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PERSPECTIVE DEVELOPMENT OF NEW SPECIES IN LATVIAN AQUACULTURE

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Abstract. The present paper studies the economic feasibility of certain new species in aquaculture and the market potential for their breeding in Latvia. Aquaculture is a rapidly developing industry in the world. Its volumes are increasing also in Latvia; however, there are few species that are bred in large volumes. Therefore, there exists an essential need for research on the species suitable for breeding. Aiming at studying the economic and market potential of particular less bred species, tilapias, chars, sturgeons and shrimps were selected for this research.

The research involves methods of economic analysis. The balance method was applied to analyse the markets for the researched species. A semi-quantitative method – McKinsey matrix – was applied to determine the potential export markets. McKinsey matrix was developed for particular species of fish on regional markets identified in advance.

The performed analysis provides a basis for concluding that breeding of sturgeons (Siberian and Russian sturgeons, sterlets and bester fish), chars as well as shrimps (L.Vannamei) has a potential in Latvia and that these fish should be included in the list of supported aquaculture products.

At the same time, taking into consideration that most of the consumers do not recognize these products, there is a need for promotional activities. Collaboration with foreign companies to acquire the export markets has a perspective regarding this.

The potential for breeding tilapias has not been justified due to the market situation in Europe (availability of cheap mass product) and the comparatively high production costs in Latvia.

Key words: aquaculture, species, production data, competition.

JEL code: D2, D4, Q22.

Introduction

The research aim is to study the economic substantiation and the market opportunities for less popular fish and shellfish bred in Latvian aquaculture.

Aquaculture is one of the most rapidly growing industries in the world. Its role in Latvia is rather small at present but it exhibits a growing tendency. According to statistical data, 680 tons of aquaculture production (fish and shellfish) were sold in Latvia in 2014. Over three years, 25% increase in production volumes has been reached. However, for the present, it does not reach even 1% of the fishery volume. At the same time, the trend both in the world and in Latvia is that the proportion of aquaculture products in the consumption of fish and other aqua products is increasing, thus the industry presents the growth potential. Aquaculture is a rather capital-intensive and high investment-risk industry. Therefore, information about the costs of breeding various potential species, about the sales prices and the market potential is of utmost importance in order to start a successful business activity.

The hypothesis set for the research is that it is possible to develop a feasible production of new, previously less known aquaculture products in Latvia.

The following objectives have been set to attain the aim:

- to assess the breeding costs (feed, energy etc.) of the selected species in particular enterprises for various species and to assess the main factors affecting them as well as the potential production price taking into account the costs;
- to develop the economic justification for selected species, taking into account the type of production technology and the production volume;
- to study the demand and supply of the aquaculture production for the selected species;
- to analyse the export opportunities for the selected species.

To perform the research, Latvian and foreign research and publications, materials of international conferences in aquaculture industry,

laws and regulations, database information of the Rural Support Service (RSS), data of the Central Statistical Bureau (CSB), EUROSTAT database information as well as consultations with leading experts of Latvian aquaculture, industry specialists and fish breeders, including the information gathering from the fishery farms.

Within the research framework, the data available on the approximate costs of the respective species when bred in recirculation systems (WRS) with different volumes are collected, the factors affecting the costs are analysed and the potential sales price are calculated, taking into account the production volume and the sales price. The Latvian and international markets for the particular species are analysed, the market potential and the opportunities for Latvian farmers are assessed. Both aspects - production costs and the market potential are taken into consideration for developing the conclusions and recommendations.

The research applied methods of economic analysis. The desk research method, interviews, calculation, comparative analysis used to calculate the economic substantiation and to obtain information. The potential export markets were determined by applying a semi-quantitative method – developing McKinsey matrix for particular types and products of fish in regional markets identified in advance.

The numerical information collected in the research is indicative, taking into consideration the small number of enterprises that deal with producing the researched products and the little experience in breeding the fish and promoting them. It has to be taken into consideration that the Latvian market is small; so a rapid increase in the supply can significantly affect the price. Hence it is understandable that attaining a significant aquaculture volume is closely linked with export opportunities.

