SUPPLY CHAIN IN THE FISHERIES SECTOR IN MAURITANIA AND ITS IMPACT ON THE LIVELIHOODS

By

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Title of Study: SUPPLY CHAIN IN THE FISHERIES SECTOR IN MAURITANIA AND ITS IMPACT ON THE LIVELIHOODS

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Abstract: This paper uses data from the Mauritanian fishing industry and fisheries value to examine how government policies in the sector are affecting the livelihood of Mauritanians, and in what ways that affects the sustainability of the fisheries industry. The government currently generates revenue from licensing fees, but it is investing less in the sector missing value-added, which is transferred to other locations outside of the country such as Las Palmas and European cities. The overselling of fishing royalties, coupled with the dangers of climate change, and the risk of food insecurity in the country, cause the nation to face possible environmental and social disaster. This paper introduces policy recommendations that can allow Mauritania to capture more value-added within the country and create additional jobs in the industry. It finds that if Mauritania improves its storage capacity and processing from 30% to 50%, it could potentially increase the value-added in the industry by $563,460,000, translating to five incremental jobs for every USD million created.

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CHAPTER I

INTRODUCTION

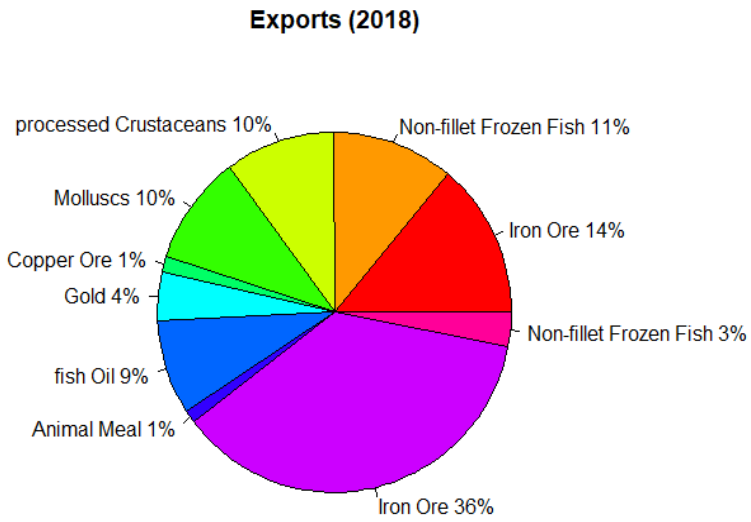
1.1 Overview

The Mauritanian fishing industry has the potential to lead economic growth in the country. It is considered one of the richest zones in the world, particularly due to the upwelling systems that drive surface water from the land. Easterly trade winds and cold nutrient-rich water rises to fertilize the euphotic layer which stimulates elevated levels of marine resource productivity (Kuipers, et al., 1993) (Belhabib, Gascuel et al. 2012). The fishery sector in Mauritania has valuable and important economic benefits. It plays a role in the national economy, generating income, employment, macroeconomic balance, and food security. The sector is projected to be a sustainable source of wealth, demonstrating the possibility of adding value to the economy and livelihoods of Mauritanians.

Mauritania suffers from underdevelopment as economic growth is lacking, and the economy remains weak. The reliance on extractive and natural resource revenues have left the economy undiversified, and completely dependent on the international prices offered for these commodities (World Bank, 2020). The Gross Domestic Product of Mauritania in 2018 was $5.23B, ranking 155 out of 196 countries. GDP Per Capita growth from 2008 to 2018 was negative 2.79%, currently ranking 156 out of 196 (2011Simoes & Hidalgo,). The Mauritanian population is estimated at around four million people with 31% of the population residing under the national poverty line of $1.90 (Simoes & Hidalgo, 2011; World Bank, 2019).

Figure 1

Total Mauritanian Exports in 2018



Note. Figure was generated with data available from the Observatory of Economic Complexity (OEC[1]). (https://oec.world/en/profile/country/mrt).

[1] An introduction of the OEC is presented by Simoes and Hidalgo (2011).

The fishing and mining industries are the primary and largest contributors to the country's national income. Together, they represent about 75 percent of the national budget and exports. The fisheries contribute 4% to 10% of the national Gross Domestic Product (GDP) depending on the year (Marti 2018). Mauritania has been trying over the years to accelerate economic growth by establishing a development policy to take advantage of its natural resources intensive margins - exploiting the volume of extraction for its natural resources rather than developing or diversifying sources of revenue and growth in the economy (Mele 2014). In the fishing industry, these measurements include the overselling of fishing rights, and increasing catch quotas to generate more financial revenue and foreign currency access (WorldBank 2020).

These policies have temporary benefits that do not guarantee sustainable sources of revenue to enhance the country's capacity and its ability to provide capital goods that generate long-term economic growth. Poor management of those financial resources will likely result in the destabilization of the political economy as well as contribute to wealth distribution inequalities (Kuipers, Witte et al. 1993). The economy cannot be dependent on natural resources. It requires the effective management of those resources, otherwise fish stocks can be depleted if no attempts are made to ensure their sustainability. This behavior leads to the depletion and damage of those resources and generates only temporary benefits to the host country as it is not benefiting from greater margins Whereas the processing industry may yield far more than merely rent revenues. It can provide more jobs and nourish the service sector in all its dimensions.

The depletion of natural resources is extremely dangerous, especially for countries like Mauritania, whose economy is fully dependent on them. Additionally, Mauritania is threatened by climate change and food insecurity (USAID 2020). The African Union has adopted the development of the fishery sector in its 1980 plan of action as an attempt to combat food insecurity in the continent as evident over the past decades, this effort has been unsuccessful. (Gibbs 1984). In the African Union's new aquaculture plan of action for 2016 to 2025, it is stated

that the African fish production is not sufficient to maintain food security, as most of the main fishing zones and fish stocks have been either exploited or overexploited (FAO 2009).

1.2 Statement of Problem

Every year, about 1.2 million fish (multi-species) are caught in Mauritanian waters, but just 5% are processed locally (UNCTAD 2016). Foreign boats represent over 60% of the total volume of catches (Marti, 2018). Most of these boats directly freeze their catch onboard and export it without ever landing the fish within Mauritanian borders, creating zero value-added opportunities in the country (Brunel 2011). The Mauritanian Government, despite its country's rich waters, is merely a raw material supplier. It does not have national processing facilities that can be utilized to expand the nation's market to processed seafood products. Consequently, such practices have created little contribution to the local demand for investment and industrial projects. The licensing fees might seem appealing for public sector revenue sources, but the local sector may increase national economic value through product and business model diversification, as well as promoting population livelihood

1.3 Research Question

This study aims to answer two key questions:

a) How many domestic jobs are created in the fishing industry in Mauritania?
b) Can increasing the usage of the local storage capacity for fisheries processing create more value-added and increase jobs in Mauritania?

