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## Regulatory mechanisms of responsible aquaculture and sustainable development of ecotourism in territorial communities

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**Abstract.** The article analyzes the current state of aquaculture production and recreation in Ukraine, industry problems, the potential and possible ways of situation improvement. It examines tools for developing aquaculture production based on the integration with ecotourism. One has developed a scheme of the interaction between industries and other

economic entities in Ukraine. The goal of the article is a comprehensive analysis of the development of responsible aquaculture combined with the ecotourism growth, encouraging the improvement of Ukraine's economic, tourist and natural potential, sustainable development and economic growth along with the application of resource-saving technologies. One has concluded that the existing synergetic effect has a positive nature and allows not only creating competitive products for Ukrainian consumers but also entering the global market, involving users of recreational services in Ukraine, which substantially increases the potential of this region. The article analyzes the current state of ecotourism in Ukraine, provides recommendations for solving existing problems and increasing the investment flow in the industry by enhancing the demand for ecotourism products, which will positively affect macroeconomic indicators and the national reputation. It is proven that the responsibility for the regional ecological state and control over local enterprise activities should be delegated to local communities because of their susceptibility to changes and rapid response in order to create social systems of environment quality control. One has developed models of dependence of ecotourism development on investments in recreation facilities where the quantity and quality of services will significantly grow, which can become competitive on both internal and external markets and have unique offers not only by applying natural resources but also by providing technological and complex services. It is proven that the use of innovative technologies based on the automation of the aquaculture production process will enhance financial results and decrease external negative effects. Besides, it is more eco-friendly than conventional pond production, but it is capital-intensive and requires investment generation.

*Keywords:* ecotourism, territorial community development, recreational services, synergetic effect in tourism, responsible aquaculture.

## Регулятивні механізми відповідальної аквакультури та сталого розвитку екотуризму територіальних громад

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**Анотація.** У статті проаналізовано сучасний стан галузі виробництва аквакультури та рекреації в Україні, зроблено аналіз щодо проблем галузей, потенціалу та можливих шляхів покращення ситуації. Розглянуті інструменти розвитку виробництва аквакультури на основі інтеграції з екотуризмом, розроблена схема взаємодії галузей та інших суб'єктів господарювання в Україні. Метою написання статті є ґрунтовний аналіз розвитку відповідальної аквакультури у поєднанні з розвитком екотуризму, що сприяє покращенню економічного, туристичного та природного потенціалу України, впровадженню сталого розвитку та економічному зростанню одночасно з використанням ресурсозберігаючих технологій. Зроблено висновок, що наявність синергетичного ефекту має позитивний характер та дозволяє створювати конкурентну продукцію не тільки

для українського споживача, а і виходити на світовий ринок, залучаючи користувачів рекреаційних послуг в Україні, що значно підвищує потенціал даного регіону. Зроблено аналіз сучасного стану екотуризму в Україні, надано рекомендації щодо вирішення існуючих проблем та збільшення потоку інвестицій у галузь, шляхом збільшення попиту на продукцію екотуризму, що позитивно відобразиться на макроекономічних показниках та іміджі всіх країни. Доведено, що відповідальність за екологічний стан регіону та контроль за діяльністю місцевого підприємництва доцільно надавати місцевим громадам через їх чутливість до змін та швидку реакцію, що допоможе створити громадські системи контролю якості природного середовища. Розроблено моделі залежності розвитку екотуризму від інвестицій у об'єкт рекреації, де кількість і якість наданих послуг значно підвищиться, що може стати конкурентноспроможним, як на внутрішньому, так і на зовнішніх ринках та мати унікальність пропозиції через використання не тільки природних ресурсів, а і надання технологічних та комплексних послуг. Доведено, що використання інноваційних технологій, заснованих на автоматизації процесу виробництва аквакультури сприятиме підвищенню фінансових результатів, зменшенню зовнішніх негативних впливів та є екологічнішим, ніж традиційне ставкове виробництво, але є капіталомістким, тому потребує залучення інвестицій.

