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**Research Article**

# A value chain analysis on tuna and tuna-like species in Iran

**Sistani M.A.[1]; Adeli A.[1*]; Mira S.A.[3]**

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**Abstract**

The present study is an attempt to analyze the value chain of tuna and tuna-like species. The study is intended to show the main loops of tuna and tuna-like species industry along with their relations. Also, the present study indicates the current map of value chain along with its problem tree for tuna and tuna-like species in Iran. According to test hypothesis, the status of tuna and tuna-like species value chain is not ideal in Iran. Weak market for various tuna products (lack of variety in the production of canned goods and the non-canned products), low rate of export to Iraq, Afghanistan and Central Asia (high cost, lack of competitiveness and non-flexibility of the rules and regulations for producing products with the preference of exporting countries) and the weakness in the export of the fresh tuna to Japan and the European Union for added value products (non-compliance with the target countries criteria and the weakness of the transport infrastructure, especially in the air transit) were identified as the main problems. Also, in the present study, the missing and weak factors which reduced the efficiency of the value chain were identified in forms of the problem trees and ranked by Friedman test. The results of this study showed that the value chain of tuna and tuna-like species suffer from the lack of fair distribution of profit between the value chain loops, no diversification in the production of value added products, neglecting the quality in the value chain and poor access to the export market of value added products.

**Keywords:** Tuna fishery, Tuna-like species, Tree of problems, Value chain analysis, Iran

1- Environmental and Fisheries Department, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran
2- Faculty of Management, Tehran University, Tehran, Iran
*Corresponding author's Email: afshinadeli@gau.ac.ir

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## Introduction

Development and sustainability of any fisheries industries require analysis of the value chain. The value chain refers to a wide range of activities involved the production providing through various processes (Kaplinsky and Moris, 2000). The value chain can include various activities such as supplying, production, distribution and marketing (Lynch, 2003). The value chain is also known as the value chain analysis, which was first introduced in a book, entitled "Competitive Advantage" (Porter, 1985). The purpose of the value chain analysis is to determine the relationship of each loop with the previous and next loops to maximize the value creation and minimize the impact of barriers and weakness on the chain. Currently, the value chain analysis has been used to develop the value chains with the emphasis on value-added (Russel and Hanoomanjee, 2012). Regarding the key role of fisheries activities in the countries located on coasts of free waters, sustainable development of the fisheries industry is very important. In this regard, Iran is a good example, which is located in the Persian Gulf and Gulf of Oman and has access to Indian Ocean (Fig. 1).




**Figure 1: Maps of the position of four southern coastal provinces of Iran in Persian Gulf and Oman Sea.**

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Iran has the second rank in catching tuna and tuna-like species from Indian Ocean (IOTC, 2017) with global rank of 10th in 2016 (FAO, 2017) (Fig. 2).