Research results and discussion

1. Brief characteristics of the species included in the research

Fish of the sturgeon family

In the world, sturgeons are mainly bred for obtaining caviar. Due to the reduced stock, fishing sturgeons has been almost completely stopped in the world. Therefore, they are mainly bred in aquaculture. The main producing countries in Europe are Italy and France. Breeding sturgeons to obtain fish meat is less popular worldwide albeit flesh constitutes 67% of the sturgeon. Its meat is of very good quality and it does not contain bones (European Commission, 2012).

Latvia also belongs to the sturgeon breeding countries. In recent years, the volumes of breeding sturgeons have increased rapidly in Latvia, and it has become the second most popular species of fish, right after carps. Siberian sturgeon, sterlet, Russian sturgeon as well as belugas and sterlet hybrids – bester fish are the most popular species of the sturgeon family.

Tilapia

Tilapia is one of the most popular aquaculture fish in the world. The total aquaculture production volume of tilapia reaches 4.7 Mt. The total volume of tilapia fishery constitutes about 0.75 Mt. In Europe, the production volumes are insignificant due to the too high production costs. All significant production countries of the world are located in the tropical climate zone. One third of the total volume is produced in China; large volumes are produced in other Asian and Latin American countries (FAO, 2013).

In 2011-2014, tilapia was cultivated in Latvia but the production volume was small: 1 – 2 tons per year. Several industry specialists have expressed their opinion that competitive breeding of tilapia is burdened because the fish loves warmth, so the power consumption would be much higher than in the countries that are located more to the south.

The fish is not demanding regarding the purity of water, hence it is suitable for mass production in the countries that have warm climate all year round. According to the information provided by the producers, other neighbouring countries (Poland, Estonia) that had started production of tilapias have also stopped it.

Char

In difference from all the other species included in the research, char is cold-water fish. Due to this reason, their breeding volumes are limited and more than 90% of the European char production comes from the region of Nordic countries (Island and Scandinavia). Char has high tolerance to fish density, so they are well suited for inland aquaculture. The global production volumes of char are comparatively small - about 6000 t in 2013. The char is bred in Iceland, Canada, Sweden, Norway, Finland, Estonia, Ireland and in West Virginia in the USA. Iceland with its 3300 t is the largest producer. The char is a high-quality salmonid fish with high fillet output (55-57%). In the north of Europe, breeding of char in aquaculture is increasing (Thorarinsdottir R.I., 2013).

In the recent 3-5 years, breeding of char has also started to develop in Latvia. Chars are feeding most actively at the temperature +4…+16 °C. In Latvia, cold-water fish can feed significantly longer and gain weight faster than in the arctic regions of Scandinavia (which are the natural areas inhabited by char), where winters are longer and colder.

The most widespread species of the char are the Arctic char and the brook trout. Interbreeding of the species is popular, resulting into the Sparctic char.

Shrimps

Searching new objects appropriate for breeding in aquaculture, especially in water recirculation systems (WRS), shrimp is a product of interest because it is the most significant fishery product in international trade regarding the value. Global production volumes of shrimp reach approximately 7 million tons (2011), with the proportion of shrimp produced in aquaculture of about 55% (FAO, 2013).

The most significant countries producing shrimp are China, Thailand, Vietnam and Indonesia, which in total produce 80% of the global output.

Although shrimp, like tilapia, are bred in aquaculture almost only in the countries with a warm climate, the breeding technology in these countries has caused sharp protests of several international environmental protection organizations (Greenpeace a.o.). The quality of shrimps produced this way is also doubtful because in many developing countries the food standards are often incomplete or are not sufficiently followed.

As a consequence, the demand for live (fresh) shrimps is becoming more stable in the rich countries' markets even though these shrimps are more expensive than the frozen products of the tropical countries. Fresh shrimps are conquering the market niches of many countries as a Premium class product.

There are several commercial shrimp species. Previous studies (Nipers etc., 2015; Mitans A., 2013) allow conclude that the most suitable specie for breeding in Nordic environment is the white shrimp (L.Vannamei).

2. Assessment of the market potential

Based on the research of the demand and supply of the aquaculture fish and shellfish market, it become possible to identify the potential domestic and export markets and factors influencing competitiveness (Table 1) for them.