*Ключові слова: екотуризм, розвиток територіальних громад, рекреаційні послуги, синергетичний ефект у туризмі, відповідальна аквакультура.*

## Introduction

Year by year, the world faces the increasing production and consumption of goods, including foodstuffs, caused by changes in the number of inhabitants, consumer preferences, structure and range of goods. Global aquaculture is one of the strategic areas of meeting public needs and one of the sectors advancing quite rapidly and becoming more and more automated. Currently, we can see a substantial difference in aquaculture production in developed countries and countries that have lower economic performance. Countries with the low level of development primarily use manual work while developed countries are establishing a system of ecological extraction and aquaculture cultivation where manufacturing automation is combined with technologies of growing eco-friendly products in compliance with all sanitary and epidemiological standards.

The world's leader in aquaculture production is China that features a growing share of the creation of artificial water management and an increasing demand for Chinese products due to the low price and simplified transportation system. At the same time, Ukraine features prevailing aquaculture import and is just forming the demand for local products (Aquaculture in China: Success Stories and Modern Trends, 2018). In Ukraine, which constantly improves the current legislation and adapts it to the European space, there are laws and regulations controlled by the State Agency of Melioration and Fisheries of Ukraine. However, the role of aquaculture shadow production and extraction is still in a high level compared to the European Union where the regulation is strict while penalties and sanctions for non-compliance with laws are much higher (Department of the State Agency for Land Reclamation and Fisheries in Kyiv and Kyiv region, 2021).

The novelty of the work is the development of the concept of combining natural systems that can be used as manufacturing resources for further eco-friendly entrepreneurship with cutting-edge automated control systems of aquaculture production and ecotourism services provision in order to improve ecological, social

and economic conditions of this region, which will encourage the steady development in Ukraine.

To enhance the protection of the rights of organic product consumers, it is necessary to advance and harmonize the legislation on the assessment of product compliance given the legislative requirements of the European Union, which will allow adapting the Ukrainian control system of organic product manufacturing to the EU requirements (Dyudyaeva, 2021).

Along with the construction of manufacturing areas and aquaculture extraction, one establishes farm management and maintenance systems nearby. In developed countries, it is more and more popular to create ecological recreation areas around the territory of aquaculture breeding and extraction, design landscape parks, conduct excursions, develop ecotourism and create eco-friendly recreation areas.

While creating an aquaculture production area, there is an issue of solving a multi-criteria task with alternative solutions. In such cases, while choosing strategies for further actions, it is viable to use the sensitivity analysis combined with MCDM methods for making appropriate economic decisions, which will allow reducing risks during project implementation (Francisco Vergara-Solana, 2019).

In developed countries, it is popular to grow aquaculture with the integration into farming and recirculation systems, create multi-trophic chains (RAS, BFT, IMTA), which allows balancing natural systems, constantly controlling the life cycle and ecological effect of enterprises (LCA) (Matheus et al., 2020).

Currently, manufacturing of permanent aquaculture and organic products is the priority in Ukraine and around the world, the demand for which constantly grows and ensures national food security (Harbar et al., 2020). With aquaculture being a part of the ecosystem and forming it, places near water bodies can be ecotourism facilities. Therefore, they should have better economic performance than other territories in order to increase the competitive ability among tourists of this area.

## Literature analysis

Ukrainian scientists state that digital globalization and integration processes worldwide make Ukraine shift to market economic systems and the concept of green economy using advanced technologies, energy saving, creation of eco-friendly products, the demand for which is defined by consumer needs while the price is formed under the-market conditions (De Schryver et al., 2008).

Ukraine has a lot of problems of aquaculture development primarily related to the low modernization of manufacturing, low purchasing ability of society, market dependence on import and especially on popular aquaculture products that are not cultivated in Ukraine; a great share of the shadow market; a slow level of the support of private entrepreneurs producing aquaculture products (Burgaz et al., 2019).

An example for Ukraine can be Denmark, according to Grant, J. et al., where except for organic cultivation of aquaculture in places of its breeding, one has developed an infrastructure for training sessions, seminars, practical classes and excursions for everyone interested, everyone desiring to increase their knowledge of agricultural product manufacturing (Grant, Pastres, 2019).

Varga, Berzi-Nagy, Csukas and Gyalog (2020) state that the world is modelling an ecosystem given dynamic indicators to control feeding, aeration, stocking density and the level of the water body and ecosystem near the water reservoir for efficient production of goods before the construction of the recreation area and for constant monitoring and analysis after construction.

Outeiro, Byron and Angelini (2018) have concluded that numerous automated systems allow calculating the manufacturing and ecological capacity of the ecosystem. Ecopath software by Climefish and other solutions will help to solve complex problems of breeding aquaculture and keeping the ecosystem in a proper state.