1.4 The Rationale of the Study

This study is particularly important, as the fisheries sector in Mauritania as well as its government policies are not heavily researched. No research has been considered on the effects of government policies and management of the sector on the livelihood of Mauritanians or the fisheries sustainability. Many studies have been conducted about the overexploitation of the Mauritanian fishing industry by foreign firms (Atta-Mills, Alder et al. 2004, Gascuel, Labrosse et al. 2007). These studies have generally focus on the implications of overfishing and the environmental damage it causes, but fail to elaborate on the management of the sector or how it can generate value without jeopardizing sustainability and local livelihoods.

This is the first study that attempts to gather data from several sources to provide analysis of the Mauritanian fishing industry, specifically as it relates to sustainability and livelihoods. This is also the first study to examine the supply chain value and the potential of how improved domestic capacity storage can generate economic advantages and improve livelihoods. Several recommendations and policies that can increase the yields of the Mauritanian fishing industry are expected to emerge from this study. This research aims to understand Mauritanian government fishing policies and those negative implications to growth and development within the sector. This considers financial revenue sources beyond or in addition to licensing fees.

CHAPTER II

REVIEW OF LITERATURE

The study will focus specifically on the fishing industry in Mauritania and opportunities for the sector to add value to the national economy. In 2013 and 2014 the fishing sector represented 10% of the country's GDP. (Obaidullah and Osinga 2010, Marti 2018). According to the Observatory of Economic Complexity, the fishing sector made up 48% of total exports in 2018, equal to $1.28B in value. The fishing sector created 45,000 jobs in 2010 (Martín 2010), and 55,000 indirect jobs in 2015. This job creation represented about 3% of the total labor force in Mauritania, 80% of which are in the Mauritanian traditional artisanal industry (Ebnou 2020).

The Fleet Composition in Mauritania

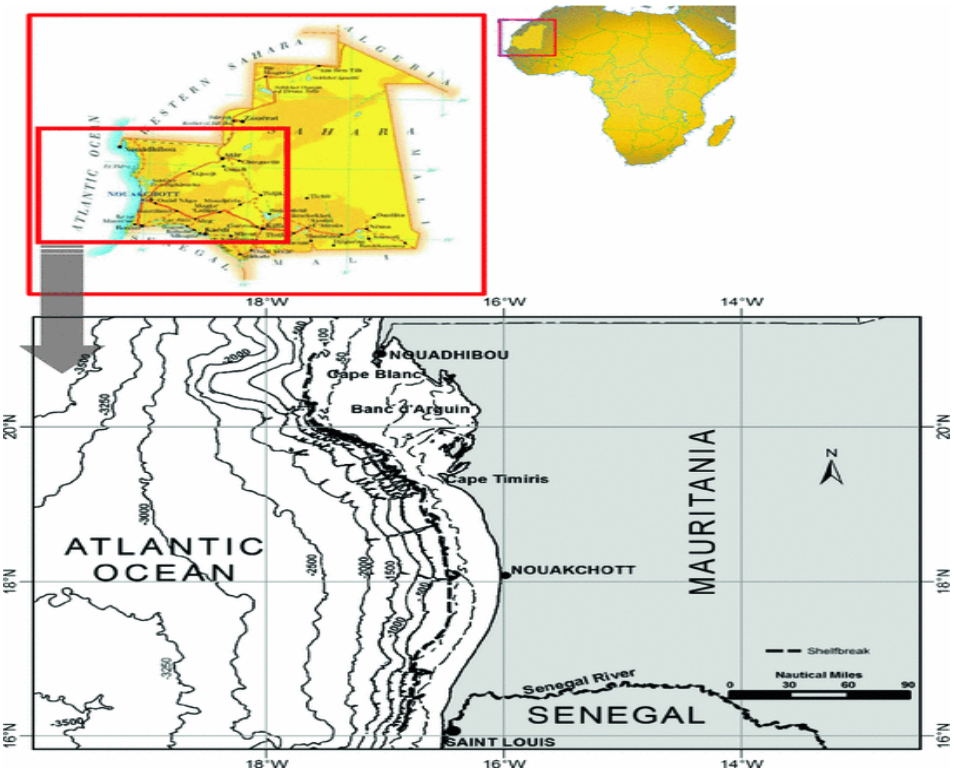
The Mauritanian fishing fleet is less competitive than foreign fleets. Mauritania has two fishing fleets: an industrial fleet and artisanal small-scale fleet (Martín 2010). There are 140 bottom trawlers in the industrial fleet, 94 of which are freezer trawlers. The industrial fleet accounts for 90% of all domestic catches, but it has minimal added-value and produced few jobs. These industrial fleets target demersal species like, hake, shrimp, crawfish, and octopus. The small scale consists of 4,000 vessels or pirogues, which operate in waters less than 20 meters deep targeting octopus and sardinella (Gascuel, Zeller et al. 2007).

The Catch Data in Mauritania

Catch data for the industrial fleet come exclusively from logbooks used by skippers to declare the amount caught. As they self-report their catch, there is no comparison of catch figures among the landing sites. This produces the possibility that catch data is underreported. Catch from industrial fleets from 2014 to2015 was about 800,000 tons, of which 95% was pelagic (Marti 2018). Trends in the volume of catches remains stable and consistent for demersal fishes while fluctuating for pelagic fish. The European Union catch about 275,000 tons, of which 90% is pelagic fish and 8% for demersal fisheries (half of it being cephalopods, and 2% tuna). The EU catch represents about 80% of the total Mauritanian shrimp catches, 20% of the cephalopods, and 30% of the pelagic fish (Brunel, 2011). The main species caught by the EU pelagic fleet are horse mackerel, sardine, and tuna (Corten, Goudswaard et al. 2006). The EU fleet target and catch cephalopods as well as fish in the same proportion which produce high volumes of discarded resources (Batsleer, Hamon et al. 2015). Catch for the artisanal fleets weigh up to 90,000 tons.

Figure 2

Marine Map of Mauritania



Note. From "Deep-Sea Ecosystems Off Mauritania: An Introduction," by A. Ramos, F. Ramil and L. J. Sanz. 2017, *Deep-Sea Ecosystems Off Mauritania*, 1-51. Springer, Dordrecht.

In 2014 and 2015, catches in the Mauritanian Economic Zone totaled a weight of 800,000 tons. The national industrial vessels caught 4,000 tons and small-scale fishing catches amounted to 36,300 tons in 2014 and 38,900 tons in 2015 (Marti 2018). The remaining volume of the catches were caught by foreign vessels, including China, Ukraine, Russia, and the EU, while the Mauritanian catches were by comparison extremely limited to foreign catches. The Mauritanian fleet only engages in fishing small pelagic species which account for 90% of its catches, with demersal species accounting for 20%, Cephalopods for 30%, and Crustaceans accounting for 10% of the value (Marti 2018).

