

# DEVELOPMENT OF FISH FARMING BASED ON INTENSIVE TECHNOLOGIES: INFLUENCING FACTORS AND ECONOMIC INDICATORS

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## Abstract

*In this article, the main prospects and directions of strategic development of fish-farming in the conditions of economic issues are considered. It is shown that the main ways to improve economic efficiency should be conservation and protection of water resources, improvement of organizational and economic mechanisms of fish-farming development; government support to fisheries as a whole. An important aspect that must be considered when determining the level of factors affecting the efficiency of fishing industry is the correct choice of factors. If we analyze this by region or organization, the same factor may have different effects on the socio-economic efficiency of the industry. Therefore, this article is devoted to determine the influence level and relationships between factors affecting the efficiency of fish-farming.*

**Key words:** factors, factor analysis, intensive fish-farming, fish production, fisheries, economic efficiency of fish-farming, state support.

**I**ntroduction. All reasonable human activity is somehow connected with the problem of efficiency. This concept is based on limited resources, the desire to save time, to get as much products as possible from available resources. The problem of efficiency - how to allocate and how much resources to use for current and future consumption. The level of efficiency affects the solution of a number of social and economic problems, such as rapid economic growth, raising the standard of living of the population, reducing inflation, and improving the working and rest conditions.

In the economic literature there are deep theoretical studies reflecting some of the problems of the economic efficiency of fish production. The works of many scientists present not only the complex problems of the theory of economic analysis of fisheries efficiency, but also reflect specific issues related to the formulation of methodological aspects on the formation of indicators of economic efficiency of fish production. Consequently, the original model of quantitative performance evaluation is the ratio between economic results and costs, resources. Maximizing outcomes per unit of costs and resources, or minimizing costs and resources per unit of outcome, is the primary goal of society, the workforce, and the individual (employee). This goal, the method of its achievement, the ways and reserves of increasing economic efficiency (their classification and quantitative assessment) are the content of economic science and economic disciplines (industry and functional). The basic principles for measuring production efficiency for all social formations are similar.

Factor analysis is a multidimensional method used to study the relationships between the values of variables. The dependence of known variables on some variables and random errors indicates the relevance of the factor.

In General, factor analysis has the following main objectives:

- determine the relationships between variables (“classifications of variables”), i.e. whether they are related to variables in the relationship, directly or indirectly, these relations are characterized directly or indirectly;
- the degree and scope of the relationship between variables;
- reduce the number of variables needed to describe the data.

Factor analysis allows the researcher to solve two main problems:

- first, in a complex and at the same time compactly

detect the object of measurement;

- secondly, factor analysis defines hidden variables responsible for the existence of linear, statistical and correlation relations between the observed variables.

To study relationships between variables, it is proposed to use methods of economic-mathematical modeling and multidimensional statistical analysis – one of the main tools for progressing the economic mechanism, structural transformation of the regional market and forecasting the dynamics of production and sales of products. A variety of economic and mathematical models is the optimization model. Its use allows you to analyze the dynamics of the development of organizations in the region and take advantage of large amounts of real information [23].

**Materials and Methods.** The effectiveness of fish-farming is characterized by its performance, which is reflected on the catch of fish and the profit from the sale of fish products by fishing organizations and enterprises. Consequently, the efficiency of fish production can be defined as the optimal use of resources in comparison with public needs.

The increase of efficiency of fish production is not an accidental, but a natural, stable, repetitive and causal process that acts objectively. It should be noted that the more civilized the society, the more important is the increase of production efficiency, as the need and awareness of the need to save public costs increase; the purpose of fish production is to meet the needs of society, and at the same time priority is given not to the material, but to the social result. All this suggests that increasing the efficiency of fish production acquires the features of economic law, which can be formulated as a law of increasing production efficiency. The law of increasing production efficiency is a law trend, since opposing factors often impede the growth of efficiency of aggregate social labor.

