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THE SUPPLY CHAIN PRACTICES OF FRESH FISH FARMERS IN KOLA, KISARAWE DISTRICT, TANZANIA.

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ABSTRACT

Purpose: The study assessed the fresh fish farming process along the supply chain of Kola-Kisarawe, Tanzania. It further digs into understanding the contributions of conducting fresh fish farming in the context of preparation and construction of ponds, site location for farms, harvesting and packaging as well as marketing and distribution.
Design/Methodology/Approach: A qualitative research design was adopted and data were drawn from 5 key informant interviewees from five ponds who were selected by purposive sampling technique. Key informant interviews, documentary reviews and non-participant observation were used in data collection. Thematic data analysis strategy was adopted whereby data gathered were analysed by content analysis using MAXQDA 2020 software.
Findings: Findings showed that fresh fish farming is conducted through the construction of ponds, site location, harvesting and packaging as well as marketing and distribution. Further, findings indicate that availability of funds, proper storage, handling and marketing to mention just a few are the processes for fresh fish farming.
Research Limitation: The study focused on the practices of fresh fish farmers along the supply chain of fish farming.
Practical implication: The study recommends stakeholders participate actively in the provision of capital, search for markets and build public awareness of the contributions of fresh fish farming. These findings contribute to the existing knowledge in the sector and insist on stakeholders' participation in the improvement of the fresh fish farming process.
Social Implication: Clearing shortcomings in the sector will help in improving fish farmers' and traders' livelihood, the country's economy and employment in general.
Originality/Value: The work stems from a novel idea and findings from the field. It is expected that the work will contribute to improving and awakening the authorities on the importance fresh fish farming has for people's livelihood.
Keywords: *Farmers; fresh fish; fish farming; pond; supply chain*

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INTRODUCTION

Background of the study

The supply chain plays a significant role in ensuring fish farmers practice farming and provide fish products to those who need them (Obiero, Meulenbroek, Drexler, Dagne, Akoll, Odong, Kaunda-arara, & Waidbacher, 2019; Biswal, 2015). This helps fish farmers to create and restructure the farming process and ensure on-time delivery of the fish to the parties in the supply chain (Of, Nikimu, & Ponds 2013). The supply chain creates sustainable delivery, allocation and production for any products and fish products in particular (FAO, 2014; Chopra & Meindl, 2013). This is suggesting that fish farmers are an important category of bringing fisheries supply chain (Alemu & Azadi, 2018; Ragasa, Agyakwah, Asmah, Mensa & Amewu, 2020). In this regard, fish farming contributes to eradicating extreme poverty and hunger, reducing child mortality, and improving maternal health, ensuring environmental sustainability as well as saving function (Ragasa *et al.,* 2020; Of, Nikimu, & Ponds, 2013). While fish farming helps farmers to increase food availability, provision highly nutritious protein and micro-nutrients, offering employment and income that improves their livelihood opportunities (Obiero *et al.*, 2019), it enables them also to ensure the continuity of the production chain through their roles and practices(FAO, 2014b; Lauzon, 2010), among which include distributing it to customers across the supply chain(Biswal, 2015).

Fresh fish farming can be referred to as the process of keeping and growing fish for profit or personal use (Ragasa *et al.,* 2020). Through the process, a reasonable amount of tonnes of fish have been supplemented in the fish market to maintain current levels of fish consumption (Fermon, 2008)**.** In this context, several types of fresh fish have been grown across the world. These include but are not limited to Oreochromis niloticus, bonny tongue, heterotis niloticus, African catfish, clarias gariepinus and alike. Because fresh fish is a perishable commodity farmers and suppliers need to distribute it in the market supply chain before it goes bad and according to varied environmental conditions (Ragasa *et al.,* 2020).

Moreover, for fish farming to be undertaken successfully, some practices are vital. Such practices include but are not limited to the construction of fish ponds, searching for fish market and distribution, site allocation and substances (Jamandre, Hatch, Bolivar, & Borski, 2011). For instance, in the construction process, site clearance, construction plan, dikes and bases (bottom), water supply, as well as the construction of structures for supply and drainage are undertaken (Fermon, 2008). Also, fish farmers require to select a suitable site for fish farming specifically for the protection of fish from diseases, introduction of fish reproduction process as well as allocation of fertilizers and food for feeding and growing of fish (Hilbrands, 2004). In fish harvesting, practices selecting harvest equipment such as a gill net for catching up matured fish required in the supply chain are vital (Aryani, Khalifa, Herjayanto, Solahudin, E. A., Rizki, E. M., Halwatiyah, ... & Pratama, 2021). In fish marketing, farmers ensure that they select, handle with care and distribute the fish in the proper channels and appropriate geographical locations for selling such fish(Hayes, Leathwick, & Hanchet, 1989). Such practices, make fresh fish farming indispensable to the business supply chain.

