

FISH PROCESSING FACILITIES IN THE KYRGYZ REPUBLIC:
MARKET AND LOCATION ANALYSIS

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ABSTRACT

The fisheries industry in the Kyrgyz Republic faces many challenges including gaps in documented data. The information collected in this thesis aims to make an input to narrow the gap of information on the fish market in the Kyrgyz Republic. In addition, information necessary in location decision-making of processing facilities and the requirements they should meet to produce safe products is also collated in this thesis. A market analysis was conducted based on the 4 P's of marketing, focusing on producer markets, by interviewing fish farmers of two associations and retail markets, by examining supermarkets, bazaars and specialized fish shops in Bishkek, the capital of the Kyrgyz Republic. The supply chain from producer to the market, for both imported and local products was determined. Location analysis compared 4 sites in the Kyrgyz Republic on the basis of logistics, building and surroundings, hygienic design and floor plan, as well as infrastructure and auxiliary services and then determined, using SWOT analysis and comparative analysis, the best possible location for a fish processing facility.

The amount of locally farmed fish in the Kyrgyz Republic is really small (less than 450 tonnes /annum in 2011) and focuses on rainbow trout (*Oncorhynchus mykiss*) and cyprinid species production. There are a few fish processors in the Kyrgyz Republic who mainly process imported fish like salmon (*Salmo salar*), herring (*Clupea harengus*), and mackerel (*Scomber scombrus*). The processing facilities surveyed are not constructed according any standard requirements, except one, and hygiene requirements are hardly adhered to during processing. Among the 4 sites evaluated in this thesis, a site located in Bishkek FEZ was determined as being the most suitable for a fish processing facility. The study also determined that supermarkets in the Kyrgyz Republic do not currently sell rainbow trout products, but in the future would consider increasing their product range if there would be a reliable supply. Monthly data on the fish prices in the retail markets revealed that there is no certain set price for fish and fisheries products in bazaars, specialized fish shops and supermarkets.

The data and information generated in this thesis provides valuable information that can be used to plan fish processing activities and build or enhance marketing strategy, as well as to plan fish processing activities in a manner that manages hygiene and ensures high quality, safe fish products.

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АННОТАЦИЯ

Рыбный сектор в Кыргызской Республике сталкивается со многими проблемами, включая пробелы в документах по базе данных. Информация, собранная в настоящей диссертационной работе нацелена на то, чтобы внести свой вклад в сокращение дефицита информации о рынке рыбы и рыбной продукции в Кыргызской Республике. Кроме того, в настоящей диссертационной работе была собрана и изучена необходимая информация для принятия решения по определению места расположения для перерабатывающего завода, также рассмотрены требования, которые должны соответствовать для производства безопасной продукции. Анализ рынка проводился на основе метода 4 Р по маркетингу, принимая во внимание рыночных производителей, путем опроса представителей рыбных хозяйств двух ассоциаций, а также представителей розничного рынка, путем изучения ситуации в супермаркетах, базарах и специализированных рыбных магазинах в Бишкеке, столице Кыргызской Республики. Были определены цепочки поставок от производителя до рынка, как для импортной, так и для отечественной продукции. Для проведения анализа места расположения завода были рассмотрены и сравнены, четыре местоположения в Кыргызской Республике, с учетом логистики, строительства и окрестностей. Были рассмотрены гигиенический дизайн и поэтажный план, также были анализированы вопросы инфраструктуры и вспомогательных услуг, и далее, используя SWOT- анализ и сравнительный анализ, было определено наилучшее место для завода по переработке рыбной продукции.

В Кыргызской Республике ежегодно производится небольшое количество рыбы (менее 450 т / год, в 2011г.), которое в основном фокусируется на радужной форели (*Oronchorynchus mykiss*) и карповых видах рыб. Имеются несколько предприятий по переработке рыбной продукции в Кыргызской Республике, но в основном они перерабатывают импортные рыбы, такие как лосось (*Salmo Salar*), сельдь (*Clupea harengus*), и скумбрия (*Scomber scombrus*). Построенные заводы по переработке рыбной продукции не соответствуют требованиям любого стандарта, кроме одного завода, также представляется, что, вряд ли они соблюдают гигиенические требования во время переработки. Среди четырех местоположений, прошедших оценку, согласно настоящей исследовательской работе, место, расположенное в СЭЗ Бишкек было определено, как наиболее подходящее для завода по переработке рыбной продукции. В ходе исследования также установлено, что в супермаркетах в Кыргызской Республике в настоящее время не продается радужная форель, но в будущем они предполагают увеличить ассортимент рыбной продукции, если будут надежные поставки продукции. Ежемесячные данные о розничных ценах на рыбную продукцию на рынках показали, что нет никакой определенной цены для рыбы и рыбной продукции на базарах, специализированных рыбных магазинах и супермаркетах.

Данные и разработанная информация в настоящей исследовательской работе представляют собой ценную информацию, которая может быть использована для планирования работ по переработке рыбной продукции, создания или расширения маркетинговой стратегии, а также для планирования работ по переработке рыбной продукции, таким образом, чтобы управление обеспечивало соблюдение гигиены, высокое качество и безопасность рыбной продукции.

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ABBREVIATIONS AND DEFINITIONS

FFAK- Fish Farmers Association of Kyrgyzstan

IKP- Issyk Kulskie Prudoviki

FAO- Food Agricultural Organization of the United Nations

EU- European Union

Exchange rate: €0.0156 per Som rate on 28 January, 2013

1 INTRODUCTION

Fish is a highly available, healthy and high quality source of cheap animal protein (Public Health Agency of Canada, 2008). The fish and fisheries products industry plays a big role in the economic and social wellbeing of nations in the world, with millions of people working in the fisheries and fish farming sector (Visvanathan et al., 2005 and FAO, 2010).

Earlier, fish was a limited in supply due to its perishability. Dried and dry salted products were the main fish and fisheries products, which could be exported or imported. However, over the last 30 years, from 1976 to 2006, improvements in storage and preservation technologies and cheap transportation possibilities have increased world fish trade. The global trade value increased from 28.3 billion to 86.4 billion USD and global trade volume increased from 7.9 to 31.3 million tonnes (FAO, 2010).

With this, an increase has been seen in the product range of fish and fisheries products and consumption levels of fish and fisheries products, while and quality has improved (Asche and Smith, 2009). About 81% (115 million tonnes) of total global fisheries production was consumed by people and 19% (27 million tonnes) was used as fish feed, ornamental fish and for stocking purposes. Also, about 40% of fish was sold as fresh and another 41% was sold as frozen, cured and other processed product for direct human consumption (FAO, 2008).

Various fish processing methods (freezing, drying, smoking, mincing, canning), different packaging methods, improvements in logistics and technologies ease the availability of fish and 90 % of international trade of fish and fisheries products is processed (Lindsay, 2005).

After the collapse of the Soviet Union, fish production in all the Central Asian countries dramatically dropped till year 1998. Later on from 1999 fish production in Uzbekistan started to increase. Fish production in Kazakhstan, Turkmenistan and Uzbekistan fell approximately between 60 to 72%, from 1992 until 2006 (FAO, 2008), while that in Tajikistan dropped by 94 %. The main reason for these dramatical decreases was the general economical crisis. In addition, there was, and still is, as lack of good water management practices in Central Asian countries, weak policies and legislation, a lack of sufficient investments in the fisheries sector and finally, unreported or illegal fishing takes place in all these countries (FAO, 2008 and Thorpe et al., 2008)

Inland capture fisheries production in the Kyrgyz Republic, dropped by 98% after the collapse of the Soviet Union, with production values of 1447 tonnes/annum in 1989 compared to 27 tonnes/annum in 2006. From 1st of January, 2003, a 10 year moratorium was declared on fishing in Lakes Issyk Kul and Son Kul in order to protect the decreased fish stocks in these large lakes. The index of illegally caught fish is much higher than the index of officially caught fish in the Kyrgyz Republic (Sarieva et al, 2008). Despite the moratorium, at least 500 people have continued their activity as illegal fishermen and the illegal catch on Lake Issyk-Kul is estimated to be between 250 and 1000 tonnes per year (Mikkola, 2012).

Today, the aquaculture sector in the Kyrgyz Republic has seen significant growth. Annual production was 12 tonnes in 2003 and it grew 133 tonnes in 2008 (Fishstat, 2013). The main aquaculture fish species in the Kyrgyz Republic is rainbow trout (*Oncorhynchus mykiss*). In 2009 the production of rainbow trout was estimated at 33 tons/a (Fishstat, 2013).

The consumption of fish in the Kyrgyz Republic was higher during Soviet times compare to present day (Sarieva et al., 2008). Annual fish consumption was less than 1 kg per capita after the collapse of the Soviet Union in the Kyrgyz Republic, in the same year global fish consumption was 16.5 kg per capita (Sarieva et al., 2008). All through history, the Kyrgyz people have had a preference for meat over fish. However, fish was adopted slowly into the Kyrgyz diet, during the Soviet era when there was a mandatory fish day. Today, fish is a luxury product in the Kyrgyz Republic, with its pricing above that of other food products like beef and chicken (Sarieva et al., 2008).

Local fisheries products are mostly from illegal catch and sold either fresh or processed under poor conditions. A significant amount of fish, 75-85%, on the Kyrgyz market is imported from Kazakhstan and the most common processed fisheries products on the market are smoked mackerel (*Scomber scombrus*), smoked salmon fillet (*Salmo salar*) and salted herring (*Clupea harengus*) (Sarieva et al., 2008) imported from Russia and Latvia (Shifugulin and Tazhibaeva, personal communication, 18.3.2012).

After independence in 1991, the Kyrgyz Republic began to develop its economical relationships with other countries. The transition to a market economy has been difficult. In 1995 the inflation level fell and about 53 thousand enterprises were privatized, leading to monopolization of the trade market by private companies by the end of 90's and early 2000 and over 90% of industrial output was produced by private enterprises (Ivasenko, 2007).

The Kyrgyz Republic is soon planning to join the Custom Union between Russia, Kazakhstan and Belarus where custom duties will be lower for imports from member countries of the Custom Union (Sovet uulu, 2013). This will no doubt encourage and ease the movements of products between the member countries of the Custom Union. The development of the fish processing industry and market is thereby called for. However, there is currently little documented data and information on the status and conditions of fish processing facilities in the Kyrgyz Republic. Also there is little documented data on the Kyrgyz fish markets.

This thesis gives a description of the present fish market in the Kyrgyz Republic as well as the demand for various fisheries products. It also examines the market and location aspects to be considered when establishing a fish processing facility by describing and comparing four locations and fish processing facilities and their suitability for processing activities according the Codex Alimentarius standards.

The information collected in this thesis aims to make an input to narrow the gap of information on the fish market in the Kyrgyz Republic. In addition, information necessary for consideration of location of processing facilities and the requirements they should meet to produce safe products is also collated in this thesis. This study will be valuable for entrepreneurs, fish producers, fish processors, policy makers and implementing agencies and authorities to enhance the Kyrgyz fish and fisheries products industry.

2 LITERATURE REVIEW

Developing the fish and fisheries products industry requires a thorough research and analysis of production and markets touching on the value chain of production, processing factors and location of establishments. These concepts are described in this section.

2.1 MARKETING

Marketing is the management process of the production chain from producer to final consumer (Kotler, 2000). Marketing identifies, predicts and meets consumer demand with a profit for the company or organization (Chartered Institute of Marketing, 2009). Market research is the first step of marketing, where the main purposes are to find out or to predict what customer demand is. Marketing is also defined as socio-economic activities that control the flow of ideas, goods or services chain from producer to consumers or users (Hillstrom and Hillstrom, 2002). Marketing also plans and designs the principles of pricing, promotion and distribution of goods, ideas and services in order to satisfy needs and wants of individuals and organizations (Carter, 1997). Market research is conducted in order to understand customer needs, wants and demand.

The 4 P's of marketing, also known as the marketing mix, is a principle used to help in the research of market and building of strategy to sell ideas, services and products that meet customer needs and wants (Goi, 2009). The 4 P's of marketing focuses on the following elements (Table 1):

Table 1. 4 P's of marketing

4 P's	Description
Product	This element of marketing mix includes ideas and services and identifying the right product to satisfy the needs of target customers
Price	Mainly focuses on identifying right price at which the customer and producer can profit. This element determining the right product offered at the right price
Place	Analysis of this element leads researcher to the right product at the right price available in the right place to be bought by customers
Promotion	Including advertising, copywriting, media selection, sales force, personal and mass selling, sales promotion, positioning is informing potential customers about available product, its price and its place

Other 'P' elements such as 'people' and 'processes' have been added to the basic marketing mix. According to Gordon (2012), Goi (2009) and Constantinides (2002) have criticized the basic marketing mix for, "focusing on the short term, sales and transactions", saying it is difficult to apply the marketing mix and that, there is no connection between variables and that the elements 'process' and 'people' are forgotten. Gordon (2012) therefore suggests that the marketing mix is adjusted to the requirements of 21st century by adding more components such as 'people' and 'processes'. 'People' under the marketing mix refers to company employees that will be in contact with customers and from whom customers will make an impression of the company. 'Process', on the other hand, refers to the delivery services process and behavior of employees which deliver company's product or service to the customer. These factors can affect decisions made by customers on whether to purchase company's product/ services or not (The Chartered Institute of Marketing, 2009).

2.2 MARKET RESEARCH

All businesses require market research to determine the demand and needs of consumers for particular products, ideas or services. Marketing research is the first step to trying understanding the current and future customers of a business and requires a lot of work and consultations with experts (Knapp et al., 2008; Young and Smith, 2002).

Market research is defined as the analysis or identification of competitors and potential customers in order to meet their demands and needs, and manage the production and its marketing in the right way (Xie, 2008; Kustin, 2004; Constantinides, 2002). In other words, with identifying or observing customer behavior the company's marketing strategy will be planned and realized (Bainer and Chansarkar, 2002). Also, analyzing the market will help to predict future trends and demands in the market. It will help to build company strategy and to come up with the decisions on which market to supply and what products to sell (Sherlekar et al., 2010; Ramachandra et al., 2010; Knapp et al., 2008; Hamersveld, 2008; Slater and Olson, 2002).

Implementation of market research involves the following steps (Sherlekar et al., 2010; Ramachandra et al., 2010; Knapp et al., 2008; Hamersveld, 2008; Slater and Olson, 2002):

- 1) Gathering of information about markets and needs to identify potential customers, their needs and expectations and the means to meet them.
- 2) Gathering of information about products to be produced and the target customers.
- 3) Gathering information about product prices and their possible fluctuations with the purpose of setting reasonable price for customers.
- 4) Gathering information about potential competitors in the markets and their influence in the market.

There are several methods used in order to analyze and survey markets including the following (Table 2).

Table 2. Example of survey tools for market analysis (adapted from Hague and Hague, 2004; Hulland et al., 1996 and Sheehan, 2010).

Methods	Description
Observation:	It can be carried out by watching or observation. It is an appropriate method for surveying retail markets. This method provides information about consumer behavior but nowadays there are possibilities that questions can be left unanswered.
Postal surveys:	This method is executed by sending questions through post, and respondents should send completed form back in a pre-paid envelope. It can cover a wide area but at the end responses are very low, usually and this method takes a long time.
Telephone interviews:	This is a quick method to gather information from customers, but the answers from respondents will be short.
Online surveys:	This is a low cost method, becoming more popular year by year. It helps to get information about the views of the customers over the Internet.
Face to face surveys:	This a personal interview method. It costs a lot but is more effective than other methods because it helps gather information more deeply.
Focus groups:	This method is used for specific targeted group and used together with other methods. This method helps to get detailed information about customer taste and preferences.
Test marketing:	This method can be conducted with selling of products or services in a small section of market in small amount in order to know the opinions and reactions of customers. This method will help to predict perception of customers in other markets as well.

