer academic programmes tend to limit the scope Outdated organizational structure Low involvement in research Weak linkages with development partners Weak private sector linkages for hands-on training for students Inadequate transport for field training for students Few opportunities for capacity building for highly specialized courses, especially in boat building and marine engineering Low student enrolment for existing programmes Low capacity to establish demonstration and practicum sites Lack of structures to accommodate disadvantaged learners Weakness in writing proposals for funding
Opportunities	**Threats**
Favorable government policy e.g. Skilling Uganda Goodwill from partners, such as GIZ Collaboration with other government departments, such as Department of Maritime in MOW&T Government grant to the institution Establishment of Directorate of Agricultural Extension Services in MAAIF creates opportunities for employment for FTI graduates Growth of aquaculture sub-sector offers opportunities for employment Regularization of water transport Proposed establishment of Maritime Search and Rescue Centre (MSRC) at the institute	Legal mandate limits scope of training in other areas of agriculture Negative attitudes of parents and students toward TVET education Increasing number of learners prefer university education to vocational training Similar programmes offered at degree level by some universities Multi-sectoral management of water transport sector limits policy guidance in marine training Lack of expert and qualified personnel to teach boat building and marine engineering core courses at diploma level.

Annex 5; Assessment Questionnaire

(A) Training Need Assessment (TNA) Form for FTI teaching staff

Name _____ Mobile No. _____
Position _____ Email_____
Department, _____ Date of birth _____
Period of performance _____ Education level: _____

Sex: Male ☐ Female ☐

Indicate your English level by ticking (√) the appropriate blank

English Level	Reading	Writing	Speaking	Understanding
Good				
Very good				
Excellent				

Computer Skill

- Typing level English ☐ W/M
- Programs_____ _

Please use additional sheets if required.

1. Below is a check list of training areas, please rate the training areas in terms of their importance and felt need in order for you to better perform your expected duties and responsibilities as Teacher.

Please rate their importance by circling the appropriate scale below of 1 to 5, where 5 is the highest/most.

Level of Implementation as Training

1. Unimportant
2. Not so important
3. Uncertain/ undecided
4. Important
5. Very important

Contents/Topic	Level of Importance as a Training Need				
Learning Theory	1	2	3	4	5
Preparing the training	1	2	3	4	5
Training delivery	1	2	3	4	5
Practical Training session and feedback	1	2	3	4	5
Presentation skills	1	2	3	4	5
Great Leadership Skills	1	2	3	4	5
Conflict Handling	1	2	3	4	5
Project management	1	2	3	4	5
Training & Responsibility - Ownership & Commitment	1	2	3	4	5
Listening - The core skill	1	2	3	4	5
Influencing and Inspiring	1	2	3	4	5
Principles of adult Learning	1	2	3	4	5
Shift from unhealthy patterns to inner greatness	1	2	3	4	5
Law of Attraction to empower the trainers	1	2	3	4	5
Emotional Freedom Technique to liberate potential	1	2	3	4	5
Designing sessions and the course with creativity	1	2	3	4	5
Methods of training - Discussions, Role play	1	2	3	4	5
Appreciation and Gratitude as a vital tool	1	2	3	4	5

2. Is there computer accessibility in your office? Yes ☐ NO ☐

3. Is there internet accessibility in your office? YES ☐ NO ☐

4. Did you participate in any training program in the past?

Training program	Organization	Date

5. What were your expectations from this program?

_____
_____

6. What challenges do you encounter in teaching and training your students?

_____
_____
_____

7. What intervention would enable you to be a better trainer, leader and teacher?

_____
_____

8. Please suggest /recommend any improvements/innovations desired in the Training Programs.

• Training methods,

_____
_____
_____

• Training Partner ships

_____
_____
_____

- Any Other

_____
_____
_____

Fisheries Training Institute, Entebbe, Uganda

Vision

All youth should have equal opportunity to reach their full potential and contribute toward the socio-economic betterment of their communities.