To analyze the tourist potential of Ukrainian regions, it is viable to combine natural resources with the improvement of the quality of services and the use of the cultural potential. Scientists in their works have proven that to increase the tourist flow, one should involve local communities as bearers of regional culture and traditions interested in preservation of natural heritage (Dickson, 2019).

To analyze regulatory mechanisms for sustainable development, one can also use a causal method of research combined with other analytical methods in order to combine different areas of eco-friendly businesses and develop responsible aquaculture in Ukraine (María Camila Sánchez-Prieto, 2021).

Technological development enables designing special mobile apps, educational programs, guides, guidance materials and games that would show activities

of this enterprise and draw attention of young people to eco-business and tourist capabilities of Ukraine (Supaporn, 2020).

Weitzman and Filgueira (2020) find out from their experiment that depending on the goal of creating an aqua ecosystem, one can distinguish types of management to support physical, industrial, ecological and social areas. However, one keeps paying more attention to eco-friendliness and cultivation of organic products (Weitzman, J., & Filgueira, R., 2020).

## Research methods

The aim of the article is to analyze regulatory mechanisms for developing responsible aquaculture and sustainable development in the context of territorial community in order to improve social welfare in the country and promote ecotourism, taking into account realities of current Ukrainian economy and experience of leading countries.

This work applies the following methods of empirical and theoretical research: analysis, synthesis, comparison, deduction and induction, abstracting to investigate the problem, analyze alternative options of its solution, choose the most appropriate one, and provide recommendations on developing ecotourism and increasing aquaculture production in Ukraine, which are based on innovative technologies. Specific research methods used in this work include mathematical modelling, graphic method, economic and statistical cognition method, encouraging visual and practical implementation of problem research results, creation of the forecast and recommendations on further activities.

## Results

Aquaculture production is possible in ponds and artificial water bodies, which are being automated as much as possible, creating so-called intelligent aquaculture farms that have higher economic efficiency, reduced risks, but higher construction and operating costs. Ukraine has a large amount of natural water bodies that can be used to grow aquaculture. The volume of water bioresources in Ukraine was 76508.1 t in 2020, 82.5% of the 2019's indicator. The leader is Mykolaiv region (23168.4 t), the territory of which is beneficial for aquaculture cultivation and is a huge net of natural water bodies (State Statistics Service of Ukraine, 2021).

Analyzing aquaculture production as a part of the volume of water bioresource production, we can see the decrease in manufacturing at the time interval, which means a crisis of this sector in Ukraine and a reducing interest of private enterprises in sector development and increase in aquaculture production (Fig. 1). Unlike Ukraine, Europe shows a constant increase in the amount of produced aquaculture, which indicates a positive trend and development prospects for the

industry generating substantial profit in such countries as Norway, Spain, France, Italy, etc.

The adoption of eco-friendly farming in Europe encourages aquaculture extraction and increasing

production efficiency in an intensive way unlike Ukraine with prevailing traditional forms of aquaculture breeding that have higher risks for agricultural companies.