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In the context of the supply chain, fish farming enables farmers to ensure the quality and value of fish, flowing them from one place to another, developing fish growth and production, facilitating site distribution as well as marketing (FAO, 2018). Throughout the supply chain, fish farmers are required to build up a production chain to maintain fish sustainability in terms of farming, delivery as well as entire supply chain process (ADB, 2005). By considering the economic and social benefits of the entire practice, some initiatives have been taken by the government and other stakeholders to improve the entire practice of fresh fish farming. The fisheries act, 2003 (no. 22 of 2003), national fisheries policy, multi-stakeholder consultation for the anti-dynamite fishing campaign in Tanzania, national agricultural development policy, national fisheries policy of 2020, fisheries investment plan at Bunda district are among such initiatives (Mbelle, 2020; URT, 2013; URT, 2015; Slade & Kalangahe, 2014).

Despite the presence of all these initiatives, the current situation shows that fresh fish farming in East Africa particularly Tanzania has been less effective in contributing to the entire sustainability of the fish and fish supply chain in the fish market. A situation that has been partly attributed to the use of rudimentary tools and techniques (Obiero *et al.*, 2019). Moreover, the practice has been said to benefit intermediaries who participate in the distribution channel by carrying out activities such as marketing, distribution, and much more than farmers themselves, a situation that has led farmers to despair in the business. However, scarcity of literature on the sector in the Tanzanian context, on how the processes in the sector contribute to the entire supply chain continuum of fish and fisheries products. Hence such a trend has prompted researchers to conduct this study to assess the contribution of the fresh fish farming process in the supply chain and recommend measures to improve the rate of contribution in the entire business supply chain. More specifically, the study examined how operations of fresh fish farming contribute to the supply chain in Kola- Kisarawe district and recommend strategies for improving the fishing farming to create contributions along the supply chain.

It is expected that the findings of the study are beneficial to decision-makers and various stakeholders such as fish farmers, state government, processing firms as well as supply chain actors in the field of fresh fish farming. It will also help the government to be aware of fresh fish farming and its contributions along the supply chain since the fish farming sub-sector makes a high economic contribution to the government as well as the business supply chain. Then this study helps the policymakers to create strategic supportive measures to invest in fish farming specifically fresh fish since it is among the critical part of the supply chain and trade in general which provides self-employment and improve livelihood opportunity.

LITERATURE REVIEW

Theoretical review

This study employed Ecosystem Approach to Fisheries (EAF). This approach has been adopted by the FAO consultation Committee on Fisheries (COFI) as the appropriate and practical way to fully

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implement the Code of Conduct for Responsible Fisheries (Fisheries & Paper, n.d.). These include the ecological, social and economic elements of sustainability, thus addressing the main pillars of Sustainable Development (FAO, 2019). The EAF identifies and deals with all the positive and negative aspects associated with fisheries. These include issues with little formal information and even issues generated from non-fishery sources (e.g. pollution, climate). The EAF process is to develop and implement an integrated set of management arrangements for a fishery to generate more acceptable, sustainable and beneficial community outcomes. The EAF planning steps have been specifically developed to apply to the management of fisheries (FAO, 2012). Similarly, EAF is defined by Ward, Axford & Krause, (2002) as an extension of conventional fisheries management recognizing more explicitly the interdependence between human well-being and ecosystem health and the need to maintain ecosystem productivity for present and future generations. This includes conserving critical habitats, reducing pollution and degradation, minimizing waste, and protecting endangered species.

Moreover, the main purpose of this approach to fisheries was to plan, develop and manage fisheries in a manner that addresses the multiplicity of societal needs and desires, without jeopardizing the options for future generations to benefit from a full range of goods and services provided by marine ecosystems (Fisheries & Paper, n.d.). Thus, this approach to fisheries is intended to balance diverse societal objectives, by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.