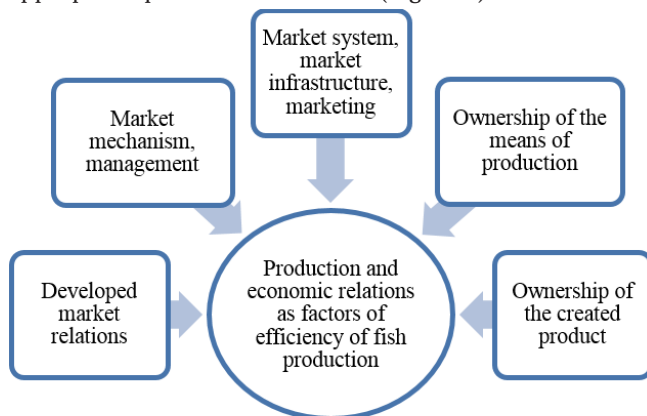
In conditions of transition to a market economy, the interpretation and hierarchy of efficiency criteria, their content and characteristics obviously change. Since the basis of a market economy is efficiency, income, the primary criterion of economic efficiency is the maximization of profit per unit of costs and resources with high quality products, works and services, ensuring their competitiveness. The national criterion of efficiency is also preserved under the new conditions: maximization of national income, gross national product per unit of costs and resources with an increasing level of well-being of the

people's life.

Evaluation of economic efficiency is always correlated with the goals of production in the future, but it describes the performance of the past, and its value is manifested in the present period. Consequently, the totality of the results of production activities for separately taken period of time is the efficiency of fish production.

All factors of the economic efficiency of the fish production can be classified: according to the resources and costs of production, according to the main directions of formation of the economic efficiency of production on the implementation of directions at various levels of management. Classification of resources and costs allows you to identify the sources of increasing the efficiency of production and its components. It answers the question of what resources or costs can be achieved saving labor, increasing the efficiency of fish production.

The main directions of formation of economic efficiency, i.e. with the help of which the growth of production efficiency is achieved. They are also very diverse, the most important of them are technology, specialization and size of production, labor organization, scientific and technical progress and the best practices. Improving the quality of work tools is to increase the productivity and profitability of production fixed assets. But no matter how the production resources themselves are committed, the economic efficiency of fish production can be relatively high, provided that these resources are used quite fully and intensively. At the same time, the realization of factors of efficiency in the use of production, resources, production as a whole, from the point of view of material-material elements, is possible only if there are appropriate production relations (Figure 1).



**Figure 1. Production and economic relations as factors of fish production efficiency [23].**

The decisive factors of efficiency from the point of view of production relations are the incentive motives of commodity producers to work and developed market relations. The realization of relations on the created product, income and on the means of production can be carried out with the greatest efficiency in the system of developed market relations.

The implementation of factor analysis begins with checking its state. The existence of such conditions will allow us to conclude that the process or phenomenon of the event, its current or future status and the influence of certain factors will allow us to evaluate and predict the course of action or changes in the process. Failure to comply with this requirement may lead to a completely unexpected conclusion and suggestions about what was

said.

Mandatory requirements for factor analysis are as follows [12]:

- all marks must be quantitative;
- the number of observations should be at least twice as large as the variables;
- samples must be identical;
- the initial variables should be symmetrically distributed;
- factor analysis should be associated with variables.

From the earliest times of independence, the country's economic and social, organizational and regulatory conditions for economic management and production organization have changed dramatically due to the implementation of economic and social reforms aimed at the formation and development of elements of a market economy in the fisheries. A new system based on market relations was created. As a result of the reform, the fisheries sector led to the work with fish farms of various formations.

During the study, we analyzed the factors affecting the efficiency of the fish production on the following four groups:

- Organizational and legal factors;
- Economic factors;
- Natural and geographical factors;
- Socio-demographic factors.