2.3 LOCATION ANALYSIS

It is important to analyze the market from the point of view of location. Location analysis provides valuable information on economical suitable site for operative activity, access and the availability of services and utilities (Knapp et al., 2008; Tabari et al., 2002).

Analyzing of sites, managing, evaluating of facilities and determining the best location for new facilities is called location analysis. The location of a new facility or business plays a big role in profitability of any starting new project and it is important to know which place or location is appropriate for a new facility. It is the first question that needs to be answered before set up new processing facility (Knapp et al., 2008; Tabari et al., 2008). Moreover, the facility location analysis is not only relevant for new businesses, but also for existing ones.

Through location analysis, it is possible to determine the economical viability of a plot for a new facility, determine market factors for launching a new product or service and discern information on the availability of necessary services and utilities for a new facility (Horner, 2009).

There are several factors that need to be considered when conducting location analysis (Table 3).

Table 3. Aspects which should be considered during location analysis

Location analysis				
Logistics	Costs	Availability of raw material	Labour availability	Accessability to market

Logistics is the science of planning and implementing the framework for the management of material, service, information and capital flows (Ghiani et al. 2004). Logistics is very important for any business which deals with tangible goods that have to be physically stored and transported. Logistics operations should be organized efficiently enough, in order to not to waste time and financial resources. Logistics can help to understand the flow process of the supply chain and it allows processes and procedures flow smoother. Logistics is one part of the supply chain and includes managing, planning, delivering and controlling the movement or distribution chain of resources or goods from the original location to the final destination in

order to meet customer needs (Farahani et al., 2011). Logistics also includes storage, transportation, and design of the supply chain. Transportation is a one of the key elements of logistics (Tseng et al., 2005), since it is important to meet the requirements of the customers in a timely manner (Hong Zhao et al., 2010). Other elements include information systems which give information or data necessary for logistics modeling and decision-making; and infrastructure and resources which cover human resources, financial resources, transport and packaging material (Tseng et al., 2005).

Alfred Weber claims that the main criteria to choose the location for new facility is the transportation cost, and that location of an industry should be situated where the transportation costs of raw material and final product is at a minimum (Horner, 2009; Friedrich, 1929).

Other experts (Snyder, 2006; Meyerson, 2001; and Sambidi et al., 2003) say that the most important factor which should be analyzed when choosing right site or location for business is economical costs, such as transportation costs, labor costs and utility costs and that it is necessary to consider all these costs and choose the site with minimum costs. Weaton and Lawson (1985) on the other hand, suggest that aspects such as location analysis, financial analysis, raw material availability and marketing of the products should be conducted when determining location of a processing facility.

The availability of raw material is another important aspect that influences the determination and identification of a location for a processing facility. Raw material should be close to a processing facility and delivered on time in order to meet production schedules (Huam et al., 2010).

It is necessary to consider whether there is sufficient raw material available close to the processing facility and its affordability. On the other hand, it is important to consider how to transport raw material from far away locations cost-effectively to the processing facility.

Labour availability is also an important factor for companies to consider when making location decisions. It is a key component for the success and profitability of a company and it is thereby essential to locate a processing facility close to its labour force (Lemke, 2012). In analyzing labour, other elements such as the skill-level, costs and productivity are also

important to consider. Factors such as need for training of the work-force should also be given careful consideration.

Accessibility to market is also a factor to be considered as it can have effects on distribution costs. Transportation networks are also significant factors that should be analysed when making location decisions as realistic estimates of drive time and distance between the facility and customer should be made (Horner, 2009).

2.4 FOOD PROCESSING FACILITIES

EU Regulation (EC) No 852/2004 defines food processing as any action that substantially alters the initial product, including heating, smoking, curing, maturing, drying, marinating, extraction, extrusion or a combination of those processes. In other words, processing is an action through which a product undergoes changes in properties, appearance, quality or form. Consequently, a food processing facility is an area where all food processing operations take place.

There are several requirements that food processing facilities should meet, in order to ensure good quality and safe food products (Figure 1). These are generally set in national laws and regulations such as Codex Alimentarius and EU Regulation (EC) No 852/2004 as well as quality standards.

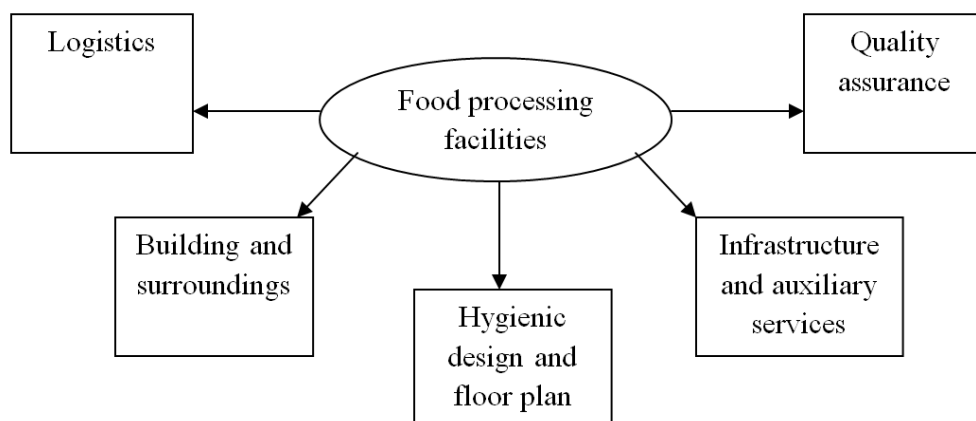


Figure 1. Aspects addressed in legislative requirements and quality standards for food processing facilities

- **Logistics**

There should be an easy access to transportation services such as road, airport, railway and water (FAO, 1996 and FAO, 1994). The conditions of roads should also be such that they do not cause unnecessary delays in the transportation of raw material to the facility, or of processed product to the market (Huam et al, 2010).

- **Building and surroundings**

Food processing facilities should be located in industrial areas or in the countryside and far from sources of contamination such as polluted air and water (FAO, 1994). Trees and bushes should be located at least 10 meters away from processing facility to reduce the probability of their becoming permanent shelter for insects that may infest the food processing facility (Ronald and Erickson, 2005).

Food processing facilities must be constructed in a way that cleaning and disinfecting operations will be easy (Codex Alimentarius, 2009; EC No 852/2004; FAO; 1996 and FAO, 1994) for instance through ensuring the following aspects:

1. Floors in the processing facility must be smooth, easily cleaned and disinfected, non-toxic, non-slippery, and resistant to brine, corrosion and disinfectants. The floor should also be sloped to let used water run out.
2. Walls should be smooth, easily cleaned, disinfected, corrosion resistant, water proof and non-toxic. Also the internal walls of processing facilities should be white-coloured in order to ease observation of dirt.
3. Windows should be easy to clean, disinfect, corrosion resistant, non-toxic and should not allow the entry of dirt and condensation, and shedding of particles. Also there should be removable, easy to clean insect-proof screen on windows. Windows should not have crevices.
4. Ceilings should be smooth, easy to clean and disinfect, non-toxic, even smooth and white coloured. Ceilings should not allow the entry of dirt and condensation, and the shedding of particles.

5. Doors must be smooth, easy to clean and disinfect, non-toxic, white coloured, and have no crevices or cracks.

- **Hygienic design and floor plan**

The flow of operations in a processing facility is important to avoid cross-contamination of products (Codex Alimentarius, 2009; Roland and Erickson, 2005; FAO 1996 and FAO, 1994). Operations which can contaminate foods must be done separately (FAO, 1994). Raw material should be received in one room but stored in another because raw material can carry a large amount of bacteria. Chilling and freezing holds must be separate from hot holds as should dry holds and wet holds. There must also be separate wash and hygiene facilities for equipment and personnel and the presence of toilets and showers is a necessity (FAO, 1994).

The flow of operations should move from unclean areas, where the product is received, to clean areas or high care areas where the final product is stored. This helps to minimize cross-contamination. All items which are used in unclean area need to be separate from items which are used in clean area, for example knives used or clothing worn by personnel in the unclean area must not be used in the clean area. Ventilation systems need to be constructed so that they enable the flow of air from clean to unclean areas.

Visitors to the processing facility should be minimized but when they do occur, should always be directed from clean areas to unclean areas.

- **Infrastructure and auxiliary services**

Food processing facilities should always have constant access to electricity and should, when necessary, have proper heating and air conditioning, and should always have ventilation systems that get rid of unwanted odours and that allow to control the temperature and humidity within the facility (Codex Alimentarius, 2009; FAO, 1996; FAO, 1994).

Food processing facilities should be well-lit for cleaning and sanitizing operations (Roland and Erickson, 2005). In addition, they should have access to potable hot and cold water to meet the needs of workers and for various processing activities (Codex Alimentarius, 2009; FAO, 1996; FAO, 1994).

There should be waste disposal and sewage collection services available. Waste must be stored in a separate place far from the food processing facility to prevent the contamination of products (FAO, 1994). According Campa and Guillen (1999) environmental factors, such as used water, solid waste, play a minor role in identifying plot location for a processing facility in less developed and developing countries.

Health checks for personnel need to be conducted regularly because workers can be transmitters of microbial pathogens such as *Salmonella typhi*, *Shigella* spp and *Escherichia coli*. These pathogens can cause foodborne diseases in human. There have been cases when the infectious and communicable diseases are transmitted through food by infected workers (Tauxe, 2002).

The quality parameters such as appearance, freshness and freedom from harmful bacteria and pathogen (Huss, 1995) in every batch of product need to be checked by veterinary services in order to provide the quality assurance of processed food. Entry of pests into processing area can cause serious problems. Pests can spread foodborne diseases and thus it is important to have pest controlling managements available (Ronald and Erickson, 2005).

- **Quality assurance in food processing facilities**

There are several quality assurance systems that can be followed to ensure the high quality of food products, such as International Standards Organization (ISO 22000), Codex Alimentarius and British Standard for occupational health and safety management systems BS OHSAS 18001.

The Hazard Analysis Critical Control Point (HACCP) systems approach is used by the food processing industry to ensure the production of safe food products. In this system, critical control points or stages in processing that can affect the safety of food are determined and trace and control measures put in place (Australian Quarantine and Inspection Service, 2005; FAO, 1994).

There are 7 main principles of HACCP (Hyder, 2006; Directive No 93/43/EEC):

1. First of all it is necessary to analyze hazards which can be presented in food from farm to fork and analyze possible occurrence of risks during processing of food.

2. With help of identifying Critical Control Points in food processing hazards of food safety can be prevented.
3. There are set Critical Limits by law and Critical Control Points have measurable limits that must meet requirements of the law.
4. There should be planned observations to ensure control of critical limits, in other words monitor Critical Control Points.
5. For unpredictable cases there must be plan B, it is called Corrective Action and it is necessary for the case if there are hazards identified.
6. All above mentioned actions should be recorded. Monitoring Critical Control Points and Corrective actions should be recorded.
7. Documented records of all stages that are important for the system should have verification.

3 OBJECTIVES

The main aim of this thesis is to examine the Kyrgyz fisheries market and to determine the best location for a fish processing facility.

First, a market analysis will be conducted, focusing mainly on the rainbow trout market in the Kyrgyz Republic. The analysis will cover the producer markets, by interviewing the members of two fish producers associations in the Kyrgyz Republic, and the retail market by through a survey of supermarkets, bazaars and fish shops in Bishkek, the capital of the Kyrgyz Republic. Aspects such as potential customers, competitors, product range and their price, and market share will be examined. The analysis shall result in a description of the supply chain of products from producer to the market, covering a view of the logistics for both imported and local fisheries products in the Kyrgyz Republic.

Secondly, the thesis will make a recommendation on a site location for a fish processing facility through a SWOT analysis and a comparative analysis of 4 locations that covers aspects such as logistics, building and surroundings, hygienic design and floor plan of the building, infrastructure and auxiliary services.

This information will provide information on the status of the fish and fisheries products market in the Kyrgyz Republic, the supply chain of fisheries products in the Kyrgyz Republic, and will also provide information on requirements for processing facilities and their location. Recommendations will be made on the basis of this information for the development of the Kyrgyz fish and fisheries products industry.

4 MATERIALS AND METHODS

4.1 MARKET SURVEY

The market survey examined the supply chain of locally produced as well as imported fish and fisheries products, products in the market and their price. Also potential market and promotion tools for fish and fisheries products in the Kyrgyz Republic were determined. The market analysis was conducted based on 4 P's of marketing focusing on Product, Price, Place and Promotion. The market survey covered producer markets and retail markets.

4.1.1 Producer markets

At the time of that this survey was conducted there were two associations of fish farmers in the Kyrgyz Republic: the Fish Farmers Association of Kyrgyzstan and Issyk Kulskie Prudoviki.

The Fish Farmers Association of Kyrgyzstan was found in 2007. There are 25 member companies in this association, of which 18 member companies only produce (farm) fish, 2 member companies process fish only and 3 member companies are engaged in both production and processing of fish (Appendix 1 and Appendix 2). There is also a member company that produces fish feed and one that supplies fish farmers with aquaculture equipment and services.

The Issyk Kulskie Prudoviki Association was founded in 2011. There are 28 members of which 27 are fish farmers all located in the Kara Kol region of Issyk Kul oblast, while 1 member is engaged in fish processing (Appendix 1 and Appendix 2).

4.1.2 Retail markets

The capital of the Kyrgyz Republic, Bishkek, was chosen as a centre to examine the retail market for fisheries products. Seven supermarket chains in Bishkek and the supplier of these supermarkets were selected for survey and face-to face interviews conducted in Russian using a questionnaire (Appendix 3) to determine the main fisheries products and fish species, product price and domestic supply chain of fish and fisheries products. The following is a short over-view of the supermarkets surveyed:

- Narodnyi, founded in 2003, is the largest retail store chain in the Kyrgyz Republic. In total there are 44 stores under this chain, of which 40 are located in Bishkek. The other stores are located in the towns of Kant, Tokmok and Kara-Balta.
- 7 Days founded in 2005. There are 8 stores under this chain and all of them are located in Bishkek.
- Triada founded in 2003. In total there are 7 stores under this chain and all 7 stores are located in Bishkek.
- Semeinyi founded in 2005. There is only one store, which is located in Bishkek.
- Stolica founded in 2011. There is only store and it is located in Bishkek.

Monthly data on fish species, products and prices in supermarkets bazaars and specialized fish stores, collected by researcher Mr. Bektemir Samagonov in the FAO trust fund project “GCP/KYR/003/FIN “Support to fisheries and aquaculture in the Kyrgyz Republic”, was also used to complete this survey.

4.2 LOCATION ANALYSIS FOR A FISH PROCESSING FACILITY

A location analysis determined comparatively the best location for a fish processing facility.

A comparative analysis was conducted of four selected sites (Figure 2). Three of these sites were already functioning fish processing facilities, while one site did not have a fish processing facility in place yet. The sites were selected on the basis of suggestions, by actors in the Kyrgyz fisheries industry, given to the FAO trust fund project “GCP/KYR/003/FIN Support to Fishery and Aquaculture Management in the Kyrgyz Republic”, where consideration was being given to equip and upgrade a fish processing facility.



Figure 2. Sites surveyed for location and comparative analysis to determine the best site for a fish processing facility (modified from United Nations, 2011)

Site 1 is located in Kara Kol town in Issyk Kul. Karakol is the main town in Issyk Kul oblast and is located about 400 km from the capital, Bishkek. Site 1 has a fish processing facility managed by FAIR Ltd. which was founded in 1998 and employs about 60 workers.

