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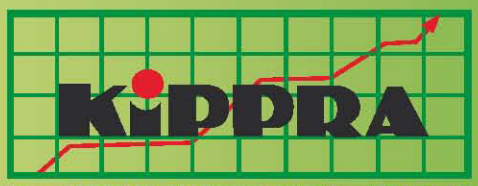

The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

Contribution of Fisheries to Job Creation Among the Youth in Kenya

Bonface Munene and Abraham Wanjiku

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THE KENYA INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS (KIPPRA)

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Contribution of Fisheries to Job Creation Among the Youth in Kenya

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Kenya Institute for Public Policy

Research and Analysis

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KIPPRA in Brief

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Abstract

Kenya has about 13.7 million youth accounting for 35.4 per cent of the total population and constitutes 60 per cent of the total labour force of which 10 per cent are directly participating in the agricultural sector. Considering the number of new labour market entrants, some 300,000 youths are left behind every year. The maximum sustainable yield of Kenya's marine and coastal waters, which is majorly for commercial fishing is between 15,000 and 300,000 metric tonnes. The current production level is only about 9,000 metric tonnes per annum showing that they are under-exploited. Full exploitation of these resources will increase production hence increasing contribution to GDP and employment creation among youths. This study aimed at exploring the potential of job creation among the youths in Kenya by mapping fisheries value chain, identifying constraints to full exploitation of the sector, assessing employment creation potential and assessing labour skills gap. The study adopted value chain approach using both quantitative and qualitative analysis. Employment elasticity of the sector was estimated. The study also established various constraints hindering the growth of the sector, namely: high cost of fish feed, lack of value addition, post-harvest losses, among others. On employment potential, the study found that the sector has potential to create employment. A one-unit change in contribution to the GDP by the fisheries sector leads to a 5.78 unit change in employment in overall fisheries sector. On skill gap analysis, there was no sectoral skills gap. On occupational skill analysis, only fish butchers did not have occupation gap. The rest of the occupation had a gap that needs to be filled. The study recommends capacity building of fish farmers through extension officers so that they are able to maintain and manage the fish farms hence reduce pre and post-harvest losses during and after production. Value addition for both farmed and capture fisheries is recommended. There is also need to encourage more youths to enrol for technical courses by offering incentives such as fee reduction by the government through the Ministry of Education.

Abbreviations and Acronyms

DWFN	Distant Water Fishing Nations
EEZ	Exclusive Economic Zone
ERPARDP	Economic Recovery, Poverty Alleviation and Regional Development Programme
ESP	Economic Stimulus Programme
FAO	Food and Agriculture Authority
FFEPP	Fish farming Enterprise productivity program
GDP	Gross Domestic Product
GoK	Government of Kenya
GVC	Global Value chain
ILO	International Organization
KFDA	Kenya Fisheries Development Authority
KFS	Kenya Fisheries services
KEMFRI	Kenya marine and Fisheries Research Institute
KHIBs	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
KNOCK	Kenya National Occupational Classification Standards
MSME	Small and Medium Enterprises
NEMA	National Environment Management Authority
VC	Value Chain

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1. Introduction

Fisheries is a key sector contributing greatly to the Kenyan economy. Moreover, the sector is critical in creating employment opportunities among the youth and, as such, lift the living standards of the people. It is against this realization that fisheries sector was identified as a potential source of jobs among the youths as envisaged in the economic pillar of the Kenya Vision 2030 and MTP III (The Kenya Vision, 2030).

The fisheries sector is mainly artisanal with few commercial activities. Kenya has been flagging long liner exploitation of the Exclusive Economic Zone (EEZ) with other vessels being purse seines and long liners owned by Distant Water Fishing Nations (DWFN) which operate under Kenyan License in the EEZ mostly targeting Tuna species. Artisanal fisheries account for large part of both marine and inland water catches. The sub-sector has been growing rapidly, a factor attributed to the intervention of the Government through the inter-sectoral Economic Stimulus Programme (ESP) in 2009, whereby Ksh 22 billion was channelled into the sector from 2009 to 2012 (Kenya Aquaculture Brief, 2017).

The Kenya Vision 2030 recognizes fish farming and aquaculture as a source of food security, poverty reduction, and employment creation. Maximum sustainable yield of Kenya's marine and coastal waters EEZ, which is majorly for commercial fishing, is between 15,000 and 300,000 metric tons. The current production level is only about 9,000 metric tons per annum, indicating under-exploitation (ASCLME, 2012). Freshwater fish account for close to 98 per cent of Kenya's aquaculture fish. Therefore, full exploitation of freshwater lakes, rivers and coastal waters and addressing the challenges in the fisheries sector is likely to lead to an increase in production (Kenya Aquaculture Brief, 2017).

Additionally, Kenya's marine fisheries is of strategic value given the role of the sector in supporting livelihoods and contributing to food security. Kenya has a coastline of 640 km on the Western Indian Ocean, in addition to a further 200 nautical miles EEZ under Kenyan jurisdiction. For rural coastal communities, small-scale fishing is essential to overall household well-being, providing both income and nutrient rich food especially since the decline in coastal tourism in recent years due to security concerns. In 2016, the marine fisheries sector employed about 27,000 fishers, including 13,000 artisanal fishers. The number of people supported indirectly by the sector as traders, processors, input suppliers, merchants of fishing accessories, or providers of related services is much higher. In addition, fish is a critical source of affordable animal protein for consumption. The sector is also important for the preservation of culture and national heritage,

including related industries such as tourism, and for recreational purposes (Kenya Aquaculture Brief, 2017).

According to the Kenya Integrated Household Budget Survey - KIHBS 2015/2016 Labour Force Report in Kenya, general unemployment rate stands at 7.4 per cent. Unemployment among the youths in Kenya also remains high at 11.4 per cent above the national unemployment rate (ILO, 2020). Global youth unemployment rate is 13.6 per cent, with a considerable regional variation, with Sub-Saharan Africa having 9 per cent. Among the youths, labour force participation rate has continued to decline globally. Between 1999 and 2019, despite the global youth population increasing from 1 billion to 1.3 billion, the total number of youths engaged in the labour force decreased from 568 million to 497 million. With the rising numbers of youths, they are three times as likely as adults to be unemployed. Aggravating the situation is the few jobs created where on average only 826,600 jobs were created annually between 2013 and 2017 (Third Medium Term Plan, 2018). More than 80 per cent of the new jobs created were in the informal sector. This is far much below the Government target of creating 6.5 million jobs in the same period. In the fisheries sector alone, the Government had a target of creating 12,000 jobs through investment in fish ports and related facilities at the Coast. The Kenyan fisheries sector has great capacity for fish farming, with over 1.14 million hectares potentially available to enable production capacity of over 11 million tonnes per year (Nyandat and Owiti, 2013).

Fishing and aquaculture sector on average contribute about 0.5 per cent to the Gross Domestic Product (GDP), thus providing direct employment opportunities to over 500,000 people and supporting over 2 million other people indirectly (KEMFRI, 2017). Fisheries has an important and increasing role to play in enhancing food security and nutrition in Kenya through increased fish consumption. For example, the "Big Four Agenda" which is the Kenya Government's strategic agenda for 2018–2022 recognizes food security as one of its pillars and the significant role of fisheries in supporting the food and nutritional security pillar. In addition to directly supplying high-quality food, sustainable fisheries development would also contribute to improving food security and nutrition in Kenya, accompanied by employment opportunities, income generation and other social benefits. On average, aquaculture production ranges from 100,000 to about 40,000 MT annually.

Though aquaculture farming has been gaining momentum, production from catch fisheries has been declining. On the other side, demand for fish has been increasing due to a rise in the population. In 2015, there was a deficit of 250,000 MT between the projected demand and the supply (production). The gap is projected to reach 360,000 MT per year by 2025. Due to the demand gap, there has been importation

of frozen fish rising from 2,664 MT in 2011 to 5,853 MT in 2015. Therefore, if this sector is fully exploited, it is capable of ensuring food nutrition, security and employment creation as a result of increased production and consumption. This study focused on creating employment opportunities among the youths by addressing various constraints along the value chain. The general objective of the study was to examine the contribution of fisheries sector to job creation among the youths in Kenya. Specifically, the study maps out the fisheries value chain in Kenya, identifies the key constraints and labour skills requirements in the sector in addition to estimating the employment creation potential along the fisheries value chain in Kenya.

The rest of the paper is organized as follows: section 2 highlights sector performance and policy, legal and institutional framework; section 3, the literature review; section 4 discusses data sources and approaches to analytical framework employed in the study; section 5, the results and discussions while the conclusion and recommendations are covered in section 6.

2. Fisheries Performance and Policy, Legal and Institutional Framework

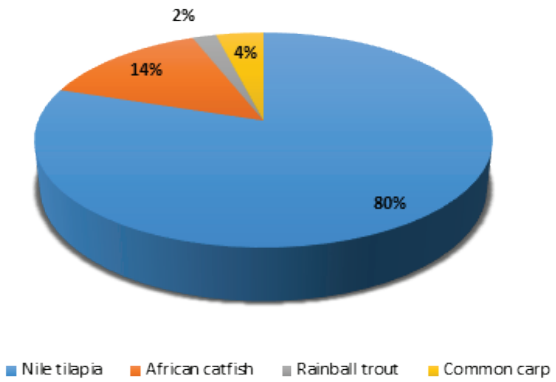
2.1 Fisheries Performance in Kenya

Fisheries in Kenya is categorized into three groups, namely aquaculture, freshwater and marine capture fisheries. Inland water resources include lakes and dams with different sizes. In addition to the inland waters resources, the country also enjoys a vast coastline of 640 km on the Western Indian Ocean on top of 200 nautical miles Exclusive Economic Zone (EEZ) under Kenyan jurisdiction (Fisheries Statistical Bulletin, 2016).

2.1.1 Inland capture

Inland capture in Kenya is mostly from main lakes such as Lake Victoria, Naivasha, Turkana, Jipe, Tana River dam and Tana Delta. The remainder is from dams and rivers. Lake Victoria on average produces about 90.8 per cent of the total inland fisheries production (Fisheries Statistical Bulletin, 2016). In terms of fishing methods, gill netting is mostly used in capture fisheries. Long line hooks, traditional traps, hand lines, ring nets, cast nets and trolling are also used. Beach seining, monofilament gill netting, scuba diving, spear gunning and trawl netting are also used despite them being illegalized due to the negative effect they have on fish production. The main cultured species in Kenya's freshwater systems are Nile Tilapia accounting for about 80 per cent of production and African catfish, contributing about 14 per cent of aquaculture production. These species are found

Figure 1: Types of common fish found in fresh waters in Kenya



Source: KEMFRI (2017)

in virtually all aquatic systems and have high demand in the local and regional markets. Polyculture of Nile Tilapia and African catfish is often done to control the prolific breeding of the former. Other exotic species include common carp (4%) and rainbow trout (2%) (see Figure 1). Trout is temperature restricted thus only cultured at temperatures below 19°C mainly in the Mt Kenya region. Potential indigenous candidates for aquaculture include African Carps, Lungfish and Tilapia Jipe. There are great opportunities in ornamental fish culture for they can be marketed within the East African region and in Europe (Kenya Aquaculture Brief, 2017)

2.1.2 Marine capture fisheries

Marine capture fisheries comprises of coastal and near shore semi-industrial and offshore industrial fisheries. Coastal local community practices artisanal and semi-industrial fisheries while foreign fishing companies carry out industrial fishing. On average, artisanal fishing fleet comprises of 2,913 fishing crafts and 12,915 fishermen while the semi-industrial fleet has two licensed trawlers (Marine Artisanal Fisheries Frame Survey, 2014).