Organizational and legal factors include regulatory documents, foreign and domestic policies, state support for industry, the level of resource provision. Decrees and resolutions of President of the Republic of Uzbekistan, decrees and resolutions of the Cabinet Ministers of the Republic, as well as decisions and regulations adopted by the interested ministries, departments and organizations (Ministry of Agriculture, Ministry of Water Resources, "Uzbekfishindustry" Association), are directly used for the development of fisheries.

It should be noted that over the past two years, conceptual changes have been made on the ground as part of the reorganization of the "Uzbekbaliksanoat" Association and within its objectives and capabilities. In addition, due to organizational and economic changes in the system of ensuring the feed base of the fish sector, especially, in providing material and technical resources, as well as new rules and regulations, the economic activity of fisheries has changed in a positive way.

Natural and geographical factors - the geographical location and relief, air temperature, rainfall and season; the number, composition and status of water; the state, number and structure of the animal and plant world are natural - geographic factors.

Economic factors – factors such as tax, credit, insurance, inflation, customs fees, purchasing power, pricing policy, payment system, monetary policy by central bank, foreign currency liberalization, including, financial independence.

Socio-demographic factors - such as population, composition and location, National mentality, traditions, Fish culture, interests and Infrastructure condition, location.

In many spheres the problem is that, according to the results of observations, it is necessary to determine the relationship between the associated parameters.

The relationship and influence between factors have been studied widely in foreign literatures, use of these factors in the development of region and fishery

sector allows them to substantiate not only economic, but also ecological sustainability [13, 14, 15].

In addition to the factors mentioned above, we should pay attention to the economic indicators of fish farming through a closed water circulation system in the Fergana region, then the total income of 0.75 hectares in a closed water circulation system in 2018 amounted to 607.2 million soums, in 2019 – the income accounted for 709.6 million soums (Table 1).

The costs of the farm in 2018 amounted to 367 million soums, in 2019 - 424 million soums, while the level of profitability was 65% and 67.2%, respectively.

The farm has taken advantage of tax incentives for setting up a fish farm using intensive technologies. The closed circulation system used 16,000 cubic meters of water. It is important to note that the water can be re-discharged into the water source by purifying it in a closed system. In this case, the water consumption is 3%.

According to the Resolution of the President of the Republic of Uzbekistan dated April 6, 2018 № PR-3657 “On additional measures for the accelerated development of the fishing industry”, the widespread introduction of innovative and modern intensive technologies, including cage, closed water circulation systems is very important. Particular attention was paid to increasing the volume of catches due to fish farming and increasing the productivity of artificial reservoirs, improving the work on the cultivation and breeding of valuable species of fish and fry within the framework of public-private partnerships [1].

Table 1.

Economic indicators of fish farming through closed water circulation systems in Fergana region [22]

Indicators	Unit of measurement	2018	2019
<b>General indicators</b>			
Total land area	ha	0,75	0,75
Grown fish	kg	50590	53214
Water consumption	thousand cubic meters	18	15
The number of workers	person	5	6
<b>Costs</b>			
Salaries and deductions	thousand soums	120000	144000
Feed costs	thousand soums	186500	214000
Electricity costs	thousand soums	34000	35000
Water costs	thousand soums	3780	4000
Cost of fry	thousand soums	9500	10000
Biostimulants	thousand soums	6000	5000
Depreciation expense	thousand soums	4562	7845
Other expenses	thousand soums	3645	4567
<b>Economic indicators</b>			
Total income	thousand soums	607185	709616
Total costs	thousand soums	367987	424412
Total profit	thousand soums	239198	240763
Profitability	percent, %	65	67,2

The issue of using intensive technologies in fish farming has risen to the level of public policy. In particular, as noted in the government videoconference on November 14, 2019: “There are many problems in the development of highly productive areas of animal husbandry in the short term, in particular, poultry farming, fish farming, rabbit farming”. In particular, today only 460 hectares (1%) out of 38,000 hectares of artificial reservoirs create an intensive form of fish farming. The main reason for this is that the cost of intensively farmed fish is 2 times more expensive than traditional farmed fish. Therefore, entrepreneurs are comfortable with the simple method. However, if fish farming in this way does not exceed 2-3 tons per hectare, you can get up to 100 tons of fish in intensive fish farming [21].