Accordingly, this theory shows the way how to plan, develop and manage the fisheries trade. On the other hand, the theory helped the authors to generate strategic measures which can be used to promote and improve fisheries development and growth of the inland fish to enhance contributions to the business supply chain which is the main thumb of this current work.

Empirical review

Several studies have been conducted relating to activities that take place in the entire process of fresh fish farming. Beginning with is site location. It is considered one of the paramount important activities in the sector. This means that fish farmers require a complete suitable location with moderate temperature and close to home and a passable road to facilitate the supply chain of fish (Of *et al.,* 2013; Hilbrands, 2004). This is associated with having adequate land (Ragasa *et al.,* 2020) with suitable soil types (Ragasa *et al.,* 2020).

It is moreover given by literature that upon successfully allocating the site, preparations for and construction of a fish pond follows, literature shows that construction of the fish pond is associated with the availability of funds for the construction of a dam or pond (Jamandre *et al.,* 2011), planning and designing fish ponds and purchasing require material (Of *et al.,* 2013) and making better use of knowledge and skills in the laying out planning and construction of such ponds (Of, *et al.,* 2013).

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Securing water for fish is vital. The farmer has to ensure the adequacy of the water supply for fish growth and development Ragasa *et al.*, 2020). Further, plan for locating fish species while facilitating this through the allocation of fingerlings, feeds and fertilizer for fish feeding and growing (Ragasa *et al.*, 2020; Hilbrands, 2004). This aspect is associated with the protection of fish from diseases as well as conducting fish inspections before harvesting (Of *et al.*, 2013). Indeed, clarify that fish farmers need to introduce the fish reproduction process to increase specie (Hilbrands, 2004). In line with this, literature depicts that the farming equipment such as scales, boats, water quality kits, bowls, scoop nets, feeding kits and graders, as well as facilities such as a farmhouse and feed storage room are crucial for the site of fish farming (Ragasa *et al.*, 2020).

Fish harvesting becomes another process for fish farming in the supply chain. This is mainly associated with the selection of matured fish species (Hilbrands, 2004). Also, this aspect is characterized by the presence of equipment for facilitating fish harvesting (Hilbrands, 2004). At this point, marketing and distribution set in by identifying geographical locations for the distribution of freshwater fish (Hayes *et al.*, 2010). This is practised through bargaining or negotiation of possible buyers or markets for fish (Of *et al.*, 2013; Ragasa *et al.*, 2020). However, the other practice in this way is ensuring proper storage and handling of fish (Ragasa *et al.*,2020).

METHODOLOGY

This study was carried out in the Pwani region and specifically concentrated in Kisarawe District at Kola village in which fresh fish farming is undertaken in much greater volumes. Specifically, the study was conducted at Kola-Kisarawe from Jakicha Agri and Aqua farm, Kisakeni freshwater fish farm, Mbuge freshwater fish farm, Nassa and Dulla freshwater fish farms whereby fish farmers are easily accessible and available making it simple for the authors to get the right information on the fresh fish farming process and its contributions along the supply chain.

This study employed a qualitative approach with a case study design to get deep information related to the practices of fresh fish water farming and their contributions to the supply chain (Suryani, 2013). Also, the qualitative approach was significant to this study since it helped to explore, explain, discover and understand the fish farming process and its contribution to the business supply chain. The approach helped the authors to be very close and engaged with respondents to know the matter they have in the context of fish farming (Astalin, 2013). In this study, respondents were obtained by the use of purposive sampling because researchers wanted to get real data from an informed person. Key-informant interviews, non-participant observation and documentary review were used for data collection (Astalin, 2013). Key-informant interview with 5 freshwater fish farmers while non-participant observation around the ponds. The authors intensively observed the types of fish, the structure of the dams or ponds, treatment of fish in terms of shelter and food and alike helped to know the practices of fish farming (Kothari, 2004). Each key-informant interview was conducted independently and all interviewees were asked similar set of questions. However, more probing was used when the need arose. All interviews covered

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between 60 to 90 minutes in order to get in-depth information regarding to the practices of fresh fish farming along the supply chain. It also helped the authors to re-structure research guiding interview as well as modified the repeated answers based on the respondents' knowledge, ideas, views and perceptions (Kothari, 2004).