The potential markets for sturgeon meat are Latvia, Europe, Russia and other countries of the CIS, the USA. However, the attractiveness of Russian and the CIS markets is reduced by the low purchasing power of their population. Hence the market opportunities for surgeon meat are assessed only in Latvian, European and USA markets.

Table 1

Factors of competitiveness and market attractiveness for Latvian aquaculture products included in McKinsey matrix and significance of these factors

Competitive power (internal factors)	Factor significance	Attractiveness of the market (external factors)	Factor significance
Market share	3	Market capacity	3
Growth of the market share	2	Market growth	2
Assets and competences	3	Pricing trends	2
Marketing and distribution	3	Intensity of competition	3
Relative costs	3	Entry barriers	2
Production capacity	2	Demand fluctuations	1
Stability of the offer	2	Segmentation	1
Quality	2	Distribution structure	2
Climatic risks of production	2		
Veterinary risks of production	2		
Logistics	2		

Source: authors' assessment

In recent years, changes have been taking place in sturgeon caviar markets as the offer of the major exporting countries Iran and Russia has been decreasing but the demand has not changed significantly (Adeli A., Namdar M., 2015; Engler M., Knapp A., 2008). The market opportunities for sturgeon caviar were assessed for the markets of Latvia, Europe, the USA and the Middle East countries of Asia.

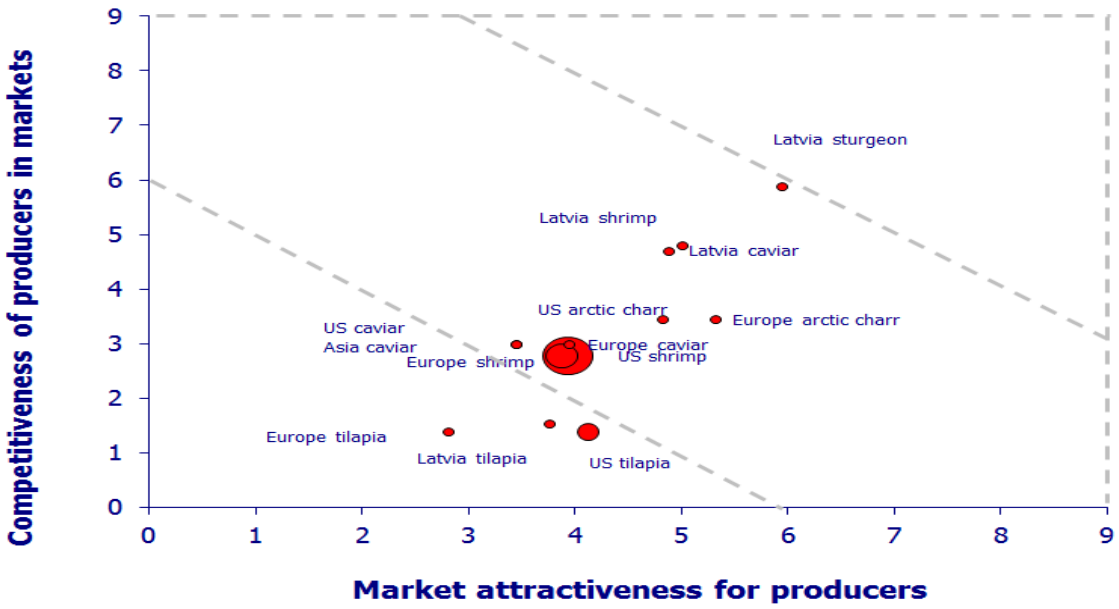
Markets for char are relatively unsaturated but the demand concentrates in developed countries with high consumer purchasing power and high impact of population health concerns on the demand (Arctic Rose Inc., 2011).

In recent years, the competitiveness of Asian countries on the most significant markets for shrimp has been decreasing due to quality problems. Hence increases the market opportunities for a more qualitative offer for a higher price (Jory D., 2014). The market opportunities for char and shrimp were assessed in Latvian, European and US markets.

After discussions with experts, the external (attractiveness of the market) and the internal (competitiveness of the specie/product) factors and their significance are established. The factors used and their estimated importance are presented in Table 1.

