DEVELOPMENT OF INTENSIVE FISH FARMING IN CONDITIONS OF FOOD SECURITY

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Abstract

This article gives information about organizational and economic supports by the state for the development of fish farming. Moreover, proposals to improve the economic and organizational base for the development of intensive fish farming and mechanisms for its implementation were proposed. As well as, to create consulting centers separately for the regions was recommended in this paper.

Key words: intensive fish farming, closed water circulation systems, cages, economic and organizational support, natural and artificial reservoirs, resource-saving technologies.

Introduction. In recent years, the country has carried out large-scale reforms in the production, sale and supply of fish and fish products to consumers. As a result of the development of science and technology, the methods and means of fish farming are also changing and improving. In particular, today, in practice, two methods of fish care are widely used, one of which is fish farming using natural reservoirs, and the other is fish farming by a manufacturer of products under technical conditions.

In the first method, the organizational and economic basis of fish farming is formed, a service system that is also based on many years of practical experience. However, aquaculture is a new area in the practice of intensive fish farming methods and technologies. In this regard, the reforms carried out by the state in recent years are also yielding positive results, and due to the created opportunities and advantages, fish farms are strengthening their material and technical base.

In particular, in order to support the fishing industry in the country, improve the efficiency of fishing, rational and efficient use of land and water resources in this area and the widespread introduction of intensive technologies there was adopted Presidential Resolution "On measures to support the fishing industry and improve its efficiency" [2]. In accordance with this Resolution No. PR-4816, in conditions of water shortage, fish farms receiving water from rivers and canals have the opportunity to gradually introduce new resource-saving technologies and the widespread use of secondary water sources in artificial reservoirs [19].

In general, the technology of intensive fish farming is understood as the technology of intensive fish farming in artificial reservoirs, small reservoirs, closed water circulation systems and cage farms.

Of these, the technology of intensive artificial reservoirs is the technology of artificial reservoirs with an area of no more than 2 hectares, with an average depth of at least 2 meters, 2-4 aerators and more than 8 tons of fish per hectare.

Intensive technology of small ponds is a technology of growing dense fish at least 10 kg (5 kg for carp) per 1 m^3 of water in the pool facilities. In recent years, the technology of an intensive closed water circulation system has also been developed, which is a technology for purifying water in a reservoir (mechanical, biological, pumping and oxygen generator) and producing fish of at least 20 kg / m^3.

In addition, another method of intensive fish farming is the technology of intensive fish farming in cage (cage) farms, which understands the technology of raising fish of at least 10 kg per 1 m^3 of water [18].

Materials and Methods. Today, intensive and extensive methods of fishing development are developing in parallel. Intensive fishing provides opportunities for the reproduction of high-yielding fish species as modern and efficient means of production, technologies and basic means of production.

If we look at the state of aquaculture in our country, it is organized mainly like pond fishing. In particular, artificial ponds have appeared, and fish productivity in these ponds remains low. This is an average of 17 centners per hectare. For the development of the industry, it is necessary, first of all, to eliminate a number of factors hindering its development.

In particular, the lack of enterprises specializing in the cultivation of fish seeds (larvae, fry);

- lack of a highly profitable fishing enterprise that could be studied as a model due to the lack of qualified specialists;
- lameness in the formation of reproductive parental forms of fish;
- fish farming in most private mini-ponds is carried out mainly in an extensive way, i.e. through the formation and development of a natural food base, and so on.

It is known that in pond fishing, polyculture feeds mainly on carp, grass carp and silver carp. According to the technology of feeding fish, carps are mainly fed with compound feed. Due to the lack of high-quality compound feed and high prices, mass feeding of carp began to reduce economic profitability, and they were replaced by silver carp, which can only grow with natural feed.

At the same time, the main part of the fish that are fed during intensive fishing is silver carp and partially grass carp and carp. Intensive fish farming technology maximizes benefits at the lowest cost.

However, there is another side to the question: to what extent does the quality of the farmed fish correspond to the market demand? That is, silver carp meat, which makes up the bulk of farmed fish, lags far behind carp in quality, which, of course, leads to a lower market price for this fish.