Some of the documentaries reviewed by authors included former relevant research reports, government reports, and website pages. These include but are not limited to the fisheries Act, 2003, national fisheries policy, multi-stakeholder consultation for the anti-dynamite fishing campaign in Tanzania, national agricultural development policy, national fisheries policy of 2020, fisheries investment plan as well as the National Strategy for Growth and Poverty Reduction II.

In this study, Swahili transcriptions were translated into English and the handwritten transcripts were typed and saved as documents in MS word. Qualitative Content Analysis was conducted using qualitative analytical software MAXQDA 2020 [VERBI Software, Marburg, Germany]. Data were summarized, arranged, organized, and interpreted. From this data set, codes and sub-code were generated which culminated in important content for each objective.

FINDINGS AND DISCUSSION

These findings are structured around the four fresh fish farming practices of the supply chain process which include preparation and construction of fish ponds, location for the fish site, fish handling and packaging as well as facilitating marketing and distribution of fish products. In this way or rather the process at which freshwater fish farming is important to feed the population as explained in the subsequent paragraphs.

Preparation and construction of fish pond;

Fresh fish farming at the construction stage was attributed to the availability of capital for the construction of modern fishing facilities as attested by three key informants which are equivalent to 60% of interviewees who dilapidated that, the project needs a high amount of funds till it is completed. However, 2 key informant interviewees which made up 40% of the respondents stated that very few amounts the fund are required to start a project only by purchasing fingerlings for those who demand traditional structure. For example, one respondent narrated that;

> *"This project cost almost 80,000,000 million from starting point till completion, we were supposed to buy adequate tools such as GS pipe, drums, nets, as well as the construction of dikes which were the major activity of collecting water from all over springs* ***(male interviewee (34), Jekicha Agri & Aqua farm, Kisarawe)"***

Secondly, this process was associated with ensuring water quality and transparency confirming that, fresh fish farms need quality as well as purity of water for maintaining fish growth. The reality shows that fresh fish farming was affected by floating grasses, industrial outputs, human activities like livestock keeping, as well as mud. Thus, the farmers were compelled to sweep waste products

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away to maintain water transparency and purity. Moreover, it was revealed that fish farmers undertake to provide knowledge to other farmers who want to start a project as evidenced around of 3 respondents. Due to this, farmers resorted to providing instructions, procedures and skills related to the construction, growing and developing of fingerlings as well as incubation for the freshwater fish. One respondent stated hereunder;

> *"It is our efforts to provide and sensitize others on knowledge, skills and awareness on the procedures, means and ways of constructing fish pond to the persons who need them. For example, we shared it with Mr. Ngemera from Jordan as well in the Morogoro region and Bagmoyo,**(Male interviewee (43), Jekicha Agri & Aqua farm, Kisarawe, Tanzania)"***

Thirdly, it was revealed that fish farmers undertake to construct fish laboratories (hatchery) for breeding of fish eggs only those who practice modern fish farming as further noted by 3 key informant respondents. They emphasised that hatchery made was costly and difficult but it was useful as it helped to provide hundreds of fingerlings before putting them into big cages for further growing.

Laboratory (hatchery) for growing and breeding of freshwater fish (Photo; Issa, 2021, **Jekicha Agri & Aqua farm, Kola-Kisarawe, Tanzania)**

Traditional pond for Fresh water fish farming **(Photo; Kisakeni,2021-Kisakeni' Fresh water farm,Kola-Kisarawe, Tanzania)**

Figure 1. Hatchery and traditional freshwater fish farm at Kola village, Kisarawe

Fourth, fish farming was facilitated by purchasing materials for fish construction across the supply chain as noted by four respondents from four fish ponds. Indeed, it was noted that modern fish farmers were compelled to buy adequate fishnets, GS pipes, drums and food for ensuring well construction of fish habitats. For example, fresh fish farmers tend to buy adequate materials from Mwanza and Koudij-Ubungo centres.