Site 2 is located in the Free Economic Zone (FEZ) in Bishkek. The site has a fish processing facility, operated by BANAKO Ltd. This company was founded in 2006 and employs 25 workers.

Site 3 was located in the area “Akun” in Bishkek. This site has an empty building which was being considered for housing a fish processing facility.

Site 4 was located in one of the industrial areas in Bishkek. The site has a fish processing facility operated by WilBi Ltd. This company was founded in 1998 and has 21 workers.

The sites were all evaluated by examining their infrastructure, logistics, building, hygienic design and floor plan, and availability of auxiliary services (Table 4) and comparing their conditions to standards and criteria set in the FAO code of food hygiene, Codex Alimentarius. A site evaluation form (Appendix 4) was drafted for this purpose.

Table 4. Factors examined under site evaluation for a fish processing facility

<p>Logistics:</p> <ul style="list-style-type: none"> • Site surrounding • Access to main road • Access to airport • Access to railway • Nearest main market • Condition of roads • Raw material availability 	<p>Infrastructure and auxiliary services:</p> <ul style="list-style-type: none"> • Electricity • Potable water • Car parking • Waste collection • Sewage collection • Maintenance services of trucks availability • Security (physical security agencies: people and video) • Maintenance services of processing equipment • Health services for inspecting personnel • Veterinary services for checking fish quality • Hygiene training services for personnel • Pest control services
<p>Building and surroundings:</p> <ul style="list-style-type: none"> • Building for the processing facility • The condition of walls • The condition of ceilings • The condition of windows • The condition of doors • The condition of floor • The condition of electrical hardware 	<p>Hygienic design and floor plan:</p> <ul style="list-style-type: none"> • Toilet • Presence of shower • Presence of locker room for personnel • Flow of operations

A SWOT analysis was conducted on each site and based on the comparison of the results of the analysis, the best site was determined. SWOT analysis (Table 5) is an acronym for Strengths, Weaknesses, Opportunities and Threats. It is a tool to analyze the company's internal and external environment in order to design strategy by building on strengths, minimizing weaknesses, using opportunities and opposing threats (Armstrong and Kotler, 2011).

Table 5. SWOT analysis (Armstrong and Kotler, 2011)

<p>Strengths: Internal capabilities the may help a company to reach its objectives</p>	<p>Weaknesses:Internal limitations that may interfere with a company's ability to achieve its objectives</p>
<p>Opportunities:External factors that the company may able to exploit to its advantage</p>	<p>Threats:Current and emerging external factors that may challenge the company's performance</p>

5 RESULTS

5.1 MARKET SURVEY

This phase covered a survey of producer markets and retail markets.

5.1.1 Producer markets

Two fish farmer associations were interviewed: Fish Farmers Association of Kyrgyzstan (FFAK) and Issyk Kulskie Prudoviki Association (IKP).

There are 25 members in FFAK and 7 of them were interviewed giving a respondent rate of 28%. The IKP association has 28 members and 11 of them were interviewed giving a respondent rate of 39%.

The average number of seasonal workers was counted during high seasons for both associations. There are 12 permanent and 18 seasonal workers in FFAK, and there are 9 permanent and 5 seasonal workers in IKP.

There are 10 member companies of IKP are producing fish, one of which doing only recreational fishing business. There are 5 member companies of FFAK are doing fish producing.

Table 6 depicts the factors that motivate the members in each association to establish a fish processing facility.

Table 6. Motivation of fish farmers associations to establish a fish processing facility.

Goals	FFAK		IKP	
	Important (%)	Unimportant (%)	Important (%)	Unimportant (%)
Prolong shelf life of fish	85.7	14.3	90.9	0
Add value	85.7	14.3	72.7	27.3
Get more customers	100	0	81.8	18.2
Increase nutritional value	100	0	90.9	0
Decrease pathogens	57.1	52.9	81.8	18.2
Increase seasonal availability of fish	100	0	90.9	0
Increase assortment	14.3			
Increase yield	14.3			
Learn and use modern technology and equipment			9.1	
Fish feed			9.1	

The most important goal for the FFAK is to attract more customers. The association members do not consider decreasing pathogens in fish as a motivation to start a fish processing facility and in fact, pointed out that in their opinion fish in the Kyrgyz Republic does not have pathogens or diseases. Also, members of FFAK mentioned that with having a fish processing facility they want to increase product range on the market.

IKP is motivated by almost all mentioned factors (Table 6) to start fish processing facility. Also, the association members mentioned that there is a need for trainings on modern technology and equipment for fish processing and there is critical need to produce fish feed in the Kyrgyz Republic. One respondent was not interested in fish processing because their focus is in producing fry.

The main fish species produced by members of FFAK is rainbow trout while IKP produces cyprinids species (Table 7).

Table 7. Fish production indexes in the fish farmers' associations.

Association	Fish species	Latin names	Tonnes per year	High season (months)	Purposes
FFK	Rainbow trout	<i>Oncorhynchus mykiss</i>	432 tonnes	Whole year	Human consumption
	Sevan trout	<i>Salmo ischchan</i>	400 000 fish	April & May	Conservation of species
IKP	Grass carp	<i>Ctenopharyngodon idella</i>	2.5 tonnes	April, May, July, August & September	Human consumption, Recreational fisheries, Brood stock, Stocking for conservation of endemic species & Feed for animals
	Common carp	<i>Cyprinus carpio</i>	4.5 tonnes		
	Mirror Carp	<i>Cyprinus carpio carpio</i>	0.15 tonnes		
	Whitefish	<i>Coregonus lavaretus</i>			
	Crucian carp	<i>Carassius carassius</i>	0.15 tonnes		
	Bream	<i>Abramis brama</i>	0.15 tonnes		
	Silver carp	<i>Hypophthalmichthys molitrix</i>	2.5 tonnes		
Pikeperch	<i>Sander lucioperca</i>	2.5 tonnes			

FFAK produces more rainbow trout (432 tonnes per annum) than IKP (about 13 tonnes per annum). One company in FFAK produces sevan trout (*Salmo ischchan*) for conservation of endemic species in Kyrgyz waterbodies. The production purposes of IKP association are quite wide, including recreational and fish feed purposes (Table 7).

FFAK has 18 workers that are qualified to process fish and fisheries products in a comparison to IKP that has only 4 workers are qualified to process fish and fisheries products .

FFAK uses a wide range of fish species for processing (Table 8), with the most popular processed species being herring (2000 tonnes per annum) with the highest seasons in July and August. IKP processes five different fish species (Table 8) with Alaska Pollock holding the highest amount of fish processed (80 tonnes per annum). Mainly, fish is processed for human consumption but IKP also produces animal feed from generated fish waste material. Processing methods applied include smoking, freezing and salting. Whole fresh fish and preserves are also found on the product range in IKP. IKP mainly gets its raw material from Norway and Russia, while FFAK members use their own locally produced rainbow trout in addition to buying raw material from Latvia, Norway, Russia and Kazakhstan.

Table 8. Fish processing indexes in the fish farmer's associations and origin of raw material

Association	Fish species	Latin names	Tonnes per year	High season months	Purposes	Method of processing	Origin of fish
FFAK	Rainbow trout	<i>Oncorhynchus mykiss</i>	205	December- September		Whole fresh, Smoked & Frozen whole	Kyrgyzstan
	Capelin	<i>Mallotus villosus</i>	40	Whole year		Smoked	Norway
	Salmon	<i>Salmo salar</i>	70			Salted	Latvia
	Mackerel	<i>Scomber scombrus</i>	108	October- March, July & August	Human consumption	Smoked	Russia, Latvia
	Herring	<i>Clupea harengus</i>	2000			Smoked, Frozen whole & Salted	Latvia, Norway
	Escolar	<i>Lepidocybium flavobrunneum</i>	50	October- March		Smoked	Latvia
	Humpback salmon	<i>Oncorhynchus gorbuscha</i>	50	November-February, July & August		Smoked, Frozen whole & Salted	Russia
IKP	Herring	<i>Clupea harengus</i>	50	October, November, December, January, February, March & April	Human consumption & Feed for animals	Whole fresh fish, Smoked fish, Frozen fillet, Preserves & Salted fish	Russia/ Norway
	Capelin	<i>Mallotus villosus</i>	30				
	Humpback salmon	<i>Oncorhynchus gorbuscha</i>	50				
	Chum salmon	<i>Oncorhynchus keta</i>	50	June, July, August & September			
	Alaska pollock	<i>Theragra chalcogramma</i>	80				

Members of FFAK use plastic or paper bags, metal or plastic or glass containers, vacuum packing, and boxes (wooden or plastic for packaging). Sometimes fish is without any packaging. Members of IKP use plastic or paper bags, metal or plastic or glass containers, vacuum packing, boxes (wooden or plastic), and bucket (plastic). Again, some do not package their products at all.

Some FFAK members hope to expand their product range to deal with fish roe in the future. In the future, however, this association will still mainly use rainbow trout for their future products (Table 5). IKP aims to continue the use of Cyprinids species for their product and aim to use pikeperch (*Sander lucioperca*), whitefish (*Coregonus lavaretus*), Oriental bream (*Abramis brama orientalis*), Issyk Kul (Sevan) trout, herring, humpback salmon (*Oncorhynchus gorbuscha*) and capelin (*Mallotus villosus*) in the future as a raw material for processing (Table 9).

Table 9. Products and fish species of future interest to fish farmers associations in the Kyrgyz Republic

Association name	Future products	Species for future products
FFAK	Live, Dried, Whole fresh, Salted, Smoked, Canned, Frozen whole, Marinated fish, Frozen fillet, Fresh fillet, Roe	Rainbow trout, Herring, Salmon, Hunchback salmon
IKP	Live, Smoked, Frozen whole, Dried, Salted, Whole fresh, Marinated, Canned fish, Frozen fillet, Fresh fillet	Common carp, Grass carp, Silver carp, Pikeperch, Whitefish, Crucian carp, Oriental Bream, Mirror carp, Issyk Kul (Sevan) trout, Herring, Hunchback salmon, Capelin

At the farm, the price for rainbow trout according to one of seven respondents from FFAK, is about 450 soms. Product prices were not given by IKP.

IKP sells its production only in the Issyk Kul region, while sales of FFAK are directed to every region in the Kyrgyz Republic and also covers foreign markets such as Kazakhstan, Uzbekistan and Russia. One IKP member has mobile shops while some FFAK members have specialized fish shops.

FFAK members intend to keep to their current strategy in supplying Kazakhstan and Russia. IKP members want to supply markets in each region of Kyrgyz Republic and markets of foreign countries like Finland, Germany, Poland and Kazakhstan. Both FFAK and IKP members use their own trucks and own cars to deliver products. FFAK members also use transportation companies' services to deliver their products to the market. FFAK members, in comparison, have only 5 trucks. These are equipped with refrigeration and freezing systems, and with water containers. IKP members hold in total 13 trucks, 12 of which are equipped with refrigeration systems and water containers. From Table 10 it can be seen that the association of FFAK delivers its fish and products to the market every day and customers pick up their products from the farms or processing facility every day. IKP delivers its fish and products to the market every day and customers pick up their products from the farms or processing facility every day.

Table 10. Market factors in Fish Farmer Association of Kyrgyzstan and Issyk Kulskie Prudoviki

Association	Market (location)	Future market	Customers	Delivery of the products	Number of trucks owned	How trucks are equipped	Times delivered and picked up
FFAK	Around Kyrgyzstan, Kazakhstan, Uzbekistan & Russia	Around Kyrgyzstan, Kazakhstan, Russia	Wholesalers, Fish shops, Supermarkets/ glossary shops, Restaurants/ café, Bazaars & Public sectors	Own trucks, transportation companies, customers picked up	5	Refrigeration system, Water containers, Freezing system	Everyday
IKP	Issyk Kul	Around Kyrgyzstan, Kazakhstan, Poland, Germany, Finland	Wholesalers, Supermarkets/ glossary shops, Restaurants/ café, Bazaars, Public sectors & Own mobile shops	Own trucks, own car & customers picked up	13	Refrigeration system, Water containers, Doesn't equipped	Everyday

The pathway of imported fish from Norway to Kyrgyz Republic (Figure 3) was determined through discussions with fish farmers and processors.

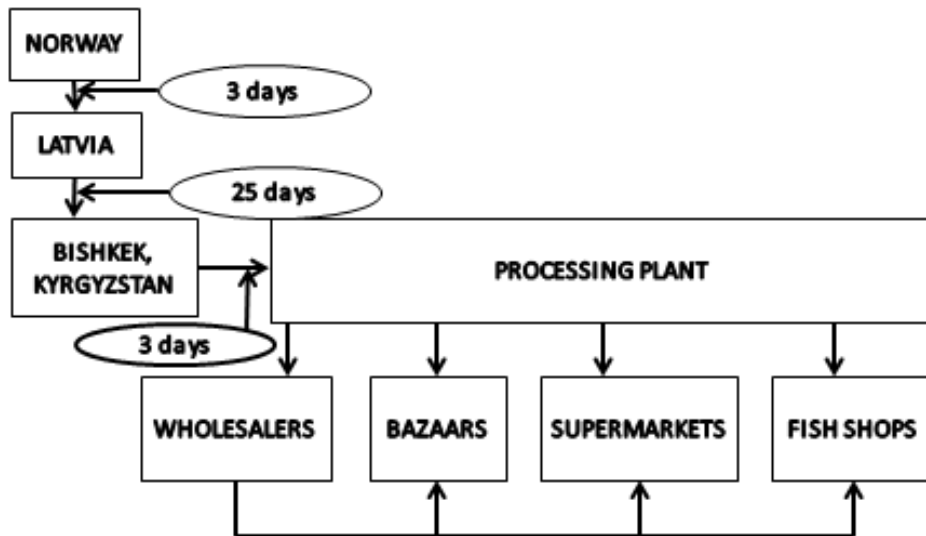


Figure 3. The pathway of fish imports to the Kyrgyz Republic

Kyrgyz fish processors have agreements with Latvian suppliers, who in turn obtain raw material from Norway. Kyrgyz fish processors order raw material from Latvia and payments are completed through banks. Delivering fish from Norway to Latvia takes 3 days by boat. This is followed by delivery from Latvia to Bishkek, by rail, which takes 25 days. Registration and custom clearance processes in Bishkek take 3 days. Processing facilities located in Bishkek, transport raw material straight from the warehouse to the processing facility with their own trucks which are equipped with freezer systems. Processed products are delivered to supermarkets, bazaars, fish shops and restaurants by the processors using their own trucks and sometimes wholesalers pick up products from the processing facility using their own trucks.

FFAK members use flyers, billboards, posters and online marketing to promote their products and services. IKP do not promote their products actively through mass media but one member company has been written about in newspapers and appeared on television.

5.1.2 Retail markets

There are 7 supermarkets in Bishkek of which 5 were interviewed giving a respondent rate of 71.4%.

During this survey all supermarkets declined to give any information about the amounts and values of fish and fisheries products sold in their supermarkets. The description of the market share (Figure 4) is based on supplier sales values of fish and fisheries products to supermarkets located in Bishkek in 2011. Only 10% of all fisheries products were sold in supermarkets in 2011. Other 90% of total production was sold in specialized fish shops and bazaars.