The most commonly farmed finfish species is milkfish, which accounts for about 90 per cent of production, followed by mullet at about 10 per cent of aquaculture production. Juveniles of these species are found in the mangrove systems and are having a lot of demand due to more communities interested in mariculture. Shellfish culture in coastal Kenya has mainly been the culture of Mud Crabs, Prawns, and Artemia (see Table 1). The experimental oyster culture was carried out at Gazi and Funzi bays of South Coast but were not sustainable due to lack of market linkages despite successful cultures. Other species found are silver pompano, indicating that potential for culture in ponds is high (Kenya Aquaculture Brief, 2017)

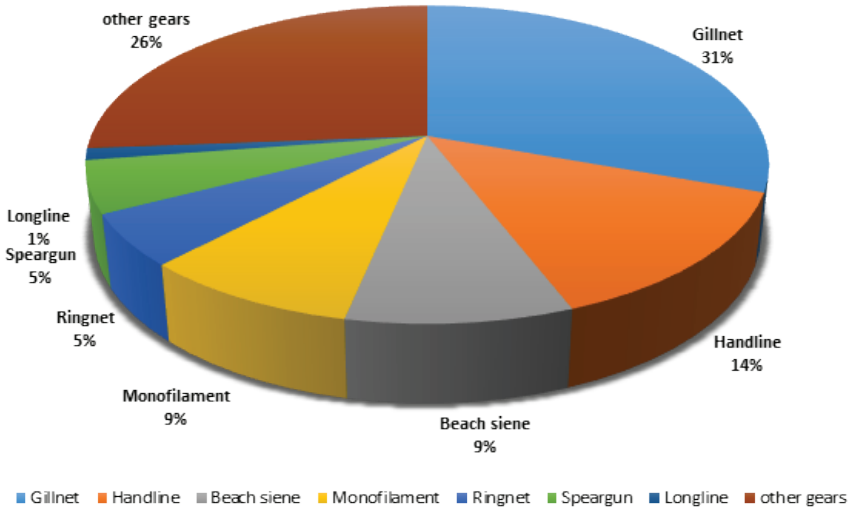
Table 1: Mariculture species cultured in Kenya and their operational scale

Common name	Scientific name	Operation scale
Milk fish	*Chanos chanos*	Commercial scale
Seaweeds	*Eucheuma denticulatum (spinosum) and Kappaphycus alvarezii (cottonii))*	Commercial scale
Mullet	*Mugil cephalus*	Commercial scale
Mud crabs	*Syclla serrata*	Commercial scale
Prawns	*Penaeus monodon and Penaeus indicus*	Commercial scale
Artemia	*Artemia franciscana*	Commercial scale
Oyster	*Saccostrea cucullata*	Pilot scale
Silver	*Pompano Trachnotus blochii*	Pilot scale

Source: KEMFRI (2017)

In terms of fishing gears for marine fisheries, there are over twenty types of gear used along the coast (Marine frame survey report, 2014). The most commonly used gears by coast fish landed which are 74 per cent of the total catch include: Gillnets (32%), handlines (14%), beach siene (9%), monofilament (9), ring net (5%), spear gun (5%), long line (1%) and other gears accounting for (26%).

Figure 2: Marine artisanal landing by gear type



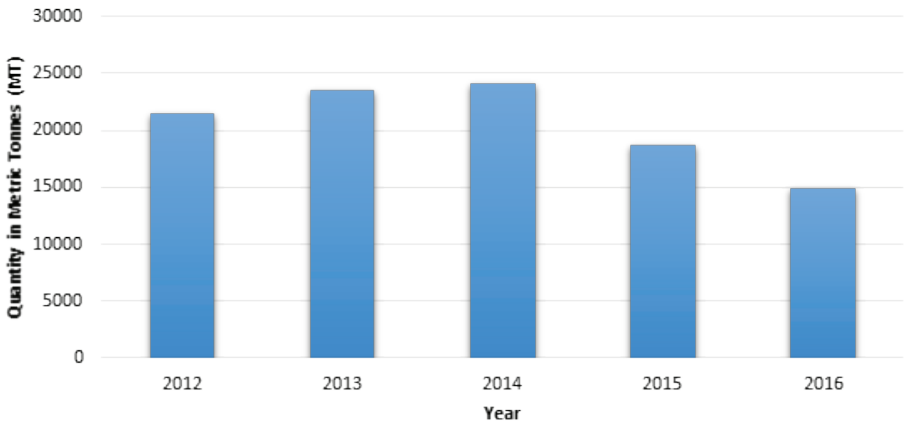
Source: KEMFRI (2017)

2.1.3 Aquaculture/Fish farming

The aquaculture sub-sector in Kenya has been experiencing tremendous growth over the past years. Production has been increasing annually from 1000 MT in 2006 to an estimated 18,656 MT in 2015 (Opiyo et al., 2018). This is attributed to the nationwide fish farming campaign under Economic Stimulus Program started by the Kenyan Government in the period 2009-2013. The Government has been popularizing fish farming through the Fish Farming Enterprise and Productivity Programme funded by the Government. It was funded through the Economic Stimulus Programme (ESP) in phase one, and the Economic Recovery, Poverty Alleviation and Regional Development Programme (ERPARDP) in the second phase. The aim of the project was to increase fish production, enhance food security, improve livelihoods of farmers, and provide employment for the youth (Charo-Karisa and Gichuri, 2010). Like other African countries, fish farming and the related activities has been extensive but not much intensive (Ngugi et al., 2007). As a result, the area under fish increased from 220 ha in 2009 to 1,873 in

2015 resulting in 7,7000 new ponds. Other support along the value chains was also offered under the stimulus programme. The different species of fish produced include Nile Tilapia at 79 per cent, African catfish at 15 per cent, rainbow trout at 4 per cent and common carp and ornamental fish at 2 per cent.

Figure 3: Aquaculture production in metric tonnes (2012-2016)



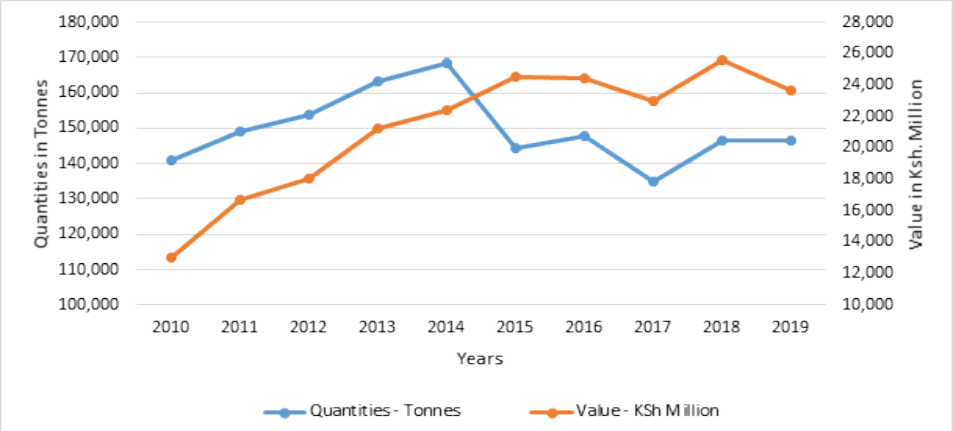
Source: Fisheries Statistical Bulletin (2016)

As seen from Figure 3, aquaculture production has not been stable. There has been increase and decline for the four-year period. Production increased form 21,487 MT in 2012 to 23,501 MT in 2013 before reducing to 14,952 MT in 2016. This can be attributed to several challenges that fish farmers faced, including the increased cost and withdrawal of sponsors of some of the projects. Thus, generally, reduction in production in the aquaculture has contributed to decline in fish production in the country against the increased demand due to population growth.

2.1.4 Quantity and value of fish landed

Generally, the economy experienced an increase in quantity of fish produced in the country from 2010 to 2014. This is due to the Government initiatives which had been adopted in marketing and encouraging people to engage in fish farming. This was under economic stimulus programme, which had started in 2009. There was a decline in fish production from the year 2016 through 2017. This was an election year and the economy slows down every time there is increased political temperatures. Additionally, the decline in production is attributed to the pollution of rivers and lakes, hence reducing the number of fish. Lake Victoria is a good example, which has suffered pollution resulting in the development of water hyacinth. Lake Victoria contributes the largest proportion of fish caught from fresh water (Figure 4).

Figure 4: Quantity and value of fish landed, 2015-2019

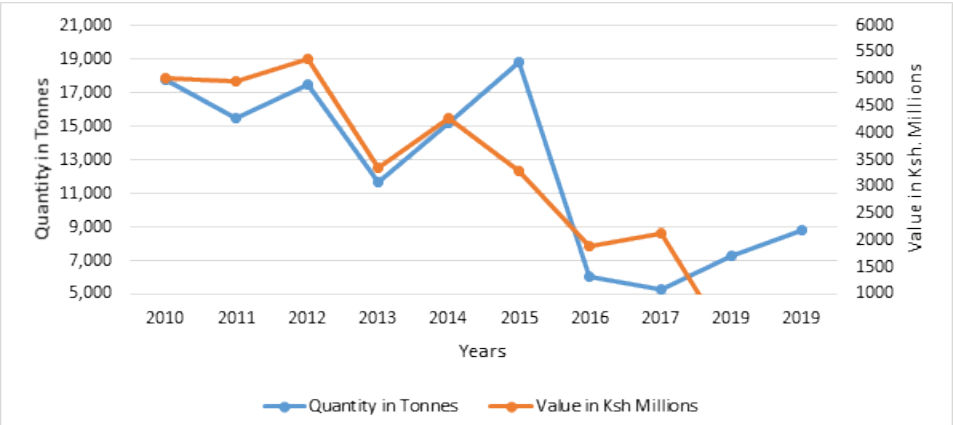


Source: KNBS (Various), Economic Survey (2010-2019)

2.1.5 Quantity and value of fish exported

Volume and value of fish exported from Kenya has been declining since 2010 (Figure 5). This can be attributed to the fading of the government initiatives, which had been started in 2009 during the economic stimulus programme. Another factor contributing to the decline is the increased local demand due to population increase, hence leaving little for export. Kenya only exports 70 per cent of the total fish produced. There is an aspect of climate change as a result of environmental pollution. This has resulted to water pollution hence reducing the number of fish found in the water bodies.

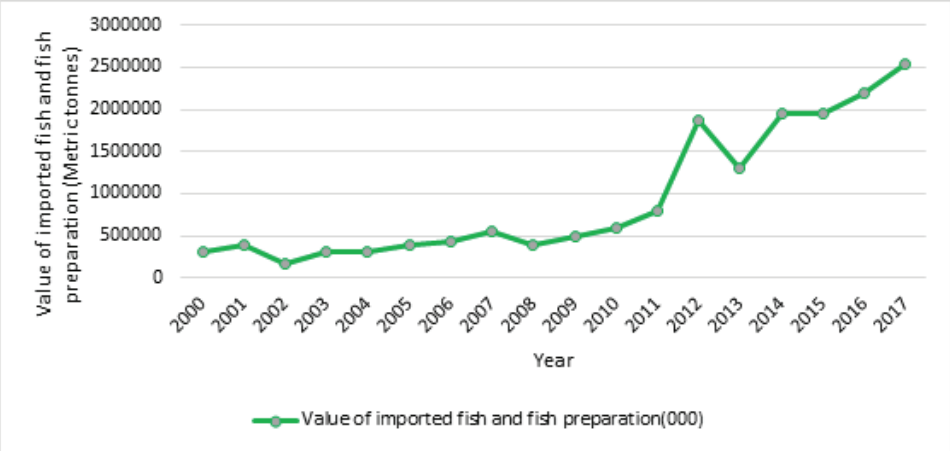
Figure 5: Quantities, value of principal domestic exports for fish, 2010-2019



Source: KNBS (2010-2019), Economic Surveys

2.1.6 Quantities of fish imported

Figure 6: Value of imported fish and fish preparation in metric tonnes 2000-2017



Source: KNBS (2000-2017), Economic Surveys

There is a general upward trend in the value of imported fish into the country for the period under consideration. For the year 2000, the value of imported fish into the country stood at Ksh 308.6 million. There was a slight decline in the value between 2001 and 2002 where the value declined from Ksh 381 million to Ksh 175.5 million. The decline in value was attributed to reduction in the value of the Kenyan currency due to elections during the same time. There was a consistent increase in the value of imported fish from 2002 to 2007, where the value increased from Ksh 175.5 million to Ksh 432 million due to increase in the demand for fish witnessed in the country during the period. There was a slight decline in the imports of fish for 2008, which was attributed to the post election violence, a factor that affected most industries including retail outlets dealing with fish. In 2009, a Government policy focused on increasing fish production in the country was introduced. The policy targeted most counties in the country and was followed by interventions such as building of fish cages, ponds and supply of fingerlings to various farmers in the country. In central Kenya, for example, the intervention included teaching farmers and residents not only how to take care of the fish, but also how to prepare fish. The intervention did not only increase the number of fish produced in the country but also the number of people who started consuming fish. This is given as one of the reasons why there was an increase in the imports, as what was produced was not sufficient to cater for the increased demand. Decline in the imports for 2013 can be attributed to the electioneering period in the country, which affects many businesses due to the uncertainties that come with it.

