

Final Report
*For the CAPACITY BUILDING FOR THE INDUSTRY CHAIN DEVELOPMENT OF TILAPIA IN
TANZANIA, KENYA AND UGANDA*

Implemented by: **Freshwater Fisheries Research Center,
Chinese Academy of Fishery
Sciences (FFRC/CAFS)**

Total Budget: **US\$74,250**

PGTF inputs: **US\$26,000**

Other inputs: **US\$48,250**

1. Overview

1.1 Project Background

Aquaculture has made outstanding contributions to global food security and nutrition, and plays a crucial role in addressing global food security challenges. According to the report of the Food and Agriculture Organization of the United Nations (FAO), 128 million tons of fish and fishery products are produced globally for human consumption each year - an annual average of 18.4 kg per person - providing 4.3 billion people with about 15 percent of their animal protein intake. Fisheries and aquaculture give an important contribution to global food security and nutrition. They are a main source of income for 55 million people, and also the primary source of protein for 17 percent of the world's population and nearly a quarter in low-income food-deficit countries.

Aquaculture in many African countries is still in its infancy or at a backward level, promising great potential for development. There is an urgent need for these countries to leverage the world's advanced aquaculture technology and expertise, so as to promote their own sound and sustainable aquaculture development. China has the largest aquaculture industry in the world, and advanced aquaculture expertise and practical technology. It has the responsibility and ability to provide aquaculture-related technical and theoretical guidance to other developing countries within its capacity, and has the obligation and the need to actively promote the

"South-South Cooperation" in the fisheries sector, thus making contributions to the sustainable development of aquaculture worldwide.

With abundant land and water resources and inputs (including fish feed, premixes, organic and inorganic fertilizers), Tanzania, Uganda and Kenya have vast potential for aquaculture development. With a total area of about 69,000 Km², Lake Victoria presents huge room for aquaculture for Tanzania, Uganda and Kenya. For decades, aquaculture has played a significant role in job creation, income generation and national economic growth in Tanzania, Uganda and Kenya and has been included in the development Vision of the countries. However, aquaculture productivity is still low due to a few reasons. Tilapia species is the most important variety for aquaculture development in Tanzania, Uganda and Kenya. Every year, the tilapia production accounts for more than 80% of the total output of aquatic products in the countries. In the long run, the key to sustainable aquaculture development and responsible production lies in the development of the tilapia industry, and attracting more and more small-scale farmers to get fully involved in production in the tilapia industry chain can make a positive contribution to the alleviation of poverty and hunger in Tanzania, Uganda and Kenya. After over 70 years of development, China has developed a technologically sophisticated and highly specialized tilapia aquaculture. Its mature production technology and management experience in the sector of tilapia culture can effectively help Tanzania, Uganda and Kenya improve the efficiency of the tilapia aquaculture.

Freshwater Fisheries Research Center, Chinese Academy of Fisheries Sciences (FFRC/CAFS) is the national research institutions in China. It is of great strength in fishery research, education and technical transfer. So far, FFRC has trained 89 fishery technicians and officers for Tanzania, Kenya and Uganda. Moreover, it is the leading institution for National Technological System on Tilapia Industry and it has a group of skilled experts in the field of tilapia aquaculture. Over 20 scientists working in FFRC have been long involved in tilapia aquaculture research and have been invited by many international organizations such as IFAD, FAO, and NACA, to help different countries develop their tilapia industry. Technology in farm design, seed production, farming management, feed development, disease prevention, fish harvest, etc. has been disseminated to over 50 developing countries. Therefore, FFRC is capable of and ready to helping Tanzania, Kenya and Uganda to get over the constraints mentioned above.

1.2 Project Content

Six Chinese experts from FFRC/CAFS in the field of tilapia aquaculture were chosen as resource persons and technical consultants. 15-day technical training and consultancy in Tanzania, Kenya and Uganda (approximately 5 days for each country) will be conducted by the Chinese experts. The experts will provide technical training and consultancy on tilapia aquaculture for 75 officers, technicians and farmers in three countries. Room lectures, lab works and technical consultations will be combined to help participants to acquire the basic theory of tilapia industry plan, tilapia seed production, aquaculture technology, feeding management, disease prevention, marketing and processing. This project will focus on making a valuable contribution to building capacity of officers, technicians and farmers to help them broaden insight, improve industry plan and farming technique. It ultimately contributes to promoting development of tilapia aquaculture and improving household food and nutritional security in three countries.