2.3 Fishing Policies

2.3.1 The Initiations of the Fishing Industry and Early Policies

Mauritania received its independence from France in 1960. Soon after that, the government began looking towards economic growth opportunities through the nation's natural resources. This effort started when the country nationalized the mining industry, a valuable source of financial resources (Hilson 2002). It initially generated revenue for the national budget, but after collapsing due to a decrease in international commodity prices, the Mauritanian economy's reliance on the industry impacted their economic progress (Gibbs 1984). Additionally, a severe drought from 1969 to1970, as well as attempts to reduce poverty, caused the country to become heavily indebted positioning the country's economy among the least developed globally (Martín 2010). The government began investing in the fishing sector, considered an especially important sector in the Mauritanian economy among herding, agriculture, and mining.

The management policies of the fishing sector took three different phases. The state-led development policy took the form of economic nationalization, which was widespread among African countries and many developing countries after decolonization (Hilson 2002, Acs and Virgill 2009). In 1965, the government decided to establish its own state-controlled fishing fleet and processing industry. The government established the SOMAP (Society Mauritanienne de armament a la Peche) that owned 13 vessels, fish freezing, drying facilities, and plants for fish meal production. The facilities were located in the city of Nouadhibou, led under the management of different private companies. After four years, in 1969, this national firm failed and closed due to sustained financial losses (Gibbs, 1984).

The failure of the company was attributed to a lack of expertise and education among the workforce. The government considered these failures in a new policy adopted during the 1990s. It attempted to extract foreign expertise by requiring foreign fleets to engage in joint ventures,

including Mauritanian staff on fishing fleets, as well as paying fees in exchange for fishing royalties. Experts questioned whether the policy was successful as foreign catches doubled. 95% percent of the catches were trans-shipped and 5% or less landed in the Nouadhibou port. Few Mauritanian's were trained by the foreigners and the country only benefited from the fishing fees. However, these fees were not adequate when compared to the high fishing volumes and illegal fishing that the government was unable to stop due to infrastructure constraints (Gibbs, 1984).

2.3.2 Current Policy Management and Control

Currently, the fisheries operations are regulated by the Ministry of Fisheries and Maritime Economy, which oversees scientific research (IMROP), fisheries maintenance (DSPCM), seafood health (ONISPA), and the formation of fishers (ENEMP). The Ministry's human capital is limited, but financial support from the EU enhances its resources, whereas other development financial assistance takes the form of project funding (Brunel 2011).

The key role among management of the fisheries sector is to restrict access to fishing, rather than setting a limit on the permissible quotas for species, as set out in the protocol with the EU. The fishing rights are a restricting measure, and only those with fishing rights are authorized to fish in the Mauritanian exclusive economic zone. This applies to all fishing vessels, both domestic and foreign. Licensing has distinct types depending on the type of the vessel (artisanal, coastal, industrial) and the species targeted. The fishing licenses vary based on size, type, and origin of the vessels, as well as for national vessels, international co-owned vessels by Mauritanian companies, and for international boats. Other restrictions exist in addition to permits, such as restricted areas, technical arrangements for fishing gears, minimum fish landing size, limits on the proportion of by-catch species, seasonal closures, and marine protected areas. The metrics, used by management, provide financial penalties for those who violate the laws explained in Table 1. (Mauritanian Ministry of Fisheries, 2015).

Table 1

Chart of Violation Fines of Vessels by Size

Vessels size by meters	Fines in USD range between:
under 50 m	$182 - 1820
50m	$1000 - $4000
51m-100m	$4000 - $32000
100m- 249m	$8000 - $12000
250m-599m	$9820 – $100000
600m+	$16000 - $ 180000

Note. This table was created with data from "Code de la peche," by the Mauritanian Ministry of Fisheries in 2015.

2.4 Major Fishing Partners

2.4.1 Mauritanian Fishing Agreement with the EU

The EU has suffered from a shortage of fish supplies to its domestic market due to overfishing within its own waters. It imports 60% of its fish from developing countries (Gorez 2006). The EU common fisheries policy sets a strict quota on member-state vessels; therefore, not allowing sufficient quotas of the fish needed and leading to a surplus of vessels (Kaczynski and Fluharty 2002). In 1972, the EU Commission began negotiating agreements with specific developing countries to give the European vessels rights to fish in their waters. These rights were granted in exchange for payments and favorable trading terms among participating developing countries exporting fish to EU members.

Before 2003, the EU agreements with participating developing countries received many criticisms, as they primarily serve the EU members' interests. Kaczynski & Fluharty (2002) argued that the agreements were only made to exploit fisheries resources among developing countries, secure employment for Europeans, and supply the Europeans with fish processing industries and domestic market consumption at the lowest cost. The EU's Directorate-General for Fishing confirmed those claims (Gorez 2006). What resulted was new reform in 2002, which took the form of partnerships among fisheries with a special objective promoting the development of the fisheries in west Africa. It aimed to help developing countries create their fishing policies in a way that increased benefits to them (Witbooi 2008).

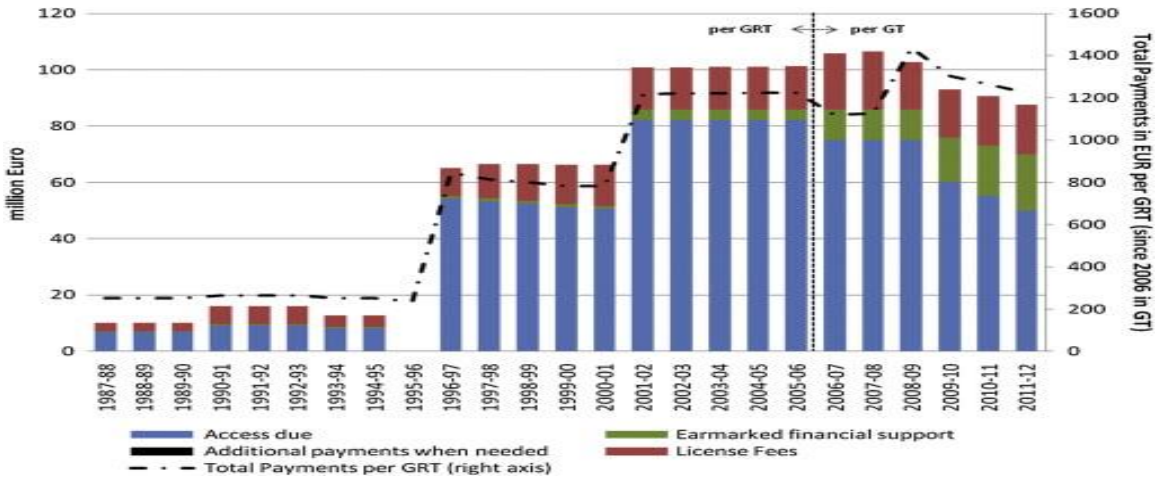
Despite the EU's efforts to address those criticisms, the critics persisted, and problems were identified in the new partnership initiative (Witbooi 2008, Cullberg 2009). The new fishing partnership agreements have been signed with 19 countries. The largest one is with Mauritania. It consists of two variations of FPAs (Fisheries Partnership Agreement): one for the tuna and the other one covering additional multi-species (Nagel and Gray 2012). This agreement increases the