Mission

We prepare our students for the greatest challenge in their life: to make decisions. For this purpose, as leaders of tomorrow they need to be knowledgeable about various disciplines and skilled in communication and analysis. Only such individuals will be best equipped to engage with people and issues from all over the world. The Fisheries Training institute (FTI) recognizes and addresses these needs by developing intellect and building character of each student through an acclaimed balanced curriculum. We're dedicated to training students using practical hands-on techniques to help them pursue a variety of in-demand career paths in Energy Sector. We provide our students with the skills, knowledge and competencies necessary to meet the entry level needs of the labor market in their chosen technical field.

How does (FTI) accomplish the above?

Objectives

1. To offer quality technical training programs.
2. To provide instructors who have extensive industry experience.
3. To provide both theoretical knowledge and hands-on applications.
4. To provide shops that will simulate the workplace.
S. To provide up-to-date tools and equipment for students to practice with.
6. To work closely with business and industry to establish and update curricula.
7. To provide educational training in work readiness skills, such as work habits and attitude.
8. To assist the students with the development of an "on-the-job" internship to help with Institute to work transition.
9. To provide the student with job search skills and assistance with job placement.

Philosophy

Through quality technical education, FTI will provide the trainee with the skills, knowledge and competencies necessary to meet entry level needs of the aquaculture sector and the labor market. FTI seeks ongoing input from employers and manufacturers into the development of curriculum to ensure their instruction reflects the current state of technology.

FTI programs strive to recreate the work place providing emphasis on good work habits, supervisory evaluations, completion of work orders, etc. ..., in order to prepare graduates for expectations of future employers. Through learning a combination of technical skills, proper use of tools and equipment, and knowledge of how to access technical information, graduates will have the potential for growth and continuing productivity to adapt to the changing needs of tomorrow's workplace, today.

Questionnaire for aquaculture Operators and Employers of FTI graduates- Survey

Please, fill in and return immediately. You can write on paper n attach, or fill directly here.

How many FTI trained graduands has your company/organization/District employed in last 10 years. You can indicate also interns you receive every year and how many you retain please.

What percentage of FTI graduates/interns are involved directly in aquaculture activities?

What are their strength and weaknesses in performing their work?

Suggest the kind of training needed to help bridge the gaps and
the curriculum needs revision in the gaps cited.
Mention the important content and infrastructure/equipment needed in the aquaculture training today if commercialization of aquaculture is to be achieved
Any additional advice/suggestions please

Annex 6. List of Aquaculture Operators in Uganda

(A) Table 6 Hatcheries that employ some of the FTI interns and Diploma graduates

Location	Name of Hatchery	contact person (Most of them are former FTI students)	telephone	status	no/ district
West Uganda (Districts)					
Kasese	Kiburara Fish Farm	Joseph Katswera	772997158		6
	Johnson Masereka	Johnson Masereka	774734208		
	Baluku Nehemia	Baluku Nehemia			
	Rwenzori integrated wildlife	DFO	772624683	Not operational	
	Kayanja landing site	DFO	772624683	Not operational	
	Kasese	Erisania Kithaghenda Bwambale	0777292959/ 0704655207		
Hoima	A.A Fisheries Ltd c/o Rashid Asiimwe				2
	Mpaaro fry center				
S. W. Uganda (Districts)					
Bushenyi	Kabeihura Fish Farmers Ltd (0772 496989 or 0772 430201)	Kabeihura Fish Farmers Ltd	0772 496989 or 0772 430201		2
	ADB Hatchery/Bushenyi Fry Centre	DFO			
	DFO	Bainenomugisha David			
Isingiro	Tukundane				1
Kisoro	Kisoro Hatchery				1
Rukungiri	Dr. Alex Kamugisha				1
Mbarara	Rwampara Fish Hatchery	Gen Koreta			2
	Jodar services	772846139	772574475		
Kanungu	District Hatchery	DFO	0772-507332		1
East Region					
Buikwe	Source of the Nile (SON)				4
	Fadisult	DFO	772587760		
	Agrofish	DFO	772587760		
	Ugachick				
DFO	Buikwe	Katali James	0772-587760		
Iganga	MUSO4 Musomerwa 0712197155;				1