Aim at solving the problems and issues mentioned above, FFRC mission group will be devoted to focusing on:

- Knowing about the information of local tilapia production system;
- Giving suggestions about industry plan, farm construction and farming models;
- Conducting training for farmers, technicians and officers in Tanzania, Kenya and Uganda on tilapia industry development, including tilapia industry plan, tilapia seed production, aquaculture technology, feeding management, disease prevention, marketing and processing, etc.;
- Providing on-the-spot technical consultancy on tilapia aquaculture system design, breeding, diseases diagnosis, feeding management and farm management to help technicians or farmers to improve tilapia production efficiency and manage farm better;
- Providing information of Chinese institutions and enterprises in fishery and bridge the cooperation between Chinese fishery institutions and local fishery institutions;
- In total, 75 technical staff and local farmers will be the beneficiaries of this project with the supports from PGTF and the Fisheries Administrations in Tanzania, Kenya and Uganda.

1.3 Brief Information on Project Implementation


The project Leaders from FFRC attached great importance to the management and implementation of the project, held special expert workshops and kickoff meetings, and provided detailed guidance and arrangements for such activities as expert selection, scheme formulation, and preparation of technical materials. Due to the outbreak of COVID-19, it was impossible for experts to carry out on-site technical guidance, demonstration and popularization in Tanzania, Uganda and Kenya. Under the guidance of the China International Center for Economic and Technical Exchanges (CICETE), after negotiations with Tanzania's Fisheries Education and Training Agency (FETA), Uganda's Fisheries Training Institute (FTI) and Kenya's Ramogi Institute of Advanced Technology (RIAT), the Chinese project team decided to adopt an innovative cooperation model, enrich the content of project cooperation, and expand the effect and influence of the project. To this end, the team successively carried out survey on aquaculture in Tanzania, Uganda and Kenya established the China-Tanzania, Uganda and Kenya fisheries cooperation partnership, compiled tilapia-related technical references (including video material) for training, organized trainings for 83 technical talents, provided financial supports to 18 scholars of master degree for Tanzania, Uganda and Kenya, and conducted technical consultancy on tilapia farming through cooperation with Chinese experts in Zhongzhi Tilapia Farm in Tanzania, Global Tilapia Husbandry and Yiruo Fish Farm in Kenya, and Pearl Fish Farm in Uganda, all the activities help achieve the expected results.

2.Fruitful results

2.1 Knowing more about the technical needs for tilapia industry development in Tanzania, Uganda and Kenya

To fully understand the current development and technical requirements of aquaculture in Tanzania, Uganda and Kenya, and therefore to provide technical guidance and training in a more effective way, the expert group of FFRC proactively organized online talks with Tanzanian fishery practitioners and managers of China-invested aquaculture enterprises in Tanzania, Uganda and Kenya. To do a detailed survey on the development history of local aquaculture, organization and functions of local research and technology promotion institutions, and status, development prospects and major bottlenecks of local aquaculture,

the expert group organized technical seminars with local personnel engaged in fishery research, management and technology promotion under the coordination of officials from the Tanzanian Ministry of Livestock and Fisheries, Uganda's Fisheries Training Institute (FTI) and Kenya's Ramogi Institute of Advanced Technology (RIAT), fishery authorities and previous trainees in the three countries. The experts of FFRC successively had technical consultations and exchanges with experts from the Fisheries and Aquaculture Division of FAO, Zhongzhi Tilapia Farming Base in Tanzania, FETA, FTI and RIAT. They communicated with local fishery enterprises in terms of the design, water quality and farming facilities of tilapia farms, fully exchanged views with technicians and farmers on selective breeding of tilapia brooder, tilapia seed production and management, tilapia grow-out farming techniques, water quality management, feed techniques, labor cost, market demand and marketing, main difficulties and technical problems in production, and consulted with officials from FAO and institutions regarding the industrial development policies, market demand, main challenges and development potential. According to survey data, they timely adjusted the technical guidance and training content, improving the effect and quality of the project in a targeted manner.