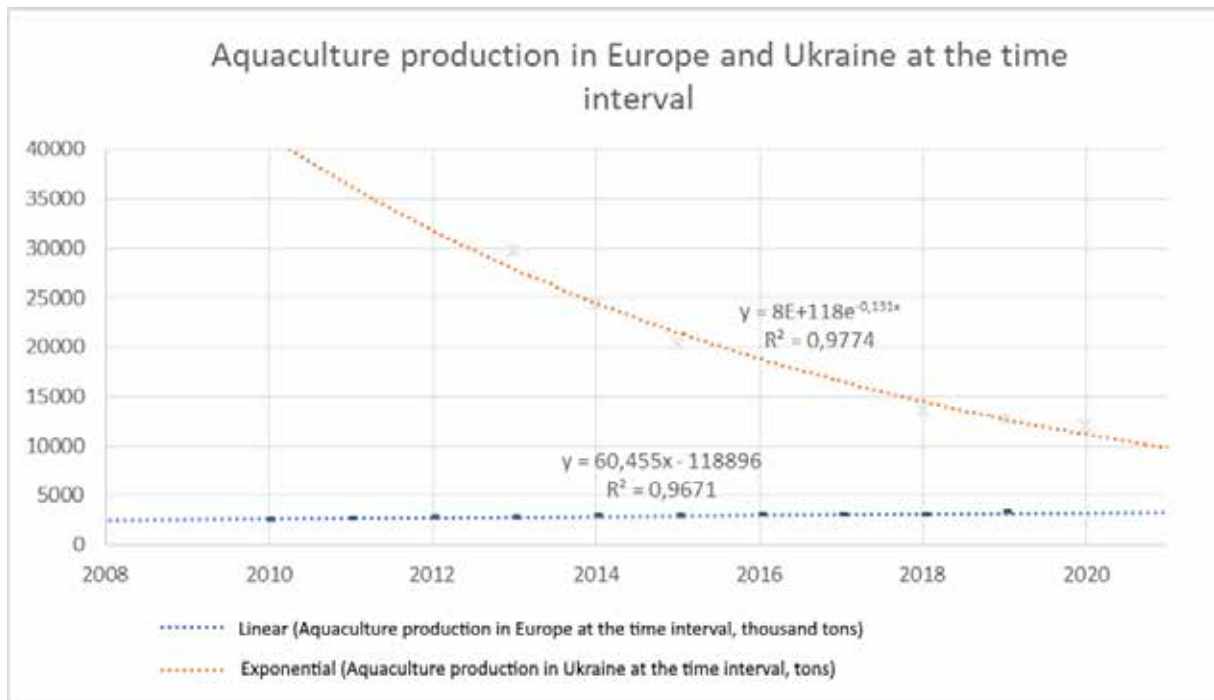


Fig. 1. Dynamics of aquaculture production at the time interval (State Statistics Service of Ukraine, 2021; Faostat, 2021).

The leader in aquaculture cultivation is Cherkasy region (2133.7 t) that has a large amount of internal water bodies and a developed fishing industry. An average price of extracted water bioresources per ton is 15601.5 UAH (578 USD), which is much lower than in many countries worldwide. The price in China is 900 USD, in Japan – 3044 USD, in Norway – 2078 UAH, in the USA – 2030 USD (Faostat, 2021). The key advantage of aquaculture breeding in Ukraine is favourable climatic conditions that encourage natural cultivation of agricultural products without significant financial investments. Complying with feeding regulations and rules, one can gain the high efficiency of business operations in a short period and use a large sales market still focused on import of fishing products because of underproduction of their own goods and irrational use of available natural resources. Having a huge potential, Ukraine faces numerous barriers to aquaculture development initially related to economic and political risks that do not allow making long-term forecasts, which has a negative impact on the behaviour of entrepreneurs desiring to generate maximum profit at minimum investments in a short time. The absence of constant state support of national manufacturers and enterprises, steps towards bringing businesses out of the shade and anti-poaching make this industry weak in the structure of Ukrainian entrepreneurship. At the

same time, permanent agricultural activities require not only human resources and efficient work but also creation of favourable conditions for employees, which is not a priority for many entrepreneurs in Ukraine unlike developed countries with maximum production automation.

Regulatory mechanisms for the development of responsible aquaculture should primarily rely on the clear scientific substantiation of their ecological efficiency and innovativeness, which is being widely integrated into enterprise control systems, automated systems, analytical programs and other solutions. Besides automation, it is viable to keep a human factor as a tool for affecting and controlling enterprises. Thus, one should design a user-friendly and high-quality business service system, ensure sustainable development for business owners and staff, as well as strive for advancement and self-improvement (Laktionova et al., 2022).

Sustainable development is primarily a process of harmonious human and ecosystem development, allowing improving social welfare, minimizing negative externalities, creating conditions for adoption of resource-saving technologies, encouraging economic growth along with preservation of natural environment. Nowadays, these trends are supported by most developed countries. They are the framework

for the further growth of the social and economic system, encouraging higher investments in ecological projects and innovations. Creation of resource-saving technologies is capital-intensive on the one hand, but on another hand, it can boast a better efficiency and reduced risks for businesses, society and the state in the long run. Sustainable development frequently means the combination of natural environment and automated innovative systems that can be used for a long time in case of proper utilization and can be upgraded.