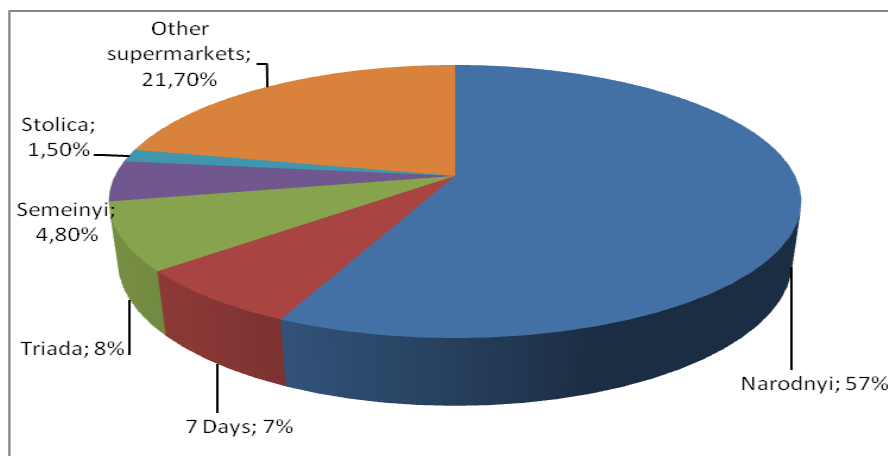


Figure 4. Market share of fish and fisheries products in supermarkets in Bishkek

The absolute fish and fisheries products sales leader among supermarket is the Narodniy chain in Bishkek (57% of market share), followed by the Triada chain and 7 Days. About 22% of fish and fisheries products were sold in other smaller supermarkets that were not covered by the survey.

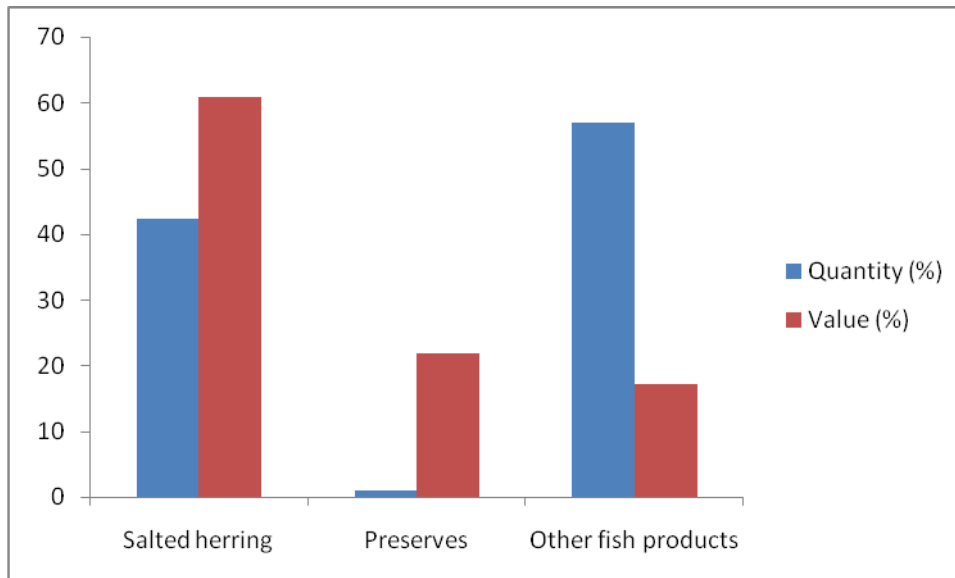


Figure 5. Proportional amount and value of annual fish and fisheries products sold in Bishkek supermarkets in 2011

The most popular fish and fisheries products, by amount was salted herring which makes about 42.4% of total amount of sales in tonnes in 2011 to supermarkets (about 3 092.5 tonnes). Preserves follow closely with 1% of total amount sales in tonnes in 2011 to supermarkets (about 16.9 tonnes). Other fish and fisheries products for example smoked herring, smoked saury and dried roach make up more than 57% of the total sales quantity in tonnes to supermarkets in 2011 (about 4 100.8 tonnes). A comprehensive list of these fish and fisheries products is compiled in Appendix 5 (Table 4).

Also Figure 5 shows the most popular fisheries products. They are fish preserves, about 21.88% (about 43 418 euros) of total value sales and other fisheries products compiled 17.24% (about 34 210.5 euros) from total value sales in supermarkets in 2011. There are other products such as fish roe, fish fillets, shrimp and smoked capelin with its value (%) and quantity (%) which is presented in Appendix 5 (Table 4).

Of the supermarket chains interviewed, 2 out of 5 are satisfied with their current product range and are not intent on making changes. The other 3 supermarkets are willing to change their range of fish and fisheries products. Canned fish and fisheries products and whole frozen fish are of interest to 2 supermarkets. Rainbow trout has not been excluded as a potential future products. In addition, 1 supermarket is willing to include all types of fish and fisheries products including rainbow trout.

Supermarkets depicted factors on how they choose the supplier of their fish and fisheries products (Table 11).

Table 11. Supplier selection factors used by supermarkets

Aspects	Stolica	Semeinyi	Triada	7 Days	Narodnyi
Quality of the product	+	+	+	+	+
Price	+	+	+	+	+
Quality certification	+	+	+	+	+
Meet customer wants		+		+	+
Popularity of the brand				+	+
Recommendations					+
Trial sales					+

There are requirements of supermarkets for processor and their products:

Supermarkets have own list of requirement on quality of products, products quality should meet those requirements. Mainly they focus on sensory characteristics such as a colour, odour and appearance

The price for new product should be affordable for consumers and it will be agreed by both sides.

Processor should have quality certification from authority which gives quality certifications.

One of the important aspects is popularity of the brand. The brand of processing company should be popular among customers.

Processor should have recommendations from health authorities and product should be healthy and safe. Also supermarkets would like to have trial sales to check out whether the product meets customer's wants or not.

Company or processor's proposals or presentation of new product will be considered in selection of new supplier for supermarkets.

The average prices for fresh rainbow trout in bazaars and specialised fish shops in Bishkek (2011-2012) was determined (Figure 6).

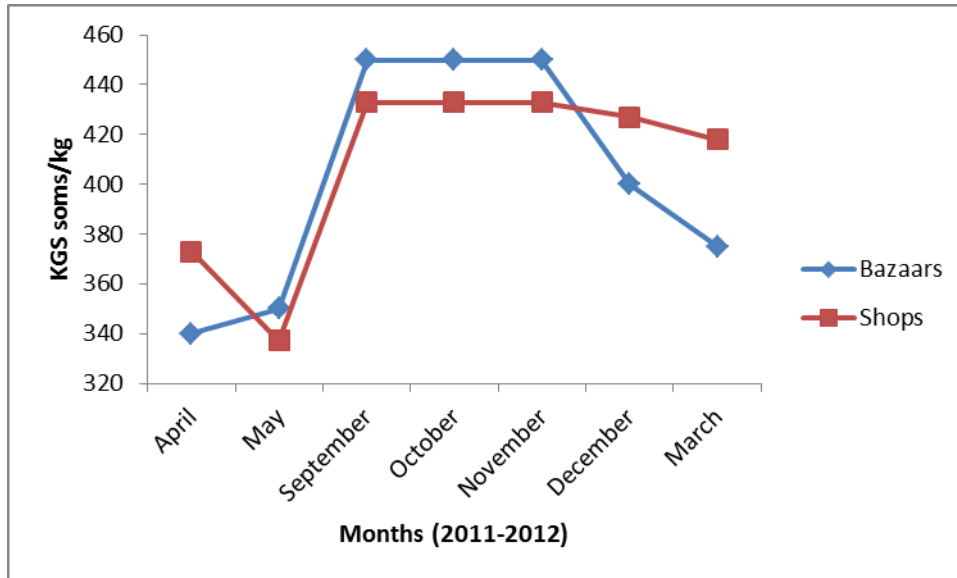


Figure 6. Average price for rainbow trout in bazaars and in specialized fish shops

This figure shows that the price for rainbow trout is higher in May, September, October and November in bazaars compare to the price in specialized fish shops. However, the price for rainbow trout is higher in specialized fish shops compare to the price in bazaars in April, December and March. The price for rainbow trout is higher in specialized fish shops (418 soms/kg) in March, 2012 compare to supermarket price (415 soms/kg) in March, 2012 (Table 18 in Appendix 5). However it is lower in bazaars (375 soms/kg) in March, 2012 compare to supermarkets price. There are other products such as fish roe, fish fillets with their prices which is presented in Appendix 5 (Table 3).

Like the price of rainbow trout, the price for fresh common carp (*Cyprinus carpio*) is also high in September, October and November 2011, after which it falls in specialized fish shops as well as in bazaars (Figure 7). However the price of fresh common carp in March 2012 is quite high in specialized fish shops (250 soms/kg) compare to the price in bazaars (165 soms/kg) and to the price in supermarkets (238 soms/kg) (Table 3 in Appendix 5). Fresh common carp price in specialized fish shops is lower in April and May 2011 compare to bazaar prices while in other months the price for common carp in specialized fish shops is higher than those in bazaars.

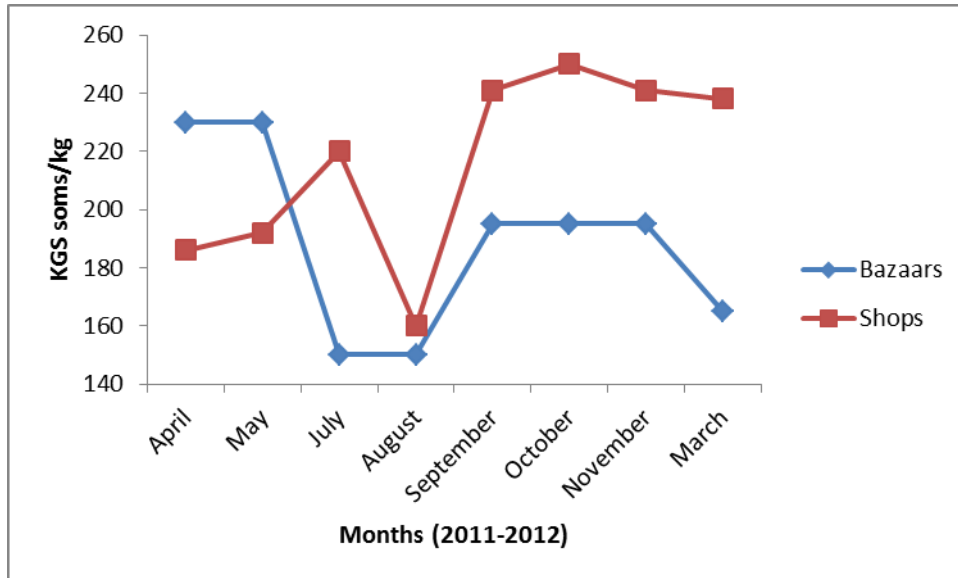


Figure 7. Average price for common carp in bazaars and in specialized fish shops

The average prices of salted herring (2011-2012) in bazaars and specialised fish shops was also determined (Figure 8).

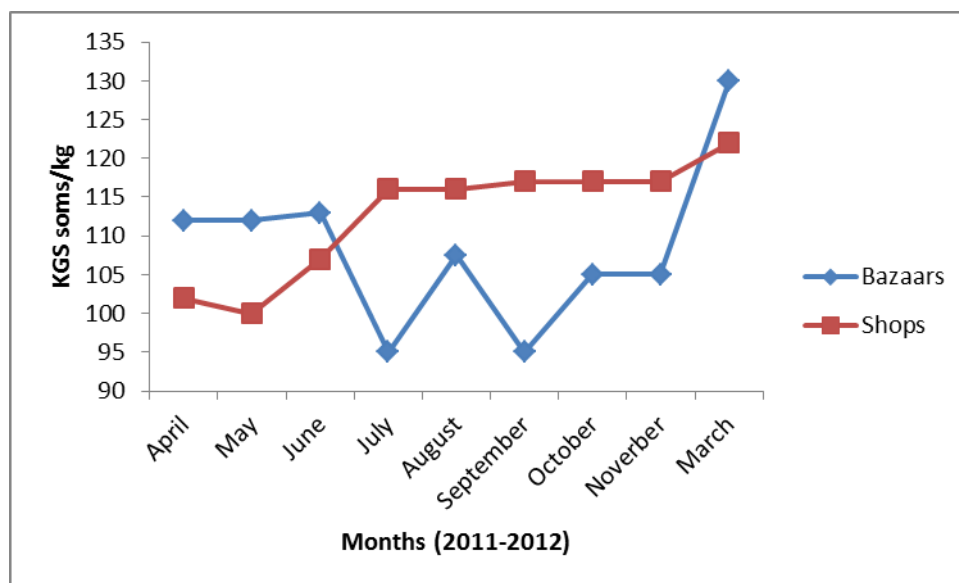


Figure 8. Average price for salted herring in bazaars and in specialized fish shops

The price for salted herring in bazaars was not stable during the period 2011-2012. In July 2011 the price in bazaars falls while in specialised fish shops the price goes up. The price for salted herring in March, 2012 in supermarkets higher (143 soms/kg) (Table 3 in Appendix 5) compare to the price in bazaars (130 soms/kg) and specialized fish shops (122 soms/kg). The

price for salted herring is higher in bazaars on March (2012), April and May (2011) but it is lower in other months compare to the prices in specialised fish shops.

The average prices for smoked salmon (2011-2012) in bazaars and specialised fish shops in Bishkek was also determined (Figure 9).

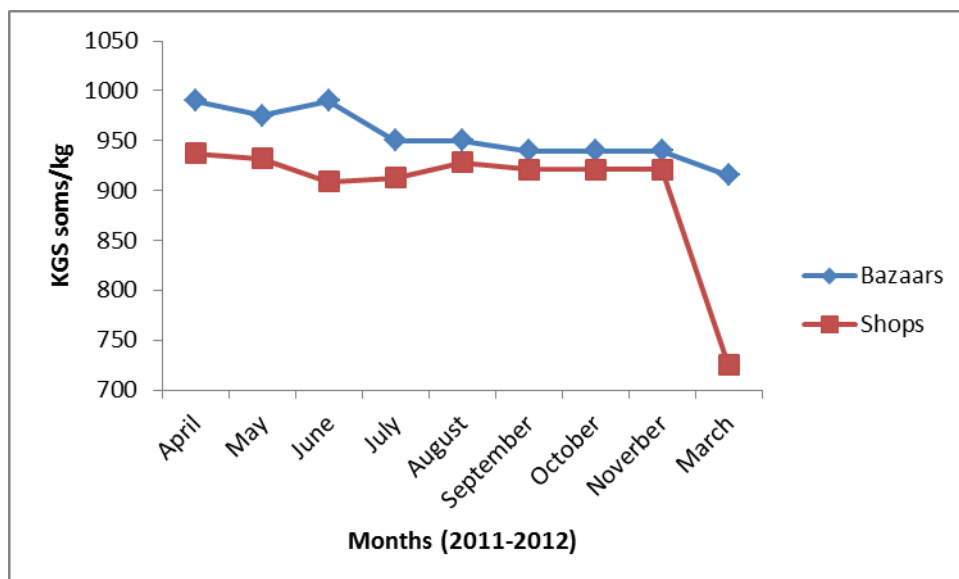


Figure 9. Average price for smoked salmon in bazaars and in specialized fish shops

Smoked salmon is the most expensive fish product on the Bishkek market. The supermarket price for smoked salmon is higher in March, 2012 (1125 soms per kg) (Table 3 in Appendix 5) compare to the price in bazaars (915 soms/kg) and specialized fish shops (725 soms/kg) in March, 2012. Also, the bazaar price for smoked salmon is higher compared to the price in specialized fish shops.

A comprehensive list of fish and fisheries products and their prices in bazaars, specialized fish shops and supermarkets in Bishkek is compiled in Appendix 5 (Table 1, Table 2 and Table 3).