Furthermore, it was associated with the construction of ethene ponds for breeding fish eggs, dikes and walls for collecting fish species in one place. This has been proved by both modern and traditional fish farmers who take consented efforts to increase the quantity of fish. Another activity undertaken in this aspect was the manufacturing of fish food as revealed by modern fish farmers from Jekicha Agri & Aqua farmers. They emphasized that it was costly to purchase fish food while

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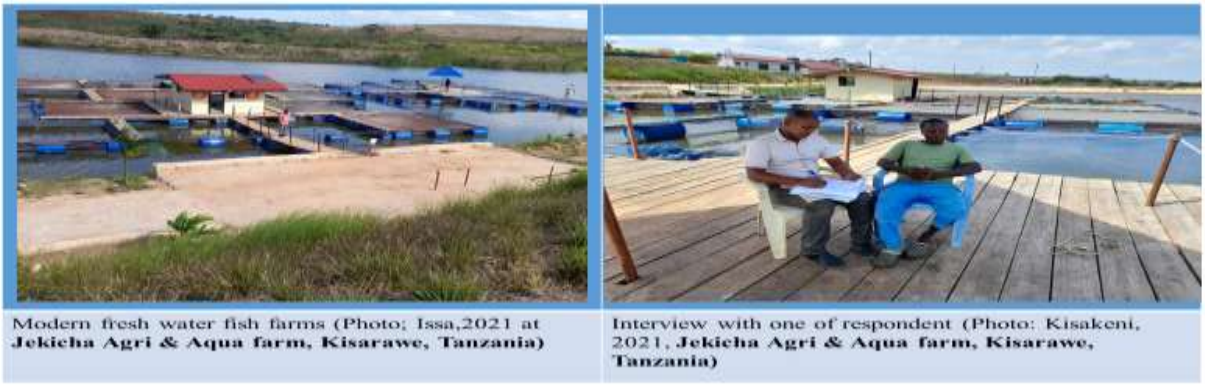
this time they bought a special machine for manufacturing fish food to avoid unnecessary costs like delaying delivery of food and feeding of fish.



Modern fresh water fish farms (Photo; Issa,2021 at **Jekicha Agri & Aqua farm, Kisarawe, Tanzania)**

Interview with one of respondent (Photo: Kisakeni, 2021, **Jekicha Agri & Aqua farm, Kisarawe, Tanzania)**

Figure 2. Modern Freshwater fish farms

Also, it was confirmed that modern fish farmers constructed nursery tanks for holding temperature as well as developing fingerlings before selling or stacking them into the cages. It was clarified that tanks were mixed with devices such as Azura for fish feeding specifically for boosting protein as well as controlling any entry that harms fingerlings fish. However, traditional fish farmers could not practice this way due to a lack of capital.

Azora for developing and boosting protein of freshwater fishes **(Photo; Kisakeni,Y 2021; Jekicha Agri & Aqua farm, Kisarawe, Tanzania)"**

Fish Processing Plant **(Photo: Kisakeni,Y 2O21; Jekicha Agri & Aqua farm, Kisarawe, Tanzania)"**

Fish Feeding Activity **(Photo; Issa, 2021; Jekicha Agri & Aqua farm, Kisarawe, Tanzania)"**

Figure 3. Fish feeding and processing plant

Based on findings, it can be said that the preparation and construction of the fish pond were undertaken by the presence of capital, water purity and transparency, knowledge and skills and above all through purchasing of materials. These results correspond well with existing literature (Jamandre *et al.*, 2011; Hilbrands, 2004; Ragasa *et al.,* 2020). This is to note that, even though the

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existing works depicted construction of ponds based much on modern construction projects, this current study has confirmed two ways of construction such as modern and traditional construction processes at Kola-Kisarawe, Tanzania. However, findings related to the construction of fish hatcheries, ethene ponds, manufacturing of fish food as well as allocation of nursery tanks from the modern fish farms were not available in the literature. These may add value and interest to this current study.

Ensuring site location for fish farms

One of the fish farming processes of ensuring site location for fish farms was related to the assurance of optimum temperature and quality of water. Findings state that high temperature led to the fish to stress and finally led to low oxygen. For example, two respondents emphasized hereunder;

> *We are taking precautions for maintaining optimum temperature of freshwater since raised temperature leads the fish to get unpredictable problems such as skin infection, affected by the parasite, protruding eyes as well as suffocating by lacking enough oxygen and finally die (Keys informants' respondents,* ***Kisakeni and Jekicha Agri & Aqua farm, Kola-Kisarawe, Tanzania)"***

Also, respondents mentioned that the location for fish farms was supposed to be very close to the road or any accessible passable roads to attract customers thereby facilitating transportation as revealed by four respondents. Similarly, selection of suitable soil classification was another way of ensuring location for fish as confirmed and evidenced by 3 respondents. This was proved that farmers considered clay soil or rather determine an appropriate place for deposition of water with little sand soil. For instance, one respondent narrated hereunder;