2.2 Fisheries Policy and Legislative Framework

The principal statutes that regulated and governed fisheries were the Fisheries Act (Cap 378) of 1989 and Regulations (1991) and the Maritimes Zones Act (CAP 371) of 1989. Since then, several regulations have been introduced to address the rapid changes in the fisheries sector. With the creation of a fully-fledged Ministry of Fisheries Development, there was need to have a comprehensive policy and legislation to support fisheries management, research and development in a coordinated and rational manner.

The Kenya Fisheries Policy 2005 provided the framework that governed the fisheries sector in Kenya. The general objective of the policy was to create an enabling environment for a vibrant fishing industry based on sustainable resource exploitation providing optimal and sustainable benefits, alleviating poverty, and creating wealth, taking into consideration gender equity. This was the first policy to be put in place as the sector had operated without a comprehensive fisheries policy. The lack of a comprehensive national fisheries policy had reduced management and research effectiveness, discouraged investment in the sector, and thus constrained production growth. The policy was tailored to promote responsible and sustainable utilization of fisheries resources taking into account environmental concerns, promote development of responsible and sustainable aquaculture, recreational and ornamental fisheries and ensuring that Kenya had a fair access and benefit from the country's shared fisheries resources. In addition, it aimed at promoting responsible fish handling and preservation measures and technologies to minimize post-harvest losses, and encourage value addition. Of interest to note is that the policy did not address the issue of employment and involvement of youths in the sector.

According to the Kenya Fisheries Policy 2005, fisheries resources in Kenya are managed by the Department of Fisheries through the Fisheries Act (Cap 378) and Maritime Act (Cap 250) of the Laws of Kenya. The Kenya Marine Fisheries Research Institute (KMFRI), established as a state corporation through the Science and Technology Act (Cap 250), undertakes fisheries research. These two institutions, which have often been in different ministries, were under the Ministry of Agriculture, Livestock and Fisheries Development. Due to lack of a fisheries apex institution at the ministry level, these two institutions lacked a mechanism for setting coordinated agenda. Other public institutions involved in fisheries activities include regional development authorities under the Ministry of Regional Development, Ministry of Environment and Natural Resources, universities and public laboratories.

The institutional framework for the fisheries sub-sector required restructuring, as without the right institutional set-up, fisheries development and management efforts were likely to achieve only partial success or fail. The Department of Fisheries, which

was responsible for fisheries management, was charged with the often-conflicting roles of enforcing legislation and coordination of development activities. KMFRI, on the other hand, is responsible for fisheries research necessary for supporting decision-making. There was no administrative mechanism of coordinating the role of KMFRI with that of the Department of Fisheries. Other public bodies that played a considerable role in the sector, with hardly any coordination, included regional development agencies such as the Lake Basin Development Authority and local authorities. The private sector, civil society and NGOs also play an important role in fisheries development although their participation is not coordinated with those of the public institutions.

Lack of coordination led to results in research that was not demand driven, duplication of roles leading to inefficiency, spreading of the available capacity thinly on the ground, and ultimately sub-optimal outcomes. Besides lack of coordination, the fisheries sector in the country is poorly funded despite its significant contribution to the national economy. To address some of these issues, the fisheries policy sought to ensure efficiency in the development and management of fisheries in the country through the establishment of an institutional framework to play the coordination role. In addition, the policy seeks to create a sustainable funding mechanism for the fisheries sector.

The Ministry of Fisheries and Livestock Development was supposed to facilitate the creation of the Kenya Fisheries Development Authority (KFDA), a state corporation established through an Act of Parliament, which was to be governed by a Fisheries Board. The purpose of the KFDA was to coordinate all aspects of fisheries development and management and all players in the fisheries sector. It would have adequate leverage over all players in the fisheries sector. The Fisheries Board of the KFDA was to have optimal stakeholder representation, including the Department of Fisheries, KMFRI, KWS, NEMA, public universities, the private sector and civil society, among others. It would be composed of individuals with proven competence in relevant areas. The Fisheries Board would be responsible for developing regular fisheries strategies and overseeing, through commissioning and coordination, their implementation. Other key functions included raising the profile of the fisheries sector and providing a sectoral framework for disaster and emergency preparedness and management. The Fisheries Board would work through committees with mandate to co-opt capacity from the fisheries sector and elsewhere, and its day to day activities be coordinated by a thin secretariat. However, the suggested formation of KFDA was never realized but, instead, the Kenya Fisheries Services was created under Fisheries Management and Development Act, 2016.

The other policy that was developed is the National Oceans and Fisheries Policy, 2008. The policy aimed at achieving coordinated framework for addressing the

challenges facing the fisheries sector. The overall aim was to guide the sustainable development of the fisheries sector in an effective and coordinated manner, hence achieving maximum benefits from the vast fisheries resources. This would enhance the fisheries sector's contribution to wealth creation, increased employment for youth and women, food security, and revenue generation through effective private, public and community partnerships". This policy focused on the promotion, implementation and monitoring of sustainable management and responsible fishing practices. It also focused on the promotion of fish consumption as a means of increasing food security, employment, income, foreign exchange earnings, arising from trade and related activities. It also aimed at securing the rights of vulnerable and traditional fisher communities. However, the policy did not achieve all the set objectives as still we have many people who have not embraced fish consumption. The challenges faced in the fisheries sector still exist despite the policy aiming at reducing them. Though the sector has grown and created some employment, it has not been fully exploited as per the policy, hence not creating enough employment for the youths as targeted.

The Science, Technology and Innovation Act, 2013 aimed at facilitating the promotion, coordination and regulation of science, technology and innovation in the country. The Act confirmed registration of Kenya marine and Fisheries Research Institute.

The Environment Management and Coordination Amendment Act, 2015 issued guidelines that aimed at regulating and preserving fishing areas, aquatic areas, water sources and other areas where water may need special protection. The Act although enabling protection of resources, does not mention the youths as being involved in the fisheries sector.

Other legal frameworks include the Fisheries Management and Development Act, 2016. This Act was enacted to streamline the existing fisheries policies with the Constitution 2010. The Act provided for the working relations and cooperation between the National government and County governments since agriculture is a devolved function. The cooperation between the two levels of government included conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of the communities. The Act also provided for the establishment of the Kenya Fisheries Services (KFS). It also provided aquaculture and fish processing and marketing, established the Kenya Fisheries Advisory Council, Fish Marketing Authority, the Fisheries Research and Development Fund and the Fish Levy Trust Fund. The Act also provided for implementation of obligations under international law pertaining to fisheries.

The Kenya Fisheries Development and Management Act No. 35 2016 provided for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities depending on fishing. Additionally, the Act created the Kenya Fisheries Advisory Council whose functions included ensuring the appropriate conservation development of standards on management, sustainable use, development and protection of fisheries resources, formulating and monitoring the implementation of policies regarding the conservation, management and utilization of all fisheries resources, developing standards for the management utilization of all fisheries resources with the scope of the Act and developing guidelines for the preparation of fisheries specific management plans for the Kenya fishery waters. Interestingly, among all the above Acts and policies, none seems focused in creating employment among the youths in the fisheries sector.

Table 2: Summary of policy and Acts in the fisheries sector

Policy /Act	Content	Accomplishments	Weakness
Kenya Fisheries Policy 2005	• Create an enabling environment for a vibrant fishing industry • Promote responsible and sustainable utilization of fisheries resources taking into account environmental concerns • Promote development of responsible and sustainable aquaculture, recreational and ornamental fisheries • Promote fish handling and preservation measures	• Provided a comprehensive national fisheries policy that improves management and research in the country. • Led to increased production and growth of the sector • Created conducive environment for fish sector to thrive	• The policy did not address the issue of youths and employment creation in the Fisheries sector
National Oceans and Fisheries Policy, 2008	• Coordinated framework for addressing the challenges facing the fisheries sector • Enhance the fisheries sector's contribution to wealth creation, increased employment for youth and women, food security, and revenue generation	• Increased fish consumption as a means of increasing food security, employment and income	• Though the policy tried to address the issue of employment, it failed to draw clear road map on how the youths would be incorporated in the sector

Science, Technology and Innovation Act, 2013	• Promotion, coordination and regulation of science, technology and innovation of the country	• Confirmed registration of Kenya Marine and Fisheries Research Institute	• The issue of youth employment was missing in the Act
Environment Management and Coordination Amendment Act, 2015	• Regulation and preservation of fishing areas, aquatic areas, water sources and other areas where water may need special protection	• Enabled protection of natural resources	• No mention of employment of youths and their role in preservation of natural resources
Fisheries Management and Development Act, 2016	• Streamline the existing fisheries policies with the Constitution 2010	• Established Kenya Fisheries Services (KFS) • Established the Kenya Fisheries Advisory Council, • Created the Fish Marketing Authority, • Created the Fisheries Research and Development Fund	• The Act created several institutions though there is no mention of how the bodies created would help create employment in the sector among the youths

Table 3: Institutions that coordinate and manage fisheries sector

Institution	Legal status	Mandate
Ministry of Agriculture, Livestock and Fisheries (State Department for Fisheries Aquaculture and Blue Economy)	Formed by Government	• Coordination of development of policy, legal, regulatory and institutional framework for the fisheries industry and the blue economy • Developing fisheries and marketing policies • Fishing licensing • Fish quality maintenance
Kenya Marine and Fisheries Research Institute (KMFRI	Act of Parliament (Science and Technology Act, Cap 250 of the Laws of Kenya) of 1979	• Conducting research and making management recommendations essential for the national exploitation of living and non-living aquatic resources in the ocean waters, and fresh water
Kenya Wildlife Service KWS	Act of Parliament (Cap 376). Repealed by WCMA (2013)	• Conserve and manage wildlife in Kenya including *Marine* National parks and marine Reserves

Coast Development Authority (CDA)	CDA Act of Parliament No.20 of 1990 (Cap 449), revised in 1992	• Provide integrated planning, development, and implementation of projects within Coast including the fisheries
National Environment Management Authority (NEMA)	Environmental Management and Coordination Act No. 8 of 1999 (EMCA)	• Supervision and coordination matters in relation to environment • Principal instrument of the Government of Kenya in the implementation of all policies Relating to the environment
Lake Basin Development Authority (LBDA)	Act of Parliament (Cap 442) of 1979	• Provide an avenue for a quicker and more meaningful coordinated development in the Kenyan portion of the Lake Victoria basin while conserving natural resources
Kenya Fisheries Service (KFS)	Fisheries Management and Development Act No. 35 of 2016	• Conserve, manage and develop Kenya fisheries and aquaculture resources

3. Literature Review

3.1 Theoretical Literature

3.1.1 Value chain theory

Value chain describes the full range of required to bring a product or service from conception, through the different phases of production involving a combination of physical transformation and the input of various producer services, delivery to final consumers, and final disposal after use (Kaplinsky and Morris, 2013).

According to Spore (2012) value chain refers to actors connected along a chain to produce and deliver goods and services through a sequenced and coordinated set of activities that add value at all stages (production, processing, and distribution). The value chain concept is used to describe approaches aimed at improving market prospects for producers and scaling up profit margins. Value chain focuses on the actors (private and public, including service providers) and the sequence of value adding activities involved in bringing a product from production to the end consumer. The objective of value systems is to position organizations in the supply chain to achieve the highest levels of customer satisfaction and value while effectively exploiting the competencies of all organizations in the supply chain (Handfield and Nichols, 2002). According to FAO (2013), value chain actors in domestic and international fish markets include the artisanal fishermen, fish farmers, fish processors, marketers which could be wholesalers and retails acting as exporters and importers of fish and fish products.