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TZP/C.50/1


中国水科院淡水鱼研究中心：

坦桑尼亚驻华大使馆向中国水科院淡水鱼研究中心致意，并谨就以下事宜和贵方沟通如下：

贵中心与坦桑尼亚畜牧渔业部一直保持良好的合作与沟通。虽然新冠疫情给双方的合作项目带来的挑战，贵中心今年继续以线上培训的方式为坦桑尼亚提供专业培训，我使馆仅代表坦桑尼亚政府深表谢意。

使馆现将坦桑畜牧渔业部提供的希望未来可以接受相关学历培训的人员名单提供如下（见附件），希望贵中心可以给予继续的支持。

顺致崇高敬意。



附件：坦桑渔业学历项目候选人名单
Attachments: The needs for capacity building in fishery in Tanzania

LEVEL	SPECIALIZATION	NAME	GENDER	AGE	EDUCATION LEVEL	CENTER
PHD	Fisheries Sciences	Ali Rashid Hamad	Male	32	MSc Fisheries Sciences	Pemba
		Nassor Rashid Ali	Male	42	MSc Marine Affair	Unguja
		Fatma Suleiman Ali	Female	32	MSc Health of Aquatic Animal	Unguja
Msc	Fisheries Sciences	Makame Haji Makame	Male	41	BSc Environment Planning	Unguja
		Khamis Hassan Ali	Male	30	BSc Aquaculture	Unguja
		Aisha Bakar Massoud	Female	34	BSc Aquaculture	Pemba
	Aquaculture (Breeding larvae rearing and Nutrition)	Azizi Suleiman Ali	Male	29	BSc Aquaculture	Unguja
BSc	Fisheries and Aquaculture Sciences	Kassim Jhuri Kassim	Male	36	Dip. Information Tecnoogy	Unguja
		Othman Mbaraka Mussa	Male	35	Dip. Fish Processessing	Unguja
		Halima Rajab Mbarouk	Female	32	Dip. Environmental coastal	Pemba
		Rabia Mohammed Omar	Female	30	Dip. Aquaculture	Pemba
Fisheries data Management		Mehanga Said Khamis	Female	51	BSc Fisheries Sciences	Unguja
		Daudi Haji Pandu	Male	52	Dip. Fisheries Sciences	Unguja
		Omar Hakim Foun	Male	50	Dip. Wild Life	Unguja
		Omar Juma Suleiman	Male	44	MSc Marine Sciences	Pemba
		Sharif Mohammed Faki	Male	55	BSc Marine Sciences	Pemba
		Mgeni Nassor Mohamed	Female	50	BSc Environmental Sciences	Pemba
IT and fisheries Software		Kassim Jhuri Kassim	Male	36	Dip. Information Tecnoogy	Unguja
		Othman Mbaraka Mussa	Male	35	Dip. Fish Processessing	Unguja
		Maryam Sharif	Female		Dip. Information	Pemba



2.2 Producing a series of knowledge products for technical officers

The technical book for this training was compiled, and it covers several key areas including selective breeding technology of tilapia brooder, tilapia seed production, feed development, inspection and quarantine, aquatic product quality and fishery development. The videos on tilapia breeding for virtual lab-work practices and technical books for consultancy on grow-out culture of tilapia were made, which help the technicians and officers to understand the key breeding technologies of tilapia. To help participants and partners better understand the industry chain and value chain development, the technical reference on construction and practices on aquaculture park were compiled and a video on case study of aquaculture park was made. The reference covers aquaculture status in the world, principle for aquaculture park, the planning, design, operation, management, cases studies on tilapia, rice-fish farming, etc. The knowledge products will be very helpful in laying strong foundation for tilapia industry development in Tanzania, Uganda and Kenya.



Figure 1. The shapes of male and female.