EU access to the Mauritanian Exclusive Economic Zone (EEZ) and diminishes its marine resources. The EU reforms or attempts to promote sustainable development of the industry were institutional, scientific, and regulatory, but there was no intention to support the small-scale fisheries and job creation. More money was spent on collecting biological data on stocks, but not any on collecting data about the socio-economic impacts of the fisheries policy (Bretherton and Vogler 2008).

2.4.1 Fishery Cooperation Agreements between the EU and Mauritania Between 1987 – 2012

Figure 3

EU Payment to Mauritania from 1987 to 2012



Note. From "Is the EU's Fisheries Partnership Agreement (FPA) with Mauritania a genuine partnership or exploitation by the EU?." by P. Nagel, T. Gray. 2012, *Ocean & coastal management, 56,* 26-34.

The agreement during the period from 1996 to 2001 was the highest amount the European Union had paid to the Mauritanian government. It was also an introduction to giving the European Union more access to the Mauritanian Exclusive Economic zone. It allowed them to catch new species and engage in small pelagic fishing through the 22 super trawlers. Those trawlers are occupied with fish processing facilities and freezing capacities, which brings no added value to Mauritanian's livelihoods. Instead, it harmed locals through increased competition with huge trawlers. The agreement also allowed the EU to increase their fleet size, adding additional tuna boats (Kaczynski and Fluharty 2002).

2.4.3 Fisheries Partnership Agreement 2002 – 2020

Payments by the EU to Mauritania under the FPA during 2008-2012 were, however, much better than before, totaling around $301 million. One part of the sum covers compensation for access to 110 European vessels from 12 different countries, while the other $10 to$19 million went towards the country's national development strategies of the sector. Another sum is paid in licensing fees directly by the EU vessel owners.(Nagel and Gray 2012). The EU is allowed to catch up to 261,500 tons of non-tuna species each year. The protocol also provides tuna fishing of up to 20,000 tons per year for more than 40 vessels from Spain and France. It also includes measures to increase transparency by which Mauritania is obliged to publish all its fishing agreements that grant access to the Mauritanian EEZ with countries or private companies (Marti 2018). The EU was criticized for introducing this agreement merely to reduce its rent and for not developing the fishing sector in the country (Nagel and Gray 2012).

A study conducted by UNDP 2006 (Mele 2014) states that the EU partnership with Mauritania did not meet its stated objective; in contrast, it is actually harming the industry. It concluded that the Mauritanian fisheries industry is merely a raw materials supplier rather than a

fish processor. It stated four major negative effects caused by this state: including a lack of production system in the industry, no investment in indigenous processing plants, low supply of fish to the local market, and the disappearance of high-value fish from the local market while replacing it with less valuable substitutes. Additionally, the Mauritanian fleet competition with the EU increased.

The EU is exploiting Mauritanian resources and contributing less to the country's development in many ways (Failler 2007). It has been accused of not investing in infrastructure and establishing unfair subsidies (Schroeer, Sakai et al. 2011) to EU vessels. The EU as also accused of inadequate landing of fish in the Mauritanian ports and transferring all the value-added components to Europe instead of Mauritania (Failler 2007, Nagel and Gray 2012). In 2006, only 12% of the catches were processed in Mauritania (UNDP, 2006).

2.4.4 Mauritania's Fishing Protocol with China

The second-largest fishing partner with Mauritania is China. China has negotiated various fishing agreements, but the Mauritanian government has often disapproved of them, specifically as the offers have not seemed beneficial to Mauritania. After the former President Mohamed Abdel Aziz came to power in 2009, the Chinese firm Poly Hon Dong, reintroduced their offer. It was approved in 2010 to be the first official fishing agreement between Mauritania and China, despite the Chinese fleets operating in Mauritanian fishing zones since 1991 Regardless, this decision is considered the largest official agreement between the countries.

Unlike the EU agreements that exchanged financial payments for fishing royalties, China instead offered development aid of $100 million worth of investments in construction projects. These investments were directed at a new processing factory, training center, and manufacturing site for traditional fishing boats. Additionally, the length of the agreement was for 25 years, instead of four to five years of renewable contracts. This deal received many objections from

senators, local fishers, and the Mauritanian society at large (Koigi 2016). The opposition against it and efforts to prevent an agreement were immense, but ultimately failed.

In 2011, a campaign was launched for a petition to stop what organizers called the China fishing deal disaster in Mauritania. The petition was based on claims that include the anonymity of the Chinese company's owner, the deal's disregard for the sustainability of the fisheries sector and future generations, the lengthy contract, and known unsustainable fishing behavior from Chinese boats (Abddellahi 2011). The environmental group, Greenpeace, also opposed the deal generally for the same reasons. The petition had been signed by only 305 people up until 2011 (Voice of America, 2011) (Pacific 2011) .

The concerns about Chinese fishing behavior did not only worry the Mauritanians. It was a major concern to the international community as China declared its intention to expand distant water fishing (DWF). This form of fishing is considered a threat to the biological and socioeconomic sustainability of the host countries. Many fisheries governance experts have argued that China's access agreements have led to an unsustainable use of the fisheries resources and negatively impact the socio-economic development of the host countries (Alder and Sumaila 2004, Mwikya 2006, Dobo 2009, Kolstad and Søreide 2009, Petrossian and Clarke 2014).

However, what drives China, the world's largest fish producer and exporter, to seek external fishing waters is generally for the same reason that drives similar EU behavior: the overfishing of their own waters since the 1980s. Overfishing in China caused low supply and high demand that dwindled employment numbers in the fishing sector. After a ban on fishing in China, illegal fishing increased among its neighboring countries, such as Taiwan and South Korea,

further heightening concerns (Mallory 2013). Most of the illegal fishing operations in Sub-Saharan Africa involve Chinese and South Koreans vessels (Petrossian and Clarke 2014).