Value chain analysis overcomes a number of important weaknesses of traditional sectoral analysis which tends to be static and suffers from the weakness of its own bounded parameters (Kaplinsky and Morris, 2013). By restricting itself to sectoral analysis, it struggles to deal with dynamic linkages between productive activities that go beyond that particular sector, whether they are of an inter-sectoral nature or between formal and informal sector activities. Value chain also goes beyond the firm-specific analysis of much of the innovation literature. By its concentration on inter-linkages, it allows for an easy uncovering of the dynamic flow of economic, organizational and coercive activities between producers within different sectors even on a global scale. Furthermore, the notion of organizational inter-linkages underpinning value chain analysis makes it easy to analyze the inter-relationship between formal and informal work with workers, particularly in developing countries, moving often seamlessly from one to the other and not to view them as disconnected spheres of activity. Additionally, value chain analysis is particularly

useful for new producers, including less endowed producers and less developed countries who are trying to enter global markets in a manner which would provide for sustainable income growth. Finally, value chain analysis is also useful as an analytical tool in understanding the policy environment, which provides for the efficient allocation of resources within the domestic economy notwithstanding its primary use thus far as an analytic tool for understanding the way in which firms and countries participate in the global economy (Kaplinsky and Morris, 2013).

Not only do value chains differ but also do so at national and local contexts. Therefore, there is no mechanistic way of applying value chain methodology. Each chain has particular characteristics, whose distinctiveness and wider relevance can only be effectively captured and analyzed though an understanding of the broader issues involved. This study applied value chain theory in the analysis, which has been used by several scholars. In summary, value chain analysis involves breaking value chain into its basic parts and activities to understand its structure, key players at each stage, their functions and relationships, the flow of information from one player to another and what governs their cooperation and competition (Page, 2019).

3.1.2 Empirical literature

Constraints

Wamukota (2009) established that fish farmers in Kenya lacked marketing skills such as negotiation and communication skills and feared that they will get a much lower price for their product if they would market it themselves. This study postulated that farmers' knowledge of fish marketing may be influenced by appropriate training. The study only concentrated on marketing skills, ignoring other challenges facing fish farmers such as lack of value addition of the fish harvested.

Ngugi et al. (2010) established that the farmer's knowledge of fish production was associated with extension services. This shows that training enhances farmers' competencies. Though this could be true, there are other factors that affect fish production apart from farmer's knowledge.

In trying to understand why farmers have abandoned pond fish farming, Shitote et al. (2012) carried out a study of problems facing farmers in pond management in Western Kenya. The study established that the most prevalent problems facing pond fish farmers were drying up of ponds during drought, flooding and siltation.

The study did not exploit other problems facing fish farmers. It also did not address the challenges of inputs such as the fish feed and other costs.

Adewumi and Olaleye (2011) found that problems facing fish farming are: Poor management skills, inadequate supply of good quality seed, lack of capital, high cost of feed, faulty data collection, lack of environmental impact consideration and marketing of products.

Aura, et al. (2019) carried out a study on fish landing sites and market information towards quantification of the blue economy to enhance fisheries management. The study found that the quantity of fish traded depended more strongly on fish production rather than the price of fish at the landing site or market. The study recommended policy review targeting social, economic and legal barriers that often inhibit sustainable fish production for improved small-scale fishers' livelihoods, which limit their food and income security.

Muma and Charo-Karisa (2015) using value chain approach conducted a study on barriers to value addition in Omena fisheries value chain in Kenya. They found that barriers to value addition in Omena value chain in Suba Sub-county, such as poor processing technology, poor adoption of solar drying innovation, poor business skills, legal and policy framework shortcomings on dry Omena processing, land access and infrastructure development, and lack of technical specifications for processing and marketing Omena were contributing to substantial losses of the product and impacting negatively on business profitability and food security especially for the locals. They also found that value chain development, increasing access to capital, technology and technical support can help reduce the gap in the advantage of value addition that wholesalers and animal feed processors have over retailers and small-scale processors. However, the study did not quantify the exact amount of losses experienced beginning from the producer to the final consumer.

Opiyo et al. (2018) did a review of aquaculture production and health management practices of farmed fish in Kenya. They found that if the high potential of aquaculture in Kenya is exploited, it can lead to increased production of fish. In addition, they found that there is no health management strategy for farmed fish in Kenya due to inadequate capacity both in human resource, infrastructure and lack of funding for fish health management. Therefore, capacity building of the various stakeholders needs to be enhanced to acquire basic skills required in the identification of sick fish.

Klein et al. (2013) undertook case studies in South Africa, Ghana, Maldives and Vietnam to analyze the economics of small and medium-scale aquaculture and fisheries enterprises. In particular, they investigated capital requirement to cover investment and operating costs, and the demand and supply of financial services. The study found that traditional financial instruments are not able to meet the

financial needs of small and medium-scale enterprises (SMEs) in the aquaculture and fisheries sector. Therefore, an alternative means of financing fish farmers is needed.

Brugere et al. (2017) study about people matter in animal disease surveillance: Challenges and opportunities for the aquaculture sector found that recurring epidemics and the emergence of new aquatic diseases are increasingly threatening the growth of aquaculture. This is more challenging especially where the fish farmers have not been well trained.

Using a structural foresight modelling approach, Chan et al. (2019) sought to establish the prospects and challenges of fish for food security in Africa. The study established that fisheries and aquaculture make a critical contribution to food security and livelihoods in Africa, and could do more to meet development goals with well-designed policies and investments. Continued rapid population growth combined with robust income growth will fuel strong increases in demand for fish. However, there is limited potential for growth in African capture fisheries and constraints in terms of capacity. Therefore, rapid expansion of aquaculture will be needed to meet this increased fish demand.

Employment potential

Charo-Karisa et al. (2018) conducted a review of aquaculture production and health management practices of farmed fish in Kenya. They found that Kenya has high potential of aquaculture, which is if exploited can lead to increased production of fish. They found that there is no strategy for health management of farmed fish in Kenya due to inadequate capacity in terms of human resource, infrastructure and fish farming funding. The study, however, did not determine the actual numbers of the jobs created by increasing production.

Ahmed Nasar-Allah et al. (2020) in a study on employment generation in the Egyptian aquaculture value chain: Implications for meeting the Sustainable Development Goals (SDGs) showed that 19.56 full time equivalent jobs are generated across the value chain per 100 tones fish produced. The study further established that aquaculture is a primary sector of the economy that has high potential to not only provide nutritious food, but also to contribute to the national economy. The aquaculture value chain provides substantial employment generation opportunities, including for females and the youth.

Valderrama (2016) through aquaculture and management conservation service carried out a study estimating employment in world aquaculture. The study was carried out in 80 countries accounting for 97 per cent of world aquaculture production in 2005 and covering the period 1970-2008. The results indicated that aquaculture employs about 23.4 million full time workers, which include 16.7

million direct and 6.7 million indirect jobs. The study did not provide the number of jobs created in the informal sector. In addition, the study did not show the number of jobs created for youths.

Patil et al. (2019) established opportunities of employment and entrepreneurship in the Indian fisheries sector. The study found that Indian fishery sector along with its allied industry has many more opportunities for livelihood generation, income generation and self-employment.

Aloo et al. (2016) carried out a review of the status and potential of the coastal and marine fisheries resources in Kenya. The study found that coastal and marine resources were of great potential and unexploited. Therefore, if fully exploited while adhering to the requirements of sustainable development, it has potential of creating many employment opportunities.

Stilwell et al. (2000) used input-output method in calculating employment multipliers to analyze the GDP multipliers for the South African economy with a view to determining the relative importance of the mining sector in employment creation. Though the model looks good and was successfully applied in the South African case, the methods main weakness is that the IO approach does not account for resource depletion.

KhairulAmri and Nazamuddin (2018) analyzed the causality between employment creation and export in Indonesia using time series data during the period 1987-2013. The data were analyzed using Johansen co-integration test, vector autoregression (VAR) and Granger causality test. They found that there is no long-term relationship between employment and export. However, the exports in a certain year period are affected by exports and employment of the previous year.

Kapso (2005) used employment elasticity when estimating the employment intensity of growth, trends and macroeconomic determinants. The global employment elasticity trends showed that while the share of employment grew in total output growth was about one-third over the past decade, there was a decline in the employment intensity of growth in the period from 1999 to 2003.

Skills gap

Balwanz (2012) sought to study youth skills development, informal employment and the enabling environment in Kenya: Trends and tensions. The study identified lack of skills development as one of several factors contributing to unemployment and slow economic growth in Kenya. It also noted trends and characteristics of the labour market where the informal sector has absorbed the majority of new workers over the past two decades. It also established that the conditions of informal sector work are likely to be unattractive to most job seekers, especially the youths. The

limitation of this study is that it assumes that youths are not likely to be attracted in the informal sector. You might find youths still getting attracted to the informal sector if the reward in terms of wages and salaries are good.

A study by Saori Imaizumi (2020) on jobs, skills and the potential of artificial intelligence in Kenya established that among the top 20 skills in demand, accounting ranked first, while computer science and engineering area saw an increase in skills demand for data, networks, developers and maintenance between 2015 and 2019. It found that whereas both universities teaching business and soft skills among available courses at select departments, 15 per cent of courses offered in University of Nairobi and 25 per cent of courses offered in Moi University focusing on business and soft skills, they need to offer more courses to meet employers' demand. The study, however, ignored the aspects of soft skills, which play a crucial role during employment process.

A survey of employers and employees in the formal and informal sectors to determine entry-level skills among youths aged 18-30 years in employment in Kenya by Orwa et al. (2019) established that there is a skills mismatch whereby the gap between the skills by the youth entering the workforce and the job market has widened due to the growing dominance of the services industry. This indicates that attention needs to be paid to the trends driving the future of work and to re-examine national priorities on training and skills development. Technical skills could be necessary but not critical in facilitating the youths in finding relevant jobs in a service-dominated economy and more so the fisheries sector. The weakness of this study is that it wishes away technical skills, whereas they are very important especially for technical fields.

Bhorat et al. (2020) developed a methodological framework of estimating employment creation potential, labour skills requirements, and skills gaps for young people. The methodology was able to estimate employment creation potential through the multiplier using different approaches such as sectoral skills gap estimation. The main limitation of the sectoral skills gap estimation in this methodology is that it only notes the existence of skills in the target population as whole. It does not take into account that not all of the target population is employed in the specific sector.

4. Data and Methodology

This section discusses data sources and approaches to analytical framework employed in the study.

4.1 Data Sources

This study used secondary data obtained from the Kenya National Bureau of Statistics (KNBS). Specifically, KIHBS 2015/2016 and Micro, Small and Medium Enterprises (MSME) Survey 2016 were the main data sets supplemented by published time series data from the Kenya Economic Surveys and Statistical Abstracts. Data from the latter were for various years and were used to obtain data for analyzing the quantities and values of both exports and imports of Kenyan fisheries and aquaculture. Data from published sources include the number of people employed annually in the marine fishing, and freshwater fishing such as the number of people employed in the boat making industry. These data were useful in calculating the elasticity.

The 2015/16 KIHBS is a cross-sectional household survey designed to provide estimates for various indicators including county level. The sample frame consisted of 5,360 clusters split into four equal sub-samples. The clusters in the frame were drawn from approximately 96,000 enumeration areas of the 2009 Kenya Population and Housing Census. The frame was stratified into urban and rural areas within each of 47 counties resulting in 92 sampling strata. The sample size was determined independently for each county, resulting in a national sample of 24,000 households. The number of youths and other age groups working in the fisheries sector was obtained from KIHBS 2015/16. KIHBS data was also used in mapping the occupations as per the Kenya National Occupational Classification Standard (KNOCS)-2000. Additionally, it was also used in establishing the skills gap requirements. Micro, Small and Medium Enterprises (MSME) Survey 2016 data was used in identifying various constraints along the value chain in the fisheries sector.

The 2016 MSMEs survey was cross-sectional and was designed to provide estimates at national and county levels. The survey had adopted a stratified random sampling method for the establishment-based sample in which a systematic random sample of establishments was drawn using equal probability selection method. For the household-based sample, a two-stage stratified cluster sampling design was used where the first stage involved selection of 600 clusters comprising 354 in rural and 246 in urban with equal probability. In the second stage, a uniform random sample

of 24 households in each cluster was selected using systematic random sampling method. Analysis was carried out and results presented in tables and charts.