Technical Book for Training Course on

Tilapia Breeding and Culture Technology



Freshwater Fisheries Research Center of Chinese Academy of Fishery Sciences

December, 2021

Construction and Practice of Aquaculture Park

Part 1

1 Foreword

1.1 Development and Contribution of Global Aquaculture

1.1.1 Development

As one of the sources of human food and nutrition, aquatic products have been playing an important role in guaranteeing global food security and enriching human dietary structure since ancient times. In addition to fishing, aquaculture is an important way for people to obtain fisheries products. However, it has been in an extensive state for a long time although it has a development history of more than 3,000 years. Aquaculture was initially linked to science & technology till the end of the 19th century with the development of science and technology (Stickney, 2005). In 1960s and 1970s, aquaculture entered a stage of rapid development, making an increasingly important contribution to poverty reduction, hunger reduction, economic growth and food security worldwide.

The global demand for aquatic products had been rising continuously in the past 50 years with the development of global economy, the general improvement of people's living standards in different countries and the continuous rising of the total population of the world. As natural fisheries resources are declining and resource protection is strengthened worldwide, major fishing countries have paid more attention to and given more support to the development of aquaculture. While continuing to rely on capture fisheries, countries have been striving to develop aquaculture to make up for the shortage of aquatic products in the consumer market, making aquaculture one of the fastest growing sectors in the world food production industry (Yue Jiahu, 2010).

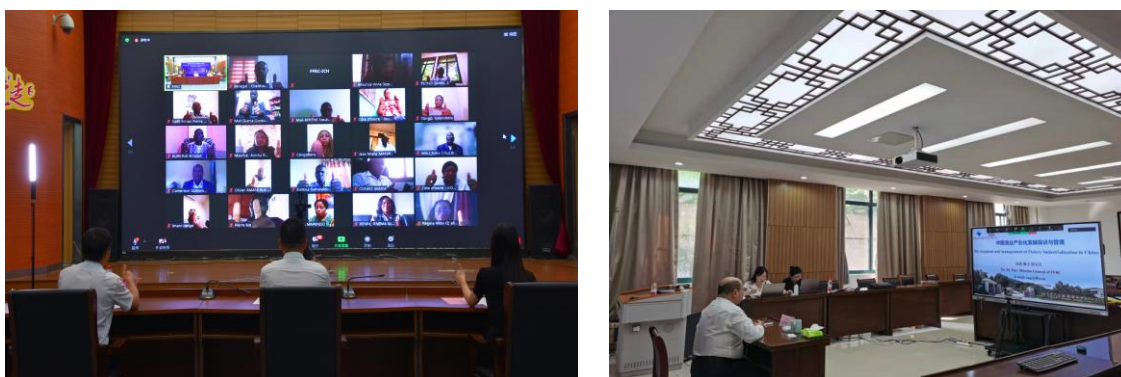
2.3 Improving the knowledge and technology on tilapia farming and industry development through training, education and technical consultancy

According to the development realities and survey report of fisheries in Tanzania, Uganda and Kenya, and combined with the epidemic situation, the experts of FFRC decided to adopt an innovative mode for the project. To be specific, they organized trainings online instead of offline, provided quota for fishery officers recommended by the Tanzanian Ministry of Livestock and Fisheries, Uganda's Minister of Agriculture Animal Industry and Fisheries (MAAIF) and Kenya's RIAT to have a 2-year study for a master's degree in fishery development, and conducted 3 technical consultancies through cooperation with experts in Zhongzhi Tilapia Farm in Tanzania, Global Tilapia Husbandry and Yiruo Fish Farm in Kenya, and Pearl Fish Farm in Uganda.

In total, there are 83 fishery technical and management officials from Tanzania, Uganda and Kenya to participate in the online trainings, covering several key areas, including industry development, selective breeding, seed production, feed development, high-yield farming, inspection and quarantine, aquatic product quality and safety, resource conservation, etc. To give fully play to FFRC's advantages in joint education programs and improve capacity in fishery technology innovation, the experts decided to recruit 18 fishery officers 2-year master's degree study in fishery development. To guarantee a smooth implementation of the trainings, education program and technical consultancy, FFRC bought advanced facility and equipment related to virtual exchange and internet connection for webinar. Moreover, to keep in line with the development requirements of the tilapia industry in the countries in the Lake Victoria Basin, FFRC organized 2 technical seminars 13-17 December, 2021 and 14-23 November, 2022, and invited 68 technicians, scholars and management officials from 15 African countries to the seminars.