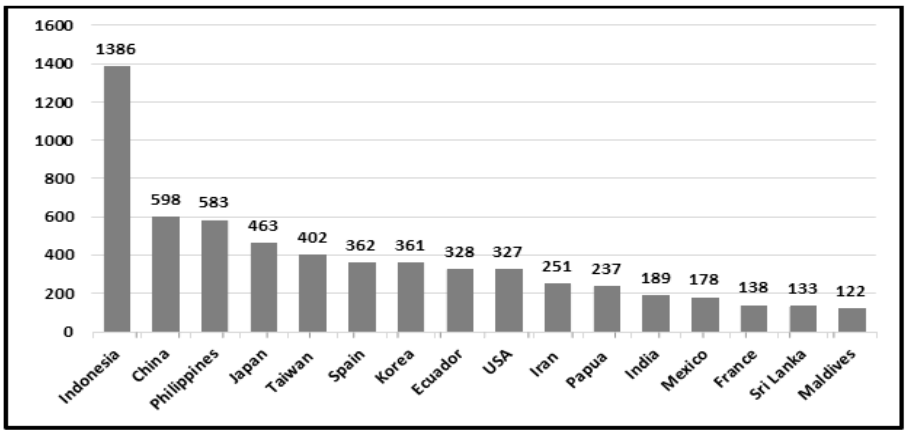



**Figure 2: The main countries catching tuna in the world in 2014 (FAO Year Book, 2016).**

The rate of catching tuna and tuna-like species in Iran has increased from 54 thousand tons in 1997 to 251 thousand tons in 2016 (around 4 times). Four coastal provinces including Sistan and Baluchistan, Hormozgan, Bushehr and Khouzestan are involved in fishing of tuna and tuna-like species. Figure 3 shows the share of each southern province in catching of tuna and tuna-like species. Fishing boat, dhows and vessels are engaged in catching large pelagic species (tuna and tuna-likes species). There are four fishing methods consist of gillnet, purse seine, trolling and longline for catching the tuna and tuna-like species. Gillnet is the dominant fishing gear in EEZ (exclusive economic zone) of Iran as well as offshore fishery (Kakoolaki, 2017).

The majority of tuna and tuna-like species are Yellowfin tuna, Skipjack tuna, Bigeye tuna, Long tail tuna, Kawakawa, Frigate tuna, Billfishes (including Sailfish and Marlin) (Shahifar, 2017; Hashemi *et al*., 2020, Sadough Niri, *et al*., 2020). Most of tuna and tuna-like species are domestically further processed (canneries) and a small proportion of tuna and tuna-like species is sent to domestic fresh markets and the smallest portion is exported to neighboring countries such as Afghanistan and Iraq (i.e. 334 tons in 2015) (Tehran Chamber of Commerce, Industries, Mines and Agriculture, 2017). There are 134 canneries with the capacity of 691 million cans per day and 147 processing factories with the daily capacity of 2307 tons (Statistical Yearbook of the Iranian Fisheries Organization, 2017); a few of them are devoted to processing of tuna and tuna-like species. On the other hand, the contribution of tuna and tuna-like species in the total catch in Iran was 39.6% in 2016 (Annual Report on Catches of Fisheries Organization of Iran, 2017) which is very high compared to its global rate (8.2%) (FAO, 2017).

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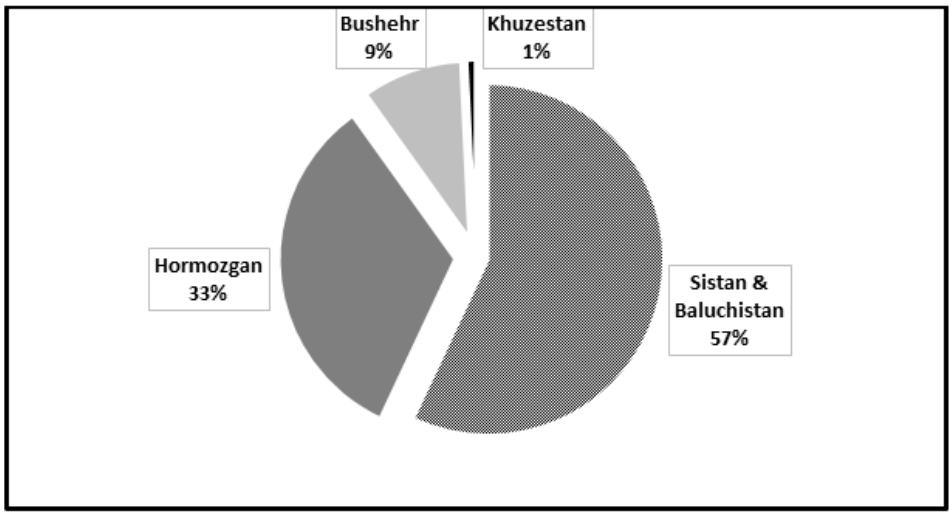



**Figure 3: Comparison of catches tuna among southern provinces of Iran (2016) (Annual Report on Catches of Iranian Fisheries Organization, 2017)**