> *It is difficult to manage freshwater fish farming since water is supposed to deposit for a long period without infiltrating. Look! here at Kisarawe, almost all farmers prefer to use clay soil more than sand soil due to assurance of existing water. This perhaps provides us with a chance of breeding hundreds of fish that generate reasonable income* ***(Males respondents, Jekicha Agri & Aqua farm, Kola- Kisarawe, Tanzania)"***

It was reported further that protection of fish from diseases was another activity for ensuring the site location of fish farms. In this regard, fish farmers proved the presence of diseases that hamper fish such as parasitic and fungal infections. It was on the same conversation that farmers compiled with the application of regulation and fairly treatment by putting anti-fungal and anti-parasite for disease control within the pond.

Findings also revealed allocation of food for fish feeding was another activity yet difficult. Modern farmers were forced to process their food an aspect that was never found among traditional farmers (who were forced to buy feeding pellets at exorbitant prices). This, obviously, jeopardize traditional fish farmers in freshwater fish farming. It is through feeding that fish grows to the required size. So, it is either supposed to be bought or processed on the farm as was fish as narrated;

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> *You have to note that, we manufacture fish food here in our project to maintain adequate fish feeding and growing. No other ways. We are compelled to feed fingerlings 6 times daily. We as well as feed mature fish 3 to 4 times daily then after six months, we harvest and distribute fish to target customers (**Male fish farmers, Jekicha Agri & Aqua farm, Kola-Kisarawe, Tanzania).***

Findings also revealed that fresh fish farmers undertake to ensure water supply and levels as required to improve fish growing and development. Moreover, respondents stated that fish farms depend on either natural spring flow or any source where water supply are existing all the time. Not only that but also, modern fish farmers constructed special tanks for irrigating water while traditional fish farmers were compelled to use generators that could help them to pull out water from either rivers or swamps channels. This is difficult for traditional fish farmers to practice freshwater fish farming in the business supply chain.

It can be summarized that the location for fish farms was appropriate based on respondents' views and perceptions on assurance of optimum temperature and quality of water, the site being close to the road or any accessible passable roads, selection of suitable soil classification, protection of fish from diseases, allocation of food for fish feeding and growing as well as ensuring water supply and level for fish growing. These findings correspond well with some former works (Of *et al.,* 2013; Ragasa *et al.,* 2020; Hilbrands, 2004). However, an interesting part of this part of the discussion relates to the allocation of fish food and the ways of obtaining it as well as the protection and control of diseases that may affect freshwater fish in the pond in the business supply chain.

Fish harvesting and packaging

Findings present that fresh fish farming has been associated with harvesting, packing and packaging by the selection of matured fish, sensitization of knowledge on harvesting and packing, selection of equipment, quality control as well as the selection of packaging facilities. Concerning the selection of matured fishes, this has been revealed that fresh fish farmers undertook to select matured fishes as confirmed by four key informants' interviewees. It was further reported that fish farmers picked only matured fishes with 400 grams and above (matured in 6 months). Harvesting and packaging have been associated with the selection of necessary equipment including scoop and gill nets for harvesting matured fishes. Moreover, a selection of packaging devices has been used for putting and packing fish once harvested from the cages as noted around by three respondents. Respondents stated that packing and picking devices are important. In this case, trays and sucks are used for fish packaging and this facilitates the entire fish supply chain.

On the other hand, quality control was used during harvesting. For example, modern fish farmers select mega three materials which contain enough protein for ensuring the quality of fish products. These, however, were missing to traditional or localized fish farmers across the supply chain. Findings also revealed that modern fish farmers installed adequate cold storage facilities after harvesting fish as reported and observed on the farms' site. Moreover, the authors noted that deep

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freezers were installed within the constructed fishing processing plants while that after processing them, farmers were compelled to put fish products within a deep freezer for proper storage

Based on the above findings it can be said that fresh fish farming at harvesting and packaging practices was conducted through the selection of matured fish, selection of harvesting equipment, selection of packing and packaging devices as well as quality control and knowledge sensitization when harvesting fishes. These results correspond well with existing literature written by Hilbrands, (2004) who revealed that fish harvesting is associated with the selection of matured fish species. Moreover, findings related to the installation of cold storage facilities, selection of packaging, quality control as well as sensitization of harvesting knowledge were not adequately captured through available literature. These could be new quadrants that add knowledge to this new work.