The peak season for fish and fisheries products in all supermarkets is winter, especially during the New Year holiday period (Table 12). Two suppliers deliver fish and fisheries products to supermarkets using their own trucks equipped with refrigerator system.

Table 12. Selling information, supplier and delivery of fisheries products in supermarkets 2011

Supermarket	Peak fish selling season	Supplier	Delivery
Narodnyi	Winter (New Year holiday period)	Supplier 1	
7 Days	Winter (New Year holiday period)	Supplier 1	Supplier (own trucks with refrigerator system)
Triada	Winter (New Year holiday period)	Supplier 2	
Semeinyi	Winter (New Year holiday period)	Supplier 1	
Stolica	Winter (New Year holiday period)	Supplier 1	

The domestic supply chain of rainbow trout in the Kyrgyz Republic was determined (Figure 10).

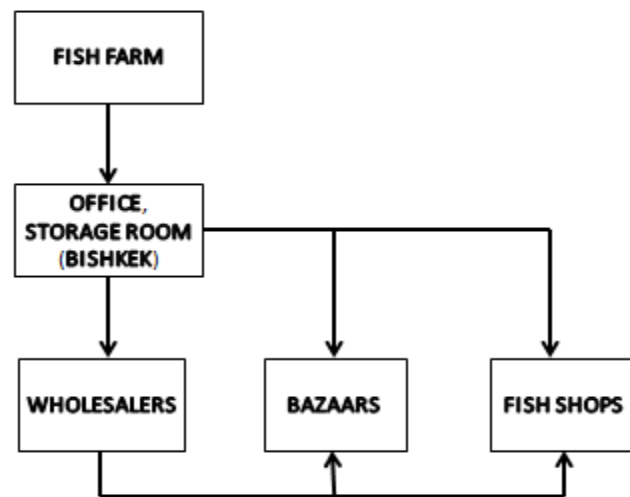


Figure 10. Domestic supply chain of fish

Fish is transported by truck from fish farms to storage rooms or offices in Bishkek. The transportation time varies depending on location of the farm, for example from Issyk Kul and Toktogul regions to Bishkek transportation time takes 6-8 hours, from Chui region to Bishkek takes 1-2 hours and from Bishkek farm to office less than 1 hour.

Mostly farmers deal with wholesalers in Bishkek who come to the Bishkek storage room or office and to collect the fish. Wholesalers distribute fish to bazaars and fish shops but sometimes retailed in bazaars and fish shops also collect fish from wholesalers.

Through observation it was determined that supermarkets in Bishkek use billboards and sometimes television advertisements to promote their products. Only one supermarket has its own web site. Some supermarkets have advertisement in social media.

To summarize the market research results, it can be concluded that there are several nuances to marketing rainbow trout in the Kyrgyz Republic (Figure 11) beginning with the logistics of distributing product from the farm to the supermarket and factors that affect the chain of distribution.

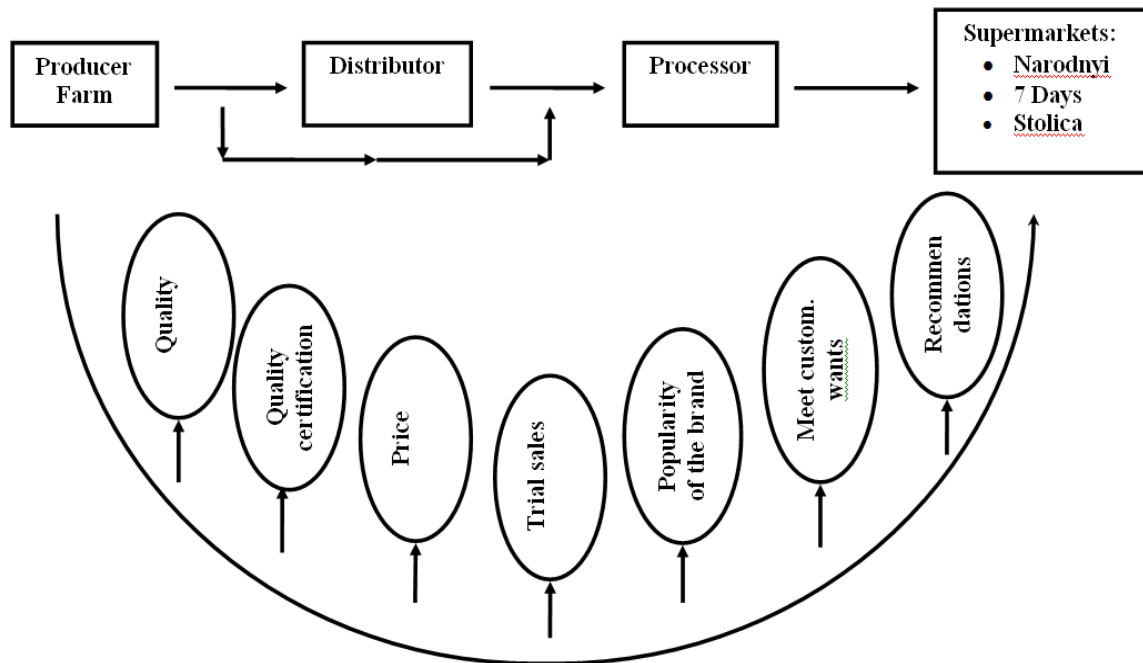


Figure 11. Factors affecting the supply chain of rainbow trout from producer to supermarket in the Kyrgyz Republic

5.2 LOCATION ANALYSIS FOR A FISH PROCESSING FACILITY

The members of FFAK and IKP were asked to rank aspects that they considered important for deciding upon the location of a fish processing facility. The results show that the most important aspects for members of FFAK are infrastructure, availability of electricity, potable water, waste and sewage collection, of the building for a fish processing facility. The building and surroundings, hygienic design and floor plan are important factors in designing a fish processing facility according to IKP association members (Table 13).

Table 13. The importance of requirements for the fish farmers associations in the Kyrgyz Republic in regard to deciding the location of a processing facility

Goals	FFA		IKP	
	Important	Unimportant	Important	Unimportant
Logistics	85.7	14.3	90.9	9.1
Building and surroundings	85.7	14.3	100	0
Hygienic design and floor plan	85.7	14.3	100	0
Infrastructure	100	0	90.9	9.1
Auxiliary services	85.7	14.3	90.9	9.1

5.2.1 Site evaluation

- **Evaluation of Site 1**

Logistics

Site 1 is located only 5 meters away from the main road Kara Kol. The distance between this site and airport is about 450 km and the distance between the facility and the railway station is about 220 km. Fish and fisheries products are sold through mobile shops around Issyk Kul. The condition of roads is not good. The asphalt is old and has potholes. The main raw material suppliers for the site 1 are Russia and Norway.

Building and surroundings

Site 1 is fully functional fish processing facility. The condition of walls, ceilings, windows, floor, doors and the electrical hardware inside the building do not meet Codex Alimentarius standards. Walls and ceilings are not smooth, have uneven surfaces, and have crevices. There are cracks on the window frames, the windows have no screens and paint cracks off the windows. Wooden and uneven surfaces make cleaning procedures difficult. The surface on doors is smooth, but is uneven and has rust stains. The floors are smooth and made from cement but have crevices. The electrical hardware inside the building should be redone or changed because it is not installed inside the wall or have not been covered with safe coverings.

Hygienic design and floor plan

Figure 12 shows the floor plan in site 1. There are outside refrigerators where raw material is stored. Raw material is brought from these refrigerators to the defreezing area. Defrosted fish is transferred to an outside smoking room. Processes such as preparation and defreezing of raw material, and salting are carried out in one room. Toilets, showers and the locker room on this site do not require repair however, lockers require repair and there is no adequate space to change clothing in locker rooms. The location of the toilets is not in direct connection to fish processing and product preparation areas. All clean and dirty clothing and shoes are stored together in the same place. The flow of operations is such that workers have to go in and out several times to get produce ready products. Dirty areas are not separated from the clean areas and can cause cross- contamination of products

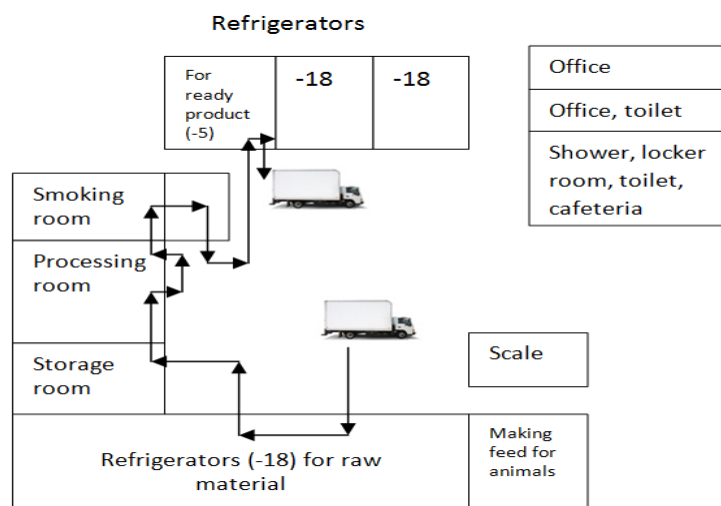


Figure 12. Floor plan of Site 1 (arrows show the flow of operation)

Infrastructure and auxiliary services

Electricity, potable water, and sewage collection services are always available in Site 1. Also, there is ample space for car parking. This site does not need waste collection agency, because all the generated waste is used for animal feed which is subsequently used for feeding the company's own fish grow in ponds (Arykova, 2013 unpublished).

Auxiliary services are available and accessible within the same village/city where this site is located. These services include following:

- Maintenance of trucks
- Security (physical security agencies: people and video),
- Maintenance services of processing equipment
- Health examination for personnel e.g. salmonella checks or other checks for microbial infections which can cause food safety pathogens
- Veterinary services for checking fish quality
- Hygiene training services for personnel
- Pest control services

For the maintenance of processing equipment this facility uses its own electrician.

- **Evaluation of Site 2**

Logistics

Site 2 is located about 300 meters away from the main road Imenaliyev Street in Bishkek, the capital of the Kyrgyz Republic. The condition of the roads is unsatisfactory. The asphalt is old and has potholes. This site is located about 38 km away from the airport, about 10 km away from the railway station and this site about 11 km away from its main market. The raw material suppliers for site 2 are Russia, Latvia and sometimes they use local fish products.

Building and surroundings

Site 2 is a fully functional fish processing facility. The condition of walls, ceilings, floor and doors do not meet Codex Alimentarius standards. The walls of this site are smooth with mostly even surfaces but have crevices which makes cleaning and disinfection difficult. The ceilings are smooth with mostly even surfaces, made from various materials cement, plastic and metal. Some crevices are however visible on doors. The doors are made from both metal, and plastic and their surfaces are uneven. The floor is made from cement and has crevices.

The electrical hardware is installed inside the wall, but there are a few places where it is open and unsafe. The condition of the windows of the facility at this site is up to Codex Alimentarius standards. They are smooth, plastic and easy to clean and disinfect.

Hygienic design and floor plan

The floor plan of Site 2 is depicted in Figure 13. Raw material comes into a storage room after which it is transferred to the preparation and defreezing area. After thawing raw material is transferred to a salting room and then to a smoking room. These rooms are separated by

doors and there is no need to go in and out, using the same door, to move forward. Nevertheless, in order to get to the cooling room one needs to exit the smoking room through the same door one enters. However, the cooling room is near the storage room for ready product. There are two ways to exit the cooling room: first is directly to the storage room for ready product and the second is through a packaging room and then to the storage room for ready product.

Site 2 has toilets, shower and a locker room which do not require repair however, lockers for personnel require repair and there is no adequate space to change clothing in locker room. The location of the toilets is not in direct connection to fish processing and product preparation areas. Clean and dirt clothing and shoes are stored together in the same place.

The big plus in Site 2 is that all processing functions take place under one roof and the flow of operations is such that dirty areas and clean ones are separated from each other.

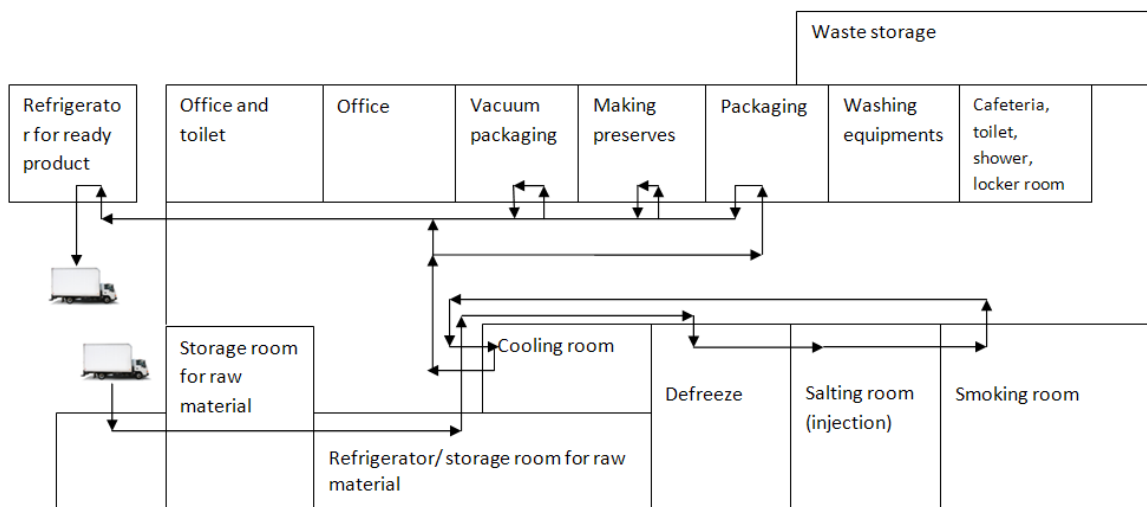


Figure 13. Floor plan of Site 2 (arrows show the flow of operation)

Infrastructure and auxiliary services

Electricity, waste collection agency and sewage collection services and potable water are always available in Site 2. There is also ample space for car parking. All the following auxiliary services are available and accessible within the Free Economic Zone where the facility is located:

- Maintenance of trucks

- Security (physical security agencies: people and video),
- Maintenance services of processing equipment
- Health examination for personnel e.g. salmonella checks or other checks for microbial infections which can cause food safety pathogens
- Veterinary services for checking fish quality
- Hygiene training services for personnel
- Pest control services

For the maintenance of processing equipment the company uses their own electrician.

- **Evaluation of Site 3**

Logistics

Site 3 is located about 100 meters away from the main road Den Xiaoping Avenue in Bishkek, the capital of the Kyrgyz Republic. The roads are old and have potholes and the road requires repair. The distance between this site and the airport is about 28 km, while the distance between the railway station and the processing facility is about 30-40 meters and the distance between its main market and site 3 is 11 km. The company plans to process locally produced fish from Issyk Kul in the future.

Building and surroundings

Site 3 is empty building, which requires much more changes compare to the other sites evaluated. The walls, ceilings and floor are made from cement, are not smooth and have uneven surfaces. There are no windows, there are no internal doors and there is no electrical hardware inside the building yet.

Hygienic design and floor plan

Site 3 is an empty building and thus has no processing rooms, no toilet, shower or locker rooms but there is ample space to build them.