In spite of its important position in tuna and tuna-like species industry of Iran, its unique capabilities and the growing market, the production and supply of value added products have failed to fully create value in this industry. Therefore, analysis of the value chain of the tuna and tuna-like species is necessary to identify the causes of such problems. So, the map of the value chain should be plotted to understand the current condition of the value chain which will identify the barriers of the industry and provide a road map for all stakeholders. Despite the important role of value chain analysis, no study has addressed tuna value chain in Iran. A limited number of researches however studied other fishes value chain analysis in Iran, among which the works carried out by Moradi (2006), Delangizan *et al*. (2008), Rashidi-komijani and Shifikhani (2008), Ebrahimzade (2012), Ghafari-darab *et al.* (2012), Asgarzade (2013) and Kahramfar (2014) can be mentioned. Numerous researches have performed the analysis of the value chain on fishery products around the world. For example, Nowsad-Alam (2016) identified the constraints in Bangladesh fisheries value chain to improve technical efficiency and distribution and ensure higher income. Knutsson *et al.* (2015) focused on the key factors affecting the structure of Iceland fishing industry. Yamashita *et al*. (2008) analyzed the effective factors on the value chain of tuna species in Philippines between 1999 and 2007 and Yagi *et al*. (2012) studied the value chain operators of five key tuna species in Cambodia in order to identify the main contributors. Also, Nguyen-Ngoc (2014) investigated Skipjack tuna value chain in Vietnam and showed that the most important contribution in the value chain is associated to fishermen, middlemen and export seafood processing firms. Gestsson *et al*. (2010) conducted a research on the fish market of Sri Lanka about the main obstacles such as the lack of knowledge and proper information flow between contributors. Also, Murielle (2012) was

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conducted on the distribution and supply chain of the fisheries industry in Haiti that did not have a clear policy and proper processing of marine products. Karningish *et al.* (2017) presented a map showing the risks of Indonesian tuna supply chain that identified 15 risk events and 13 risk factors concerning fishing, trading and processing. As noted in the above studies, the tuna industry of each country has its own problems. Similarly, Iranian tuna industry also has its own issues such as lack of harmony between the production and consumption in the next loops of the value chain; therefore, a lot of value added may be annually lost every year in this industry. Hence, this research has tried to show the production process of tuna and tuna-like species to form a chain, focusing on showing the first to the last stages. Moreover, the main purpose of this research was to analyze the value chain of tuna and tuna-like species in Iran to find the weaknesses and obstacles affecting the value chain to improve the efficiency of the value chain by determining the best production method with the highest economic benefits.

## Materials and methods

In terms of purpose, the present research is classified as applied research; while concerning data collection methods, it can be regarded as a descriptive one. At first, the map of the value chain of tuna and tuna-like species in Iran was drawn using available data. Typically, descriptive studies with a wide range of geography use questionnaires and interview methods (Axinn *et al*, 2009). Therefore, in order to identify the importance and priority (ranking) of the missing and poor factors affecting the value chain of tuna and tuna-like species, it was necessary to design the questionnaires and distribute them among the people involved in this procedure. Four questionnaires were designed for 4 main loops (fisheries, production, distribution and consumption). The questionnaires included demographic data, relevant activities, the missing and weak factors and issues on upgrading and improving the value chain and other required information. Some questions employed 5-scale Likert options to measure the variables, so that the respondents should determine the importance of each of the missing and weak factors. Validity of the questionnaire was confirmed through the opinions of experts and connoisseurs. The reliability was examined by completing the pilot questionnaires to number 30 pcs and the Cronbach's alpha coefficient calculated as 0.76.

To determine the weak and missed factors, first a large number of factors were extracted by reviewing the literature; after eliminating the repeated factors, a series of factors were summed up for each loop. Finally, after three rounds of review by the experts and elites, variables were identified as the main obstacles; using the sign test, factors were determined as the final main obstacles.

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Considering the cost of the survey and the reliability required for the accuracy of the results, the sample size was selected proportional and the variance of the classes was assumed to be the same. The Cochran formula 2 was used to estimate the number of samples (Mendenhall *et al*, 1990). According to Cochran's formula, the number of samples with an error level of 0.1% was equal to 490 questionnaires (90, 60, 40 and 300 questionnaires for fishing, production, distribution and consumption loops, respectively). Finally, respondents returned 478 questionnaires. For factor ranking, Kolmogorov-Smirnov test was employed to determine the distribution of the data. Also, Friedman's test as nonparametric test was utilized to rank the effective factors on value chain. The study was conducted on data related to 2016 and 2017.