4.2 Analytical Framework

4.2.1 Value chain mapping

This study applied the value chain theory to understand activities and the various actors in the fisheries value chain. This study analysed the main nodes of the value chain, namely: production, transformation and marketing and distribution. Transport and research and extension cuts across the different chains.

4.2.2 Constraint analysis

The study also identified underlying constraints along the value chain and at each node. The study used qualitative data collected from interviews with key informants in addition to information captured in the MSMEs Survey 2016 and Department of Fisheries report.

4.2.3 Employment potential analysis

Employment elasticity is the percentage change in the number of employed persons in an economy or region associated with a percentage change in economic output, measured by gross domestic product (Kapsos, 2005). In estimating employment potential, our study estimates employment elasticity. The weakness of this approach is that it does not take into account demography. However, despite this limitation, the concept of employment elasticity, in comparison to alternative measures of employment intensities such as employment/output ratio, employment/capital ratio and employment multiplier, is considered to provide the best picture of the complex relationship between growth and jobs. This study adopted the approach used by Kapsos (2005) to estimate the employment potential in the fisheries sector. For this reason, the estimation equation 4.1 is formulated as:

$$ln\,(E_t) = \beta_o + \beta_1\, ln\,(GDP_t) + \varepsilon_t \quad \text{..... 4.1}$$

E_t gives the fisheries sector employment in Kenya for t years, GDP_t gives the fishery sector contribution to GDP for a t years. β_1 is the sectoral employment elasticity that can be used to make further employment projections.

4.2.4 Labour skills gap analysis

In assessing the labour skills in the sector, this study obtained data from KIHBS 2015/16 on the levels of education of those participating in the fisheries sector. Both sectoral and occupational skills gap were analyzed using skills gap ratio. The study adopted approach by Bhorat et al. (2020) where in equation form, for each occupation *i*, would have a skills requirement as per the chosen measure of skills, *R*, and this would then need to be compared against the typical youth's skills level according to that measure, *Y*. For any occupation *i*, the skills gap can then be represented as:

$$Y - Ri \quad \text{..... 4.2}$$

Equation 4.2 can be re-written as:

$$Skill\ gap = Y - R \quad \text{..... 4.3}$$

Where: *Y* is the skill supply and *R* is the skill requirement.

5. Results and Discussions

5.1 Descriptive Statistics and Analysis

5.1.1 Production/Extraction

Sources of fish

Fish in the country comes from different sources both inland and in the oceans with each source producing different species. Table 4 shows the number of fish in metric tonnes caught from various sources from 1990 to 2018. Among the key sources of fish in Kenya include inland water sources such as Lake Victoria, Lake Turkana, Lake Baringo, Lake Naivasha, Lake Jipe, Tana River dams and Tana River; aquaculture; and the Indian ocean in Lamu, Kilifi, Mombasa and Kwale. According to the statistics provided, the mentioned lakes and regions are the main source of fish in Kenya for both domestic consumption and exports.

Table 4: Descriptive statistics of sources of Kenyan fish in metric tonnes 1990-2018

Variable	Mean	Std. Dev.	Min	Max
Lake Victoria	207,689.2	346,281.5	92,727	2,001,513
Lake Turkana	4,237.724	2,131.255	871	10,605
Lake Baringo	141.2069	119.7993	0	456
Lake Naivasha	402.6552	520.3436	5	2,287
Lake Jipe	95.9	23.21728	40	131
Tana River dam	1,035.586	597.1431	297	2,380
Aquaculture	3,870.241	6,358.268	632	24,096
Lamu	2,150.552	2,292.585	10	6,325
TanaRiver	872.8966	1,028.586	24	4,130
Kilifi	2,862.828	2,598.715	174	10,958
Mombasa	869.5172	554.8823	29	1,619
Kwale	2,442.346	1,686.042	622	5,909

Source: KNBS (Various), Statistical Abstracts (1990-2018)

The highest producer of Kenyan fish is Lake Victoria located in Kisumu County, which produces on average 207,689.2 MT annually. The maximum production from the lake is 2,001,513 MT and the lowest was 92,727 MT in the stated period.

The standard deviation was 346,281.5 MT, indicating huge disparities in the number of fish caught during the period.

The second highest producer of Kenyan fish is lake Turkana, which produced on average 4,238 metric tonnes during the period. The highest number ever recorded was 10,605 MT and the lowest was 871 MT. The standard deviation of 2,131 MT is an indication that there is also high disparity in the number of fish caught from this lake in the years under consideration. Aquaculture sources forms the third largest producer of fish in Kenya with an average of 3,870 MT for the number of years considered. The maximum weight of fish recorded from this source was approximately equal to 24,096 MT while the lowest value was 632 MT. The standard deviation value of 6,358 MT is an indication of high variation in the number of fish caught from this source. The lowest producer of Kenyan fish is lake Jipe, which produced on average 96 MT of fish within the period considered. The maximum weight recorded was 131 MT while the lowest weight was 40 MT. The standard deviation value of 23 MT shows little variations in the number of fish caught from this lake. There are a number of policy concerns that can be derived from the descriptive statistics for sources of fish in Kenya. Some of the concerns includes what happens when there are huge disparities in the number of fish caught from the main sources of fish. Other concerns regard what bridges the gap when there is low volume caught from the main sources as indicated by the data. Looking at the statistics for the imports, this explains why there is a consistent increase in the value of imported fish in the country. This assertion is further supported by the graph on exports that shows fluctuations in the export value of fish in the country, that due to this disparities, the country cannot maintain a consistent supply of fish in the market, but can bridge the gap by maintaining a consistent import of fish in the country.

Consumers of Kenyan fish

The other important piece of information to the study is on who consumes Kenyan fish locally. Basically, out of the total amount of fish produced in Kenya, 70 per cent is consumed locally with only 30 per cent being exported. It is therefore important to understand the consumers by age distribution. Fish is classified into fresh, frozen, dried, Omena, prawns, tinned fish and others as shown in Table 5.

Table 5: Fish consumption by age cohort (%)

	15-34	35-59	60 and above	Total
Fresh fish	25.72	29.24	22.18	26.12
Frozen fish fillets	1.29	1.62	0.96	1.33
Dried/smoked fish	17.84	16.75	19.97	17.8

Omena	50.41	47.68	51.24	49.95
Prawns /other sea food	0.66	0.90	0.69	0.71
Tinned fish	0.42	0.17	0.55	0.39
Other fish	3.66	3.64	4.41	3.72

Source: KNBS (2016), KIHBs 2015/2016

From Table 5, Omena is the most consumed fish type across the different age groups. It is even consumed more by the youths who fall under the age bracket 15-34. Tinned fish is the least consumed product. This comparison is important since it shows that majority of people do not consume value added commodities. There could be several factors leading to this low consumption of tinned fish. It could be because the tinned fish are expensive hence majority cannot afford it. Another reason could be due to supply constraint where the commodity does not reach many consumers across the country. Therefore, understanding the consumption pattern one is able to tell that there is a potential in value added fish.

Supply of fishing materials

The other factor that plays a key role at production level is the supply of materials used at production level, such as fish feed, fingerlings, pond construction material and services from fish managers and other technical experts. According to a report by FAO (2010), there are various types of gear and craft used by fishers in the actual extraction of fish in the country. The main ones, however, include vessels and nets. The vessels include canoes, motorized boats, sailboat (dhow), outrigger canoe (ngalawa), and open fishing boat (mashuwa). Built to withstand rough seas and open fishing voyages, dhows and 'ngalawas' are equipped with shark net, driftnet and gillnets. There are also different types of gears used by artisan fishers in the country. They include gill nets, seine nets, cast-nets, long-lines, hand-lines, spears, 'lema' (basket traps), 'uzio' (barricades) and 'tata' (weir).

The current study notes that making of the fishing gears and the vessels have potential to employ youths as the demand of fish and fish products continue to increase in the country. The argument on making of vessels and other types of fishing gears is in line with a report by FAO (2010) that indicated that 6,500 fishers operated 1,800 artisanal fishing craft in Kenya's marine and coastal waters. Since 2010, as shown in the analysis, consumption and export of fish has been increasing ever since the report was produced. This indicates that, the number of people engaged in these activities has also been rising. There are a number of extension services by the government and various institution dealing with the Fisheries sector to the fishermen and their families. These are in the areas of research and provision of fishing equipment. A good example in this regard is KMFRI and the Wildlife Conservation Society (WCS) who in 2014 developed a new

fish-trap basket with escape gaps to reduce the fish caught. The trap basket allows juvenile and non-target fish species to escape in each catch and thus farmers get higher returns on selling.

Further, by enabling more under-sized fish to escape, the traps minimize the impact of fishing on coastal reef systems and help fishing communities boost profits. There are many actors that are involved in the fishing, feed production and supply to the fish farmers. Fish feed is an important ingredient in the fish production industry, as the cost of production is likely to impact heavily on the amount of fish produced in the country. According to Munguti et al. (2014), the Kenyan fish feed industry has been boosted with the development of fish feed standards, which is expected to ensure quality fish feeds for all farmers. The study further noted that much of the aquafeeds used in Kenya are either produced on-farm or by small-scale semi-commercial feed manufacturers. The study also noted that improvements to the quality and preparation of these feeds are likely to bring about improved productivity and cost savings. There are various ingredients that go into fish feed production. The feeds come in the form of granules, also called pellets known to provide the nutrition in a stable and concentrated form and enables the fish to feed efficiently and grow to their full potential. In other instances, the feeds are combined with other ingredients such as vegetable proteins, cereal grains, vitamins and minerals and formed into feed pellets.

Ship and boat building

Ship building in Kenya is done by Southern Engineering Company Limited, which is a leading shipbuilder located in Mombasa. However, there are small groups especially at the coast of Kenya who make small boats that are used by fishermen to do fishing but limited in many ways including accessing deep water seas.

The all-purpose boat christened 'Tintin Tu' was built by Automobile Vehicle Assembly (AVA) based in Miritini, Jomvu, Mombasa County. This was commissioned to start operations in the country in March 2018. The 42-foot long and five-meter wide boat can be used for fishing and leisure.

Service providers

Other people employed at this level include those involved in the manufacture and supply of fishing nets, ship fenders, unloading cushions and loading slings and those involved in the repair of fishnets. Additionally, fisheries officers are involved in studying aquatic life forms. They also conduct experiments and observe effects of environmental, nutrition and chemical composition of fish water. Fish farm workers are involved in breeding or catching fish and cultivating other forms of aquatic life for sale. Fish scouts are also employed at this level. Their work

includes enforcing rules and regulations governing fish. Inland fishermen are also employed at this level where they carry out the actual fishing in deep sea waters. Finally, we have fish farm managers who manage the fish ponds monitoring the growth of fingerlings. Deep sea fishing is done by foreign countries who own large ships. They obtain license from the Kenya Government after paying some revenue so that they fish in Kenyan waters.

5.1.2 Transformation

According to the Department of Marine Resources (2002), fish processing is the application of preservative or the use of methods to the flesh of fish to ensure that it maintains its quality and prevent deterioration. There are a whole range of activities, including but not limited to preparation, supply, storage, refrigeration, or transportation of unprocessed fish. This has been regarded as fish processing value chain from extraction to final consumption. However, many misunderstand processing to take place at the packaging stage, which is only a component of the entire value chain.

There are various activities that take place in the processing of fish before they are packaged for export or local consumption at a later date. The activities are meant to make sure that the fish is preserved in a manner that reduces spoilage or to ensure that the packaged fish is safe for human consumption. The four basic procedures used in the final processing of fish products are heating, freezing, controlling water activity normally done by drying or adding chemicals, and irradiating. All these procedures increase the shelf life of the fish by inhibiting the mechanisms that promote spoilage and degradation. There are various ways or procedures conducted on the fish before it is packaged. After the fish is caught, it is recommended that the first procedure is to kill the fish. This is what is referred as stunning and it is always recommended that this be done in a clean and hygienic condition. What follows immediately after this process is gutting of the fish, which is simply opening up the fish on one of the sides so as to remove the intestines, other unwanted parts and the excess blood. It is recommended that this activity takes place under running water and on a corrosion resistant table.