Infrastructure and auxiliary services

Electricity, potable water, waste collection agency and sewage collection services are all available at this Site. There is ample space for car parking in this area and the roof of the building needs to be repaired. All following auxiliary services are available and accessible within the same region where processing facility is located:

- Maintenance of trucks
 - Security (physical security agencies: people and video),
 - Maintenance services of processing equipment
 - Health examination for personnel e.g. salmonella checks or other checks for microbial infections which can cause food safety pathogens
 - Veterinary services for checking fish quality
 - Hygiene training services for personnel
 - Pest control services
-
- **Evaluation of Site 4**

Logistics

Site 4 is located 50 meters away from the main road Toygonbaeva Street in Bishkek, the capital of the Kyrgyz Republic. The roads are not good, with old and potholed asphalt. Site 4 is 15 km away from the airport, about 3 meters away from the railway station and less than 11 km away from its own main market in Bishkek. Russia and Norway are the main raw material suppliers for this site.

Building and surroundings

Site 4 is a fully functional fish processing facility. The condition of walls, door, floor, ceilings, windows and electrical hardware inside the building do not meet Codex Alimentarius standards. Walls, floor and ceilings are not smooth, have an uneven surface, and have crevices. There are cracks on the window frames; there are no screens on the window and paint cracks off the windows. Wooden and uneven surface makes cleaning and disinfecting processes difficult. Some rooms have no doors and the doors seen were mostly wooden, not smooth and had cracking paint. The electrical hardware inside the building should be redone or changed because it is not installed inside the wall and has not been covered with safe sheet.

Hygienic design and floor plan

The floor plan for Site 4 is depicted in Figure 14. There is no storage room for raw material at this site. Raw material comes in straight to either the salting room or defreezing room. Following, defrosted fish goes via elevator to the second floor to the drying room or to smoking room, preserves making room or paté making room. Following, it goes via the elevator to the first floor or through packaging room. Ready products are stored in a

refrigerator for ready products. Preparation areas of this site are located in different parts of the building. There are toilets, shower and locker room, in Site 4, which should be repaired because they are broken and rusty. Toilets are not in direct connection to the fish processing and product preparation areas. All clean and dirt clothing and shoes are stored together in the same place. There is adequate space and facilities to change clothing in locker rooms but lockers should be repaired. Dirty areas are not separated from clean areas and it can cause cross- contamination of the products.

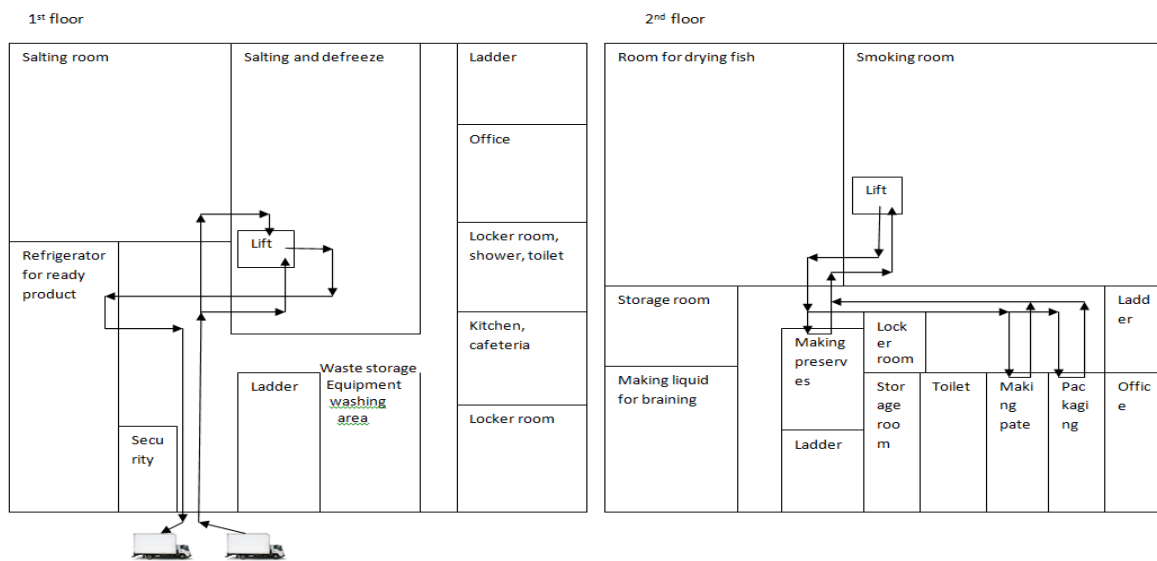


Figure 14. Floor plan of Site 4 (arrows show the flow of operation)

Infrastructure and auxiliary services

Electricity, potable water, waste collection agency and sewage collection services are available at this site. There is ample space for car parking. All following auxiliary services are available and accessible within the region where this site is located:

- Maintenance of trucks
- Security (physical security agencies: people and video),
- Maintenance services of processing equipment
- Health examination for personnel e.g. salmonella checks or other checks for microbial infections which can cause food safety pathogens
- Veterinary services for checking fish quality
- Hygiene training services for personnel
- Pest control services

For the maintenance of processing equipment the company uses its own electrician.

5.2.2 SWOT analysis and comparison of sites

A SWOT analysis was conducted to determine the strength, weaknesses, opportunities and threats of sites (Table 14). From the analysis it can be seen that all the sites are located close to logistics services except Site 1, which is far from both the railway station and the airport. All the sites have access to auxiliary services such as:

- Maintenance of trucks
- Security (physical security agencies: people and video),
- Maintenance services of processing equipment
- Health examination for personnel e.g. salmonella checks or other checks for microbial infections which can cause food safety pathogens
- Veterinary services for checking fish quality
- Hygiene training services for personnel
- Pest control services

Mobile shops of site 1 are a good type of delivering services, it helps to reach remote communities and get more/new customers. Also there is ample space to build all necessary facilities in site 3.

Sites 1 and 4 are inadequate in regard to flow of operations which pose great risks of cross-contamination during processing of fish. Site 2 also has inadequacies in regard to flow of operations, but not as much as in Sites 1 and 4. Also the hygiene practices of personnel cause doubt that processed product is safe for consumption. Employees at Site 1, Site 2 and Site 4 do not observe good hygiene practices: employees do not change shoes, clothing which they are wearing outside and they do not use protective clothing during processing.

All the sites need to pay attention to the condition of the buildings, surfaces need to be even without crevices and should be easy to clean and disinfect. Cracking paint should be removed and renewed in order that products are not contaminated.

Site 1 is located in residential, urban area, which is against the standard requirements. Also, the distance between this processing facility and railway and airport are far. In this case there is no problem with pest control services. However, during observation it was seen that pest control services have not visit Site 1 and Site 4 because these sites do not protected against pests: there are holes on windows, no presence of screen and there are holes in the roofs. Also there are no problems with all considered auxiliary services, as they are available in all sites.

Table 14. SWOT analysis of the fish processing facility sites

SITE	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Site 1	<ul style="list-style-type: none"> Fully functional processing facility Close to the main road Availability of main services (electricity, potable water, and sewage collection services) Car parking, toilets, showers, and locker rooms do not require repair issues Toilets are not in direct connection with processing and preparing areas Availability of auxiliary services(maintenance of trucks, security, maintenance services of processing equipment, health services, veterinary services, hygiene training services) No waste No competitors With mobile shops they can reach remote communities and get more consumers 	<ul style="list-style-type: none"> Lockers are broken Floor plan, flow of operations does not flow according standard requirements, it can cause cross contamination of products Clean and dirty clothing stores in the same place and it can cause cross-contamination The doors, windows, ceilings, walls and electrical hardware of the facility need renovation The facility is located in urban area 	<ul style="list-style-type: none"> With repairing of roads the transport of products will be more efficient Repairing and renovation of facility 	<ul style="list-style-type: none"> Railway and airport are too far Raw material supplier is threat due to the entry of Kyrgyzstan into the customs union Importers of fish meet big rate of taxes
Site 2	<ul style="list-style-type: none"> The facility is located in Free Economic Zone Fully functional processing facility Availability of the main services The main road and market, airport, railway are close to the facility Toilets, showers, car parking, windows do not need renovation Toilets are not in direct connection with processing and preparing areas Floor plan and flow of operations according requirements Availability of auxiliary services 	<ul style="list-style-type: none"> Lockers are broken Clean and dirty clothing stores in the same place and it can cause cross-contamination 	<ul style="list-style-type: none"> With repairing of roads the transport of products will be more efficient Workshops, trainings and consulting are available in Bishkek There are few fish processors in KR consequently there is little competition Repairing and renovation of facility 	<ul style="list-style-type: none"> Raw material supplier is threat due to the entry of Kyrgyzstan into the customs union Importers of fish face high rate of taxes
Site 3	<ul style="list-style-type: none"> The building is located in industrial area The main road, airport, railway are close to the facility Availability of the main services Availability of auxiliary services Ample space for all facilities 	<ul style="list-style-type: none"> Empty building 	<ul style="list-style-type: none"> With repairing of roads the transport of products will be more efficient Workshops, trainings and consulting are available in Bishkek 	<ul style="list-style-type: none"> There are big fish processing companies which can be competitor for new processing facility
Site 4	<ul style="list-style-type: none"> The facility is located in industrial area Fully functional processing facility The main road, airport, railway are close to the facility Availability of the main services Car parking does not require renovation Toilets are not in direct connection with processing and preparing areas Availability of auxiliary services 	<ul style="list-style-type: none"> Floor plan, flow of operations does not flow according standard requirements, it can cause cross contamination of products Waste stores in preparing area Clean and dirty clothing stores in the same place and it can cause cross-contamination The doors, windows, ceilings, walls and electrical hardware of the facility need renovation 	<ul style="list-style-type: none"> With repairing of roads the transport of products will be more efficient Workshops, trainings and consulting are available in Bishkek There are few fish processors in KR consequently there is little competition Repairing and renovation of facility 	<ul style="list-style-type: none"> Raw material supplier is threat due to the entry of Kyrgyzstan into the customs union Importers of fish meet big rate of taxes

There are plenty of opportunities to develop processing operations such as:

Reparation of roads makes the transportation of products more effective for all four sites.

There are also workshops, trainings and consulting available in Bishkek which can be useful for processing facilities, which are located in Bishkek, in improving processing process or facilities.

Reparations and renovation of facilities gives opportunity to process safe products for all facilities.

A major external threat to the processing activities is the Custom Union which the Kyrgyz Republic aims to join soon. After joining the Custom Union the tax rate for imported products, outside the Union area, will become high. It will subsequently cause challenges in obtaining raw material for processing.

On the basis of the SWOT analysis, a comparative analysis of the 4 sites was conducted (Table 15). Site 2 fairs better than the other sites in terms of logistics, building and surroundings, hygienic design and flow plan, and infrastructure and auxiliary services. It is close to the airport, railway station and to the main market. It does not need much work to upgrade this facility to meet Codex Alimentarius requirements. The floor plan of this site is appropriate for safe processing and there are auxiliary services available in Bishkek

Table 15. A comparative analysis of 4 sites in the Kyrgyz Republic to determine the best location for a fish processing facility

Aspects	CodexAlimentarius requirements	The best site
Logistics	Facility should be close to logistics services	Based on logistics analysis site 1 is the weakest site compare to other three sites. Site 1 is located far from railway and airport. However, this site uses its own mobile shops for selling products and it is one of strength for this site. Site 2,3 and 4 are good choices
Building and surroundings	All food contact surfaces should be: smooth, impervious, free of cracks and crevices, non-contaminating, corrosion resistant, nontoxic and cleanable	According to building analysis the best site is site 2, because its windows meet standard requirements and the condition of walls, ceilings, floor and doors almost meet the requirements of Codex Alimentarius standards. This site needs minor repair in order to meet all Codex Alimentarius requirements
Hygienic design and floor plan	Hygienic design and floor plan of processing facility should be constructed in a way that will ensure the safeness of processed food and will reduce risks of product contamination	Based on hygienic design and floor plan of the sites the best site is site 2. The floor plan is appropriate for processing facility. The flow of operations goes according requirements which allows to be sure on safety of products and clean areas are separated from dirt ones
Infrastructure and auxiliary services	The fish processing facility should have all necessary operational facilities and they should not cause any problems for product safeness. There is need for regularly checking in processing facility in order to guarantee the safety of products. Also it is important that processing facility will be close to auxiliary services which are needed for processing	Infrastructure analysis shows that the best sites are site 1, site 2 and site 4. All necessary operation facilities such as electricity, potable water, sewage and waste collection are available for these sites and there is ample space for car parking in these sites. However site 1 is located in urban area. Auxiliary services will be as strength for all sites, because they are available always and accessible within the same region where the sites are located

5.3 RELIABILITY AND VALIDITY OF DATA

The respondent rates, in interviews with FFAK and IKP reached 28% while interviews with supermarkets reached 71.4% and thus the gathered data can be said to be reliable. Information generated from the interviews may not be completely accurate because entrepreneurs do not share information about specific numbers. Data gathered from fish farmers in regard to production figures were compared to the data in Fishstat (Food Agricultural Organization's database of fisheries industry) and they are completely different. The information gathered in this thesis is however deemed correct, because the interviewer is not an official. In addition, a lot of cross checking was completed through interviews, visiting sites and observation.

6 DISCUSSION

This thesis aimed to examine the Kyrgyz fisheries market and to determine the best location for a fish processing facility. The thesis aimed to describe the supply chain of fish and fisheries products from producer to market in both producer and retail markets, as well as making a recommendation on a site location for a fish processing facility. The thesis provides information on the status of the fish and fisheries products market in the Kyrgyz Republic, the supply chain of fish and fisheries products in the Kyrgyz Republic and requirements for processing facilities and their location. Finally, the thesis aimed to make recommendations for the development of the Kyrgyz fish and fisheries products industry

From farm to fork it takes more than one month for imported fish to get to Kyrgyz Republic after which it is processed. The quality of imported processed fish is thus most likely low. After refreezing fish, the quality will be lower compare to fresh fish as fish gets drier due to water loss and oxygenation of fat (Kavita, 2010).

There is no evidence that fish transported from remote areas of the Kyrgyz Republic to Bishkek is a good quality fish. As shown in result it takes about 6-8 hours to transport fish from Issyk Kul and Toktogul regions and mainly it sold fresh. Fish is a perishable food and the texture and flavor of fish changes quickly after fish has been taken out of water. Fish should be passed through primary processing and immediately deheaded, gutted, washed and chilled in order to save quality and prolong shelf life of it (Bykowski and Dutkiewics, 1996).

This study shows that all members of both associations interviewed FFAK and IKP are mostly concerned about profits from fish producing and processing and less concerned with ecology. Members of FFAK said that there is no need to worry about fish pathogens or diseases because our water bodies are clean. However all rainbow trout fish producers import fertilized fish eggs from foreign countries in the Kyrgyz Republic (Tazhibaeva and Beyshembiev, personal communication, 24.09.2011). Also the Kyrgyz Republic does not have agencies which controls or checks whether fertilized fish eggs are free from diseases or pathogens or not". As we well known, fish pathogens and diseases can be spread through fertilized eggs and water (Rahkonen et al., 2003).

The respondents of this study showed their willingness to start a fish processing facility. In addition to this they showed their willingness to export processed products to other countries including EU countries. Getting customers is the important motivation to start processing fish for FFAK.

IKP members do not produce a big amount of fish (about 12 tonnes/a) and supply only one region where the member farms are located. The association members do not market their fish and fisheries products using any promotion tools like mass media or social media. However, the members of IKP have mentioned in interviews that they aim to export their fish to some EU countries. This is an unrealistic aim for this association because members of this association do not produce and process fish which can meet EU food safety requirements. Also, there are many local competitors with whom it will be difficult to compete with and there is big international competition on the export market. Most of the IKP association members farm fish for recreational fishing not for commercial purposes (Arykova, 2013, unpublished). It is recommended that the members of IKP focus on local regions and start by supplying other regions in the Kyrgyz Republic, rather than focusing on export markets.