**Results**

A generalized value chain map shows the general direction of tuna and tuna-like species from fishing to consumer. The map was simplified to obtain a clear image of how the tuna and tuna-like species move along the chain. The figure 4 shows the value chain map. The first level of value chain was fishing loop. The next level involved evacuation of the tuna and tuna-like species by fishing vessels as well as discharge of imported tuna into commercial ports. In the following, the raw materials passed through different levels of the value chain and finally reached to the last level: consumer. Various tuna and tuna-like products are presented to the final customers in local markets, supermarkets, hypermarkets, seasonal exhibitions and export markets. As figure 4 suggests, 90.8% of tuna fishes entering the chain were caught by Iranian fishing vessels and 9.8% were imported from different countries such as Pakistan and India. The first loop of the value chain of tuna and tuna-like species (fishing loop) is under the dominance of the gillnet fishing method with about 93.4% contribution. The hook fishing method had the second rank (4.2%) and the third rank was assigned to the purse seine fishing (2.4%). The next level of the value chain involved distribution, in which wholesalers, representatives of the processing factories, intermediaries and retailers. Intermediaries (42.9%) had the contribution in providing fish for the production loop. The share of wholesalers and envoys of processing factories were 29.2% and 17.8%, respectively. Retailers' contribution in distribution was evaluated as 10.1%. The third loop of the tuna and tuna-like species value chain was assigned to production. Tuna fishes are presented in four forms: 84.2% are presented as canned tuna; 3.8% are presented as fillet packaged tuna; 0.3% are presented as fried packaged tuna and 7.6% are freshly sold usually to local communities in the coastal provinces.

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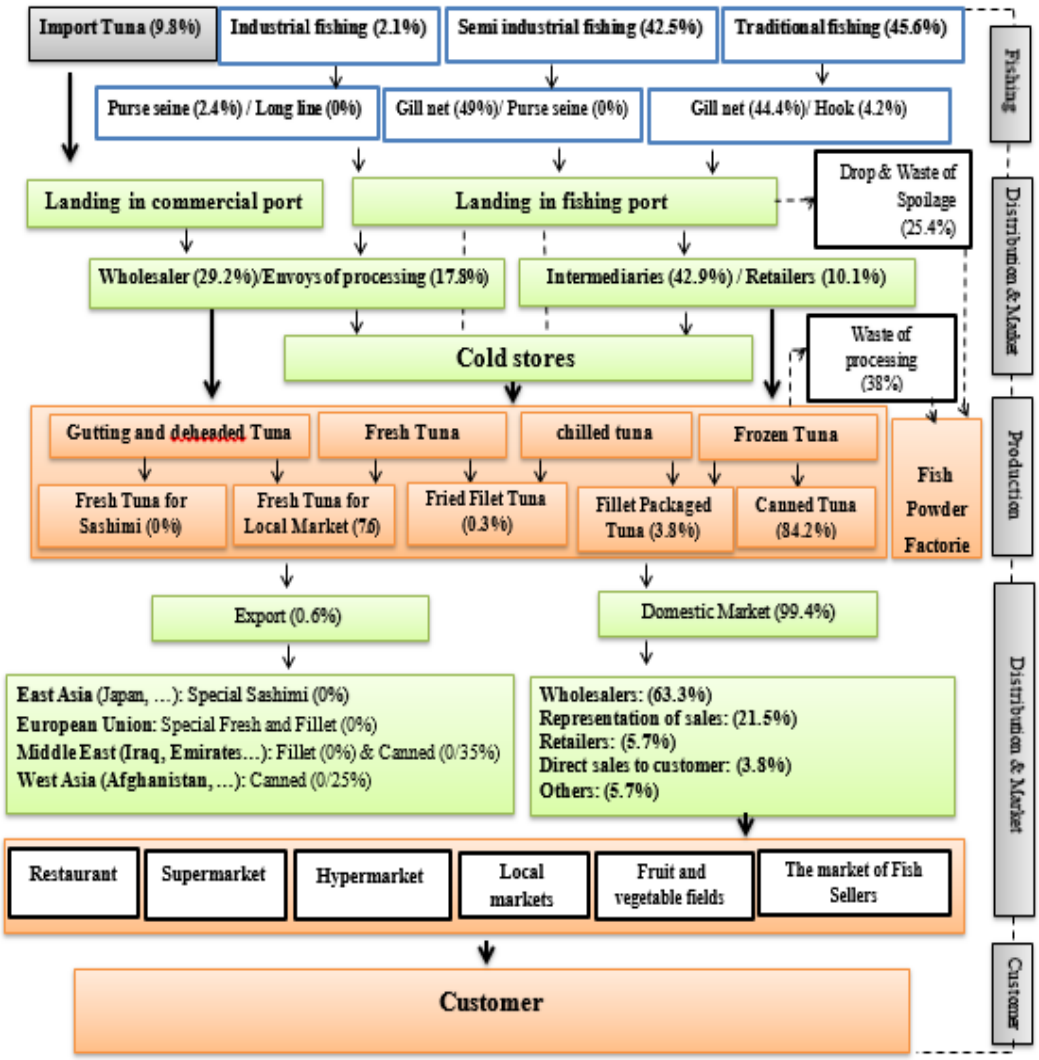