Another effective method of intensive fish farming is the cage method, which is also very promising in our country.

Intensive fish farming in cages has advantages over traditional fish farming in ponds. One of them should be placed directly in water bodies and occupy only a part of them.

This allows the use of water resources not only for fish farming, but also for other industries. Another advantage is that, as in water bodies, the use of significant land areas in agricultural use is not required.

Unlike traditional fish farming, cage culture does not require forced water exchange or energy consumption to pump water. Cages are always passive, that is, they do not require special labor from a person. The exchange of water inside the cage is created by the movement of the fish and occurs due to the movement of waves. Therefore, the cages have a constant renewal of water and its quality complies with the standards of fish farming. The same physicochemical regime is created in reservoirs with good water permeability of cages. This allows an increase in the number of fish species compared to water bodies. More carp and African catfish can be grown this way.

The cages installed in lakes and reservoirs make it possible to use the natural forage resources of lakes and reservoirs. That is, an increased concentration of zooplankton, phytoplankton, benthos, and wild fish is observed around the cages, which can enter the cages using a jet of water with mixed feed and fecal residues washed through nylon holes.

One of the social benefits of cages is the ability to place them in and around settlements.

This will open access to the farm, labor resources, the use of ready-made communications (power lines, water supply, gas pipelines, transport, food, etc.).

The cages use plastic nets with cells from 8x8 cm to 20x20 cm, each side of which is 5 meters. The depth of the mesh is 8 meters. As the fish grows, they are transferred from one mesh to another.

Marketable fish in cages is raised for 5-7 months. During this period, the fish grows from 250 g to 1.5 kg. The water temperature should not exceed 20 degrees, and the oxygen content in the water should not be less than 7 mg / l. It is advisable to discard 100-250 eggs per m3. On average, 10-15 kg of commercial fish are caught from 1 m3 of the basin. The average profit of 1 kg fish is 10 thousand soums [22].

Discussion and suggestions.

The main expected economic results of intensive fish culture in cages are:

- does not require placement on large areas of water

bodies or lakes;

- As in traditional fishing, it is not necessary to equip large reservoirs, occupy agricultural land;

- The physical and chemical regimes in the cage are the same as in water bodies, which allows reproduction of valuable fish species, including salmon and sturgeon, in comparison with water bodies.

- It is possible to place the cage near to ready-made communication stations, which reduces the cost of production (power lines, water supply, gas pipelines, transport, etc.).

Expected ecological results of intensive fish culture in cages:

- cage fish farming is aimed at preserving the environment;

- does not harm the water body or natural landscape;

- a zone with a high concentration of zooplankton, phytoplankton, benthos, wild fish has been created around the cage.

Expected technical results of intensive fish farming in cages:

- there is no need to consume the water pump and the electricity to provide forced water exchange.

Expected social results of intensive fish culture in cages:

- additional jobs will be created for the local population;
- provide the population with local valuable fish species.

It is advisable to develop an organizational and economic basis for the development of intensive fish farming in the future and implement the following ways to improve it. Including:

Economic support methods:

1. One of the important factors in ensuring the efficiency of the intensive fish farming sector is the cleanliness of the water in the fish ponds. The analysis shows that after the introduction of innovative and resource-saving fish farming technologies in the most intensive fish farms, due to the lack of working capital from 2-3 years of operation, repair and replace equipment and structures that purify unusable water and transfer it to new ones. Due to the lack of working capital, they are unable to ensure the quality of water at the standard level. This leads to an insufficient weight of fish during the technological period, incomplete absorption of nutrients and a decrease in quality, which ultimately leads to a decrease in the productivity of the basin.

Therefore, we consider it expedient to introduce a system of state subsidies for 50% of the costs of water treatment in fisheries for 5 years and 30% for the next 3 years. Targeting saved water treatment costs towards farm modernization and mechanization of cooling and work processes, as well as building the farm infrastructure will serve as a criterion for this subsidy system to ensure the complete establishment and development of farm infrastructure in 3-5 years.