The Mauritanian sea is overexploited. The domestic market has reduced for both high-valued and low-valued fish with some seasons offering no fish at all. Local fishers were unable to supply the domestic market as they had to compete with Chinese and EU vessels, sometimes in the same zone that was designated for them. This affects the livelihood of many fishers and the populations that live on the coast, due to their high dependency on fish as a source of income and nutrition. The local fishermen have to compete with Chinese and European industrial fleets, leading to unemployment and eventual efforts to migrate to Europe. The women who sell fish became incapable of feeding their families because of the scarcity of resources (Failler 2007, Bretherton and Vogler 2008).

2.5 Challenges in the Fishing Sector

The fishing sector could be very promising to the country if managed effectively, especially the Mauritanian waters, which are extraordinarily rich in resources. It can reinforce food security, promote large-scale employment, and attract more foreign investors to the country. It suffers from a collection of problems and challenges that need to be addressed.

2.5.1 High Species Overexploitation

Assessment of the sector conducted by IMROP in 2006 confirmed that most of the high-value species have been either overexploited or fully exploited. They warned that the consequences of the persistence of this practice will diminish the remaining fishery resources, especially with the increasing demand for fish in Mauritania and other Sub-Saharan countries

Table 2

The Exploitation of Fishery Resources in Mauritania by Species

product	Fishing	Total Catch, 2005-2010	Diagnosis
Cephalopods	Octopus	~ 30 million tons	Overexploited
	Cuttlefish	~ 7 million tons	Fully exploited
Non-cephalopods	Black Hake (cod-like)	~ 12 million tons	Moderately exploited
	Sardine (stock C)	~ 5 million tons	Moderately exploited
	Sardine (round)	~ 1.5 million tons	Overexploited
	Sardine (flat)	~ 1.3 million tons	under-exploited
	Jack mackerel (black + Atlantic)	~ 1 million tons	Overexploited
	Mackerel	~ 0.6 million tons	Fully exploited
	Thief (white grouper)	~ 12 million tons	Overexploited

Note. This table was produced with data gathered by Mele from "Mauritania: counting on natural wealth for a sustainable future," by G. Mele, 2014, The World Bank.

The impacts of overfishing are not limited to the effects it causes to the local market, fishers, and the livelihood of the population. In reality, it has riskier and more damaging long-term impacts on the environment and represents a serious threat to the sustainability of fisheries resources. The Chinese use of unsustainable fishing methods, to include pair trawling (two vessels connected by a net that catches all it encounters), resulted in bycatch of juvenile and

untargeted species. It leaves less fish available to extract for the market, and instead discards much of the catch (Mallory 2013). This practice has been banned in Mauritania, but following the deal with China it was permitted, along with other rules being modified (Ebnou 2020).

2.5.2 Poor Regulation and Surveillance

In fact, poor technical resources that should enforce regulations and conduct inspections contribute to overfishing practices and illegal fishing in the Mauritanian Economic Zone.(Marti 2018). The fact that vessel owners self-report their catches demonstrates the impracticality of those measurements in tracing overfishing or illegal fishing. A random inspection does not ensure that all the vessel owners have complied with the regulations (Trouillet, Guineberteau et al. 2011).

Policies and oversight need to be well structured and organized. For example, the use of technology to locate the vessels and having scanners and camera surveillance on the catch reports would assist with monitoring activity. Each vessel should have requirements to scan and weigh the amount of catch, so the information can be numerically registered. The scanners can have options to report catches by species. The use of technology, logistics, and well-trained experts in the field is very important to ensuring policies are enforced. The measures put in place currently to fight illegal fishing are not effective. The fine amounts for violating regulations or committing illegal fishing are not deterring these activities. There should be higher sanctions and penalties that can prevent those vessels from such practices.

2.5.3 Poor Infrastructure of the Ports and Facilities

There are only two fishing ports, one is located in the capital city of Nouakchott and the other in Nouadhibou. The Nouadhibou port offers better facilities than the one in Nouakchott. It has a specific area for small scale fleets. The industrial fleet sells all their catches at this location while the small-scale and inshore fleets sell only 20% of their catches. It is the center of exports,

while the Nouakchott location lacks all equipment that can make it an effective port. The government has made efforts to rebuild it, but it has not improved with only one fish market by the landing area (Marti 2018).

The processing facilities are not in adequate shape with some of them being outdated. 80 facilities are storages and freezers, but only 66 comply with European Union[2] standards, and only 33 are operational. The freezing storage is 700 tons daily with a usage rate at around only 30%. Their capacity is incredibly low compared to the daily catches (Marti 2018). Usually, foreigners would rather pay the extra $400 per ton than use these inadequate facilities, concerned that their fish might rot, because of the low electricity that supplies the facilities. The processing fees are higher than those in Las Palmas where most of the EU vessels transport their catches to be processed (Blas 2014). A $400 charge per ton is not enough of an incentive to encourage vessels to use Mauritanian ports.

The poor infrastructure of the ports and processing facilities limit landing opportunities and reduces the value-added that Mauritania can advantage from. An increase in jobs in the processing sector, where most of the value is made and where locals can participate, is necessary. The lack of national human capital and expertise in the field also prevents the country from collecting the spillover of the fishing operations conducted in its waters, restricting its revenue to merely the licensing fees paid by the foreign fleets to access its waters (Marti 2018)

2.5.4 Poor Governance and Management

The development of the sector and its sustainability is the mission of the fisheries ministry, but it has done little to rapidly develop the sector and secure food, employment, and the natural fisheries resources for future generations. The policies that have been created indicate that other Mauritanian administrations seem to have similar initiatives, intended to maximize revenue

[2] The largest partner in the sector.

and exploit intensive margins, rather than investing in the sector to make it more attractive and convenient to post-fishing operations.

The latest joint-venture policy further worsened the sector's development and increased the inequality of wealth distribution among the population. It provided the government fewer incentives to invest in the sector, as revenue generated through joint venture with foreign fleets were more enticing to businessmen and government officials. The government didn't conduct further action, although the overall population continues to suffer as 31% percent of them currently live under the poverty line (WorldBank 2020).The government had to ignore the overfishing, violations, and not push for fair trade, due to their dependency on the revenue from these contracts (Andr, xe et al. 2015).

The Mauritanian government faces a large issue with corruption and low governance, generally quite common in African natural resource management (Kolstad and Søreide 2009). Corruption is systematic, and usually takes the form of bribes, to facilitate or authorize a violation (Trouillet, Guineberteau et al. 2011). Another problem is with missing funds that the government receives for the development of the sector from the EU, China, The World Bank, and The African Development Bank. The financial aid usually disappears, and no improvement to the Mauritanian fishing sector is accomplished (Auty 2007).