Kamuli	DFO	Kanakutanda Henry James	0750679567/ 0784004757		1
Busia	Salama integrated Fish Farm	Adome Philip	779464858/070272 7616/779464858;		3
	David Masiga				
	Nangoma integrated agricultural Co.ltd		07727112336/0717 315195/070013720 2		
	DFO	Egesa Eugene	0701-119540/ 0772-328779		
Tororo	Rock Springs Fish Farm % Sam Orukan				4
	Bamukwasi				
	NBEF fish farm				
	DFO	Nkwanga Patrick	772587602		
Bugiri	Kange	Kange	782019059		1
	DFO	Immaculate Weere	0772-609298		
Mbale	Mbale Fry Center/Nkoma				1
	DFO	Paul Mboga	774100578		
Namutumba	FO	Were Ronald	783065128		1
Budaka	Nasenji Fish Farm				2
	Budaka hatchery				
Kumi	DFO	Alupo Caroline	770621308		1
Mayuge	Mayuge hatchery	Edward	750499392		1
	DFO	Sarah Nakaziba	0772-590847		
Kaberamaid o	Ojama Fish hatchery	Anyara subcounty	751888365		1
	DFO	Agaja Joseph	0775-004193/ 0752-451894	not operatio nal	
Kapchorwa	Cassius to provide name				1
Sironko	Nalugugu Hatchery	Wamusi/Gidudu			1
Serere	Serere hatchery				2
	Kikota mixed farm	Odisi Stephen	771828980		
	DFO	Achibu John Peter	0772-698033 / 0751-698033		
Omoro	Touchi hide	Joyce Ikwaput			1
	DFO	Oyet Godfrey Jomo A	0777-367393 / 0757-112684		
Central Region					
Mukono	Namuyenje Mixed Farm c/o Eng Wadda				4
	Grow fish Uganda				
	Majorine Fish farm				
	Kabali fish farm				

	DFO	Mulambi Romulus	0753-197141/ 0783-589170		
Mpigi	Cebar	Kwiri cornelius willy	751916391		1
	DFO	Munyami Ali	0772-459765 / 0392-967496		
Gomba	Cougar	Julius	781031333		2
		Walakira	772490330		
	DFO	Kiddu Ben	774955878		
Wakiso	Sun fish farm, Kajjansi %Digo 0772462776;	Sun fish farm, Kajjansi %Digo 0772462776;	Sun fish farm, Kajjansi %Digo 0772462776;		18
	Interfish fish farm, Garunga % Borel	Kasonga	751937341		
	Aquafarm fish farm, Buloba;	Rutaisire	772501227		
	Sissa Integrated Fish Farm, late Ben Musoloza				
	Kireka Fish Farm % Hajji Mubiru 0772453042	Hajji Mubiru			
	Ssebutemba Vincent, Nsangi;0788629803		772453044		
	Nakabale Peter 0757814847				
	Matugga Fish Farm				
	Kasanje				
	Kakunyu				
	Gomba				
	Kira c/o Dr. Balikuddembe				
	Nkoowe Hatchery				
	sabra and sons				
	Crane fish farm				
	Khizar marine	Mukwaba John	701305040		
	Bira integrated fish farm	mugambwa B. james	776516296		
	Luuka Plastics	simon owani			
	FO	Ssekayi	776186932		
Kampala	Kasumba Ali	Kasumba Ali	752945824		5
	Lwanga Charles	Lwanga Charles	772617158		
	Kasangati fish farm				
	Simon Owani				
	Mary Rumanyika				
	DFO	Ayebare Jude	0782-966930/ 0794-661259		
Nakaseke			772646408		1
	DFO	Mpaata Edmond	0782854583/ 0701947758		
Lwengo	Ssenya fish farm fish farm	Ssekyewa Paul			1