The experts conducted the technical trainings in close combination with the tilapia-related technical requirements and local fishery production conditions of African countries, especially Tanzania, Uganda and Kenya. Based on simple and practical technical measures and operation essentials, they explained the profound theories regarding tilapia breeding and culture technologies, and encouraged the trainees to actively share their points of view and experience, greatly arousing the interests of the trainees. During the trainings and seminars,

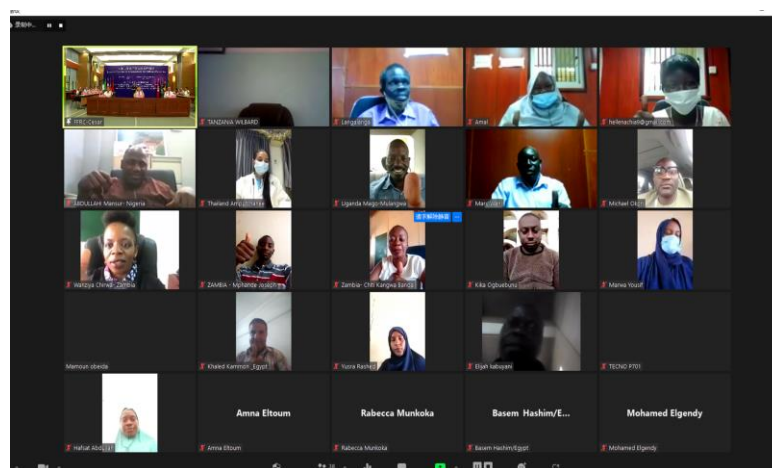
the trainees did not let go of every technical link, and sought advice from the Chinese experts on the difficulties they encountered in production. The trainees said that they benefited a lot from the trainings, and they would like to apply what they have learnt in trainings in aquaculture practice. To help solve the technical constraints in Tilapia farms, the expertise team prepared Chinese-version book on tilapia farming for technical consultancy and then the technical book was translated into English version. The technicians in Zhongzhi Tilapia Farm in Tanzania, Global Tilapia Husbandry and Yiruo Fish Farm in Kenya, and Pearl Fish Farm in Uganda said that with the help of Chinese experts, through project cooperation and government promotion, the recommendations from experts will definitely improve the development of aquaculture by virtue of its rich aquaculture resources.



Schedule of Workshop on Tilapia Culture Technology

Date	Week	Time (GMT+8)	Activity	Resource person
13, Dec	Mon	16:30-17:00	Opening ceremony	Prof. Xu Pao
		17:30-19:30	Presentation: Current Status and Trends of China's Tilapia Industry	Prof. Xu Pao
14, Dec	Tue	16:30-18:30	Presentation: Tilapia brooder selective breeding technology	Prof. Qiang Jun
		19:30-21:30	Presentation: Tilapia seed production technology	Prof. Qiang Jun
15, Dec	Wed	16:30-18:30	Presentation: Tilapia grow-out farming techniques	Prof. He Jie
		19:30-21:30	Presentation: Tilapia nutrition requirements and feed formula design	Prof. Liu Bo
16, Dec	Thurs	16:30-18:30	Presentation: Tilapia disease prevention and control technology and strategy	Prof. Xi Bingwen

		19:30-21:30	Presentation: Tilapia processing technology	Prof. Zhang Chengfeng
17, Dec	Fri	16:30-18:30	Presentation: Tilapia Farm Operation and Management	Prof. Jing Xiaojun
		18:30-19:00	Closing ceremony	