We consider it expedient to determine the rating of fish farming and introduce such a system of benefits and support based on the rating of fish farming, so that this system and the mechanism of economic support from the state are not periodic, but targeted and permanent, and the conditions for subsidies are transparent. We consider it expedient to use the basis of such a rating as a system of indicators reflecting the production and socio-economic and environmental efficiency of economic activity. Giving farms priority in the ranking of such economic

support systems will increase the interest of these farms in the modernization of production and the formation of economic infrastructure, as well as encourage other farms to work more efficiently and actively.

Recommendations. One of the most pressing problems of the development of fish-farming in modern conditions is to increase the efficiency of the industry. Economic efficiency is a complex economic category in which the action of economic laws is reflected and the most important aspect of an enterprise's activity is shown - its effectiveness.

On the basis of theoretical assumptions, it can be concluded that the criterion of the economic efficiency of fish production is the quantity and quality of incubated caviar at minimal cost, fishing, and making a profit from the sale of fish products by fishing organizations and enterprises.

Consequently, the efficiency of fish production can be defined as the optimal use of resources in comparison with the social needs of caviar and juveniles released into reservoirs.

The significant importance of fisheries takes priority over the accelerated development of aquaculture in the country. But the lack of investment resources and working capital, high credit and tax rates, legal restrictions and bureaucratic obstacles complicate the development of this sphere. Therefore, the main task at the present stage is the search for an economic mechanism that stimulates the recreation and development of aquaculture. Currently, the most important process in aquaculture is to develop the market economy methods by fish enterprises.

The new conditions of their economic activity predetermine the need to develop new approaches to the problems of economic development, to improve management and production efficiency including, improving competitiveness of fishery products.

We believe that in order to implement, effectively manage and engage the interests of different levels of government, it is necessary to consider the size of efficiency. And in this regard, we propose a methodology for managing fish farms taking into account the effect of specific factors and processes of fish production on efficiency.

In order to better understand the specifics and essence of the efficiency of fish production as a component of fisheries, which will manifest itself in the current state of the economy and be taken into account, we have systematized a number of concepts and indicators in the future; characterizing only fish production and not using in other sectors of the economy, the relative indicators for evaluating the effectiveness of the main links of the technological cycle of fish production.

Conclusions. We propose a procedure for the formation of the management strategy of the fish-breeding enterprise, allowing to ensure the development of fish-farming.

When considering the characteristics and specifics of fish production, the main factors that have a significant impact on the development of fish-farming are formulated:

- natural factors in modern conditions are still not controlled;

- socio-economic favorable labor regime, optimal infrastructure, the general economic situation of the country, raising the living standards of the fish industry workers. These elements create favorable conditions for the efficient management of fisheries and fish production in particular, sustainable production, the implementation

of expanded reproduction;

- biological factors allow to increase the stability and efficiency of production;
- organizational - effective government support, rational use of production potential, organization of scientific activity.

All this is intended to ensure the rational use of labor, material and natural resources, to promote the sustainability of development and the efficiency of fish production.

Thus, the rational and skillful use of the above factors and management strategy will ensure further sustainable development and the efficiency of fish-farming.

The study revealed that there is a link between fish farming and the feeding system in private farms.

In general, defining and analyzing the factors, affecting the development and efficiency of the fish-farming might be give a big opportunity to prepare favourable conclusions, to identify factors and eliminate problems relative to the sector, and in the end this can be give great results. In addition, intensive fish farming is a new direction in the country, and by improving it, it will be possible to satisfy the population's demand for fish farming products, increase their processing and the possibility of creating added value in the industry. Short-term experience in the field of fish farming shows that the development of closed fish farming, increasing its productivity and resource efficiency remain among the urgent tasks, and the solution to this problem is the organizational and economic support by the state.

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