A promising area in Ukraine is recreation aquaculture supposing creation of resorts and green tourism near water bodies with the possibility of fishing and artificial maintenance of the ecosystem. It will allow promoting leisure activities in the territory of Ukraine, making it comfortable and exciting, using available natural resources rationally, breeding aquaculture and keeping natural resources in the environmentally safe condition, generating profit, involving entrepreneurs in the industry, adopting the latest technologies, attracting foreign tourists and investors in Ukraine, promoting local products, as well as developing green tourism in Ukraine.

According to the State Agency of Water Resources of Ukraine, the total volume of aquaculture products in Ukraine was 18.57 thousand tons in 2020 (35.9 tons less than in 2019) (Department of the State Agency for Land Reclamation and Fisheries in Kyiv and Kyiv region, 2021). Traditional aquaculture objects in Ukraine are carps, which are less demanded to the ecological

condition of water bodies (Arktikfish, 2021). Currently, one adopting and promoting recirculation systems considered innovative and resource-saving, which is the priority for Ukraine and can significantly increase the efficiency of aquaculture breeding.

As of 2021, Ukraine has registered 2502 enterprises engaged in aquaculture breeding where the majority of water objects are natural and in long-term leased by private entrepreneurs whose activities are shown on the interactive map (Department of the State Agency for Land Reclamation and Fisheries in Kyiv and Kyiv region, 2022).

During 2020’s decentralization, Ukraine has established 1469 communities in order to examine the situation of each region and promptly respond to changes, rationally allocate funds and use existing resources. It is better to consider protection and preservation of water object ecosystem at the level of territorial communities whose population is interested in the improvement of their functioning and state, which allows enhancing the control over rental business operations focused on aquaculture production. All this results in a responsible attitude to existing natural resources.

Currently, Ukraine is facing a huge number of problems slowing down the creation of efficient recreation areas and aquaculture breeding. Therefore, one has developed a range of tasks aimed at improving the situation and enhancing the level of aquaculture extraction (Fig. 2).

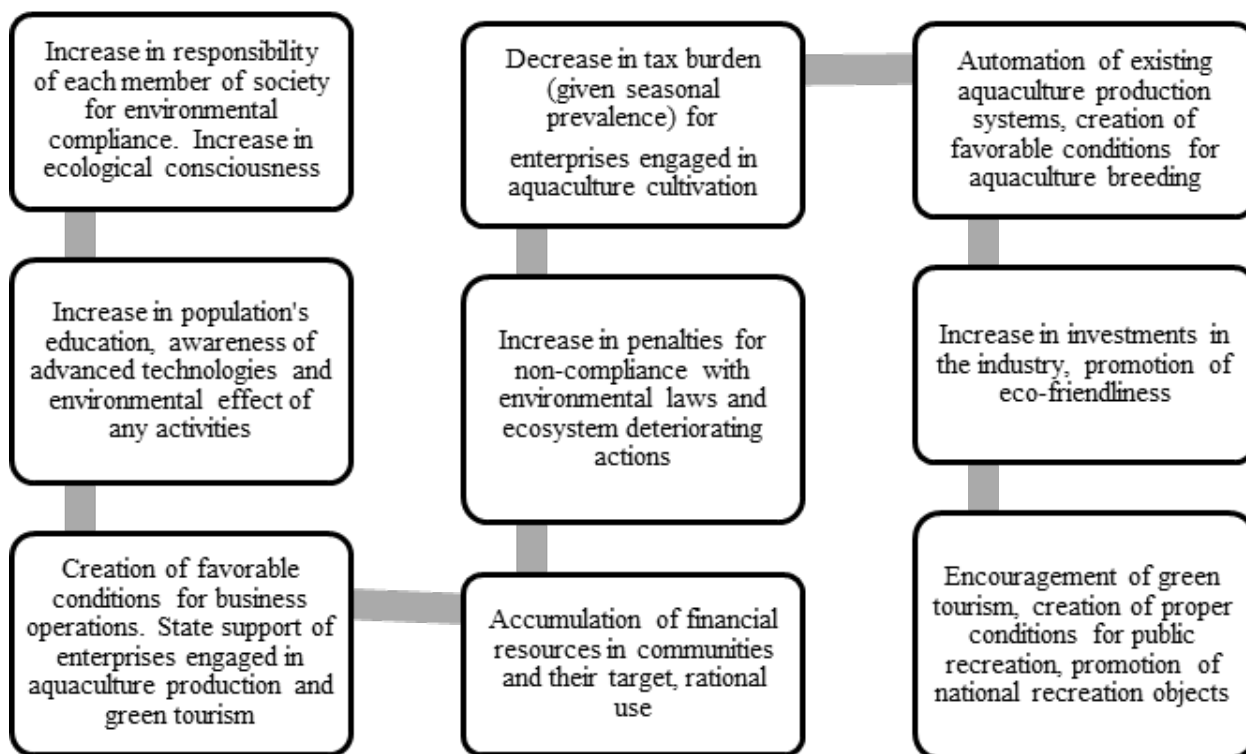


Fig. 2. Key tasks for Ukrainian society and state aimed at developing aquaculture production and advancing recreation areas.