Schedule of Workshop on Healthy Culture of Tilapia

Date	Day	Time (GMT+8)	Activity	Resource Person	Note
Nov 14	Mon	09:00-09:30	Opening ceremony	Prof. Xu Pao Prof. Jing Xiaojun	Interpreter: Mr. You Lei
		09:30-11:00	Ice breaking (3 or 4 groups)	Prof. ZHANG Lin Prof. Li Hongxia Mr. Y Wei Ms. Chen Xi Ms. Zhong Chunyi	
		14:00-16:00	Presentation: China's Fishery Industrialization Development Policy-Taking Tilapia as an Example	Prof. Li Juetong from China Fishery Society	
		16:00-18:00	Discussion		
Nov 15	Tue	09:00-11:30	Presentation: China's Tilapia Industry Organizational Construction-Taking Guangxi as an Example	Prof. Xu Pao	Interpreter: Mr. You Lei
		14:00-16:30	Discussion: Tilapia Development Policy and Organization		

Nov 16	Wed	09:00-11:30	-Breeding of tilapia and production of high-quality fry -Hybrid technology in New Variety Development	Prof. Chen Songlin/Academician from Yellow Sea Fishery Research Institute	Interpreter: Ms. Wen Lujun
		14:00-16:30	Discussion: Analysis of the advantages and challenges of tilapia breeding and seed production in various countries		
Nov 17	Thurs	09:00-11:30	-Healthy farming technology of commercial tilapia -Water Quality Control of Tilapia farming	Prof. He Jie	Interpreter: Ms. Wen Lujun
		14:00-16:30	Discussion: Sharing and exchange of experience and technical characteristics of commercial tilapia aquaculture in various countries		
Nov 18	Fri	09:00-11:30	-Development and feeding technology of high-quality feed for tilapia -Tilapia disease control and prevention	Prof. LIU Bo Dr. SONG Changyou	Interpreter: Mr. You Lei
		14:00-16:30	Discussion: Analysis of the advantages and challenges of tilapia feed production in various countries		
Nov 19	Sat	09:00-17:00	Review	Prof. Jing Xiaojun	Mr. Ye Wei
Nov 20	Sun	09:00-17:00	Preview	Prof. Jing Xiaojun	Mr. Ye Wei
Nov 21	Mon	09:00-11:30	- Tilapia Processing - Market System Construction	Prof. Xu Shijian from Xunlong Fishery Technology Company	Interpreter: Mr. You Lei
		14:00-16:30	Discussion: Tilapia Processing and Market System Construction		
Nov 22	Tue	09:00-11:30	- Planning and Operation of Tilapia Farming Park - Case studies of Aqua-park	Prof. He Xugang from Huazhong Agricultural University	Interpreter: Ms. Wen Lujun
		14:00-16:30	Discussion: The development status of		

			aquatic parks in various countries		
Nov 23	Wed	09:00-11:30	Training Summary: Healthy Tilapia Farming: Theory and Practice	Prof. LI Hongxia	Interpreter: Ms. Wen Lujun
		14:00-16:30	Summary, Evaluation and Certificate Issue		
		16:30-17:00	Closing Ceremony	Prof. Xu Pao	

To make the technical consultation more scientific and practical, FFRC provided 4 technical consultancies for 4 farms through cooperation with experts in Zhongzhi Tilapia Farm, Tanzania, Global Tilapia Husbandry and Yiruo Fish Farm in Kenya, and Pearl Fish Farm in Uganda.. The experts visited many these 4 local farms and hatcheries. After learnt more about the challenges and technical problems faced by the farms and hatcheries, the experts gave more practical and feasible suggestions and guidance to the farmers and managerial personnel on how to improve the seed production, increase the growth rate of tilapia, develop the nutritious feeds using local raw material, enhance the level of farm operation and marketing, etc..



