

Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills Project

Annual Technical Progress Report

January 1 to December 31, 2019



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1. BACKGROUND

1.1 Project Summary

The “Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills” (AQ TEVET) project is implemented by [WorldFish](#) and partners ([BluePlanet Academy \[BluePlanet\]](#), [Natural Resources Development College \[NRDC\]](#) and [Musika Development Initiatives \[Musika\]](#)), with financial support from the Norwegian Agency for Development Cooperation ([Norad](#)). The project is being implemented in Lusaka, Northern and Luapula Provinces over 3.5 years from mid-2018 to the end of 2021. Total funding for the project is NOK20,000,000. The project comprises two components:

- i. Upgrading the fisheries science curriculum (long- and short-term courses) and training tools as well as developing an online training platform and internship program at the NRDC, but with links to other TEVET institutions to scale the upgraded curriculum over the project life span and beyond.
- ii. Enhancing the technical education, vocational and entrepreneurship skills of rural women, men and youth smallholder commercial fish farmers and increasing their linkages to input/output markets and entrepreneurship opportunities via private sector extension support and services delivery.

Concerning the aquaculture value-chain development goal, the project will contribute to two critical areas. First, the project will increase the number and quality of human resources working for the private sector. Secondly, the project contributes to increasing the number of smallholder commercial fish farmers with enhanced aquaculture knowledge and up-to-date practical skills to help sustainably grow the sector and make it more inclusive. Its objective is to develop the aquaculture knowledge and practical skills of students and smallholder commercial fish farmers (especially women and female youths) participating in TEVET to enable them to find gainful employment in the private sector.

1.2 Key Project Activities, Outputs, and Outcomes

Below is a summary of the activities implemented by the project. Activities 1–4 fall under Component 1 of the project, while Activity 5 falls under Component 2.

1.2.1 Activity 1: Training Students from the NRDC using the Upgraded Curriculum, Tools and Online Training Platform

The aim of this activity is to upgrade the fisheries science curriculum (for long- and short-term courses), training tools and online training platform at the NRDC.

Activity 1 outputs: Upgraded curriculum (long- and short-term courses), training tools (including training modules, manuals, and bibliographic references to up-to-date fisheries/aquaculture publications and other online resources), an online training platform and a training of trainers manual to implement the upgraded package.

Activity 1 outcome: Enhanced knowledge base of students trained at the NRDC.

1.2.2 Activity 2: Students from the NRDC Gain Practical Skills through Internships specifically Tailored to Address the Needs of the Private Sector

The activity aims to develop and operationalize a novel internship program that links students (especially women and female youths) to private companies operating throughout the aquaculture value chain to acquire necessary practical skills. The skills will help them find gainful employment after completing their training.

Activity 2 outputs: Outputs for this activity include (1) an internship program document and assessment report to inform the design of tailored internships that are both gender- and youth-responsive and fit the needs of the private sector, and (2) an aquaculture field training center constructed at NRDC.

Activity 2 outcome: Enhanced practical skills of students gained from internships specifically tailored to the needs of the individual private company.

1.2.3 Activity 3: Students from the NRDC find Gainful Employment with Companies Operating in the Aquaculture Value Chain or set up own Aquaculture-related Businesses, and Prospective Students are Encouraged to Apply to the Fisheries Science Department at the NRDC

Activity 3 has two objectives. The first objective to increase opportunities for students (especially women and female youths) either to find gainful employment with private companies operating in the aquaculture value chain or to set up their own aquaculture-related businesses. The second objective is to increase the number of students (especially women and female youths) applying to the fisheries science department at the NRDC.

Activity 3 outputs: This activity has four outputs as follows: (1) an internship review forms, (2) reports on the assessment of the needs and aspirations of women and female youths aquapreneurs, fish farmers and learners and the barriers they face, (3) gender- and youth-responsive marketing tools developed over the course of the project to attract more students to aquaculture training centers, and (4) a plan to link students who wish to set up their own aquaculture-related businesses to financial institutions

Activity 3 outcome: Contracts signed with private companies, or new businesses opened along the aquaculture value chain after students complete their studies, along with an increase in the number of students applying to the NRDC.

1.2.4 Activity 4: Scaling the Upgraded Fisheries/Aquaculture Package for Adoption/Modification by other TEVET Institutes in Zambia

Linking up with other TEVET institutions to scale the upgraded package.