From interviews conducted, it was depicted that there are some few fish farms which produce more than 100 tonnes of rainbow trout per annum. Sariyeva et al. (2008) states the total annual production of rainbow trout was 54.8 tonnes in 2007. This is collaborated by data in Fishstat which gives similar figures. In the year 2009 annual production of rainbow trout was 33 tonnes, according to the official data reported in Fishstat, showing a decrease of 39.2%. This was followed by a drop in production. In 2011 the annual production of rainbow trout was 15 tonnes. However there is a discrepancy. Interviews with the fish farmers as discussed in section 4 revealed that the production figures are much higher.

In total two associations produce about 450 tonnes of fish. In the same time fish processing companies of both associations process more than 3 000 tonnes of fish per year. It means about 85% of processed fish is imported from other countries, if the amount of fresh sold fish will not be counted.

Almost all processed fish in Kyrgyz market is imported from foreign countries. Herring imported from Russia and it is the most popular fish within the processed fisheries products in Kyrgyz fish market. The amount of sold salted herring in supermarkets was (about 3 092.5 tonnes) much higher compare to other fisheries products which were described, for example

the second most sold fish product in supermarkets is fish preserves and it was sold about 16.9 tonnes in 2011. The reason is that it is the cheapest fisheries products in Kyrgyz fish market about 90soms/kg in Kyrgyz fish markets. It was seen during observation of bazaars, shops and supermarkets. Fish is mostly sold unpackaged.

The fact that supermarkets in Bishkek do not sell rainbow trout should be pointed out despite of the fact that rainbow trout is the main aquaculture fish species in the Kyrgyz Republic. However, during interviews it was determined that supermarkets are interested in selling rainbow trout.

Rainbow trout is becoming a popular aquaculture fish species in the Kyrgyz Republic and supermarkets answers showed that frozen rainbow trout is preferable fish species for them. In addition FAO states that the most preferable fish product in the Kyrgyz Republic is frozen ones, about 27% out of total sold fisheries products (FAO, 2012). That is why frozen rainbow trout is most efficient option in this case.

The market leader in selling fish and fisheries products among supermarkets, is the Narodniy market chain. More than 50% of total amount of fish and fisheries products, sold in supermarkets in 2011, was sold through Narodniy market stores. It can be explained that this is due to the large number of stores under this chain compared to other market chains.

Supermarkets in Bishkek pose a good option as potential customer targets for rainbow trout fish producers and fish processors. None of the supermarkets in Bishkek currently sell rainbow trout. Supermarkets have shown and expressed their willingness to sell rainbow trout if a reliable partner or supplier can be identified. The current Kyrgyz supermarket market share is monopolized by one supplier. However this supplier does not produce nor process rainbow trout.

One of the interesting results concerns the price for fish and fisheries products in bazaars and shops. There seems to be no logic in pricing mechanism which varies greatly. It is difficult to find logic in pricing fish and fisheries products in specialized fish shops and bazaars in the Kyrgyz Republic. In one month, prices in specialized fish shops are higher than those in bazaars, while in another month the pricing is the other way around for the same product. There are no agencies or organizations who sets or controls price for products in markets in the Kyrgyz Republic.

The processing market in the Kyrgyz Republic is monopolized by one processing company. From the results, it is also clear that there are also other fish processors on the market, with a smaller market share. Also, fish sold in bazaars at the roadside indicate the presence of small-scale processing activities.

All member companies of both associations, FFAK and IKP, remarked that all aspects that were analyzed during location analyses are important for determination of location for a processing facility. The results of this research shows that Bishkek is the best place for processing facilities, because there many industrial areas for processing facilities and there is access/roads to all regions in the Kyrgyz Republic. Ready products can be easily transported from Bishkek to other regions.

Marketing factors playing a big role in identifying plot for processing facility (Turhan et al., 2007). However there are other factors, such as infrastructure, availability of raw materials and labor, which can influence in making decision where to put processing facility. Hygienic design and floor plan of the facility and infrastructure were considered as main factors in identifying location for a facility in this study.

During examination of existing fish processing facilities in the Kyrgyz Republic it was determined that none meet Codex Alimentarius requirements.

The number of small-scale fish processors in the Kyrgyz Republic is not known (Sarieva et al., 2008). A survey of the status of small-scale processing activities would be useful to develop this sector as a whole.

All the fish processing facilities evaluated under this thesis project obtain their raw material for processing from foreign countries. Mainly imported fish from Russia, Norway and Kazakhstan is processed, while locally produced fish are sold fresh. As fish processors of FFAK mentioned, during personal conversation, there are no enough amounts of locally produced fish for processing. Only small-scale processing is practiced in the Kyrgyz Republic, where fish is mainly dried and sold on the streets (Sarieva, et al., 2008). Kyrgyz Republic is planning to join the customs union in 2014, where all members will be mainly former Soviet Union countries. It means import fish from outside can be problematic and costly that is why it is better to have suppliers from countries which are in this union.

This research showed that there are many industrial areas in Bishkek with all infrastructural factors available. However, visits to examined sites showed that the condition of roads in the Kyrgyz Republic needs to be improved. There are auxiliary services available in all the sites evaluated. However there is no evidence that the processing facility surveyed use the listed services.

Existing facilities can be renovated and upgraded, which can eventually save company budgets. Inside of the building should be constructed according to hygienic design principles (Ronald and Erickson, 2005). This study showed that none of the fish processing companies are designed with good hygiene aspects in mind. Processing areas in the facilities are mixed and easily cause cross-contamination of products. Also clothing for work, both dirty and clean are stored together.

7 CONCLUSION AND RECOMMENDATIONS

For the development of this sector some suggestions and recommendations are given in this section.

There is a need to improve the supply chain of fish and fisheries products in the Kyrgyz Republic. As was discussed before it took about 1 month to receive raw material from Norway and the duration of transportation plays a big role. That is why it is important to mobilize fish transportation from foreign countries by speeding up the transportation and for example by using air ways. Also the quality of all imported fish should be checked before processing it.

There is also need to improve supply chain of locally produced fish and fisheries products, especially after distributing to the retail market. Some retail sellers, especially in bazaars, do not care about quality and safety of the product. They used to sell it in open area without ice or refrigerators. In addition it is important to put primary fish processing facility close to fish farms, especially in remote regions of the country.

There is need to check imported fertilized fish eggs for freedom from diseases and there trainings on impact of contaminated fertilized fish eggs to the environment should take place.

It is important to develop small scale fish processing and put investment onto it especially for local economy.

Joining the Custom Union can cause serious problems in raw material supply of fish and fisheries products. The Kyrgyz Republic is not ready to supply all existed fish processing companies with raw material. According to the results of this study the production of fish in farms is less than 450 tonnes/annum and the production capacity of the processing facilities is more than 3 000 tonnes/annum. There is therefore a great need to increase fish production in the Kyrgyz Republic.

Fish importers currently face high tax rates (FAO, 2012). However, after joining the Custom Union taxes for imported products from country which is not the member of Custom Union will increase. It is important to carefully consider how this can affect the developing industries in the Kyrgyz Republic. Increasing of fish production in the Kyrgyz Republic cannot be the sole solution to combat potential high tax rates on imports of fish and fisheries

product raw materials. The product range of fish species on the market is quite limited. The Kyrgyz Republic shows a big potential in aquaculture sector, and it would be beneficial to consider culturing other fish species especially local species.

In addition there is need to increase consumption of fish and fisheries products and to encourage people in the Kyrgyz Republic to consume fish as it is not enough to just increase the production. Fish consumption in the country is low 1.6 kg/capita and mostly Kyrgyz people prefer to eat fish (Sarieva et al., 2008). Fish consumption campaigns should be arranged for example a fish day or fish market.

Also there is need to have training on advantages and disadvantages of packaging and its impact to the quality of the product.

All evaluated fish processing facilities should be renovated and observe hygiene requirements in their facility and during processing operations. It is important for customer health. Also there trainings on impact of observing hygiene in the facility and during processing operations to the quality of final product should take place.

There is also need to check out of building material which was used for evaluated facilities for non-toxicity. In addition there is need to calculate exact index of fish consumption and exact index of fish productions in the country.

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APPENDIX 1

List of member companies of the association FFK

1. "Aqua Service" Ltd (goods for aquaculture and services for culturing fish)
2. "Ecos International" Ltd (cage culture of rainbow trout in Issyk Kul Lake)
3. "Aqua-Da" Ltd (cage culture of rainbow trout in Issyk Kul Lake)
4. "IZVB" Ltd (incubation of eggs of all fish species, rearing fingerlings)
5. "Aquafond-K" Ltd (cage culture of rainbow trout in Issyk Kul Lake)
6. Trademark "Rybnyi den" (distribution of fisheries products)
7. Peasant Farm "Abyl" (cage culture of rainbow trout in Issyk Kul Lake)
8. Private Entrepreneur "Chokunov" (pond culture of fish)
9. "Issyk Kul EXPORT" Ltd (distribution of fisheries products)
10. "BALYKCHYLAR" Ltd (cage and pond culture of rainbow trout in Issyk Kul Lake)
11. Trademark "Issyk Kulskej Bereg" (distribution of fisheries products)
12. "IssykkulRybService" Ltd (pond culture of rainbow trout)
13. "Tegirmen" Ltd (pond culture of rainbow trout)
14. "BANAKO" and "AKYLMAN" Ltd (processing of fisheries products)
15. "VIL-BI" Ltd (processing of fisheries products)
16. Private rainbow trout farm in Arashan village (rearing and marketing/selling of trout)
17. Private rainbow trout farm in At-Bashi village (rearing and marketing/selling of trout)
18. Private rainbow trout farm in Issyk Ata (rearing and marketing/selling of trout)
19. "Combifood" Ltd (production of fish feed)
20. "BKS" Ltd (rainbow cultivation and projecting fish farms)
21. "Caviar" Ltd (basin cultivation of trout and sturgeon)
22. "Fishka" Ltd (basin and pond culture of trout and sturgeon)
23. "Supara" Ltd (rearing of trout and selling in own restaurant)
24. Private rainbow trout farm in Leninskoe village (rearing and marketing/selling of trout)
25. Private rainbow trout farm in Belovodskoe village (rearing and marketing/selling of rainbow trout)

List of member farms of the association IKP

1. Pond farm in Lipenko village "Melnichnyi"
2. Pond farm in Lipenko village "Boldyreva"
3. Pond farm in Lipenko village "Sidenko"
4. Pond farm in Lipenko village "Dreshpan"
5. Pond farm 1 in Lipenko village
6. Pond farm 1 in Kabak village
7. Pond farm in Karakol town "Zelenyi Gai"
8. Pond farm in Ak-Dobo village "Kokui-Kol"
9. Pond farm in Lipenko village "Zhydykol"
10. Pond farm in Lipenko village "Pyatkova"
11. Pond farm in Lipenko village "Zapravka"
12. Pond farm in Ichke-Bulun "Suhaya balka"
13. Pond farm 2 in Kabak village
14. Pond farm in Munduz village "Vyrostnoi"
15. Pond farm 1 in Bogatyrovka village
16. Pond farm 2 in Bogatyrovka village
17. Pond farm 3 in Bogatyrovka village
18. Pond farm in Bosteri village
19. Pond farm 4 in Bogatyrovka village
20. Pond farm in Ichke-Bulun village "Dachnyi"
21. Pond farm in Lipenko village "Galushkina Balka"
22. Pond farm in Zhany-Aryk village
23. Pond farm in Mihaylovka village and fish processing company in Karakol town
24. Pond farm 3 in Kabak village
25. Pond farm 2 in Lipenko village
26. Pond farm 3 in Lipenko village
27. Pond farm in Lipenko village "7 thousand"
28. "Karakol Balygy" Ltd

APPENDIX 2

LOCATION AND MARKET ANALYSIS FOR A FISH PROCESSING FACILITY (CASE STUDY)

Bermet Tazhibaeva, University of Eastern Finland, Department of Biosciences

QUESTIONNAIRE

September 21, 2011

Hello! My name is Bermet Tazhibaeva. I am a Master of Science degree student, presently studying Fisheries and Aquaculture at the University of Eastern Finland in Kuopio.

The subject of my thesis work is "Location and market analysis for a fish processing facility". In this case study the most appropriate place for a fish processing facility in Kyrgyzstan will be identified. My thesis is one part of FAO project's "Support to fisheries and aquaculture in Kyrgyzstan". The project is important for the fish farming and processing in Kyrgyzstan and the facility with its resources and equipment is designed to be open for everybody interested in fish processing in Kyrgyzstan. This survey will gather the essential data from the users (from you) on their (on your) needs, opinions and wishes in order to construct a well-designed and functional processing facility. Also, the feedback you give will be useful for my thesis analysis.

QUESTIONS 1-2 ARE FOR THE ASSOCIATION ONLY

Association name: _____

Contact info: 1. Phone number _____

2. E-mail _____

1) When was the association established? _____

2) How many members (companies) are in the association? _____

Only in fish production _____

Only in processing _____

Both in production and processing _____

QUESTIONS FOR THE COMPANY

Production in your company

Company name: _____

3) When was the company established? _____

4) Address: _____

5) How important are the following goals in regard to your company's initiative to start a fish processing facility?

Goals	Unimportant/1	Slightly important/2	Important/3	Very important/4	Critical /5
<ul style="list-style-type: none">• Prolong shelf life of fish• Add value (through processing)• Get more customers• Increase the nutritional value• Decrease pathogen contamination in fish• Increase seasonal availability of fish• Other, specify					

- 6) How many permanent workers are in the company? _____
- 7) How many seasonal workers are employed during high season in your company?
- 8) Is your company involved in fish production?
- a) Yes
- b) No

If yes, answer question 9. If no, move on to question 10

- 9) Describe fish production in your company

Fish species	Tonnes per year	High season months	Purposes (codes)
--------------	-----------------	--------------------	------------------

- Codes: 1- human consumption
 2- Stocking for conservation of natural populations
 3- Stocking for recreational fishing
 4- Feed for animals
 5- Ornamental/aquarium fish
 6- Other, please specify _____

- 10) Is your company involved in fish processing?
- a) Yes
- b) No
- If yes answer question 11 and 12. If no, move on to question 13.

- 11) Describe fish processing in your company

Fish species	Tonnes per year	High season months	Purposes (codes)	Method of processing (codes)
--------------	-----------------	--------------------	------------------	------------------------------

- Codes for purposes:
- 1- Human consumption
 2- Feed for animals
 3- Other, please specify _____
- Codes for methods: 1- Whole fresh fish
 2- Smoked fish
 3- Dried fish
 4- Canned fish
 5- Fish roe
 6- Marinated fish
 7- Frozen whole fish
 8- Frozen fillet
 9- Fresh fish fillet
 10- Other, please specify _____

- 12) Where do you obtain your raw material for processing?

Fish species	Own production	Local producers (where/ oblast)	Other countries (where/country name)	Other, specify
--------------	----------------	---------------------------------	--------------------------------------	----------------

Marketing in your company

13) Where is your fish sold?

- a) Bishkek
- b) Chui
- c) Issy-Kul
- d) Talas
- e) Naryn
- f) Osh
- g) Jalal-Abad
- h) Batken
- i) Abroad, where? _____
- j) Other, please specify _____

14) To whom do you sell your fish?

- a) Wholesalers
- b) Specialized fish shops
- c) Supermarkets/grocery stores
- d) Restaurants/cafes
- e) Bazaars
- f) Public sectors (e.g. schools, hospitals, military etc.)
- g) Other, please specify _____

15) What kind of marketing do you use?