Another important activity in fish processing is descaling, which involves removal of scales, fins head and tail which simply depends on the type of fish and the purpose of processing. Descaling can be done using a rough surface on the fish or using a knife. It is also recommended that thorough cleaning of the fish should be done at this stage to prevent micro-organism contamination.

Sorting and grading should be done after cleaning the fish, which is the practice of separating the fish into groups with different physical properties such as size,

species and color. It also involves separating fish by quality according to certain pre-determined criteria. Containers such as tumblers are used during this process; in addition, sizing devices and scales may be used.

Slicing to steaks or cut to preferred sizes: Depending on fish species, size and degree of processing, fish are cut, sliced to steaks, filleted and deboned where necessary. Curing is another process used in fish preservation, which simply means subjecting the fish to fermentation, pickling, smoking, or some combination of these, before it is eaten. Several people are involved at this level. These includes the fish smoker who controls a battery of smoke chambers in which the meat cuts are smoked or curried. Another team of people involved are the fish butchers. They scrap the skin and picks bloody meat and other parts from the uncooked fish. They then grade and pack fish for sale, freezing or further processing. This stage also involves fish canning, fish processing, fish sterilizing and fish freezing machine operators. All the above-mentioned personnel are required to have skills level equivalent to a trade certificate. Despite the qualifications being low, majority of people involved do not meet the minimum requirements.

Table 6 presents results of different people in different age categories who are involved in the fish business. The table shows disaggregated fish market and the different players. Majority of the individuals are involved at the lower point of value chain, which is fish mongering. Fish mongers makes 80.83 per cent of the total players in the sector. Fish processors mostly manufactures make the least of people in the chain by having only 0.63 per cent of the total individuals in the fisheries value chain. This is consistent with the expectation since the country has only a few processors. It also important to note that of the 88.83 per cent of youths aged 15-34 years are fish mongers.

Table 6: Individuals involved in fish sector by age (%)

	15-34	35-59	60 and above	Total
Boat repairing	2.59	0.36	4.44	2.31
Fish scaling	1.91	0.36	0	1.65
Fish cooling	2.34	0	0	1.95
Fish monger	88.83	92.11	95.56	89.46
Fish processor	0.68	0.72	0	0.67
Fisher	3.64	6.45	0	3.96

Source: KNBS (2016), KIHBS 2015/2016

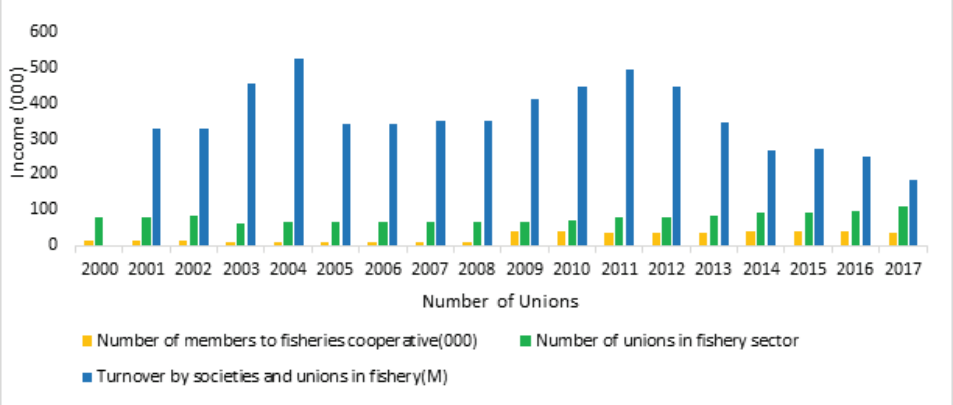
5.1.3 Marketing and distribution

Marine and freshwater fish and those farmed are sold at the market after harvesting. However, not all harvested fish ends up in the market. Some are consumed by the fisher's family. Fish for home consumption are harvested throughout the production cycle, usually on a weekly basis. This is common to the aquaculture setting as opposed to marine fishing. In this way, fish farming contributes significantly to household food security. The main fish harvests are done at the end of the production cycle (usually nine months) for those doing fish farming (Ngugi et al., 2010). Those involved in fishing in the rivers, lakes and oceans, there is no specified period as the fishing is continuous throughout the year. During this time, traders from the main towns and trading centres visit fishing shores and fish farms to purchase fish. Fish harvested in bulk is sold to both small-scale and large-scale traders. Most of the people are the wholesalers and retailers that have small groupings in form of associations. Wholesalers purchase fish, which they transport to other major towns such as Nairobi for resell. Some of the retailers hawk the remaining fish among the surrounding community members. Those involved in bulk buying process the fish for export (Ngugi et al., 2010). Majority of people involved in the marketing and distribution of fish and related products do not have high skills since majority have attained only primary level of education (see Figure 12).

Number of unions in the fisheries sector

Apart from the source of Kenyan fish and those who consume the fish, the study went further to find out the number of unions/cooperatives, number of members and income to the members of the cooperatives. This was important in helping understand who owns the sector that the study is focusing on. Using KNBS statistical abstracts for various years, distribution of the mentioned variables can be seen in Figure 7. The main reason behind formation of unions and cooperatives in the country is to organize farmers into groups that will enhance the marketability of their products. This works by eliminating the number of middle men within the value chain who benefit from incomes meant for the farmers. In the fisheries sector, unions were formed to help in value addition, processing fish for both local and international markets (Government of Kenya, 2010). The unions also act as a source of capital for supporting fish farming among the farmers who borrow loans from the associations. Earnings to the unions and cooperatives is one factor that can encourage growth in the number of such groups. However, it is important to note that increase in exports reduces incomes to the farmers in the unions, a factor that can cause collapse of such organizations.

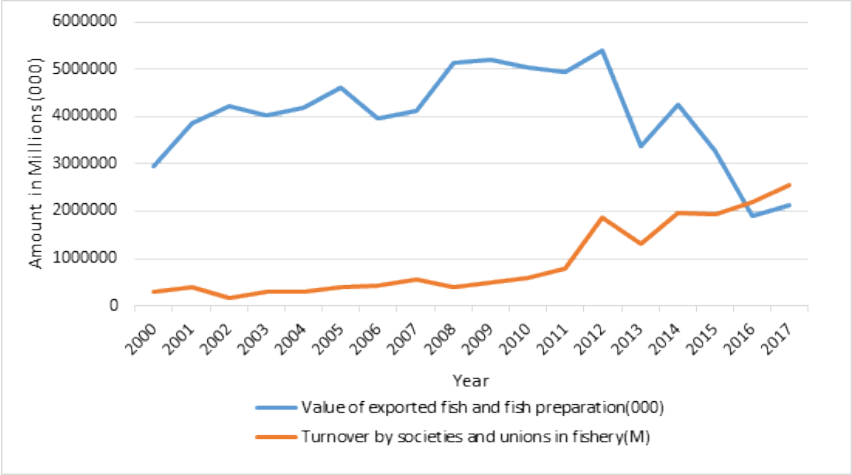
Figure 7: Membership, number of and turnover to unions



Source: KNBS (Various), Statistical Abstracts (2000-2017)

Fluctuations in the income to the fish farmers have had effect on the number of people joining the unions. Turnover to the societies has not been consistent but fluctuating during the period under consideration. As can be seen from the Figure 7, income to the unions has been decreasing since 2011 to 2017. The number of unions and the number of people in the unions has shown little change, with little improvement witnessed between 2009 and 2017. Increasing the number of unions and incomes to such groups can go a long way in increasing production of fish. Members of the unions may therefore be required to employ more people to help in the production. Few changes witnessed in the figure in terms of the number of unions is therefore an indication that the sector may not be generating the required levels of employment in the country.

Figure 8: Export value and amount received by unions



Source: KNBS (Various), Statistical Abstracts (2000-2017)

The constraints have remained the greatest challenge to fish farmers in the country, a factor that has affected incomes to the households that depend on the activity. The turnover to the societies owned by the fish farmers has been fluctuating every year. Various challenges have been cited, affecting fish farmers in the country and therefore limiting production of fish. A good example is in production where it has been indicated that there are no sufficient people with experience on fingerlings production. Others included fluctuations in the price due to import of fish. Jointly, these factors work together to affect the amount of money that fish farmers receive from this activity.

As can be seen from the Figure 8, the amount received by the fish farmers fluctuates in the period under analysis. There was an increase from 2002 to 2004 in income to the societies, a factor that was attributed to efforts by the Government to organize farmers into unions and therefore eliminating the number of middle men in the sector. The increase witnessed between 2007 to 2002 was attributed to Government initiative to fish farmers, which included building of fish cages and provision of fingerings to the farmers. This saw tremendous increase in production of fish and therefore the incomes (Government of Kenya, 2017).

Addressing the various constraints such as the cost and quality of fish feeds is expected to have a major effect on fish production. Quality of feeds has also been cited as one of the factors affecting growth rate of fish. Poor quality of feeds prolongs the maturity time of fish, the size of fish and therefore incomes to the farmers. For this reason, the Government of Kenya has introduced various policies to improve this, including educating farmers on the correct food formulation. The sharp decline in the amount of money received by the unions from 2012 has been attributed to various factors. The main one including decline in consumption of local fish as many retailers go for cheap imported fish from other countries. As the number of unions increase together with income as can be seen from Figure 8, it is important to consider the effect that this has on employment creation in the fisheries sector. Increase in income to the unions encourages more production due to distributive effect. The implication here is that more ponds would be built hence bringing in more farmers to the sector, which would mean more employment.

5.1.4 Transport, research and development

Traditionally, fish farmers have incurred losses amounting to millions every year due to post-harvest losses and delays occasioned by the transport system in accessing the market. However, there has been improvement in the recent past in the way the fish are transported to the market by way of refrigerated containers. Before this, most farmers dropped out of the programme initiated by

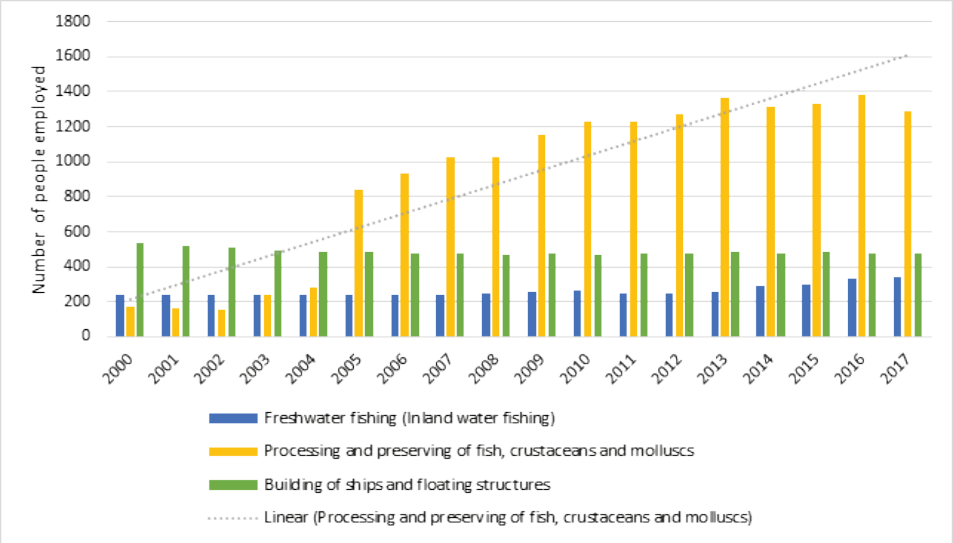
the Government to promote fish production in the country. The main challenge at this node is the poor infrastructure due to poor road networks which leads to delay of the fisheries products hence leading to losses (Mwirigi and Theuri, 2012) .

Employment within selected nodes

The fisheries sector generates employment from actual extraction of fish from various sources both inland and in the oceans. Among the various forms of employment generated include making of boats and floating structures, processing of fish and freshwater fishing. The employment that is considered at this level, or reported by the statistical abstract, is for both youths and adults (see Figure 9).