Facilitation of marketing and distribution of fishes

One of the activities for fresh fish farming was marketing and distribution and this related to the determination of location for distribution, price bargaining with customers, ensuring proper storage and handling, searching for the markets as well as handling vehicles. Respondents revealed that fish and its products were distributed far from farm sites where customers' orders are. It was further confirmed that both traditional/local and modern fresh fish farmers bargained with customers on the price of fish before harvesting from the farms.

The presence of storage and handling facilities has also facilitated fish marketing and distribution. Indeed, farmers stated that they use cold storage facilities, smoking, trays, plastics trays and vehicles for facilitating the handling of fish products. One interviewee confirmed that:

> *"We are using trays, plastics and smoking method for storage of fishes before distributing to the customers. Similarly, traditional/localized farmers use the same especially smoking, frying, salting and alike for fish storage while others used buckets for handling and distribution of fish* **(Freshwater farmers, Kola-Kisakeni & Nassa fish farms Kisarawe, Tanzania)".**

It was reported further that common fish marketing and distribution roles played by farmers included searching for fish markets and customers. As opposed to marine fishing and modern freshwater fish farmers in which customers tend to find out where the fish is located take it and supply it in the market. Modern fish farmers receive and deliver orders from potential customers. For example, during an interview session, it was revealed that farmers receive orders from catering companies and hotels. On this one interviewee was quoted saying;

> *Normally, traditional fish farmers suffered from finding out potential customers compared to modern freshwater fish farmers who promote their projects via Television, social media and radio. Taking an example of Jekicha Agri & Aqua farm, they always*

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> *advertise themselves and are always watched by customers through media compared to us. This is our business, we would like to have potential customers but we don't have enough funds and assistance to promote this project to the public and media in particular"* ***(Male respondent, traditional freshwater fish farm-Kisakeni fish farms, Kola-Kisarawe-Tanzania)***

With regards to vehicles for handling and transporting fish, findings reveal that the presence of these vehicles serves to transfer fish from one place to another. Findings further maintained that handling vehicles were installed with freezers as well as handling facilities for easy distribution of fish. Such a practice plays an important function in distributing the required amount of fish in the market and the general supply chain.

It can be summarized that fresh fish farming during marketing and distribution contributes widely to enriching the amount of fish in the entire fish markets and thereby contributing to the general business supply chain. These findings correspond well with some former works (Hayes *et al.*, 2010; Of *et al.*, 2013; Ragasa *et al.*, 2020;). However, an interesting part of this discussion relates to searching for the markets as well as the presence of special vehicles for transporting and distributing fish. These vehicles ensure that fish reaches the market at the right time and to the required standard. This contributes directly to the entire supply chain of fish. Such facts have not been captured by other previous works.

Contributions to conducting Freshwater Fish Farming along the Supply Chain

The study intended to get a better understanding of the contributions of fresh fish farming practices along the supply chain. Specifically, the work has revealed five major benefits that fresh fish farmers obtained when engaged with freshwater fish farming. These include;

Increased numbers of customers**;** from the verbal expression of interviewees it was stated that fresh fish farming depends on consumers' demand and supply, by the way, it increases the number of consumers day after the other. This was proved that fish farmers received and delivered a variety of orders from urban areas including hotels by using specialized vehicles.

Promoted marketing and distribution. Findings expressed that, through daily consumption and harvesting of fish products, fish farmers were responsible to promote their means of distribution and marketing of fresh fish. However, this was granted by the presence of adequate localized markets and customers for maintaining product distributions. In the way of market promotion, vehicles which were installed with deep freezers acted as fish mobile markets and storage. Indeed, this method has been recognized for having a reliable electric power supply that was ensured by the existing of reliable cold storage facilities when it comes to storing fresh fish products. This owes to investing heavily in modern fishing technology within the vehicles.

Created employment opportunities; Thirdly, from the verbal expression depicted by both localized and modern fresh fish farmers, it was reported that fish farming creates employment opportunities

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for the farmers, traders and customers who bought fresh fish. For example, some catering markets enabled create employment by offering the persons the delivery and ordering for fisheries produces.