The Mauritanian government also lacks the political and economic power of bargaining as it is heavily dependent on the access fees. The foreign contractor determines what rules work in his favor and the government adopts his terms and conditions ((Andr, xe et al. 2015, Ebnou 2020). Therefore, the terms and conditions do not cover some issues like paying for an extra capacity of catches, negotiating the amount paid to access the resources, or reduce the quotas of endangered species (Standing 2008). Additionally, the issue of human rights, which is a huge problem for Mauritanian workers with Chinese firms. They often report human rights abuses, like

inadequate housing, employment termination with no cause, underpayment for long working hours, and physical abuse from the Chinese management, but the government has never been able to investigate these issues (Alakhbar 2019).

On paper, the Mauritanian government has attempted to promote the industrial development of the sector by requiring foreign and national vessels to unload and process fish in the Nouadhibou port. This move is intended to ensure that they benefit from the value-added, while also promoting job creation (Sid'AhmedBouh 2015) The infrastructure and poor resources, however, prevent the realization of those objectives (Blas 2014, Marti 2018)

2.6 An Assessment to the Government Policies in the Fisheries

Marine fisheries are of significant value to the Mauritanian economy, through employment, food security, and socio-economic development. However, the inadequate fisheries, policies, and management have led to a decline in the marine fish stocks, ecosystem's health, and economic underperformance (Wunder 2005, Trouillet, Guineberteau et al. 2011). Effective implementation of sustainable management that is more based in the ecosystem and recognizes the fisheries as an integrated part of the general socio-economic system is limited, due to the absence of an adequate financing as well as appropriate institutional support. The previous and current management of the Mauritanian fisheries sector, which focused on extracting the industry, has caused profound consequences to both the sustainability of the sector and the livelihoods.

The Impact of Fisheries Policies on the Livelihood of the Population

The impacts on the livelihood are embodied in the underdevelopment of the artisanal small-scale sector that most Mauritanians and the fishing communities rely on for food and economic well-being (Trouillet, Guineberteau et al. 2011). The problems in the fisheries sector are often multi-sectorial, but to ensure profits are being maximized, they should be addressed. For example, the fishing communities often suffer from the shortage of proper infrastructure, in

particular roads that can facilitate their mobility to distribute their catches. They are often isolated and have limited access to schools, drinking water, sanitation, and most importantly, electricity. Electricity can allow them to establish cold storage for their fisheries infrastructure. There is a lack of financial credit facilities and communication equipment, that can allow them to communicate with the outside world and find buyers or distributors of their fishery products (Béné and Neiland 2003).

The unrecognition of the importance of small-scale fisheries to the economic development and its socio-economic importance to the livelihood of the people when making the fisheries policy presents a large problem as well. The government should put the development of the small scale-sector in its policy plans. It should also provide good life conditions to the fishing communities and issue favorable terms as well as regulations for them (Sharma 2011). The underdevelopment of the port's infrastructure minimizes the revenues and the scale of employment because of the unestablished supply chain operations (Marti 2018). If the ports were well equipped and designed, more jobs and small businesses could have emerged. The country could have benefited from coastline tourism, the financial system, and the fisheries supporting services. These types of ecosystem services, along with the supply chain and improved processing sector, can create more jobs, revenue, and better livelihoods. It could also change incentives for environmental decisions and allow the management to pay more attention to the sustainability of fish stocks of the country (Engel, Pagiola et al. 2008, Muradian, Corbera et al. 2010).

The Impact of the Fisheries Management on the Sustainability of the Marine Resources

The over-granting of fishing access and lack of political will and capacity for monitoring control and surveillance remains a major challenge in creating or enabling a sustainable approach to the Mauritanian fisheries management (Grafton, Hilborn et al. 2008). The overselling of

fishing royalties has already caused severe damage to the marine resources, and the unsustainable fishing methods, which are dominantly practiced by Chinese vessels, damaging the marine ecosystem health and environment. It has also put the country in the danger of climate change through the rising sea levels and food insecurity (Dobo 2009).

2.7 Supply Chain Structure

Supply chain is a combination of facilities and distribution channels that facilitate the delivery of products to the end-user. It consists of suppliers, producers, distributers, and customers. This network of facilitators works to transform raw material products into finished products that are ready to be distributed and consumed. Figure 4 illustrates the structure of the supply chain. An empirical study in Bangladesh conducted by Islam and Habib (2013) has revealed that the supply chain network and distribution model can generate more value added from the fisheries resources.

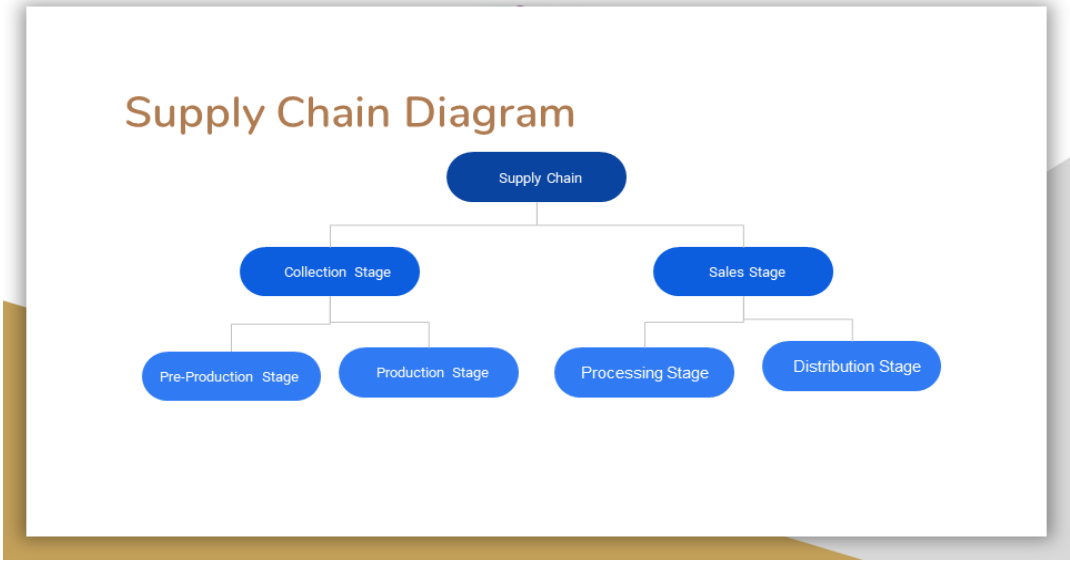
It is known that processed goods are much more expensive than raw materials. Mauritania is mainly capturing the fees of licensees and small-scale jobs. Due to the limited processing capacity, the value-added goes to other countries, and the fishing sector does not contribute much to the livelihood of the population. The high-value jobs are within the supply chain, but since this operation is not performed in Mauritania, locals do not benefit much from it. In all the stages of supply chain distribution or connections, huge financial benefits and high value jobs exist. This applies not only to the fisheries, but to similar problems faced by the mining industry and other underdeveloped sectors in the Mauritanian economy.