Activity 4 output: A plan to scale the upgraded fisheries/aquaculture package to other TEVET institutions in Zambia.

Activity 4 outcome: TEVET institutes in Zambia adopt/modify the curriculum, training tools, online training platform and internship program for integration within their institutions.

1.2.5 Activity 5: Private Sector Linkages with and TEVET Provided to Smallholder Commercial Fish Farmers

The key objective of Activity 5 is to develop the capacities of commercial actors along the aquaculture value chain to deliver sustainable and profitable pro-poor, gender- and youth-responsive market services to the smallholder sector, including the provision of inputs and technologies, output marketing opportunities and extension, vocational training and technology transfer.

1.2.5.1 Sub Activity 5.1: Assess Market Actors

The project will work with partners to identify and meet key commercial players along the aquaculture supply chain already active within the two target provinces and those who have the potential to invest in the region to enter the aquaculture market. The project will assess actors in the aquaculture value chain in terms of their current or potential “value” to the market. In particular, it will review their willingness and ability to make sustained and commercially oriented investments in developing the smallholder aquaculture market and determine those who are willing to integrate a gender- and youth-focused lens into their business models. From this assessment, a portfolio of “clients” will be developed, including:

- seed and feed suppliers;
- suppliers of equipment and other technologies relevant to the lower end of the market;
- formal fish buyers and processors;
- small rural "intermediary" businesses that do or could act as "last mile" distributors of inputs and training/extension services and/or "first-mile" aggregators of outputs;
- auxiliary service providers, such as financial institutions and transporters.

1.2.5.2 Sub Activity 5.2: Conduct Commercially Oriented, Gender- and Youth-responsive Market Research

One of the key constraints to private investment in the aquaculture market is the lack of understanding of the smallholder landscape, especially women and youth smallholders. Therefore, the project will support the private sector to carry out the necessary market research to identify and select commercially oriented fish farmers and eventually organize them for more accessible training and skills development, as well as linkages to input suppliers and output markets.

1.2.5.3 Sub Activity 5.3: Provide Early-stage Investment Support

The project will devote funds to bring down some of the initial costs and risks of investments in the "greenfield" market through demand-driven catalytic grant support to corporate clients. Bringing down the costs will occur, for example, in terms of logistics and setting up basic infrastructure, such as decentralized distribution, aggregation and storage facilities. The emphasis will be on supporting the elements of the business that directly involve engagement of the smallholder aquaculture market, particularly women and female youths who are interested in playing a significant role in and benefiting from the market.

1.2.5.4 Sub Activity 5.4: Increase the Capacity of Private Actors to Deliver Outreach, Farmer Training and Extension Services

The project will support private companies to pursue aggressive market outreach strategies. Outreach strategies will involve going out to the market with gender- and youth-responsive products, marketing opportunities, extension, training and capacity building services. This type of market outreach is preferable to the traditional way where companies wait for clients to come to them in search of products and services.

1.2.5.5 Sub Activity 5.5: Demonstrate and Test Technologies

The project will support the private sector to demonstrate and test productivity-enhancing and labor-saving technologies as well as best management practices. Testing technologies and demonstrating best management practices will form part of the farmer engagement strategy by the private sector. Testing labour-saving technologies will be used as a means of including more women and female youths, who carry the extra burden of performing unpaid/domestic tasks in addition to agricultural duties. Equally, relevant approaches will be used to improve the efficiency of the supply chain, such as strategies (but also technologies) for the distribution of fingerlings and commercial feeds and cold chain innovations.

1.2.5.6 Sub Activity 5.6: Strengthen Capacity Development of Value Chain Intermediaries

The project will integrate small gender- and youth-inclusive businesses (agro-dealers, processors, traders and service providers) within the aquaculture value chain into the capacity development process.

Students at the NRDC will have the opportunity to intern with identified private sector partners. Internships will help develop their technical and vocational skills on how to provide extension support to smallholder fish farmers to ensure the private sector can continue to provide such services after the life of the project.

Activity 5 outputs: Outputs for this activity will include (1) private sector landscaping and capacity needs assessments and development plans, (2) a smallholder fish farmer population census (in each target district) and a cluster farmer identification and selection plan, (3) a fish

farming systems analysis, (4) a smallholder project component detailed implementation plan, and (5) smallholder training tools (e.g. private sector, lead farmer and smallholder best management practices manuals).