But, nevertheless, fishermen see the future of this style as promising. Since, as mentioned above, the high cost or lack of compound feed creates the need for intensive development of fishing, which allows efficient use of feed. If we pay attention to the components of the natural food base of fish, as well as to the scientific and material basis of their development, then in any body of water there will be a certain number of natural species of plants and animals. In particular, fish ponds contain a certain amount of phytoplankton, zooplankton, macrophytes and benthic organisms. These living organisms, present in water bodies, constitute the natural food base

of fish. This natural nutrient base in ponds cannot produce enough to feed the compressed fish.

Therefore, fishermen are developing a number of measures to develop the natural nutritional base of ponds. In particular, the ponds are covered with various organic and mineral fertilizers. Organic fertilizers are mainly manure, compost, poultry manure, which contain nitrogen, phosphorus, potassium, calcium and others. Mineral fertilizers include potassium, nitrogen, phosphorus, calcium and other types of fertilizers and lime. These fertilizers serve as food for algae, bacteria and invertebrates. These organisms, in turn, become a direct or indirect food source for fish.

Today, special attention is paid to the creation of new artificial reservoirs for intensive fish farming, the allocation of additional land, soft loans to meet the needs of the fish industry in mineral fertilizers and high-protein pelleted feed. But along with quantitative indicators, the problem of improving quality indicators is urgent.

The purpose of the development of intensive fish farming in our country is to obtain the maximum productivity per unit of water at the lowest cost.

Intensive fish farming is characterized by the improvement of biotechnology, the use of artificial means, feeding the fish with pellets, controlling the water, increasing productivity, caring for fish of different breeds and ages, and the comprehensive mechanization of the fish farming process. As a result of intensification of production, labor productivity will increase, and all types of resources will be used more efficiently.

Intensification of fish farming will require additional costs per unit of water body, but they will be effective only if the growth in the added value of additional production exceeds the growth rate of additional costs.

Intensification of fish farming is considered cost-effective, and depending on the direction of scientific and technological development, the following types of intensification are distinguished:

- intensification of labor costs in intensive fish farming - this will increase labor productivity by reducing the number of people employed in fish farming;

- saving money with intensive fish farming - this means less resources in the size and cost of fixed assets in the farm;

- cost savings in intensive fish farming - saving resources such as raw materials, fuel, electricity, at the expense of one unit of growing fish.

The only way to significantly increase the volume of fish farming in the country based on intensive technologies is to develop new high-performance biotechnologies based on the principles of integrated water use and expand the list of intensively farmed fish. By increasing the productivity of cages to 40 kg / m^3, we have the opportunity to increase production by 50%, and through the development of intensive fish farming in closed basins, to produce 2-3 times more than at present. The issue of choosing new objects for intensive fish farming remains relevant. Two factors are very important: the ratio of fish species to salinity and water temperature. Currently, only freshwater fish species are suitable for Uzbekistan, and in the future it is necessary to use salt water. The water in the foothills and mountainous regions of Uzbekistan is cold, and the temperature does not exceed 18 degrees throughout the year, therefore, it is necessary to develop fish farming in cold water in these zones. And fish species can be raised in warm water on the plains [8].

On the other hand, intensive indoor fish farming makes it possible to care for the two aforementioned fish species through the ability to control the water temperature, which also reflects the superiority of intensive technologies. Therefore, in recent years, special attention has been paid to the development of intensive fish farming. In particular, in the Fergana region, a project has been implemented on intensive fish farming in indoor pools, which today has shown its economic efficiency in practice.

If we 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 No. 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].

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 [17]. 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

Table 1

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

Indicators	Unit of measurement	2018	2019
General indicators			
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
Costs			
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
Economic indicators			
Total income	thousand soums	607185	709616
Total costs	thousand soums	367987	424412
Total profit	thousand soums	239198	240763
Profitability	percent, %	65	67,2

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 m^3. On average, 10-15 kg of commercial fish are caught from 1 m^3 of the basin. The average profit of 1 kg fish is 10 thousand soums.

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.

An aspect that should be taken into account when implementing this system and mechanism is that support tools should be organized separately between fisheries in the plains, mountains and foothills. This is due to the fact that the water quality in the mountainous and foothill regions is relatively clean, and the probability of water drying out is relatively low (Figure 1).