Facilitated learning and knowledge provisions; Moreover, interviewees depicted that; the fresh fishery project has led a chance for various stakeholders including universities and training institutions like UDSM to share and partner with knowledge on the ways of conducting the fresh fish farming process. Also, the study revealed that freshwater fish farmers sensitized knowledge to the customers and stakeholders like Mr. Ngemera from Jordan and UNDP to study fresh fish farming along with preparation till harvesting them.

Increased incomes and improved livelihood: Further, from the verbal expression, it was depicted that fresh fish farmers benefited through the marketing and selling of fish products. For example, it was reported that the harvesting of 1200 grams of fresh fish to 1kg. This means that 1kg generates 8,000 to 10,000 Tzs. Therefore, fresh fish farming is difficult to conduct but quickly improves farmers' livelihoods and incomes if there is an adequate market, marketing, selling and distribution

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study intended to get a better understanding of the practices of fresh fish farming and its contributions to the supply chain. Specifically, the study intended to examine the fresh fish farming process in the context of the supply chain at Kola village -Kisarawe district. The findings were structured around the four activities of the fishery supply chain which include, the preparation and construction of fish ponds, site location for fish farms, harvesting and packaging as well as marketing and distribution. However, in this process, fish farming processes are explained based on the above activities.

Accordingly, it is revealed that the construction, designing and entire farming of fresh fish farming in Tanzania has not been considered to be one livelihood activity. The project incurs a lot in terms of pond constructions, fish feeding and even marketing of the products but receives less support from the government and other stakeholders making it hard for the sector to contribute effectively to the supply chain of the entire fish market. Moreover, the conundrum of higher prices for fish feeds makes the sector more of a threat than an opportunity.

With the way on it, fish farmers are overwhelmed in selecting suitable sites or locations for investing in fish farms. This requires them to take consented efforts to find out a proper location such as areas near to water sources like natural springs, rivers, canals, or valley areas. In the same way, these efforts need to consider human and natural factors affecting freshwater fish farms and fish itself. Moreover, since there is no stakeholder's participation, fish farmers monitor themselves in the provisions of information, knowledge, and awareness to the public on the importance of fresh fish products, but hardly lack of funds for the promotion of business hinders fish farming.

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The situation leads them to suffer while searching for adequate materials, markets and customers day after the other.

Concerning harvesting and packaging of fish, there are limited efforts of ensuring the harvesting and packing of freshwater fish products. This shows that while modern fish farmers have adequate modern harvesting and packaging facilities, traditional ones suffer in search of customers. Such disparities have revealed to be ambivalent that fresh fishery practice is very hard for the low-income farmers even though the process continues to rot the localized market in Tanzania.

Also, it can further be generalized that marketing and distribution of fish are more difficult for the traditional than modern fish farmers. However, even though traditional farmers practice farming for fish, they delay in delivery of orders to the markets, and lack potential customers as well as marketing sources to which fish products may be distributed easily. It further tells that these undetermined customers discourage farmers to continue with the practice.

The study provides some suggestions to improve freshwater fish farming since the projects earn contributions along the supply chain of Tanzania. These include the active involvement of different stakeholders in improving freshwater fish farming. With the way it stands, the government through LGAs and other private sectors in Tanzania can provide special aid and assistance to farmers such as agricultural based capital with low-interest rates. This will facilitate the growth of the freshwater fish farming business. Also, various stakeholders should be well sensitized on the provisions of equipment to the local fish farmers like GS pipes, nets, drums, knowledge as well as determination of international markets for selling of freshwater fish. Moreover, stakeholders may consider the provision of adequate and relevant handling and storage facilities for the localized fish farmers to improve freshwater fish farming.

To improve the harvesting and packaging of fresh fish farming, firstly government through the ministry of fisheries and natural resources should work hard to improve and build awareness among the public on the importance of using fresh fish products. The general public should be well-publicized of the innovativeness and investment in freshwater fish farming. These can be done by designing harvesting and packaging facilities along the supply chain of freshwater fish farming. Nevertheless, the government and private sectors should take their time to visit freshwater fish farms to observe the activities and processes involved in the preparation, harvesting and processing of fish across the supply chain.

To improve marketing and distribution, the ministry of fisheries with the ministry of investment ,as well as the ministry of natural resources, should encourage the establishment of fresh fish farms. These will improve the individual and national economy, enable to penetrate easily into the international market, and mproves the livelihood of the farmers in this business. Apart from the above, training on marketing, promotion and selling of freshwater farmed fish should be taken regularly.

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