To assess the market potential for Latvian aquaculture products, McKinsey matrix is developed as follows: the horizontal axis is used to depict the product position in the potential markets but the vertical axis is used to depict the market attractiveness of the region or a particular country.

The obtained competitiveness matrix is presented in Figure 1.



Source: authors' construction

Fig. 1. **Competitiveness of Latvian aquaculture produce for markets with different levels of attractiveness**

Enterprises are advised to start or continue their operation in the markets that are positioned in the top right triangle of the competitiveness matrix. However, location in the bottom left triangle in the competitiveness matrix requires divesting – either terminating the present operation or not starting it. Starting or continuing business activity in the markets whose position in the competitiveness matrix is in the middle segment is related to risks. The risks are lower if the position of the enterprise in the competitiveness matrix is above the diagonal which is drawn from the bottom right corner to the top left corner.

Development of the economic substantiation

This subsection comprises the information analysed during the research about the production costs and the sales prices in order to assess the feasibility of breeding the studied species. The paper summarises the breeding costs in WRS, which is the most rapidly developing aquaculture technology in Latvia and which provides the opportunity to produce larger volumes.

To assess the breeding costs, the tentative costs for producing 1 kg of fish (or shrimp) were summarised across the most important positions (Table 2). Taking into account the particular applied technologies depending on the planned production volumes, the dependence of costs on the production volume can also be assessed. Using the example with sturgeons (this species offered the most detailed information available), it can be assessed that increase of the production volume from 5 to 45 tons per year reduces production costs per every kg of production output by EUR 0.5 or by 13%.

Table 2

Indicative assessment of production costs for the live weight of 1 kg of the aquaculture species included in the research (EUR)

Products	Production volume (t/year)	Feed	Energy	Work	Finger-lings/ larvae	Mainte-nance	Other cost	Total cost (EUR/kg, without investment)
Sturgeon	5	1.61	1.64	0.38	0.39	0.25		4.27
	10	1.61	1.54	0.33	0.39	0.25		4.12
	45	1.61	1.27	0.29	0.31	0.25		3.73
Sturgeon roe	2	1.61	24.83	45.00	42.50	35.00		148.94
Tilapia	100	0.83	0.69	0.20	0.23	0.10	0.20	2.25
Char	150	1.40	0.40	1.00	0.50	0.25	0.50	4.05
Shrimp	50	2.34	0.58	2.40	0.35	0.20	0.55	6.42

Source: author's calculations based on the information provided by industry specialists

As the data in the table indicate, production of sturgeon roe or caviar has the highest costs but taking into consideration the high price, its production can also be the most profitable one because the producer's price for caviar reaches 600 EUR/kg in Europe, and even more for the most valuable species. The retail price in Latvia reaches 700-1500 EUR/kg.

Regarding breeding, the second most expensive species is shrimp. However, as the table indicates, when bred in large volumes, its costs increase the production costs of sturgeon and char only almost twice but their sales price is significantly higher.

Char and surgeon belong to the "expensive" fish whose production costs comprise about 4 EUR/kg even without any investment. At the same time, if cost reduction measures are implemented, these fish can also be produced in a cheaper manner. For example, sturgeon need warm water resulting into is higher power-intensity. Therefore, heat isolation of a building, economic heating and other factors are important as well as the possibility to build a WRS at a cogeneration station to utilize the heat it produces (Muscalu-Nagi R., 2009). The mentioned aspect of heat is even more significant when breeding shrimp and tilapia, as the optimal temperature for their breeding is 26°-30°C.

Breeding of tilapia at Latvian conditions is significantly limited by the heat requirement of the fish. The heat consumption for its breeding is similar to that for shrimp but the product price is many times lower. It has to be added that the table reveals costs for producing large volumes of tilapia – 100 t per year but considering the cheap import, developing a large capacity tilapia production unit in Latvia would be extremely risky.

In addition to this, different investment costs should be taken into consideration. The paper summarises information about the necessary investment for a particular production volume. Entering both investment and production costs in the calculation, it is possible to calculate the period for the return on investment (Table 3) given the particular expected sales prices.