Activity 5 outcome: Enhanced organization of farmers trained on TEVET, and services provided by the private sector.

2. IMPLEMENTATION PROGRESS

2.1 Activity 1: Training students from the NRDC using the Upgraded Curriculum, Tools and Online Training Platform

NRDC's fisheries science curriculum has been upgraded (see annexes 1 and 2). The University of Zambia endorsed the upgraded fisheries and aquaculture curriculum on 10th December 2019. NRDC will implement the curriculum in 2020, starting with the current cohort of first and second-year students.

The curriculum was upgraded first to address challenges in the sector and second to build the knowledge base of sector practitioners to take advantage of existing opportunities. Specifically, the following revisions were undertaken:

- i. modernized and updated the curriculum to meet the needs for well trained, practically skilled and competent graduates who will contribute effectively to the growth of the industry upon graduation;
- ii. strengthened the aquaculture component of the to address the historical bias towards capture fisheries. This bias resulted in inadequately trained graduates for the rapidly growing and generally private-sector driven aquaculture industry;
- iii. strengthened the business skills development to improve the entrepreneurial capacity of students to enable them to establish their own aquaculture related enterprises and create jobs and socio-economic opportunities for other citizens upon graduation instead of always looking for employment and;
- iv. Integrated a gender component in the curriculum to build graduates' knowledge base of gender and other social issues affecting the sector and equip them with the ability to build gender-inclusive businesses and business models.

The curriculum was revised using a participatory process (See Figure 1 photo of participants attending a curriculum validation workshop). Three workshops on institutional capacity building and information sharing were convened during the period under review. Workshops participants from training colleges, universities, public and private sector identified gaps in the current curriculum that needed to be addressed – see Table 3 at the end of the report for the breakdown of



Figure 1: Photo of participants who attended the curriculum validation workshop (Photo by Tabitha Mulilo)

The faculty of fisheries science enrolled a total of 58 students (66% males, 34% females) in 2019, an increase of 232% compared to 25 students in 2018. Factors that led to an increase in enrollment will be examined during the midterm evaluation assessment in 2020. The enrollment figure of 58 students in 2019 is 42.9% of the intended target of 135 students trained by 2021. At this rate, the project is highly expected to meet the planned output of training at least 135 students and enhance their knowledge base by the end of the project in 2021.

The project has made significant progress in setting up and implementing the aquaculture (tilapia) online training platform at NRDC. The online training is the first of its kind for fishery science in Zambia and supplements the traditional training model of direct contact between the trainer and the student. The project has set up a computer laboratory with 18 computers connected to fully functional internet connectivity. Through our partnership with BluePlanet, the project has produced 85 English animations/movies with scripts on the following topics (i) Fish Biology; (ii) Fish Welfare; and (iii) Fish Processing Hygiene. A female narrator was used for the movies to encourage women into the aquaculture business.

User manuals to guide the platform users have been produced and shared with NRDC. The user manuals describe how to administer the online platform, including setting up users and classes and assign courses to learners and, assessing learners engagement with the platform. It also guides training officers to monitor the progress achieved by the registered online students.

2.2 Activity 2: Students from the NRDC Gain Practical Skills through Internships specifically Tailored to Address the Needs of the Private Sector

The project has constructed a skills field training center at NRDC to help the fisheries and aquaculture students carry out their practical learning (see figure 2). The training center, which is about 90% completed, has a four-roomed building, housing an indoor hatchery and separate rooms for feed formulation and storage, a small office, and ablution facilities. The indoor hatchery with

all-year-round water supply has a production capacity of one million fingerlings per year. In addition, the center has the following facilities (i) 6 nursery ponds (20m² each); (ii) 4 broodstock ponds (50m² each); (iii) 4 production ponds (300m² each); and (iv) a sedimentation pond (600m²) for biosecurity and waste control system. To further reinforce biosecurity measures, foot-baths have been constructed at the main entry point (see figure 3).



Figure 2: Photo of Aquaculture Field Training Center at NRDC (photo by Ian Bbole)



Figure 3: Photo depicting biosecurity measures at the Aquaculture Field Training Center - (photo by Ian Bbole)

Activity 2 and Activity 1 are linked. The next steps for activity 2 involve assessing how the 2019/2020 fisheries and aquaculture students are utilizing the training facility to gain practical skills. In addition, in collaboration with private sector enterprises hosting interns, the project will assess the performance of interns. The project will also assess the gender-related opportunities for male and female students, the obstacles they face and how these can be addressed. Findings will be used to improve the program, students attachments as well as to design marketing approaches targeting future students.