2. One of the conditions for the introduction of such a system is the introduction of the digital economy and IT-technologies in the field of fish farming. The reorganization of the industry based on the digital economy and IT technologies should become one of the strategic tasks of the "Uzbekbaliksanoat Association" in the near future, and these measures should be organized on the basis of the state target program based on the production and management characteristics of the industry. This approach, firstly, provides the basis for the formation of a database of fish farms; secondly, it allows one to pursue a unified and modern state technological policy in the field of fish farming; thirdly, to control the activities of fish farms in the industry, and to increase economic efficiency. It allows to quickly implement decisions and conclusions in practice and, fourthly, ensures the transparency of economic support measures provided by the state based on the rating of these farms.

Thus, the gradual organization of the implementation of the digital economy and IT technologies in the fishing industry on the basis of targeted government programs will ensure the intensive development of the industry, the organization and effectiveness of "Smart Fish Farming" in the industry.

3. The analysis shows that the main equipment and machinery in the intensive fish farms of the country are imported from abroad at the expense of foreign currency.

The most important thing is that not only fish care, but also fry, fish food, as well as the cultivation, preparation, technology of fish feed and a significant part of the feed are imported from abroad at the expense of large amounts of foreign currency. The lack of marketing and logistics centers for intensive fish farming technologies has led to the formation of an expensive gross cost of technological equipment for fish care and fish production at intermediary enterprises, which ultimately leads to an increase in the cost of fish and fish products.

4. Fish farming is one of the most vulnerable areas to natural disasters and adverse weather conditions. This situation requires the introduction of special forms and systems of insurance for fish farms against adverse events, such as sudden changes in weather (temperature rise, cold, deterioration of water supply due to a decrease in precipitation), fish diseases. However, it is proposed to provide long-term technological processes for the production of fish products - 8-12 months, as well as additional time and financial resources for organizing expanded reproduction and the lack of such funds to ensure economic sustainability through insurance of farms that have introduced intensive fish farming. In this case, it is recommended to subsidize up to 30% of the insurance premium, differentiated according to the geographic location of the area where the farms are located.

In terms of organizational support:

1. Although practical experience in the field of intensive fish farming is being formed, the question of its approach from the point of view of its specificity in the regions of the country, requirements for water resources and their conditions remains open. In addition, the characteristics of demand and consumption in regions for fish and fishery products in the context of intensive fish farming is one of the aspects that needs to be studied separately.

Therefore, it is advisable to create exemplary intensive farms and centers for their popularization in areas with a developed fishing industry. At the same time, special attention should be paid to the broad involvement of economic entities based on the principles of public-private partnership. It is advisable to introduce tax and customs benefits when creating centers for stimulating intensive fish farming by private entrepreneurs, and to develop a separate water supply system.

2. The issue of growing fish species and their seeds in conditions of intensive fish farming is one of the main problems facing fishermen today. Entrepreneurs face difficulties in importing and caring for fish seeds. From an organizational point of view, a scientific and practical solution is coordination with fish farming research centers, agro-consulting centers, which ensure the integration of