From Figure 9, the number of people employed in building of ships and floating structures used to extract fish has remained fairly constant for the period under consideration.

Figure 9: Employment in fisheries sector (2000-2017)



Source: KNBS (Various), Statistical Abstracts (2000-2017)

There is only one company in the country that specializes in building of ships in the country, having completed its first ship in 2018. The other small groups of people who make small boats therefore contribute significant levels of employment as well. On the other hand, there is an upward trend in the number of people employed in the processing and preservation of fish. The number of people employed at this level has been rising since year 2000 with slight fluctuations between 2014 and 2017. Fresh water fishing did not show significant change in the number of people employed for the period under consideration.

5.2 Value Chain and Constraint Analysis

Figure 10 maps various activities in the fisheries sector starting from production to the final stage, which is processing and packaging for both local and international markets. This approach describes the activities and constraints at each node.

5.2.1 Production

At the input stage, there are several actors who supply the inputs required in the production of fish. Inputs include research and extension services, fishing nets, fish feeds, fishing boats, fishing hooks and fingerlings as shown in Figure 10. The actors involved include landing sites managers, fishermen, equipment constructors and repairers, fingerlings experts, boat owners and repairers. In addition, the node has activities such as landing sites preparations and management, boat construction, hiring and repairing. Fishermen are the main actors for the artisanal fisheries.

There are several constraints experienced at this node in the value chain. According to the Kenya Aquaculture Report (2017), there are no spaces set aside for practicing aquaculture, lack of quality fish feeds, poor management of ponds and breeding of fingerlings, high cost of feed thus making the cost of breeding fish to be high. High cost of fish feeds is a key constraint accounting for more than 75 per cent of the cost. Currently, most of the fish feed is imported; however, local production of fish feeds has picked up. KMFRI has set up a fish feed processing factory which is aimed at providing feed at low prices. Additionally, there are few people with experience in producing fingerlings hence leading to poor quality of breed, overreliance on donor funding and other development partners. Also, there is a problem of depletion of fresh water for fish rearing among the farmers practicing fishpond farming and lakes and rivers which are drying up due to climate change. Moreover, there is the problem of acquiring fishing equipment such as boats for those fishing in the lakes and rivers. Environmental pollution leads to materials such as plastics and river hyacinth in the fishing waters. Lake Victoria is a good example of the impact of environmental pollution where the fish landing sites have been covered by hyacinth (USAID, 2010). Kenya lacks large fishing vessels, therefore not able to fully exploit deep sea fishing along the Indian Ocean at the Coast.

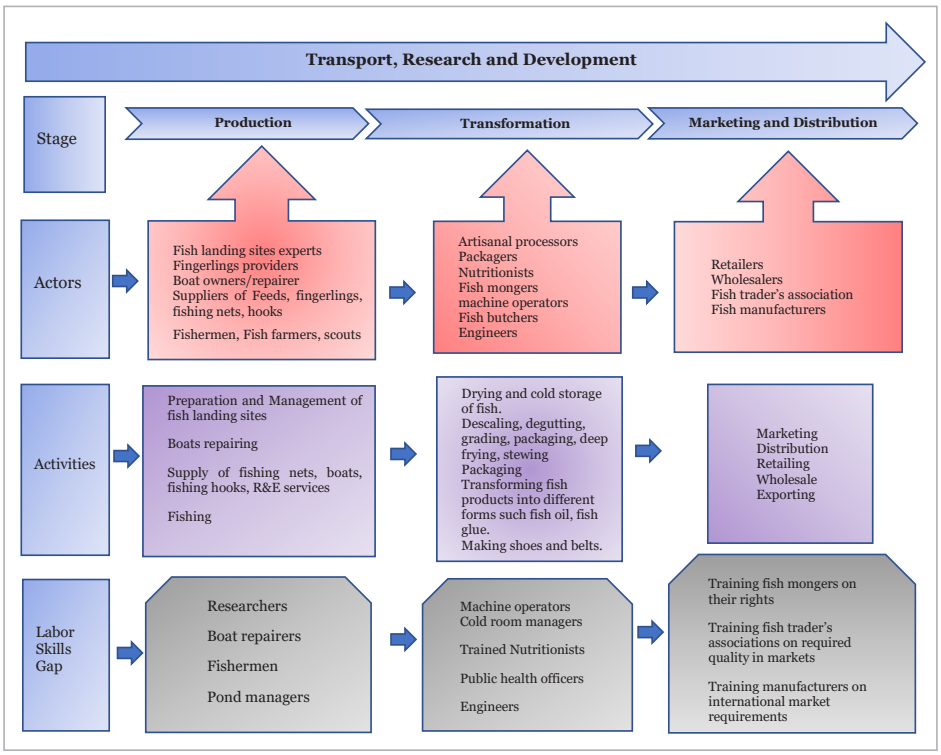
5.2.2 Transformation

Transformation of the fish is the next stage after production. This involves transformation and preparation of fish for final market. Actors here include fish mongers, the artisanal processors, manufacturers, nutritionists, public health

workers, cold room managers, machine operators, packagers, fish butchers and graders. Here, fish undergoes industrial and artisanal processing and preparation for domestic and export markets, food and feed products.

There are several constraints experienced at this stage. The main challenge is the high cost of electricity used in the drying and cooling of the fish. Other challenges include lack of value addition of the farmed and those caught from the lakes and rivers. Most of the farmers and fishermen harvest fish, which they sell without adding any value. This is in line with what was established by Muma and Charo-Karisa (2019).

Figure 10: Summary of fish value chain and job creation in Kenya



Source: Author own construction

In addition, machines used in the processing require huge capital and are not affordable. Finally, post-harvest losses due to lack storage facilities is another bottleneck to the fisheries sector. This affects the quality of fish reaching the market. Post-harvest losses are also contributed by poor road transport which delays the delivery of the products in the market.

5.2.3 Marketing and distribution

Marketing is the final stage in the value chain. There are various actors involved in marketing and export of fish end products. Actors include retailers (fish mongers), wholesalers, fish trader's associations and manufacturers. Fish ready for market are distributed to local consumers and international markets as exports.

The main constraint at this level is the information asymmetry. Fish traders do not have the information about the market demand, hence end up being exploited by those traders buying fish in bulk for export. These results are consistent with what Aura et al. (2019) regard as information barrier. Additionally, low volumes of fish produced make it difficult to access large international markets. Low quality of fish produced also end up being rejected in the market. This could be because the fish are harvested prematurely, therefore not meeting the required size and weight. There is also the problem of many middlemen involved in the fisheries sector, hence the profit to the farmer is much less.

5.2.4 Transport, research and development

Transport, research and development cut across all the nodes in the value chain. Transport is capable of creating employment to the youths if increased activities and production of fish is attained. There are people involved in the transportation of the fish from the lakes, rivers and ponds to the storage place. Others are also involved in transporting the fish to the processing place and then market. On the other hand, research and development also cuts across the value chain since research is done from the starting point about the breed of fingerlings. Research is also carried out about the quality of fish produced and consumed in the market and the production pattern in the landing sites. Market research is also done about the demand of fish in the market and prevailing challenges. All these activities create employment to the people involved. This stage mainly employs university graduates.

5.3 Employment Potential

5.3.1 Regression analysis on employment in fisheries sector using exports

Going by the discussion in the foregoing section, it is important to find out whether exports of fish were important contributors to employment generation in the country.

Table 7: Regression analysis of export value on employment in the fisheries sector in Kenya

Dependent variable; Total employment in the fisheries sector			
Variable	**Coefficient**	**Std. Error**	**P-Value**
VEXPO	0.0200999	0.012689	0.113
Emp_1	0.921796	0.0565092	0.000***
Cons	0.3119771	0.3185708	0.327
*** Significant at 1%, Log likelihood = 28.66054897			

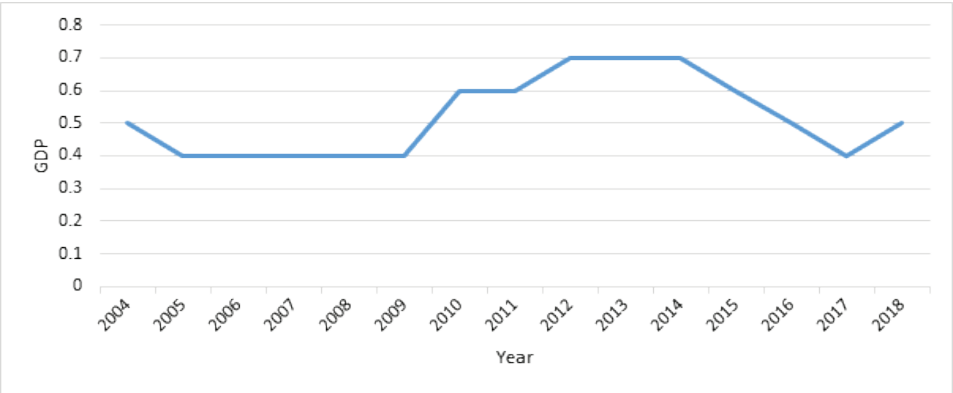
The regression results indicate that there is a positive relationship between value of exported fish in Kenya and employment. A one per cent change in the value of exported fish increased employment by 0.020 per cent, holding all the other factors constant. The coefficient of value of exported fish was, however, not statistically significant.

The regression results further indicated that a one per cent change in employment in the previous year would increase employment in the current period by 0.92 per cent, holding all the other factors constant. The coefficient of the previous year level of employment was statistically significant in affecting the current year employment at one per cent. There are various reasons that can be attributed to the current observation regarding the relationship between previous levels of employment and current levels of employment. An increase in last year employment would mean an increase in production in the previous year. The implication of this is that there will be more export of fish in the same period. Holding all other factors constant, this would imply that domestic consumption of fish would also go up. Increase in exported fish and increase in local consumption of fish would translate into more income to the unions, cooperatives and therefore the fish farmers. In an attempt to increase production in the current period owing to improved incomes from previous period, fish farmers would hire more people, therefore increasing total employment in the sector Khairul and Nazamuddin (2018). The regression results from the study are not much different from other studies conducted in other parts of the world of the relationship between exports and employment creation. Although most studies have focused on exports of manufactured goods, there are important relationships that can be borrowed and compared for the case of fisheries sector in Kenya. Specifically, these studies show that there is positive relationship between exports and employment creation in an economy (Dizaji and Badri, 2014; Uexkull, 2012; Lapadre's, 2011; Kiyota, 2011; Katz and Istrate, 2011; Goldar, 2009).

5.3.2 Elasticity of employment to GDP in the fisheries sector in Kenya

There are various theories on the relationship between GDP and employment creation. Some economists maintain that growth of GDP is associated with growth in employment. Others maintain that there is bidirectional relationship between the two variables. The contribution of fisheries to the Kenyan GDP has not been consistent (Figure 11). The highest contribution to the GDP was in 2013, which witnessed a value of approximately 0.7 per cent and later started to decline to date.

Figure 11: Contribution of fisheries to GDP (2004-2018)



Source: KNBS (Various), Statistical Abstracts (2004-2018)

From Figure 11, the contribution of the fisheries sector to GDP has not been consistent from 2004 to 2018. In 2005, the sector contributed 0.5 to the GDP of the country, which reduced to 0.4 by the year 2005. This remained constant for the next three years and began to rise reaching 0.6 in 2010. The highest contribution of the sector to GDP was between 2012 to 2014 at 0.7 per cent. Currently, the sector is showing some improvement as the contribution has indicated an upward trend. One important thing to note is on how employment in the sector has been fluctuating with a change in income to the sector.

There are various ways to calculate employment potential of a sector. One way is to calculate how elastic a sector is with regard to GDP, in our case using total employment in the fisheries sector in Kenya and contribution to GDP statistics. The most straightforward method is the arithmetic method, also called arc-elasticity, which requires only two data points, the starting and end-period. In this case, elasticity can be computed as follows; $\varepsilon = \Delta E / E / (\Delta Y / Y)$, where the numerator represents the growth rate of employment and the denominator, the growth rate of output.