2.3 Activity 3: Students from the NRDC find Gainful Employment with Companies Operating in the Aquaculture Value Chain or Set Up Their Own Aquaculture-related Businesses, and Prospective Students are encouraged to apply to the Fisheries Science Department at the NRDC

The project is still preparing students for both employment and entrepreneurship in the aquaculture industry through the upgrading of the curriculum and design of an industry responsive internship program. In 2019 the project conducted a Fisheries Awareness and Sensitization Seminar for students at NRDC involving current and past fisheries science students and private companies (see annex 3). The seminar aimed to raise (i) awareness of the project activities for NRDC and, (ii) further motivate students' interest in fisheries and aquaculture training program. Private sector representatives and carefully selected former students made motivational talks to educate the students of possible career paths in fisheries vis-à-vis potential employers; career prospects and entrepreneurial opportunities in the aquaculture value chain.

As soon as the upgraded curriculum is rolled out for the 2020 academic year, profiles of students will be published on NRDC website as a way of marketing the students to potential employers. The student profiles will include, among others the students' specific areas of interest in fisheries and aquaculture and their experience if any. The project will circulate the link to the students' page to companies willing to host interns.

Research conducted by WorldFish has shown that private sector companies hire expatriates from Europe and some selected African countries because they do not have confidence in locally-trained graduates. The project engaged the private sector in the curriculum upgrading process to ensure alignment of the revised curriculum to the needs of the private sector. In 2020 the project will continue to engage with the private sector to develop an internship program that responds to the human resource needs of the aquaculture subsector in Zambia. This collaborative effort is expected to ultimately restore private sector confidence in NRDC graduates. Furthermore, the project will link fisheries and aquaculture graduating students (who wish to set up aquaculture enterprises after graduation) to financial lending agencies such as banks and micro-financing companies to help them get affordable loans for their businesses.

2.4 Activity 4: Scaling the Upgraded Fisheries/Aquaculture Package for Adoption/Modification by other TEVET Institutes in Zambia

The planned results for *Activity 3* have been achieved. In addition to NRDC, Kasaka Fisheries Training Institute (KFTI) expressed interest in upgrading their curriculum and worked closely with WorldFish and its partners. Unlike NRDC, KFTI does not have any external quality assurance system. Building on the WorldFish relationship with the University of Zambia, the project collaborated with the University of Zambia who agreed to evaluate the KFTI upgraded curriculum as part of its contributions to improving quality of training offered by other tertiary institutions in the country. As part of the commitment of the project to improve the quality of graduates from training institutions, the project advised the KFTI to affiliate its certificate program to either TEVET or the University of Zambia. The project will follow up on this activity as part of its monitoring and evaluation of the performance of KFTI on the upgraded curriculum. Lastly, the online training platform which is being led by Blue Planet has been scaled to the private sector and will be launched as a training program for Lake Harvest investments in both Zambia and Zimbabwe in May 2020.

2.5 Activity 5: Private sector Linkages with and TEVET Provided to Smallholder Commercial Fish Farmers

Activity 2.5.5 has five sub-activities, as reported below.

Sub Activity 5.1: Assess Market Actors

The project activities in 2019 built on the assessment of private sector market actors carried out in 2018. The project now has 22 market actors profiled in the database from the initial five in 2018 - see Annex 4. Private-sector market assessment study aimed to (i) understand the existing level of private sector engagement with the smallholder fish farmers and; (ii) determine the willingness and ability of commercial actors to make sustainable investments in smallholder aquaculture markets, and integrate a gender- and youth-focused lens into their business models. The findings from this study were used to select private companies to work with to develop the aquaculture sector in Zambia, particularly in Northern and Luapula Provinces.

Sub Activity 5.2: Conduct Commercially Oriented, Gender- and Youth-responsive Market Research

A total of 1,942 smallholder farmers were profiled and mapped in 2019. This brings the number of farmers profiled and mapped into the project database since 2018 to 2,361 (14% females and 86% males). The maps showing the distribution of the farmers have been given to the private sector actors for them to understand the distribution of smallholder farmers and develop effective outreach plans. Commercial players need information on the characteristics and cluster of smallholder farmers for them to make meaningful investments in this subsector. Lastly, the results of the smallholder census show that women participation is low at 14 per cent. As indicated in the previous section, the project will continue working with the private sector to promote aquaculture

technologies that are gender-responsive to encourage women participation. The project is also developing strategies to increase the number of women participating in project-related activities, including training and hosting demonstrations.