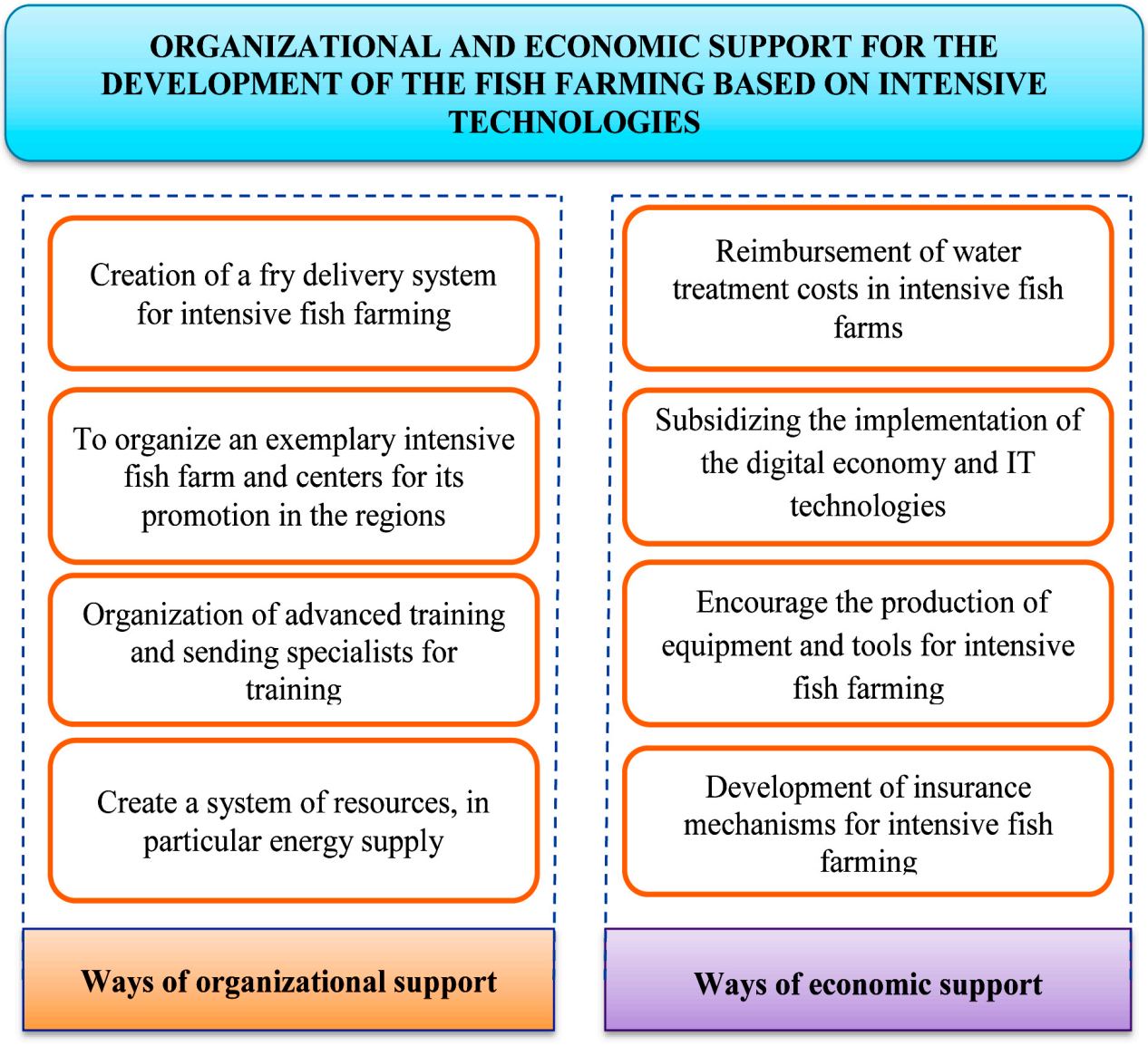


Fig.1. Ways of organizational and economic support for the development of the fish farming based on intensive technologies

science and practice in agriculture, in order to focus on the creation of their consulting centers in the regions.

According to the results of studies on the development of intensive fish farming in the Mingbulak district of the Namangan region, where fish farming is developed, enterprising entrepreneurs of the region prefer to raise fish in an open pool. The main reasons for this are that the farmed fish are adapted to the water and the natural climate of the area, while the intensive fish has special demands on the water temperature and salt content. They believe that ensuring this will create difficulties. Therefore, it is proposed to create consulting centers separately for the regions.

3. The main direction of intensive fish farming, which should be supported by the state, is the creation of a system for providing resources. This is due to the fact that during intensive fish farming it is necessary to maintain a constant water temperature of 20-220 C. But due to power outages in the regions, it is difficult to maintain it constantly. In this context, the state should develop special programs for the energy supply of fish farming. In particular, it is advisable to supply fish farms with electricity in an intensive mode through a separate line.

4. It is important to study the experience of countries such as Vietnam and Singapore, where intensive fish farming is developed. In particular, it is desirable to develop practical skills through mutual exchange of experience, training, and sending specialists to internships.

Today, lending and financing, insurance, training and professional development, the system for the development of breeding and genetic fund are one of the important factors in providing the industry with feed (Figure 2).

This is, firstly, partial and full coverage by the interest rate of bank loans and secondly, the increase in the level of water salinity as a result of the rise in the surface of groundwater is not included in the current procedure, it is necessary to enter these indicators as insurance and set the maximum amount of insurance money in the amount of 30 percent and an insurance premium of 5 percent and thirdly, providing the industry with qualified specialists armed with modern knowledge will serve as the basis for further strengthening the food base.