- a) Mass media (newspaper, TV, radio)
- b) Flyers, billboards, posters
- c) Face to face
- d) Online marketing
- e) Other, please specify _____

16) How do you deliver products to the market?

- a) By own trucks
- b) By trucks owned by transport companies
- c) By air
- d) By rail
- e) Customers pick up the products themselves
- f) Other, please specify _____

17) If you have your own trucks,

- How many do you have? _____
- How are trucks equipped?
 - a) With refrigeration system
 - b) With water containers
 - c) With freezing system
 - d) Other, please specify _____

18) How often are products delivered/ picked up during the high season of your production?

Fish species/products	Times delivered per week	Times picked up per week

19) What packaging methods do you use? Please specify the material by underlining

- a) No packing
- b) Wrapped in paper
- c) Plastic/paper bags
- d) Metal/plastic/glass containers
- e) Boxes (paper, wood, plastic etc)
- f) Vacuum packing
- g) Other, please specify _____

Plans and objectives for Processing

1) Which markets does company want to supply in future?

- a) Bishkek
- b) Chui
- c) Issy-Kul
- d) Talas
- e) Naryn
- f) Osh
- g) Jalal-Abad
- h) Batken
- i) Abroad, where? _____
- j) Other, please specify _____

2) What kind of fisheries products does company want to supply in future? Please indicate the fish species as well.

- a) Live fish: _____
- b) Dried fish: _____
- c) Whole fresh fish: _____
- d) Salted fish: _____
- e) Smoked fish: _____
- f) Canned fish: _____
- g) Fish roe: _____
- h) Marinated fish: _____
- i) Frozen whole fish: _____
- j) Frozen fillet: _____
- k) Fresh fish fillet: _____
- l) Other, please specify _____

3) How many people in your company are qualified to process fisheries products? ___

4) How important are the following requirements for your company in regard to deciding the location of a processing facility?

Requirements	Unimportant/1	Slightly important/2	Important/3	Very important/4	Critical/5
<u>Logistics</u>					
• Site surrounding					
• Access to main road					
• Access to airport					
• Access to railway					
• Nearest main market					
• Condition of roads					
• Raw material availability					
<u>Infrastructure</u>					
• Electricity					
• Potable water					
• Car parking					
• Waste collection					
• Sewage collection					
<u>Building</u>					
• Building for the processing facility					
• Walls					
• Ceilings					
• Windows					
• Doors					
• Floor					
• Electrical hardware					
<u>Hygienic design and floor plan</u>					
• Toilet					
• Presence of shower					
• Presence of locker room for personnel etc.					
<u>Auxiliary services</u>					
• Maintenance services of trucks availability					
• Security (physical security agencies: people and video)					
• Maintenance services of processing equipments					
• Health services for inspecting personnel					
• Veterinary services for checking fish quality					
• Hygiene training services for personnel					
• Pest control services					

Other, please specify _____

Notes: _____

APPENDIX 3

LOCATION AND MARKET ANALYSIS FOR A FISH PROCESSING FACILITY (CASE STUDY)

Bermet Tazhibaeva, University of Eastern Finland, Department of Biosciences

QUESTIONNAIRE

March 21, 2012

Hello! My name is Bermet Tazhibaeva. I am a Master of Science degree student, presently studying Fisheries and Aquaculture at the University of Eastern Finland in Kuopio.

The subject of my thesis work is "Location and market analysis for a fish processing facility". In this case study market analysis on supply chain from the producer to the supermarket will be completed. This survey will gather the essential data on the needs, opinions and wishes of supermarkets (from you) for the identification of potential products for the market, points of sales and logistics related to fisheries products. The feedback you give will be useful for my thesis analysis.

Background information:

1. Supermarket chain name: _____
2. Year of establishment: _____
3. How many stores does the chain have in Kyrgyzstan: _____
4. How many stores does the chain have in Bishkek: _____

Present:

5. What is the amount and value of the following food products sold per year:

Products	Amount (tonnes per year)	Value (soms per year)
Meat		
Fish		
Vegetables		
Fruits		
Cereals		
Beverages		
Frozen foods		
Breads		
Readymade food		
Canned food		
Candy		
Dairy		
Alcoholic beverages		

6. Fisheries products in the supermarket

Fish species/ Fisheries products	Amount	Value	Buying day	Peak selling day	Peak selling month	Supplier
-------------------------------------	--------	-------	---------------	---------------------	-----------------------	----------

7. How and in what type of transport (e.g. trucks with refrigeration system, cooling system or car etc.) are products delivered to the supermarket?

1. Delivered by suppliers: _____
2. By supermarket's own transport: _____
3. By delivery companies: _____
4. Other, specify _____

Future:

8. According to which aspects do you choose new suppliers of fisheries products for the supermarket?
 1. According company's image: _____
 2. Recommendation/ references (from buyers, government, health authorities, from ecological agencies etc)
 3. Product packaging (which type of packages are used)
 4. Trial sales (checking perception of people with selling small amount of the product)
 5. Certification
 6. Production standards (which standards do processors used for processing)
 7. Taste sampling products (first you are tasting product)
 8. Delivery schedule
 9. Delivery reliability
 10. Pricing of products
 11. Financial stability of the company
 12. Quality of the provided product _____
 13. Speed in response to requests for information
 14. Speed and cooperation in resolving problems and/or settlement of claims
 15. Other, specify _____

9. What type of fish/fisheries products and species do you want to sell in your supermarket?
 1. Live fish _____
 2. Dried fish _____
 3. Whole fresh fish _____
 4. Salted fish _____
 5. Smoked fish _____
 6. Canned fish _____
 7. Fish roe _____
 8. Marinated fish _____
 9. Frozen whole fish _____
 10. Frozen fillet _____
 11. Fresh fish fillet _____
 12. Other, please specify _____

Notes: _____

APPENDIX 4

LOCATION AND MARKET ANALYSIS FOR A FISH PROCESSING FACILITY (M. Sc. Thesis work)

EVALUATION ASPECTS FOR FISH PROCESSING FACILITY LOCATION

Bermet Tazhibaeva, University of Eastern Finland, Department of Biosciences

Date: _____

Location: _____

1. Logistics

- 1) Site surrounding: _____
- 2) Access to main road (how far): _____
- 3) Access to airport (how far): _____
- 4) Access to railway (how far): _____
- 5) Nearest main market (how far): _____
- 6) Condition of roads: 0- there is no road
 1- There is dirt-road
 2- There is asphalt, requires repair
 3- There is asphalt road, no need to repair
- 7) Raw material availability: _____

2. Infrastructure

<u>Infrastructure</u>		
Electricity	0	There is no electricity available
	1	There is electricity available in the area, it has to be connected to the building, electricity cuts occur
	2	There is electricity available in the area, it has to be connected to the building, no electricity cuts occur
	3	There is electricity, electricity cuts occur
	4	There is electricity available
Potable water	0	There is no potable water
	1	There is potable water in the area, it has to be connected to the building
	2	There is potable water available, pipes require repair
	3	There is potable water available, no need to repair pipes
Car parking	0	There is no ample space for truck transport
	1	There is space to build car parking
	2	There is car parking which required repair
	3	There is ample space for truck transport
Waste collection	0	There is no waste collection agency in that area
	1	There is waste collection agency, which must be agreed with services
	2	There is waste collection agency, which collecting waste 2-3 times in a week
	3	There is waste collection agency available every day
Sewage collection	0	There is no sewage collection services
	1	There is sewage collection in that area, it has to be connected to the building
	2	There is sewage collection services, pipes of which required repair
	3	There is sewage collection services

3. Building

- 1) Building for the processing facility:
 - 0- there is no building for the processing facility
 - 1- there is an empty building
 - 2- there is building for a processing facility
 - 3- there is building for a processing facility, which does not require repair

2) Walls

- a. does not meet codex standards: _____
- b. meets codex standards: _____

3) Ceilings

- a. does not meet codex standards: _____
- b. meets codex standards: _____

4) Windows

- a. does not meet codex standards: _____
- b. meets codex standards: _____

5) Doors

- a. does not meet codex standards: _____
- b. meets codex standards: _____

6) Floor

- a. does not meet codex standards: _____
- b. meets codex standards: _____

7) Electrical hardware

- 0- There is no electrical hardware inside the building
- 1- There is electrical hardware which should be redone (changed)
- 2- There is electrical hardware installed inside the wall, but it should be repaired
- 3- There is electrical hardware installed inside the wall

4. Hygienic design and floor plan (draw the plan of the facility or building for questions from 4 to 10)

1) Toilet

- 0- There is no toilet
- 1- There is space to build the toilet
- 2- There is a toilet, which require repair
- 3- There is a toilet, no need to repair

2) Presence of shower

- 0- There is no shower
- 1- There is space to build the shower
- 2- There is a shower, which require repair
- 3- There is a shower, no need to repair

3) Presence of locker room for personnel

- 0- There is no locker room
- 1- There is space to build the locker room
- 2- There is a locker room, which require repair
- 3- There is a locker room, no need to repair

4) Where toilets located- are they in direct connection to fish processing and product preparation areas? ____

5) Where are clean clothing's and shoes stored? _____

6) Where are dirty clothing's and shoes stored? _____

7) Do they have adequate space and facilities to change clothing? _____

8) When fish, raw material comes in how is it moved through the facility? _____

9) Are "dirty" areas separated from "clean areas to avoid cross-contamination? _____

10) The flow of operations- how do people move through the facility? _____

5. Auxiliary services

1) Maintenance services of trucks availability

- 0- Service is unavailable
- 1- Service is available in other oblast only
- 2- Services are available and accessible within the oblast
- 3- Services are available and accessible within the same village/city where the proposed site is located

2) Security (physical security agencies: people and video)

- 0- There is no security in that area
- 1- There is security agency, which is working for 2-3 days in a week
- 2- There is security agency available always

3) Maintenance services of processing equipments: _____

4) Health services for inspecting personnel e.g. for salmonella or other microbial infections which can cause food safety challenges.

- 0- Service is unavailable
- 1- Service is available in other oblast only
- 2- Services are available and accessible within the oblast
- 3- Services are available and accessible within the same village/city where the proposed site is located

5) Veterinary services for checking fish quality

- 0- Service is unavailable
- 1- Service is available in other oblast only
- 2- Services are available and accessible within the oblast
- 3- Services are available and accessible within the same village/city where the proposed site is located

6) Hygiene training services for personnel

- 0- Service is unavailable
- 1- Service is available in other oblast only
- 2- Services are available and accessible within the oblast
- 3- Services are available and accessible within the same village/city where the proposed site is located

7) Pest control services

- 0- Service is unavailable
- 1- Service is available in other oblast only
- 2- Services are available and accessible within the oblast
- 3- Services are available and accessible within the same village/city where the proposed site is located

Notes: _____

APPENDIX 5

Table 1. Average fish and fisheries products prices in soms in Bishkek bazaars (2011-2012)

Fish species/products	April	May	June	July	August	September	October	November	December	March
Rainbow trout	340	350			450	450	450	450	400	375
Common carp	230	230	170	150	150	195	195	195		165
Silver carp	150	147	147	125	143	153	153	153	150	150
Grass carp	177	150	135	100	100	160	163	163	170	170
Issyk Kul trout	420	420				400	400	400		500
Big powan	85	85	80		120	100	100	100	115	113
Whiefish	250	250	220			257	257	257	250	250
European carp	150	150	148	140	143	170	163	163		160
Pikeperch	267	265	280	283	282	228	265	265	250	250
Sheatfish	152	180	213	178	168	217	217			187
Caspian roach	65			45	45	95	70	70	80	
Bream	65	60		55	60	68	65	65	65	68
Crician carp						57	60	60		78
Frozen herring	90	97	93	85	95	95	95	95		120
Frozen mackerel	240	240	240	230	238	240	240	240		250
Frozen hake	195			135	198	230	230	230		
Frozen capelin	110	110	110	100	105	105	105	105		110
Frozen Alaska pollack	147	145	145	130	140	140	140	140		143
Salted herring	112	112	113	95	107,5	95	105	105		130
Smoked herring	135	143	140	145	145	158	158	158	140	162
Dried bream	140	175	180	100	150	160	160	160	300	130
Smoked mackerel	280	280	280		280	300	300	300		300
Smoked salmon	990	975	990	950	950	940	940	940		915
Smoked escolar	755	750	765	760	755	735	735	735		815

Table 2. Average fish and fisheries products prices in soms in specialized fish shops (2011-2012)

Fish species/products	April	May	June	July	August	September	October	November	December	March
Rainbow trout	373	337	353	450		433	433	433	427	418
Common carp	186	192		220	160	241	250	241	241	238
Silver carp	165	125	140			210	210	210	150	160
Grass carp	213	208	215	220		217	217	217	228	205
Issyk Kul trout						487	487	487	450	
Big powan	75	75	85		130			140	88	100
Whiefish			220			180	180	155	235	
European carp	168	178	175		150	199	199	200	160	160
Pikeperch	264	258	260	293	290	289	283	279	244	235
Sheatfish	155	167	230	227	190	190	190			250
Caspian roach	65	65	65			70	70	70		
Bream	58	58	58			80	80	80	65	
Frozen herring	93	89	97	84	91	100	100	112	107	90
Frozen mackerel	232	234	231	226	231	234	234	238	227	222
Frozen hake	183	183	198	215	215	235	221	221	216	218
Frozen capelin	105	105	102	105	105	104	120	104	102	101
Frozen Alaska pollack	141	139	139	138	138	135	133	146	132	128
Salted herring	102	100	107	116	116	117	117	117	122	122
Smoked herring	118	120	139	141		177	177	177	145	142
Dried bream	158	146	169	182	197	184	184	184	139	143
Smoked mackerel	286	288	279	295	287	282	282	282	272	261
Smoked salmon	937	932	909	913	928	921	921	921	800	725
Smoked escolar	739	729	732	752	744	723	723	723	726	708

Table 3. Average fish and fisheries products prices in soms in supermarkets (2011-2012)

Fish species/products	August	March	April
Rainbow trout		415	
Common carp		250	160
Grass carp		250	
Issyk Kul trout		460	
Pikeperch		500	
Sheatfish		160	190
Bream		260	300
Frozen herring		140	
Frozen mackerel	260	285	280
Frozen hake	119	115	120
Frozen capelin	159	150	
Salted herring	140	143	134
Smoked herring	252	180	215
Dried bream	281	150	223
Smoked mackerel	406	345	399
Smoked salmon	1830	1125	999
Smoked escolar	1235	975	850
Smoked bream			308
Smoked roach			423
Dried roach			414

Table 4. Amount and value of fisheries products sold in supermarkets in 2011 (%)

Fisheries products	Quantity (%)	Value (%)
Hunchback salmon	0,15	0,37
Smoked hunchback salmon	0,21	0,61
Salted hunchback salmon	0,19	0,59
Fish roe	0,29	5,72
Spiced sprats	1,14	0,61
Shrimp	1,32	2,85
Dried roach	3,68	2,42
Smoked roach	2,71	1,78
Salmonids oil	0,48	0,85
Frozen alaska pollack	0,08	0,06
Smoked capelin	4,03	3,70
Seafood cocktail	0,03	0,09
Sole fillet	2,97	2,67
Smoked saury	0,85	0,75
Herring	2,25	1,52
Smoked herring	5,18	3,77
Salmon	0,09	0,27
Salted salmon	0,31	1,98
He fish	0,15	0,14
Smoked escolar fillet	0,24	1,00
Salted herring fillet	0,15	0,16
Smoked rainbow trout	0,01	0,04
Capelin	0,02	0,01
Hakeling	0,01	0,01
Smoked chum salmon	0,00	0,00
Chum salmon	0,00	0,01

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