Table 8: Fish and aquaculture sector elasticities computation

Year	Fishing and aquaculture	Employment	ΔE/E	ΔY/Y	ΔE/E/ (ΔY/Y)
1995	5,010	870			
1996	5,420	832	-38	410	-0.09268
1997	5,540	884	52	120	0.433333
1998	5,620	885	1	80	0.0125
1999	8,428	890	5	2,808	0.001781
2000	7,995	950	60	-433	-0.13857
2001	6,532	927	-23	-1,463	0.015721
2002	5,119	900	-27	-1,413	0.019108
2003	4,765	978	78	-354	-0.22034
2004	5,246	1,010	32	481	0.066528
2005	5,751	1,563	553	505	1.09505
2006	6,249	1,652	89	498	0.178715
2007	6,588	1,745	93	339	0.274336
2008	6,791	1,744	-1	203	-0.00493
2009	5,564	1,884	140	-1,227	-0.1141
2010	5,713	1,960	76	149	0.510067
2011	23,000	1,961	1	17,287	5.7800
2012	28,903	2,001	40	5,903	0.006776
2013	34,315	2,107	106	5,412	0.019586
2014	38,732	2,090	-17	4,417	-0.00385
2015	40,300	2,125	35	1,568	0.022321
2016	34,909	2,196	71	-5,391	-0.01317
2017	36,616	2,118	-78	1,707	-0.04569

Source: KNBS (Various) Statistical Abstracts (1995-2017)

Using different periods from 1995 to 2017 (Table 8), there are different values of responsiveness of employment to the GDP. For the year 1996, for example, elasticity of employment to the GDP is approximately equal to -0.09268. This implies that there was a negative relationship between the two variables as can be seen from contribution of fisheries to GDP, which increased against overall employment from the fisheries sector that declined from 870 to 832. The implication here is that an increase in contribution to the GDP by the fisheries sector by one unit led to a decline in employment in the sector by 0.09 units. Employment in this case can be said to be inelastic to GDP for the year under consideration.

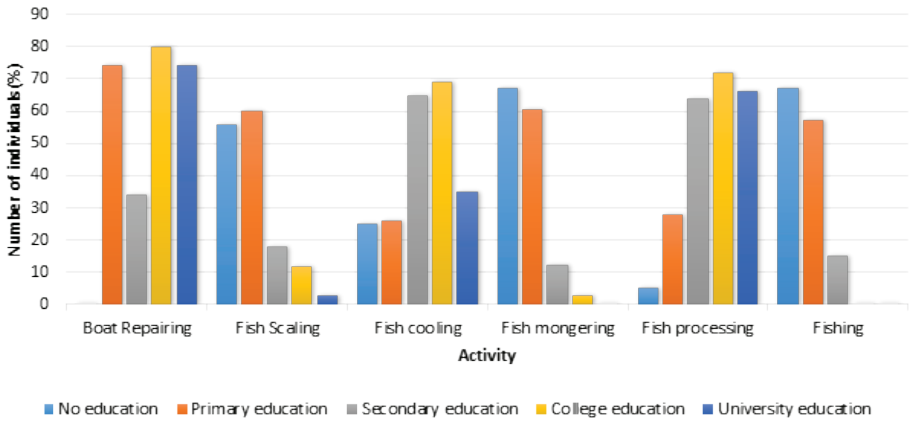
There are two years of interest that require attention to the policy makers and this include 2005 and 2011. An increase in contribution to the GDP by the fisheries

sector by one-unit lead to more than one-unit increase in employment. For 2005, a one-unit change in contribution in the fisheries sector to GDP led to 1.09505-unit increase in employment. Employment was therefore perfectly elastic to growth in the output from the sector. For the year 2011, a one-unit change in contribution to GDP by the fisheries sector led to a 5.78 unit change in employment in overall fisheries sector. The implication here is that employment was highly responsive to changes in GDP. Coincidentally, the year coincides with the period that the Government implemented various policies in the fisheries sector. The other period under analysis can be said to have varying levels of elasticity of employment to changes in GDP.

5.4 Labour Skills Requirements

Education plays a key role in equipping people with skills necessary to enter into the job market. Therefore, if the education system fails or one does acquire the required skills, it becomes difficult in being absorbed in respective sectors in the economy. As seen in Figure 12, majority of people engaged in fishing, fish mongering, fish scaling either have no education or have attained primary level of education. Specifically, majority of those involved in boat repairing have primary and college level of education with 74 and 80 per cent, respectively. This can be attributed to the Government initiative, which advocated for employment of youths in boat building and repairing. The high percentage of individuals with college level are those involved in engineering activities. Fish processing and cooling also attracted high percentage of people with college and university level of education. This can be attributed to people running the cooling machines, nutritionists and other production processes. This shows that majority of the people in the fisheries sector do not have the needed skills for them to be employed in the formal sector. Only a few people involved in the fish value chain have acquired secondary education and above with big per cent having acquired pre-primary and primary education only. For the people involved in the fisheries value chain to get good jobs, they need to enhance their skills through training and additional years of schooling.

Figure 12: Individuals involved in the fish enterprise by education



Source: KNBS (2016), KIHBs 2015/2016

5.4.1 Sectoral skill gap

In most cases, education is used as a measure of the skills based on the level and years spent in school. Sectoral skills gap relates the skills gap requirement for a sector to the availability of the skills in a particular country.

In this case, skills gap was calculated by subtracting skills requirement of the sector from the skills supply in the sector. There was no skills gap found since in both cases there is skill surplus for those without education (1,381,428), primary education (2,828,455), secondary (130,7597), college (214,127), and university (78,657) (see Table 9). This means that there is an already existing population of youth who already have the needed skills to get to work but are not engaged. On the other side, the skills availability ratio is positive 6.6, 11.7, 16.2, 13.1 and 392.3 for no education, primary, secondary, college and university level of education, respectively (see Table 9). Skills availability ratio measures the skills that exist in the population against the skills required in the sector for each skills category. It is a measure of the extent to which the skills required are available in the target population. If it is large, the chance that the required skill will be available is high. If the ratio is small and mostly less than 10, then the required skills may not be available. In our case, the skills availability ratios for both levels are large for all levels except that of no formal education. This means that available population of unemployed youths with no formal education are not likely to be attracted to the fisheries sector.

Table 9: Estimating the sectoral skill gap for the fisheries sector

	No formal education	Primary	Secondary	College	University
Skills supply	1,627,626	3,093,074	1,393,392	231,752	78,858
Skills requirements	246,198	264,619	85,795	17,625	201
Ships and boat engineers	0	0	0	0	0
Fisheries workers	14,426	10,802	1,569	234	0
Subsistence agriculture and fisheries workers	220,332	229,320	70,392	15,600	201
Fisherman	-	-	-	-	-
Handcraft worker (fishing baskets)		-	-	-	-
Fish butchers	7,251	19,815	11,449	1,791	0
Fish processing machine operators	0	503	1,599	0	0
Fish mongers	-	-	-	-	-
Fish smokers					
Fishing managers	-	-	-	-	-
Fisheries, hunting and trapping labourers	4,189	4,179	786	0	0
Fish scouts	-	-	-	-	-
Fisheries officers	-	-	-	-	-
Boat body-builders	-	-	-	-	-
Skills gap	1,381,428	2,828,455	130,7597	214,127	78,657
Skills availability ratio	6.6	11.7	16.2	13.1	392.3

Source: KNBS (2016), KIHBs 2015/2016

5.4.2 Occupational skills gap

In the occupation skills gap analysis, negative gap indicates that there is gap that needs to be filled to meet the occupational skills requirement for the typical unemployed youth, while a positive number suggests that the typical unemployed youth already has the skills required for that occupation.

Table 10: Occupational skills gap for the unemployed youth, by years of schooling

Occupation	Skills supply	Skills requirement	Skill gap
Ships and boat engineers	16	18	-2
Fish workers	0	8	-8
Subsistence agriculture and fisheries workers	8	14	-6
Fishermen	-	-	-
Handcraft worker (fishing baskets)	-	-	-
Fish butchers	8	0	8
Fish processing machine operators	14	15	-1
Fish mongers	-	-	-
Fish smokers	-	-	-
Fish managers	-	-	-
Fisheries, hunting and trapping labourers	0	0	0
Fisheries scouts	-	-	-
Fisheries officers	-	-	-
Boat body-builders	-	-	-

Source: KHIBS 2015/2016

Only fish butchers' occupation did not have an occupation gap. The rest of the occupations, namel ship and boat builders, fisheries workers, subsistence agriculture and fisheries workers and fish processing machine operators had gaps (Table 10). This could be attributed to the fact that one is required to spend a number of years studying in these fields. The skills requirement in these occupations are mostly technical, hence requiring high level of qualifications.

6. Conclusion and Recommendations

6.1 Conclusion

This study set out to assess the contribution of fisheries to job creation among the youths in Kenya. The target was to map fisheries value chain, identify the constraints in the sector so that if they are addressed, then the sector can achieve full potential, hence creating the employment. Additionally, the study aimed at establishing the employment potential by computing the elasticities of employment in the sector. The study also aimed at estimating skills gap in the fisheries sector. The literature reviewed provided a basis for the adoption of value chain analysis approach. Stages in the value chain were identified ands the activities involved and the actors. The study was able to identify both supply and demand side actors and the role played by each actor in the value chain. Key constraints such as high cost of feeds, lack of value addition, poor infrastructure, lack of adequate capital and lack of information among fish farmers were identified. Employment creation potential was established after computing the elasticities and regression. The results show that there is potential for the fisheries sector to create employment by increasing its contribution to GDP. There is a positive relationship between employment and contribution of the sector to GDP. A one per cent increase in the contribution of the sector to GDP increases employment in the sector by 5.56 per cent, holding all the other factors constant. The coefficient of fisheries sector contribution to employment creation is statistically significant at 10 per cent level of significance. Skills gap analysis was also carried out and the results showed that there is no sectoral skills gap in the fisheries sector. However, there exists skills gap in the technical occupations which require high level of education. In conclusion, the fisheries sector has great potential in creating employment among the youths at various nodes of the value chain. This is possible through the supply of raw materials and services needed at different levels of the value chain as highlighted in earlier discussion under results. Additionally, addressing the constraints in the sector will have a positive impact of increasing production. Increase in production in the sector would increase GDP contribution and in return create more employment among the youths. There exists occupational skills gap which needs to be addressed so that people can acquire the required skills through training.

6.2 Recommendations

i) To reduce the high cost of production, the Government through the Ministry of Agriculture, Livestock and Fisheries need to subsidize the cost of fish feeds and fishing equipment. This can also be done through tax reduction for fish feeds or establishing more fish feeds production industries. This will reduce the cost, hence encouraging more youths to join the sector at production node in the value chain.

ii) To deal with poor management of ponds and fish capture, there is need to capacity-build fish farmers and fishermen through the Ministry of Agriculture. This is possible by recruiting more extension officers and dispersing them to train fish farmers and fishermen on how to produce quality fish needed in the market at the same time observing environmental conservation. Majority of these officers should be youths since they can cover large area over short time since they are more active.

iii) To deal with the problem of post-harvest losses, the Ministry of Agriculture, Livestock and Fisheries need to ensure strict adherence of the 40 per cent requirement of value addition to fish landed in Kenya before export. This is in line with the Fisheries Act of 2016. This will create employment among the youths involved in the activities of value addition and at the same time reducing losses among farmers and traders. Additionally, farmers and fishermen will be supplied with storage facilities and coolers through Beach Management Units (BMUs)/cooperatives in collaboration with the Ministry of Trade and Cooperatives. This will enable them cut down losses due to poor storage and at the same time speculate with fish stock, which can be sold when prices are high.

iv) To deal with occupation skills gap, the Government through the Ministry of Education needs to encourage more youths to be enrolled in technical courses such as ship construction engineering, fish processing machine operators and boat-body building. This will ensure that youths acquire the necessary skills required in the fisheries sector.

6.3 Limitations

This study encountered challenges in terms of data. Data used in the analysis was not disaggregated to the lowest level of the value chain. It was also difficult to identify the exact number of people employed at each node due to lack of data disaggregated to the lowest level of the activities.

6.3 Further Research

Further research needs to be undertaken to determine:

a) The youths employed at each node of the value chain using more disaggregated data.

b) The exact skills gap requirement in the fisheries sector using a more disaggregated data set at the occupational level.

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