**Figure 4: The map of the tuna and tuna-like species value chain in Iran.**

According to the results of this study, 99.4% of the total tuna production was used in domestic market and only 0.6% of the tuna products were exported to other countries. Of the total exported tuna fishes, 77.8% was in form of canned products and 22.2% was the whole fish. About 63.3% of the tuna products were marketed by the wholesalers after passing through the production loop. The sales agents of the production units supplied 21.6% of processed tuna and retailers' share was 5.7%. Direct sales of tuna products from factory to customer also had the lowest share (3.8%).

After drawing of the value chain map and analyzing the distributed questionnaires, the missing and weak factors affecting the value chain of tuna and tuna-like species were determined using the problems tree technique. Figure 5 shows the focal problems which caused inefficient value chain of tuna and tuna-like species.

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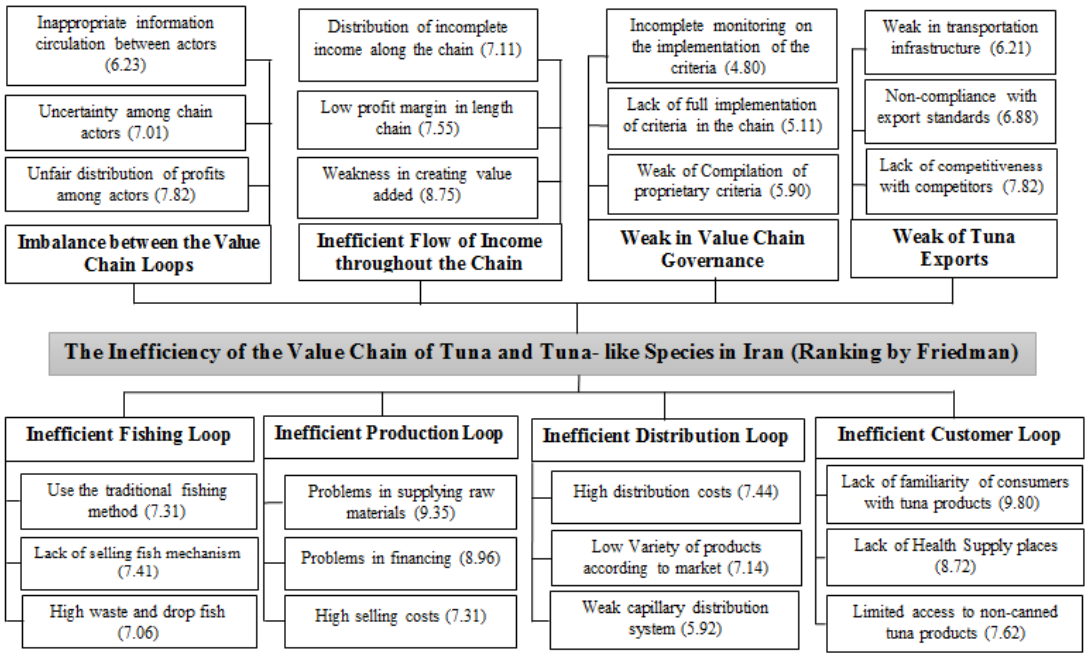



**Figure 5: Problem tree of the tuna and tuna-like species value chain in Iran.**

Problems (causes) could be classified into two sections. The first section was related to inefficiency of the value chain loops such as inefficient fishing, production loop, distribution and customer loops; while the second section dealt with inefficiency in the whole value chain consisting of inefficient flow of income throughout the value chain, the weakness in the value chain governance and the poor export to the foreign countries which resulted in the inefficient value chain of tuna and tuna-like species in Iran.