Table 3

Indicative assessment of costs, potential sales price and return on investment for breeding the aquaculture species included in the research

Products	Production volume (t/year)	Required investment (thous.EUR)	Production costs (EUR/kg, no investment)	Expected market price, EUR/kg	Return on investment period (years)*
Sturgeon	5	142	4.3	6.5	12.9
	10	250	4.1	6.5	10.4
	45	700	3.7	6.0	6.8
Sturgeon roe	2	1 060	150.0	400.0	2.1
Tilapia	100	520	2.3	2.0	-20.8
Char	150	2 100	4.1	6.0	7.4
Shrimp	50	3 100	6.4	25.0	3.3

** A negative figure indicates that production costs increase the sales price; thus, the investment cannot pay off*

Sources: authors' calculations using the information collected

The calculation of the period for the return on investment is performed applying the following formula: return on investment period = required investment / market price*breeding volume – costs*breeding volume.

If the period for the return on investment is positive, then it is concluded that production is feasible upon the given conditions. It has to be added that the price of shrimps is conditional because now, with the volume of 2 t per year, it reaches 35-45 EUR/kg but when the volume increases, it is planned that the price declines, making the product more available. However, it will stay higher than the one for the imported product. The perspective of breeding shrimps has to be attributed exactly to the Premium class product, which is demanded in Europe.

The current sales price for surgeon and char is from 5 to 10 and more EUR/kg. The price included in the table 6.0 – 6.5 EUR/kg has to be assessed as rather modest but realistic when the production volume increases and the products become more recognized on the market.

The data in the table indicate that following the assumed conditions, breeding surgeon for caviar and breeding shrimps have the shortest period for the return on investment. The results obtained via calculations also approve the assessment of the industry specialists. It has to be admitted, however, that for producing surgeon caviar, the table comprises only the time after when the first production starts appearing but prior to that at least 5 more years are required to breed the females. Theoretically, it would also be possible to purchase the females but it is rather difficult to carry out..

The experience shows that enterprises producing lower volumes usually can sell their products for a higher price. That happens because the product is more often sold to the end users not to wholesalers. In addition, there is a demand for fresh products.

It is difficult to determine the expected price for tilapia because the current price for fresh tilapias is 3-3.6 EUR/kg but farmers admit that there is lack of demand. Hence in breeding large volumes, the price of the imported product should be taken into account (1.50-1.90 EUR/kg). Therefore, there is a basis to question the opportunity to produce tilapias successfully at the present competitive price.

Assessment of the dependence of the costs on the production volume according to the data summarised in the table proves that the production volume impacts significantly the period for the return on investment (in the example with sturgeons it is from 6 to 13 years depending on the production volume). However,

such calculation is true only with the indicated sales prices. When the price increases to 7 EUR/kg, with the production volume 5 t per year, the return on investment period will reduce to 10.5 years. Farmers' experience (including the data about the beneficiaries of the RSS support) approve that feasible aquaculture is possible only with relatively small production volumes. Of course, in this case it will be a supplementary business for the enterprise or the rural farm that also operates in other businesses.

Fish-farming specialists indicate that the cost level can significantly differ for every producer, and it depends on several individual factors. Hence the figures offered in the present paper should not be perceived as a standard but rather as an example for comparing the species considered for breeding. Potential farmers have the opportunity to enter their particular parameters in the calculation and thus obtain an idea about the expected costs and the required sales price.

Conclusions

1) The performed analysis provides the basis to conclude that there is a perspective for breeding sturgeon (Siberian and Russian sturgeon, sterlet and bester fish), char as well as shrimp (L.Vannamei) as Premium product in Latvia.

2) Taking into consideration that most of the consumers have little recognition of these products, there is a need for promotional activities. Collaboration with foreign companies in acquiring export markets has a perspective.

3) The perspective of tilapia breeding has not been justified taking into account the market situation in Europe (availability of cheap mass product) and the comparatively high production costs in Latvia.

4) It is possible to make the production by 25-30% cheaper by increasing the production volume from 5 t to 45 t per year. Further increase of the production volume (above 50 t per year) provides a relatively lower reduction of costs. At the same time, profitable production is possible also with small volumes but in this case, it will be just a supplementary business for the enterprise or the farm.

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