Sub Activity 5.3: Provide Early-stage Investment Support

One of the key project milestones is to recruit at least 10 commercial actors who are willing and able to invest in input and output aquaculture markets. The project has made some progress on this activity. Four commercial actors signed Memoranda of Understanding (MOUs) with the project aimed at supporting the growth of the smallholder aquaculture based on the parties mutual interests. The signing of MOUs has so far yielded exciting results such as (i) the opening of a [new aquaculture input supply store](#) in Kasama district of Northern Province to provide feed and extension services to the smallholder fish farmers and; (ii) establishment of a nucleus breeding center (hatchery) to provide sex-reversed fingerlings, technical services and training to smallholder farmers. The WorldFish communications team reported the opening of a first-ever aquaculture shop in Kasama district that was witnessed by top government officials and fish farmers in the region (see [here](#)).

Through the project's engagement with private sector actors, a cluster of 380 (38% of 1,000 farmers targeted by 2021) have received various aquaculture extension service support (access to fish feed, seed and aquaculture training). However, engagement of private sector players to invest in smallholder aquaculture took longer than expected. Some private sector actors were skeptical about investing in smallholder farmers as they considered the smallholder fish farmers to operate at sub-commercial levels. Additionally, the private sector perceives smallholder farmers as preferring local feed to high-quality commercial inputs and, as well as lacking capacity to buy high-quality inputs. The project is confident that working with the four willing private sector actors, it will deliver on the planned results and create a model for private sector investment in smallholder aquaculture. The project expects the number of smallholder farmers receiving extension service support to increase in 2020 following the investments made so far to create and strengthen the input and output aquaculture markets that are linked to the smallholder farmers. Availability of quality extension support is expected to improve smallholder farmers productivity and profitability of their enterprises.

Sub Activity 5.4: Increase the Capacity of Private Actors to Deliver Outreach, Farmer Training and Extension Services

The project produced maps indicating the spatial location and production potential of smallholder farmers and their willingness among others to modernize and improve their productivity. Data from the mapping exercise has been made available to the private sector companies linked to the project. The private sector is expected to use these maps to plan how to efficiently and effectively deliver extension and support services and roll out their supply chain. Although the project

database has detailed information on smallholder farmers, data was anonymized when developing maps to protect smallholder farmers' privacy (see annex 5).

Furthermore, a [Better Management Practices](#) (BMP) manual for farmers farming tilapia in pond-based systems in Zambia has been developed (see [here](#)). The BMP was developed jointly with WorldFish and private sector actors to enhance ownership of the manual by private sector partners and increase their ability to use the manual to deliver high-quality extension service to smallholders. WorldFish developed and shared training materials and brochures with private sector players for their use as they interact with the smallholder farmers. The developed materials will improve the quality of knowledge and information available to farmers which will ultimately improve the productivity of smallholder farmers. The smallholder-private sector linkages will help smallholder farmers learn about new technologies that they can adopt or adapt to increase their productivity. Linkages to the private sector may also improve farmer linkages to markets and by extension income generation potential.

Sub Activity 5.5: Demonstrate and Test Technologies

The project carried out consultative meetings with private actors to identify technologies that could be transferable to smallholders. The consultative meetings came up with a list of technologies, including labor-saving technologies that can be beneficial to women and female youth who carry the extra burden of performing unpaid/ domestic tasks in addition to agricultural duties. Table 1 shows a list of technologies that were identified and agreed for prioritization.

Technology demonstration sites for tilapia and catfish farmers were identified for construction of demonstration fish ponds. Selected private actors and lead farmers in target communities will operate the demonstration site. Extra efforts will be made to engage women in hosting some of the demonstrations, including engaging women farmer groups. It is hoped that more smallholder farmers will adopt the technologies on their respective farms.