The main purpose of supply chain is maximizing benefits and creating more jobs. It could be the means by which to enter the international market to enhance sustainable growth and income. It also creates diversification in the economy, work divisions, and increases competitiveness of the country. The Mauritanian government should benefit from this operation

by establishing national processing facilities. It should start processing its own fishery products and construct a supply chain network to maximize the revenues of its natural resources such as mining, fisheries, oil, and gas.

Figure 4

The Supply Chain Stages



Note. This figure has been created with data from "Supply chain management in fishing industry: A case study," by S. B. Islam & M. M. Habib in 2013. *International Journal of Supply Chain Management*, *2*(2), 40-50.

The first stage is the pre-production stage. It includes the collection of data and information analysis, important for sustainable fisheries management and fish farms. The Mauritanian fishing sector is highly affected by the lack of this data regarding the ecosystem and the sustainable allowed volume of quotas, resulting from the lack of expertise and developed technological framework in the sector.

The second stage is the production stage, where fish are actually captured from the sea or produced on farms. It is where most of the domestic jobs are located, held by fishers who work in the small-scale sector (Marti 2018). They fish and sell their catches in the fish market located in the port. Their customers are mostly traders who sell fish in the domestic market or in restaurants. Some families also purchase fresh fish from local markets. Their catches are generally small, the amount that their customers can buy immediately, as they do not have any freezing/storing facilities or distributing channels. Whereas the Mauritanian industrial fleet sell catches are bought by the national monopoly of fish export.

The third stage is the collection of seafood either from docks or farms. It provides a respectable number of jobs, generally from national firms recruiting workers for these positions that provide services to foreign and national fleets and vessels. They do the handling and delivering from the fleets to other vessels or processing facilities. It is a large stage and requires muscle power. It includes the lifting and handling of additional commodities other than fish that were shipped. The port's infrastructure lacks the equipment that can facilitate this job; therefore, the lifters usually suffer from chronic diseases without any medical insurance or care. The fourth stage is the processing stage, where the fish is filleted, breaded, canned, or packaged to reach the end-user. Another high number of jobs are also provided by this operation. Most people who work in the Mauritanian fishing sector fulfill this job. It is mostly provided by the foreign firms' facilities that operate in the country. The average salary is $200 per month with no insurance. Some firms provide transportation. Working hours are 10 hours per day on average.

The fifth stage is the distribution of fresh or frozen seafood products to the customers. The last stage is the sales stage when fish reach to the end-user to include restaurants, supermarkets, and fish markets. This is performed almost entirely by the foreign vessels and firms. Mauritania has a national export company that is a monopoly for frozen fish and juveniles. There are other companies that operate in this capacity, but they do not process the fish and

instead mostly export to China, Europe, and other African countries. Local and traditional business opportunities to capture the market share create more benefits and jobs within each of these stages.

CHAPTER III

DATA AND METHODOLOGY

3.1 Methods

The data will be extracted from secondary sources of variables including:

1) the annual catches to measure the worth of the industry
2) the fishing sector employment to determine how many jobs are created
3) calculate value generated from storage and processing facilities in Mauritanian ports by measuring the capacity of that storage and the fees paid for each processed ton

Due to the scarcity of reliable data, there will be assumptions and benchmarks for some variables. As mentioned earlier, the purpose of this paper is to provide a method in which Mauritania can create additional jobs and extract value added from its marine resources. Calculations will be done to answer previously stated research questions.

3.2 Data

Table 3

Employment in the Fisheries Sector

Employment in the Fisheries Sector 2015				
Total Labor Force	Unemployment Rate	Total unemployment	Total Employment	Total Employment in the fisheries
1,061,636	10%	1,061,63.6	95547.6 jobs	28,664 jobs

Equation 1) 0.10 x 1,061,636 = 106163.6 jobs

Equation 2) 1,061,636 -106163.6 = 95547.6 jobs

Equation 3) 0.03 x 95547.6 = 28,664 jobs

Table 4

Storage Capacity

Storage Capacity						
Number of Facilities	Active Facilities	Inactive Facilities	Capacity per day	Usage Rate	Total Storage per year	Storage per year
88	33	33	700t	30%	23,100t	7,045,500t

Equation 4) 33Af * 700tc = 23,100per day * 305 = 7,045,500t per year

Table 5

Storage Value

Storage Value				
Processed ton Est. Price in USD	Storage capacity per year for 33 facilities	Usage Rate	Total value of the 33 facilities in USD If 100% used.	Total value of the 33 facilities in USD at 30% usage rate
$400	7,045,500t	30%	$2.8818,200,000	$845,460,000

Equation 5) 7,045,500 X $400pt = $ 2,818,200,000

Equation 6) 0.3 *2,818,200,000 = $845,460,000

Table 6

The Value of the Processing Sector

The value of the processing sector in 2013-2014						
Total value of the 33 facilities in USD at 30% usage rate	Average Catches of the years 2013-2014	Total processed tons in Mauritania in 2013-2014	Processed ton Est. Price in USD	The value of the processing sector in 2013-2014	The value of the fishing sector	What the processing sector accounts for from the fishing sector
$845,460,000	800,000t	94,623t	$400	$37,849,200	$920,000,000	$41.141

Equation 7) 800,000t / $845,460,000 = 94,623t

Equation 8) 94,623t x $400 = $37,849,200

Equation 9) $37,849,200/920,000,000 = $41.140

Table 7

Estimation of Jobs Created per Dollar Invested in the Industry

Calculating how many jobs every $1 million can create		
Total Employment in the fisheries	The value of the fishing sector	Total jobs created by every $1million invested in the sector
28,664 jobs	$920,000,000	32 jobs

Equation 10) 28,664 Jobs / 920,000,000 = 32 jobs

Table 8

Estimation of Sectoral Job Creation Potential after Increasing the Usage Rate

Estimation of Jobs that could be Created in the Sector after Increasing the Usage Rate				
Total value of the 33 facilities in USD If 100% used.	Estimated Usage Rate	Total value of the 33 facilities in USD at 50% usage rate	USD value Amount added to the processing sector value after increasing the Usage Rate	Jobs that can be created by every $1 million after increasing the processing sector value.
$2.8818,200,000	50%	$1,409,100,000	$563,460,000	5 jobs

Equation 11) 0.5 *$2,818,200,000 = $1,409,100,000

Equation 12) $1,409,100,000 - $845,460,000 = $563,460,000

Equation 13) $563,460,000 /32 = 5 jobs

CHAPTER IV

RESULTS ANALYSIS

4.1 Employment in the Fisheries Sector

Equation 1) 0.10 x 1,061,636 = 106163.6 jobs

Equation 2) 1,061,636 -106163.6= 95547.6 jobs

Equation 3) 0.03 x 95547.6= 28,664 jobs

The export value of fishery products was estimated at USD 920.000.000 in 2014 (2011 Simoes & Hidalgo,), and the labor force of the entire country in 2014 equals 1,061,636 (World Bank, 2020). Total official unemployment rate equals 10%. To calculate the total employment, we will multiply 10% with the total labor force. Equation 1 intends to get the total unemployment in the country. Equation 2 intends to get the total employment in the country in the various sectors, and Equation 3 intends to extract the total employment in the fishing sector since we already know that it represents 3% of the total labor force in 2015 (Ebnou 2020). Percentage of the labor force employed by the fishing sector equals direct and indirect jobs of 40%, most of which are foreign and Mauritanian traditional fishers who are self-employed as well as people who work in fish sales but not in the processing sector (Marti, 2018). The fishing sector contribution to employment is very limited.