To improve the environmental condition in Ukraine and the efficiency of business operations, one should initially increase the responsibility of each member of society, provide necessary knowledge of the future and forecasts for the each step of the triangle: state, business and society. One of the efficient tools to implement this goal is the creation of social and ecological advertising, involvement of influencers, prominent figures to clarify the situation, creation of favourable conditions for environmental preservation, joint events and encouraging activities. In case of changes in the cultural level of Ukrainians, we could see changes in behavioural responses and entrepreneurial actions, which would positively affect the ecosystem and the efficiency of business operations. One has found out that the adoption of green economy has a long-term positive effect and is more efficient than extensive economic activities (Mikhno et al., 2021).

Key tools for aquaculture development for a particular enterprise can include:

- Analysis of the global market and local sales market to examine the supply and demand, create its own concept, uniqueness, and to enhance the interest of potential customers.
- Reallocation of profits via a progressive taxation system, development of a transfer payment system.
- Financing of innovations and scientific achievements in aquaculture production and green tourism.
- Control over product prices and prevention of corruption.

- Expansion of a range of finished products and a number of services provided.
- Encouragement of entrepreneurship eco-friendliness.
- Creation of recreation areas near water bodies and in territories of aquaculture cultivation.
- Creation of advertising campaigns, active SMM marketing of enterprises, positive newsworthy events and interest of consumers.
- Tourist fishing and infrastructure development in this territory.
- Development of educational eco-friendly tourist programs on the basis of the enterprise.
- Expansion of relations, exchange of experience with other enterprises, collaborations.
- Creation of high-quality service in the territory of the enterprise, developed service sector given innovations and national identity, enterprise particularities.
- Creation of a reliable insurance system for enterprises against risks and uncontrolled situations, insurance of all consumers and staff.
- Rational use of natural resources and minimization of the negative impact on the environment by showing this performance in financial results and application of eco-friendly technologies.

Considering the general system isomorphic, we are drawing a chart of interrelations between recreation point subsystems and aquaculture breeding. Let us assume that key elements of the model have a significant impact on the ecosystem balance while others, less significant, are negated.

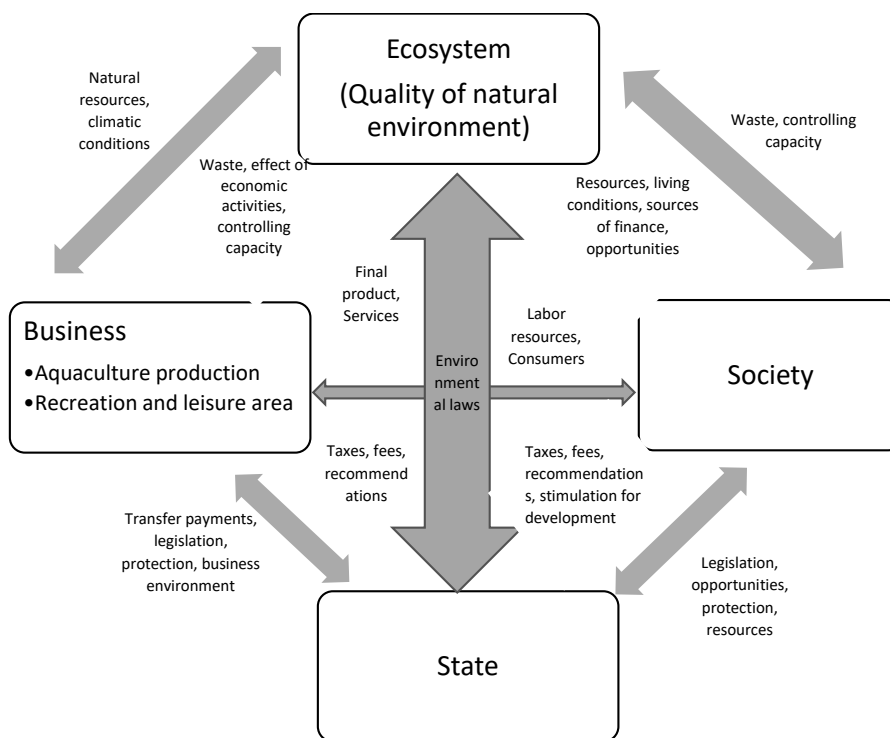


Fig. 3. Block diagram of the interaction between the aquaculture enterprise and other economic entities.