Table 1: Proposed Productivity-enhancing and Labour-saving Technologies for Smallholder Fish Farmers

Productivity Enhancing Technologies	Labor Saving Technologies
<ul style="list-style-type: none"> Improved quality fish feed 	<ul style="list-style-type: none"> Improved pond design to improve harvest efficiency
<ul style="list-style-type: none"> Improved quality fingerlings 	<ul style="list-style-type: none"> Demand feeders
<ul style="list-style-type: none"> Improved genetics on local species 	<ul style="list-style-type: none"> Use of nets for harvesting
<ul style="list-style-type: none"> Fertilization of ponds 	<ul style="list-style-type: none"> Use of refrigeration
<ul style="list-style-type: none"> Liming of ponds 	<ul style="list-style-type: none"> Aggregation of fish during harvest
<ul style="list-style-type: none"> Use of greenhouses 	
<ul style="list-style-type: none"> Use of PH meters 	
<ul style="list-style-type: none"> Use of oxygen meters 	
<ul style="list-style-type: none"> Use of thermometers 	

Productivity Enhancing Technologies	Labor Saving Technologies
• Use of ammonia kits	
• Use of aerators	
• Use of total dissolved solids meters	
• Use of hapas to enhance feeding of fingerlings	
• Use of refrigerated trucks	
• Drying and salting of fish	
• Use of disinfectants	

The project also facilitated three community meetings and radio call-in promotional programs to improve engagement with the farmers. The radio program included discussions with various experts on several topics, including fish farming technologies and inputs offered by the private sector. Additionally, farmers and experts discussed feed prices, feed composition and, recommended feeding practices under various condition.

3. Project Formal Meetings

During the reporting period, the project held two key formal meetings to review the implementation progress for 2019 and plan and for 2020, respectively. The 2019 planning took place in March (see annex 6) while the 2020 planning meeting was held in November 2019 (see annex 7). The meeting was organized and chaired by WorldFish as part of the annual formal project meetings. The objectives of the meeting were to (i) discuss the 2019 AQ TEVET progress report and financial report; and (ii) prepare the 2020 implementation plan. Among the Participants were the WorldFish Country Director, Director of Strategy (Musika), Project Managers, Vice-Principal (NRDC), Representatives from Kasaka and many others. The following were the key presentations made during the meeting: (i) project overview and objectives of the meeting; (ii) 2019 finance progress report; (iii) the 2019 technical progress report; (iv) communications outputs; (v) and the monitoring evaluation report. The second session involved group discussions and detailing of the consolidated 2020 implementation plan (see annex 8). The key discussions were on the progress made in terms of implementation; project burn rate, including recommendations for the coming year for efficient delivery of results.

Also, the project held quarterly project management meetings with partners, Musika, Blue Planet and NRDC. There were also internal meetings that were held by the project team every month where a project management dashboard, including monthly expenditure, were presented and discussed. Key results and success stories were shared to the public using various media platforms such as blogs, Facebook, television, radio and public meetings. The fisheries and aquaculture program was also advertised during primetime on national media (television and radio to reach the intended target group). On television, we ensured that female students and practitioners appeared on the visuals to promote the program to potential female candidates (see annex 9 and 10).

4. Account and Assessment of Deviations from the Latest Approved Implementation Plan and Application

Most of the planned activities were implemented, as indicated in the previous sections. Based on the progress achieved to date, the project is expected to achieve the planned outcomes. The only deviation from the latest approved implementation plan is a reduction in expenditure of the personnel budget line following the resignation of the Project Leader in April 2019 and delayed recruitment of his successor, who is expected to report in February 2020. The Project Manager secondment was approved, and she reported for work in August 2019.

Consultants who were hired to carry out the curriculum upgrade process did not fully deliver on their assignment. The consultants developed the gap analysis report and shared these findings, including the draft curricula for both NRDC and Kasaka. However, the curricula did not address the key issues that were identified and prioritised during the curricula validation workshops. Based on this discrepancy, NRDC and Kasaka did not approve the draft upgraded curricula developed by the consultants. To finalize the curricula and learning modules the project hosted a series of workshops during which participants who included experts from WorldFish, NRDC, University of Zambia, Kasaka Fisheries Training Institute, Ministry of Agriculture, and Ministry of Fisheries and Livestock collaborated to revise the curricula for the two training institutions. The new curriculum has since been approved for implementation.

5. Assessment of how Efficiently Project Resources have been Turned into Outputs

The project resources to deliver many of the reported results were allocated in a very efficient manner. All meetings with the project team and partners, including trips resulted in strategies for delivering outputs towards achieving key outcomes. The monitoring and evaluation and learning unit provided monthly updates on the progress made and senior management made strategies to use the available resources to achieve maximum sustainable results efficiently.