4.2 Storage Capacity

Equation 4) 33Af * 700tc = 23,100per day * 305 = 7,045,500t per year

In Equation 4, we calculate the capacity of the storage per year.

There are 80 facilities in Mauritania, 66 of them comply with European standards (Marti, 2018), but only 33 are active (Voice of America, 2011). Storage is 700t/ per day. Storage capacity is simply the storage capacity of all facilities per day multiplied by 33 which is the number of the active facilities (AF) and 700 which is the daily capacity for the facilities. Then, we will multiply the total with 305 days (about 10 months). There are two months of year that the ports do not operate in. They are considered seasonal closures. No fishing activities are allowed during this timeframe therefore they will not be calculated in the yearly storage.

4.3 Storage Value

Equation 5) 7,045,500 X $400pt = $ 2,818,200,000

Equation 6) 0.3 * 2,818,200,000 = $845,460,000

The Storage value is calculated in Equation 5. We assume that the price for a stored ton is $400, which is what should be paid if a vessel owner did not store the imposed tonnage in those facilities. The total size of the storage is multiplied by the estimated price of a processed ton to get the value of the Storage which is $2.8B. In fact, the usage rates of those facilities are extremely limited, at only 30%. Due to the poor sanitary conditions and power supplies, most of the foreign vessels contain freezing facilities onboard. The processing prices are more expensive in comparison to those of Las Palmas. In Equation 6 the value of the 33 facilities of $2.8B was multiplied by the 30% to get the value of the storage at 30% a usage rate.

4.4 The Value of the Processing Sector

Equation 7) 800,000t / $845,460,000 = 94,623t

Equation 8) 94,623t x $400 = $37,849,200

Equation 9) $37,849,200/920,000,000 = $41.140

The value of the processing sector in Mauritania is calculated in Equation 7 by dividing the average catches of years 2013-2014 by the $845,460,000 storage capacity to see how much is processed in the country. About 12% of the total catch was processed in Mauritania. In Equation 8 the processing capacity is calculated by multiplying the total processed tons in Mauritania from the average catches from 2014-2015 by $400 which is the estimated price of a processed ton. Equation 9 calculated the value of the processing capacity from the total value of the fishing sector exports in 2014. It accounts for around 5% of the value of the fishing sector.

4.5 Estimation of Jobs Created per Dollar Invested in the Industry

Equation 10) 28,664 Jobs / 920,000,000 = 32 jobs

Equation 10 calculates how many jobs every $1 million creates in the fishing industry. The total jobs in the sector are divided by the value of the sector. Every $1 million creates 32 jobs in the fishing sector.

4.6 Estimation of Sectoral Job Creation Potential after Increasing the Usage Rate

Equation 11) 0.5 *$2,818,200,000 = $1,409,100,000

Equation 12) $1,409,100,000 - $845,460,000 = $563,460,000

Equation 13) 32 / $563,460,000 = 5 jobs

Equation 11 calculated if the utilization of the storage increases from 30% to 50% in terms of how much value can be created. As visible, the value of the sector increased.

Equation 12: Recalculating the value of the processing capacity after the utilization of the facilities increased to 50% by subtracting the amount that will be generated after the utilization increases to 50% instead of 30% from the total value.

Equation 13 showed that with the increase of utilization every $1 million can create five more jobs. The total processing capacity after increasing the utilization rate by 50% is divided by the total jobs created by every $1 million invested in the sector. Every additional million made by the increase in the utilization of the facilities can create five more jobs in the industry. This indicates that if the capacity of those facilities and utilization increased more value-added will be captured and more jobs created.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

In this paper, we argue that the Mauritanian government should adopt the extensive margins strategy to generate more revenue, increase jobs, and guarantee sustainability of the sector without having to overexploit the fish stock by over renting and increasing allowable catch quotas. These extensive margins include the improvement of the port structure, benefiting from coastal tourism, improving the financial system of the country, and most importantly benefiting from the processing industry. To benefit from the processing industry, which can create many small business and high-value jobs, the government needs to establish a national processing facility and expand its storage capacity for daily caches.

The socio-economic strategy of maximizing the value-added in the supply chain demands more than obliging vessels to unload their catches on the Mauritanian soil. It requires development in the port infrastructure. The ports should be well equipped with all accessories that help in providing the needed services from landing to unloading mechanisms, large storages, processing facilities, and improvement of the surveillance to limit overfishing and illegal unreported fishing that maintain sustainability. This will need the Mauritanian government to invest in developing the infrastructure and build its human capital to ensure high-value job creation and to maximize its revenue from the processing industry.

The government can expand the processing facilities to generate more revenue and decrease deals that grant fishing royalties. It should build its own national processing facilities and seafood products that are processed locally. Even though the fish market is very limited, due to the small size of the population and the low consumption of fish, it can export the products internationally. It should take advantage of the added value on processed goods rather than selling fresh raw material. The Mauritanian government should envision the fishing industry, not only as a source for foreign currency, but as a sector that has all the potentials to lead the country to economic growth. Therefore, the sustainability of the sector should always be considered. The diversification of the economy will also allow them gain leverage in negotiating a deal with future investors.

Transforming the ports into sustainable establishments that have better infrastructure will have positive impacts, including on entrepreneurship. It will help create medium to large scale industries. It will also create the right environment for relevant and focused fishing investment in pelagic, for instance, SMSs that provide services such as access to the port, better sanitation, trained labor, better monitoring of fish processing, and other business development support services.

This paper examines how the Mauritanian government has been managing the fisheries industry, and if those policies are working. The government's management of the fisheries sector is very revenue oriented, with less consideration for the human capital, port infrastructure, or job creation opportunities. After examining the port's poor infrastructure, and the value-added captured in the processing industry (which amounts to 5%), it became clear that the country should start adopting policies that can generate more profit. This paper argues that the government should invest in the port's infrastructure, expand the size of the processing facilities and improve the quality of services. This will allow the government to generate more revenue as

the processing sector offers more benefits and creates more jobs and small enterprises that offer support services.

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