## Discussion

According to the obtained results, the current situation of tuna and tuna-like species value chain is not ideal. All value chain loops had some problems. So, the study was focused on analyzing the tuna value chain to identify the lost and weak factors affecting the value chain in Iran. Using the map of the value chain associated with the problem tree could help these challenges were identified as 'inefficient value chain' and when policy makers and decision makers know how to prioritize these factors, they can predict how resolving each barrier will improve the industry efficiency. Also, resolution of these negative factors will resulted in an efficient value chain leading to efficiency in all the loops of value chain, balance between them, and proper flow of income throughout the value chain, strong governance and efficient export markets. For this purpose, some researchers including Drury O'Neill (2013) in Ghana, Nguyen-Ngoc (2014) in Vietnam, Gestsson *et al.* (2010) in Sri Lanka, Yamashita (2008) in Philippines and

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Karningsih *et al*. (2017) in Indonesia drewn the map of value chain. Also, some researchers consist of Murielle (2012) in Haiti, Drury O'Neill (2013) in Ghana, Nguyen-Ngoc (2014) in Vietnam and Karningsih *et al*. (2017) in Indonesia showed the lost and weak factors affecting on the tuna value chain.

The owners of fishing vessels, processing centers, intermediaries, wholesalers and retailers, fish importers and exporters, consumers and, ultimately, the government were the main actors of the value chain. Karningsih *et al.* (2017) expressed the same results, whereas, in this study, other actors such as active human forces on fishing vessels (captain, assistant captain, sailors, etc.), agents, international organizations and NGO with secondary effects on the value chain were also taken into the account.

This study indicated the lack of balance between value chain loops which is consistent to Drury O'Neill (2013) suggesting imbalance between active actors in the tuna value chain of Ghana. In the present study, unfair distribution of profit among contributors was recognized as the main reason of this problem. Unreliability and inappropriate information circulations between value chain actors was the other reason of this problem which is in agreement with the results of Gestsson *et al*. (2010) on the value chain of yellowfin tuna in Sri Lanka. Similarly, Galbraith and Kazanjian (1986) emphasized on the information and knowledge flow through the chain from suppliers to consumers as an essential factor for efficiency and productivity of value chain. It also plays a key role in relationship and cooperation among the major contributors. Trust in business can enable efficient transactions with more speed through the value chain, especially for complex business with extra emphasis on quality which requires delicate interaction between supplier and customer (Tveteras and Kvaloy, 2006). Accordingly, Pitta *et al*. (2004) showed that when one actor gains at the expense of another one using his/her unconventional power without collaboration, uncertainty and distrust will grow between them and hence throughout the value chain. The study revealed that income distribution across the tuna and tuna-like species value chain was generally in favor of intermediaries. Study of Nguyen-Ngoc *et al.* (2014) in Vietnam also showed that the income distribution in the skipjack tuna value chain is in favor of intermediaries. The results of this study showed that these products are passed through several intermediaries. For canned tuna, the theme is quite different and the fishes are mostly exchanged between a wholesaler and intermediaries playing a key role in the value chain of canned tuna factories. However, for non-canned tuna products such as fresh tuna, retailers have the major role in delivery of these products, and income distribution occurs in several steps.

The present study showed that the value chain of tuna and tuna-like species is

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controlled in two levels: national and regional. The analysis of the value chain structure from the national point of view showed that the rules, regulations of the value chain in all chain loops including catching, production, distribution and consumption are obeyed by the governmental organizations (i.e. Iranian Fisheries Organization, Veterinary Organization, the Ports and Maritime Organization). But implementation and performing of these regulations could be difficult in some cases. Murielle (2012) also found that Haitian tuna industry did not have a specific policy and suffered from law and administrative frameworks. Drury O'Neill (2013) found similar findings which showed that the governance on the value chain was well defined, but they are weakly implemented.