6. Project Implementation Constraints

It took more time than expected to upgrade the curriculum. The curriculum was eventually finalized and approved by December 2019, implying that the project will only be able to monitor curriculum implementation by NRDC for 18 months instead of the planned 24 months.

A key constraint under component II of the project has been the difficulty in obtaining 'buy-in' from private market actors to support smallholder farmers who are widely dispersed over a large geography and characterized with low levels of commercialization and productivity, technical capacity and purchasing power. This low buy-in from the private actors led to failure to meet the planned numbers (4 out of the planned 10 private actors by 2020) of cost-shared partnerships. However, the project has continued working with these four companies and is optimistic that it will achieve the desired results by 2021. The four companies will be a model for other commercial players. The component is also re-strategizing to engage more small businesses that have been working with a project partner, Musika in the northern region.

Furthermore, the effects of the drought experienced in the southern region of the country where most commercial production facilities, (for fish feed mills are located), and the countrywide rationing of electricity resulted in a significant rise in the cost of feed due to increased production costs. The increase in production cost has impacted negatively the smallholder farmers who are still struggling to purchase commercial feed at higher prices. The project is discussing with aquaculture feed producers to make smaller packages which could be affordable for smallholder farmers.

7. Project Risks

Table 2 provides a summary of project related risks and how they are being managed.

Table 2: Project risk analysis

Identification	Analysis			Management
Risk	Probability	Impact	Overall risk	Risk-reducing measures
Lack of opportunities for students to find gainful employment	10%	Part of the goal of the project would not be achieved	Low	Based on the analyses carried out during the design phase of the project, there is considerable interest from the private sector to acquire better trained/skilled human resources to improve their businesses. Currently, such skilled labor is not readily available in Zambia and creates a massive bottleneck for industry players. Secondly, the project has been working with the private sector during the curriculum upgrade program, and also to design an internship program to ensure students acquire the necessary and relevant technical and practical skills to enter the market immediately after graduating.
Lack of smallholder farmers who have the interest to farm fish as a business or get involved in value chain activities	30%	Links to the private sector would be fewer than expected	Low to medium	The project has identified and profiled a database of active and none active smallholder farmers. Intensify linkages with four private sector actors as a way of creating a 'win-win' situation, and ultimately become a model for others to learn
Low women participation aquaculture	20%	The project does not	Low	Registration of women cooperatives to encourage women participation in aquaculture

Identification	Analysis			Management
Risk	Probability	Impact	Overall risk	Risk-reducing measures
		reach its goal of helping make the sector more inclusive		Designing and testing pro-poor, gender- and youth-responsive business models with the private sector and smallholders will increase the likelihood that smallholders will be afforded opportunities to increase their productivity and profit from their participation in the value chain.

8. Tables

Table 3: Composition of Participants at the Curriculum Revision Workshop

Sector Category	Name of Institution	Number of Participants
Training Institutions	NRDC	10
	Kasaka Fisheries Training Institute	5
	University of Zambia	3
	Mulungushi University	1
	Copperbelt University	1
	Sub-total	20 (27%)
Public Sector	Ministry of Agriculture	1
	Ministry of Fisheries and Livestock	1
	Curriculum Development Centre	1
	Technical Education Vocational, and Entrepreneurship Training Authority (TEVETA)	1
	Sub-total	4 (5%)
Private Sector	Aquaculture Development Association of Zambia	2
	Aquaculture Private Sector Enterprises;	7
	Sub-total	9 (12%)
Alumnis	2013 to 2017 NRDC alumni; students;	38
	Sub-total	38 (51%)
Project Executing Agency	WorldFish	4
	Sub-total	4 (5%)
Consultants – Curriculum Review	University of Stirling, UK	2
	Sub-total	2 (3%)
Total		75 (100%)

9. Annexes

Annex 1: NRDC Fisheries and aquaculture upgraded curriculum

Annex 2: NRDC Fisheries and Aquaculture justification for modification of the curriculum

Annex 3: Private sector and student seminar report

Annex 4: Summary of private sector companies assessed

Annex 5: Maps showing the distribution of smallholder fish farmers

Annex 6: 2020 reflection and planning meeting report held in November 2019

Annex 7: 2019 planning meeting report

Annex 8: 2020 project implementation plan

Annex 9: TV project advert calling for enrollment at NRDC

Annex 10: Radio advert for fisheries and aquaculture program