Stimulus	Name of Measures	Sources of Financing	Responsible Executors	Expected Results
Through lending and financing	- to guarantee partial or full repayment of the interest rate on loans for feeding fish farms; - to develop a feeding system for fish farms, encourage investors to participate; - to carry out research and innovation projects to improve the food supply of fisheries and improve the organizational and economic foundations of fisheries.	Funds of commercial banks and profit of fish farms, means of international grants, grant funds of state scientific and technical programs	State Committee for the Development of Veterinary and Livestock of the Republic of Uzbekistan, Scientific and production Center for Agriculture and Food, Ministry of Innovative Development, Commercial Banks, Scientific-Research Institute of Fish Farming	The feed provision system for the fish farms will be improved, the type and quantity of quality feed will increase
Through insurance	- insurance of losses associated with the supply of feed to fish farms and cases of non-fulfillment of the contract clauses; - insure an increase in the level of water mineralization and set the maximum amount of insurance money at 30 percent and insurance premiums at 5 percent.	Funds of insurance companies	State Committee for the Development of Veterinary and Livestock of the Republic of Uzbekistan, Scientific and Production Center for Agriculture and Food Supply, "Ozbekbaliksanoat" Association, insurance company, relevant departments and organizations	Efficient business environment will be created by eliminating possible risks
Through training, professional development and training of personnel	- advanced training of fish industry specialists once every three years; - organization of short-term training seminars with the involvement of specialists and scientists working in this field at least twice a year; - organization of internships for fish industry specialists at universities and research centers of advanced foreign countries with intensive fish farming; - training of personnel in the field of master degree in cooperation with developed countries of fish farming, training of highly qualified scientific personnel.	Own funds of performers, means of the Fish Farming Development Fund, means of international grants, grant funds of state scientific and technical programs	State Committee for the Development of Veterinary and Livestock of the Republic of Uzbekistan, Scientific and Production Center for Agriculture and Food Supply, Ministry of Innovative Development, Association "Uzbekbaliksanoat", Scientific-Research Institute of Fish Farming, relevant higher educational institutions	Specialists armed with modern technolo-gies and knowledge will be formed in the industry
Through selection and development of the genetic fund	- stimulating the import of breeding materials (fish fry, genetic devices, etc.) from countries where the fishing industry is developed (Russia, Hungary, Vietnam, China, Turkey); - stimulating the development of a genetic fund aimed at the development of science in the field of fisheries.	Means of international grants, grant funds of state scientific and technical programs, means of the Fish Farming Development Fund	State Committee for the Development of Veterinary and Livestock of the Republic of Uzbekistan, Scientific and Production Center for Agriculture and Food Supply, Ministry of Innovative Development, Scientific Research Institute of Fish Farming	As a result of the import of fish breeding materials, the genetic fund will be developed

Fig.2. Ways of organizational and economic support for the development of the fish farming based on intensive technologies

Conclusion

We think that at the regional level the real support of the fish farms can be ensured by the formation of a system of basic laws and regulations, the identification of priority areas and, on their basis, investments in the development of the fishing industry, conducting the continuous monitoring of financial investments, implementation of measures to create different conditions for the formation and use of financial resources, implementation of the strategy for the development of fish farming.

Thus, the fish farming has great economic importance in the present conditions and can bring an even greater economic effect in the long term, with the introduction of new innovative technologies for processing of products.

Organizational and economic stimulation of strengthening the fodder base in the fish farms themselves and supplying them with fodder from external sources, as well as in order to improve the food supply of farms, the allocation of land area based on the area of the reservoir, fish productivity per 1 m^3 of the reservoir and the level of groundwater will give good results.

Therefore, it is advisable to carry out economic stimulation of food supply for fish farms by the state through guaranteeing partial coverage of bank loans and covering their full interest rates, apply insurance at a 30 percent rate for damage caused as a result of water mineralization and establish a 5 percent level of insurance premium, issuance of customs and tax benefits for feed-processing and pellet-producing enterprises, fish farms and organizations. In short, 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.

Therefore, in the course of the study, proposals were developed to improve the economic and organizational base for the development of intensive fish farming and mechanisms for its implementation were proposed.

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