About trading, the present study showed that Iran does not have a suitable position in the trade of tuna compared to the other countries with similar conditions. Gestsson *et al.* (2010) and Al-Busaidi (2015) found the similar results in Sri Lanka and Oman. In this study, exporting of tuna and tuna-like species products was very low (~1780 tons in 2016) (Tehran Chamber of Commerce Industries, Mines and Agriculture, 2017) counting on about less than 1% of the total production. About 81% of the exported products are sent to Iraq and Afghanistan. Karningsih *et al.* (2017) showed that the best solution for development of the tuna industry in Indonesia is to increase the production of various products including fresh and canned fish for export to the developing countries. The present study indicated that the lack of competitiveness, high price and low quality are the main reasons explaining the lack of export to these; poor air transit is also another cause.

According to the obtained results, the important challenge in processing tuna and tuna-like species industries is the supply of raw materials (stable supply and price stability). Murielle (2012) addressed Haitian tuna value chain and expressed that the inefficient supply of raw material is a vital problem in terms of quality and stability. The results of this study showed that according to the capacity of tuna processing plants at least 273 thousand tons of raw materials (fish) are needed. However, the total catch of tuna and tuna-like species summed up to 233 thousand tons in 2015 showing 17.1% shortage. Moreover, the loss of raw material (fish) quality can be attributed to lack of refrigeration facilities in many fishing vessels, long distance from catching places to harbors and inappropriate transport by vessels, ports and processing centers. Huss *et al.* (2003) showed that inappropriate management at different stages of the supply chain can lead to quality deterioration and fish corruption. Murielle (2012) also mentioned the long distances from catching places to harbors as the most important factor in decline of raw

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materials quality in tuna value chain of Haiti.

This study showed that the production was focused on one type of production method in the value chain of tuna and tuna-like species in Iran. Also, the tuna production method is mainly based on gillnet fishing method in a way that 93% of the total tuna and tuna-like species were caught by gillnet in 2016. Regarding the dominance of gillnets method which resulted in lower quality of fish production compared to other methods; the production of non-canned products with an emphasis on value-added products was limited in Iran. The present study showed that 84.2% of tuna and tuna-like species were canned and the share of non-canned products was only 15.8% with just about 4.1% value added products; 7.6% were sold as fresh tuna in local market. However, the share of non-canned tuna products has been more than 25% throughout the world (FAO, 2017). The variety of canned tuna products is also limited. According to the obtained results, 75.9%, 5.5% and 3.9% of canned tuna products are processed by vegetable oil, olive oil and vegetables, respectively. Generally, the condition of diversification and added value is not suitable in the tuna and tuna-like species value chain in Iran. Gestsson *et al*. (2010) also expressed similar condition for the tuna value chain in Seri Lanka. The margin of profit for non-canned fish is higher per unit, but regarding the low sales volume of these products on the market, it is obvious that the costs of producing, distributing and selling of these types of products are higher than canned ones. Therefore, despite their higher margin of profit per unit production, the margin of profit for the total production is low and not attractive for producers.

The results of this study indicated that establishment of a mechanism to balance the value chain, especially preventing from excessive intermediaries and providing a competitive environment for selling fish is one of the important steps to improve the value chain. Moreover, strong governance over the value chain is also important. Other factors such as diversification of tuna products, producing the added value products, improving the supply of the raw materials and products can enhance the export of all kinds of tuna products which should be put on agenda. The starting point is focusing on the gradual change of fishing method from gillnet to purse seine, long line and pole and line. The next step can be raising the quality and use of safety systems throughout the value chain. Changing the production method in processing factories in accordance with the market need is another important step which can increase the efficiency of the value chain. Furthermore, increasing the share of non-canned products compare to the canned tuna products is essential to reach to the minimum of 25% (world average). It is also necessary to increase the export of value-added products of tuna and tuna-like species. It is also important to increase the number of target countries for export especially

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export of the value-added products to developed countries such as Japan and the European Union.

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