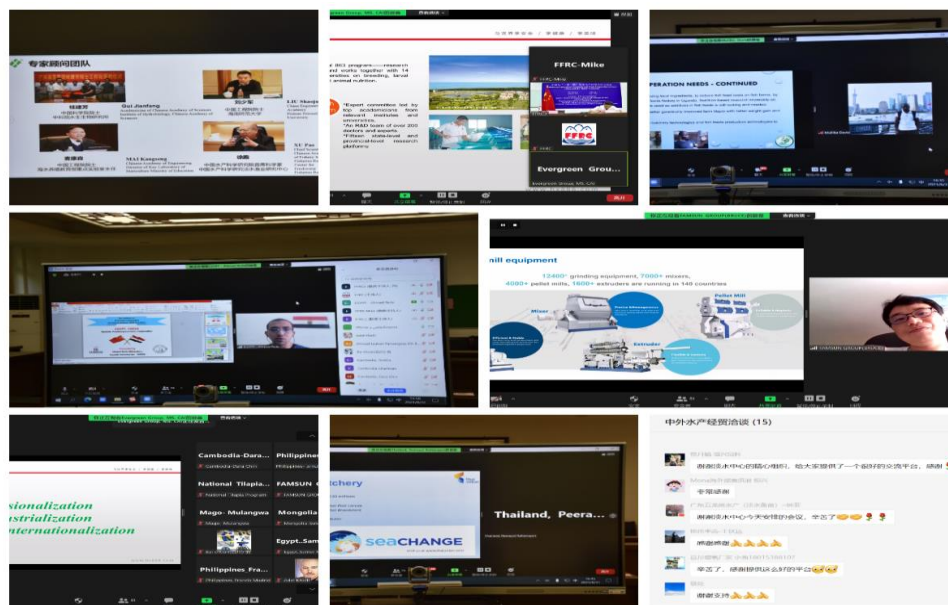
2.4 Enhancing skills of technological transfer

During the project, the experts of FFRC conducted an online survey of more than 20 representatives of the trainees who had participated in the training in China, distributed to them the electronic version of *Fish Today* compiled and printed by FFRC, and introduced to them China's main progress in the development of aquaculture and FFRC's remarkable achievements in scientific research, technology promotion, and education and training. They had an in-depth exchange of views with the trainees about changes in their work after the training, the application of technology, the main problems they encountered in their work and their needs for new knowledge and technology. They also asked the trainees to share their opinions and suggestions about FFRC's international training. The trainees said that FFRC's training courses were informative, technologically advanced and practical, and could be applied to their work according to local conditions. In the trainees' opinions, the high organization and management level and the rich activities of the project were impressive, the knowledgeable lecturers and the innovative training mode, especially the "modular training" in recent years, had greatly improved their learning effect. Furthermore, the trainees also proposed many valuable comments and suggestions on the sustainable development of FFRC in South-South Cooperation. Through follow-up visits, the experts answered the trainees' new questions in their work and gave opinions and suggestions on how to apply what they learned to constantly promote the development of local fisheries economy. They also had an in-depth understanding of the trainees' new cooperation needs, and clearly defined new goals of the South-South Cooperation, laying a solid foundation for FFRC to effectively develop the South-South Cooperation.



2.5 Promoting the cooperation through communication and proposals

FFRC takes the project as an important platform to boost the cooperation between China and Tanzania in agriculture and fisheries. During the project, the experts of FFRC had in-depth exchanges and discussions with officials, researchers and technicians from the Tanzanian Embassy in China, the Tanzanian Ministry of Livestock and Fisheries, Zhongzhi Tilapia Farming Base in Tanzania, and other Tanzanian institutions and enterprises, Global Tilapia Husbandry and Yiruo Fish Farm in Kenya, and Pearl Fish Farm in Uganda, Fishery Resources Directorate, Uganda's Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Kenya RIAT and Uganda FTI, etc. In this way, the experts obtained first-hand information on the technical requirements of aquaculture development in real time, and analyzed aquaculture development in terms of advantages, disadvantages, opportunities and challenges. On this basis, and through communication with the management officials and technicians from FTI, RIAT and FEAT and other subordinate organizations of the Ministries, the experts prepared a proposal for cooperation in selective breeding of all-male tilapia species, feed development, scientific research capacity development, and upgrading of practical fisheries production system. The proposal has been highly appreciated by senior agencies in Tanzania, Uganda and Kenya. During the training, FFRC organized a webinar on aquaculture economic and trade cooperation, which showed the technology and products of enterprises to each other and laid a strong foundation for future cooperation.



A FISHERIES TRAINING PLAN FOR 2020/2021 – 2024/2025

1. Background

Fisheries sector is among the important economic sub sectors of the economy in Tanzania. The sector provides substantial employment, income, livelihood, foreign earnings and revenue to the country. In addition to having all three African Great Lakes of Victoria, Tanganyika and Nyasa, the country has coastline of **1,424** km long, a Territorial Sea estimated at **64,000** square kilometers and the Exclusive Economic Zone (EEZ) of **223,000** square kilometers (Figure 1).