	DFO	Nabbanja Resty	702569217		
Luwero		Mukalazi Joseph, kiddukulu village, makulubita parish, makulubita subcounty	777160010		2
	5-acre farm, Timba village, Ngalonkalu parish, Zirobwe subcounty	Adrabo	786795666		
	Sanga Fish Farm, Zirobwe subcounty	Kiyaga Ali	75511150/075946444		
West Nile region					
Arua	ABI ZARDI, NARO				3
	District hatchery	Kitamirike Joseph	0773858003/ 0751302414		
	Caritas	Cosmos	775655249		
DFO	Arua	Kitamirike Joseph	0773858003/ 0751302415		
Adjumani	Nile Crocodile Farm				1
	Adjuman	Okuonzi Peter	0772-571794		
Zombo	Zombo District LG Hatchery	Rama Charles	0772-624634		1
Maracha	Eyofea memorial farm kochi (titia haphrey), Abinyu village, Lamila parish, Kijomoro subcounty	Titia Hamphrey	0782153046/0788789646		3
	Oluvu youth intergrated farm, Oluvu subcountry, Ombaci parish and Marubeke village	Atiku Francis	785215509		
	Neville Long Bottom mixed farm, Kijomoro subcounty, Lamila parish, Abinyu village	Inaku Patrick Wole	782106423		
	DFO	Draman Caeser	772447743		
Northern Region					
Kole	Kole fish hatchery		772557954		1
		Aguzu Alex	772667237		
Soroti	Paradise		759999451		1
		Enyaku Micheal	0772-554273 / 0750-554273		
Lira	306A Fish Farm David Obong 0772702416;	David Obong			4
	Lira Integrated Fish Farm	Beatrice Ayivu	772702416		

	0784450154				
	Anai Community Fish Farm; DFO	John Peter Ariong	0785454900/07844 50156		
	Ogur Fry Center		772557954		
		Ariong John Peter	0772-557954		
Gulu	Pukure Orphan Cate Integrated Farm Simon 0782635203	Simon	782635205		2
	Gulu fry centre				
	DFO	Omara Emmanuel	772533797		
Kitgum	Manjola fish farmers Not yet operational				1
	Kitgum hatchery		772356866		
	DFO	Omony Alfred	0777-074492/ 0756-074492		
Amuru	Tarad	Okello Tarad	773200407		3
	Jamar rice LTD		703461884		
	Intergrated fish farm		772321875		
	DFO				96

ANNEX 7. Volumes of the Approved Certificate and Diploma in Aquaculture Curricula Plus Short Courses for FTI


Final Diploma in Aquaculture curriculu


Final Certificate in Aquaculture curriculu


Final -Short course in Aquaculture Fish (sig

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i FAO Fisheries and Aquaculture Statistics and UBOS Statistics (2018)

ii Delegation of the European Union in Uganda (2012). Beneficiary Framework Contract EA/127054/C/SER/multi, Lot 1: Rural Development. Request No. 2012/298807 - Version 1. Feasibility study to design, cost and operationalize model commercial aquaculture parks in Uganda– Draft Final Report Nov. 2012

iii Dr. Nattabi Juliet Kigongo; Dept. Zoology / Lecturer for Fisheries & Aquaculture
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iv CBA proposed in the ASSP and NDPII, which is governed by political legitimacy (i.e. legislation and governance),
institutional capacity (including appropriate competence on all levels, from government to villages dependent upon goods and/or services) and what is technically feasible (and possible).

v It should be noted that this was before FTI had revised its syllabus, which now includes certificate & Diploma programmes in Aquaculture that GIZ supported and approved by MAAIF in 2020 (See Annex).

vi This has already been done by FTI with help of GIZ

vii FTI dispelled this as not true, there is an objective evidence for FTI academic supervisors visiting the interns, communicating with field supervisors, and the internship reports are well structured.

viii The recently approved non formal programme for Aquaculture stewards addresses this according to FTI administration

ix This may not be clearly highlighted on the curriculum but it is part of the training. The Principal confirmed that Mr. Kakuru, one of their aquaculture staff, practically trains students on cage assembling and installation

x It should be noted that this was the syllabus in use before GIZ reviewed it and came up with the one approved by MAAIF prior to this mission.