Figure 1: Map describing potential fishing areas in Tanzania

2. Justification for the training plan

Tanzania has never undertaken large-scale commercial fishing activities in its EEZ. Currently the country is in the process of modernizing its fishing industry by putting in place major infrastructure including construction of a fishing port and establish a National Fishing fleet that will undertake fishing activities in the EEZ in partnership with the Private Sector.

In line with the modernization of the fishing industry the sector is seeking to solicit support in human resource capacity building in relevant technical areas including fishing technology, marine engineering, commercial fish processing techniques and marketing. Training in these major areas will include both short- and long-term courses as shown in Tables 1 and 2 below:

Table 1: Short term courses (3 – 6 months)

No.	Proposed Courses	Proposed No. Participants
1.	Navigation and Seamanship	16
2.	Gear Technology	10
3.	Marine Engines maintenance	20
4.	Marine Engines maintenance	20
5.	Fish Processing and Marketing	30
6.	International Negotiation Skills	10
7.	Aquaculture Nutrition (feeds and feeding)	12
8.	Aquaculture Production Systems (inland & marine)	12
9.	Aquaculture Diseases and Health Management	12
10.	Fisheries and Aquaculture Business Management	5

Table 2: Long term courses (2 - 3 years)

No.	Proposed Courses	Proposed No. Participants
1.	BSc. Fishing Gear Technology	8
2.	MSc. Food Science and Technology (Post harvest Handling and Processing)	8
3.	MSc. Aquaculture Nutrition	8
4.	MSc. Project Management and M&E skills	8
5.	MSc & PhD in Aquaculture Breed Improvement, Larviculture and Hatchery Management	8
6.	MSc & PhD in Aquaculture Production Systems	10
7.	Aquaculture Diseases and Health Management	8
8.	MSc & PhD in Fisheries and Aquaculture Business Management	10

3.Challenges

COVID-19 Pandemic: One of the major challenges is the pandemic before 2022. With the pandemic globally ongoing and travel restrictions both internationally and domestically, many researches and international cooperation projects and tasks of can only be partly carried out online, some of the implementation progress was delayed.

Insufficient financial support: Due to the limited budget, the project could not cover more beneficiaries, and could not provide more supports to farms technicians, such as consultancy on the whole industry chain including breeding, seed production, aquaculture, processing, marketing, etc..

4. Lessons Learned

Due to the pandemic, measures such as webinar, on-line exchange through various channels such as email, WeChat, WhatsApp etc. should be organized to ensure necessary and smooth communication. Strengthen researches on impacts of the pandemic on aquaculture sector especially on small-scale fish farmers, finding out efficient countermeasures to constraint the impacts and ensure the smooth development of the sector in post-pandemic period, contribute more to the food security worldwide.

Innovative training modes and method, for example, new equipment was installed, videos were recorded beforehand on practice or experiments, allowing the participants watch the whole process, virtually “visits” farms and fields, and even “experience” Chinese culture, and flipped classroom methods should be adopted to ensure the online lecturing more targeted and effective.

A stable technology transfer platform should be established, so many practical or upgraded aquaculture technologies can be transferred to more developing countries in time. Make better use of current cooperation foundations and invite more private sectors, group companies and enterprises to get involved in project, so that to allow the cooperation more pragmatic, value-chain orientated and longer lasting effects.

5. Prospect

FFRC will strengthen communication with CICETE in a timely manner for specific guidance to strive for follow-up projects.

FFRC will keep in close contact with Tanzania, Uganda and Kenya to strengthen the follow-up technology tracking.

FFRC will work with all sides to prepare the proposals for project cooperation, and continue to promote human resource capacity building and cooperative research projects in the sectors of all-male tilapia selective breeding, carp seed production, and catfish aquaculture.

FFRC will provide more technical consultancy for tilapia demonstration farms establishment.

FFRC will publicize the results of the project through various media in real time.