The impact on the given system (Fig. 3) is possible not only by controlling economic entities but also by external factors that primarily depend on the ecosystem and can substantially increase profit by improving natural conditions and automating the aquaculture production system as a way of stabilization from uncontrolled situations.

Key regulatory levers of setting up eco-friendly aquaculture businesses can include:

- Setting of a competitive price for services and goods;
- Budgetary economic tools (financing, subsidy assistance, leasing, etc.);
- Tax regulation tools (tax holidays and benefits, simplified taxation system, penalties for violations);
- Social tools (improvement of living conditions due to employment and environmentally safe conditions for all attendees, cultural service and preservation of local natural resources, launch of educational courses, classes, research laboratories, educational apps, etc.);
- Scientific level (establishment of fundamental innovative scientific laboratories, training of specialists and involvement of university students in practical classes);
- Regulation of profits in the region (creation of a arginal level of profitability, interindustry exchange, increasing profit of enterprise staff, flexible price regulation);
- Foreign economic levers (export of aquaculture products abroad, involvement of international investors and advisers, enhancement of tourist potential at the global level, protection of the internal market and own production on the Ukrainian market, decreasing rates of enterprise services and goods when entering the global market);
- Credit tools (loans on favourable terms, investment crediting, note-backed lending, cooperation with other enterprises);
- Innovativeness (establishment of the innovative infrastructure at the enterprise, creation of interactive maps and application of GIS technologies, launch of own programs and apps for involving potential consumers, etc.).

Considering  $x$ -input costs (the volume of invested goods) in a certain time ( $t$ ), the result can be array  $A$  (the amount of goods or services received) obtained from a certain type of raw material (in material equivalent), taking into account external impacts ( $f$ ) for the present time, which can both improve the result and worsen it. External impacts can include natural disasters, aquaculture epidemics, feeding problems, advertising campaign, the ecosystem state of the region, and other factors that have a significant impact on the final result.

$$\frac{dx}{dt} = A_1x + f(t), x(0) = 0, \quad (1)$$

Equation 1 can be compared to Forrester's model exploring global equilibrium, social trends, sustainable development (Forrester, 1995).

We can build a model of creating a water body for aquaculture breeding, which is similar to the model of society. The population generation in this model is possible due to the creation of appropriate conditions and constant regulation. System steadiness can be now guaranteed only by production automation, which is the priority for entrepreneurs, as steadiness of the tourism industry is the key to constant interest of consumers and increasing investments in businesses (Kostetska, 2018).

$$\frac{dl}{dt} = A_2(x) + u(t) + k(t), \quad (2)$$

If we increase the time of investments ( $I$ ), the initial result stabilizes profit and can reduce external impacts. Where  $u$  is adjusted external impacts at production automation and improvement of conditions of the recreation area,  $k$  is the increase in proceeds and popularity of the place of aquaculture production due to stabilization of manufacturing activities and improvement of enterprise's reputation.

With increased investments and improved farming conditions, one predicts the increase in incomes (the amount of goods or services received).

Digital transformation has changed the idea of modern businesses while the development of the service market has resulted in the global tough competition among recreation areas (Burkynskiy et al., 2018). Ukraine's travel services market is at the low level and fails to satisfy even the internal demand because of economic and political problems in Ukraine, the undeveloped innovative services market, poor roads and service sector. The increasing amount of services causes the effect of synergy, which can enhance the efficiency of each area. Creating an organizational structure of the recreation area, it is viable to design integration systems that could complement one another and allocate resources more efficiently. As illustrated by the establishment of the recreation area with a huge number of services, it is desirable for Ukraine whose territory is rich in natural resources.

To involve investors in the project, one should introduce indicators determining the return on capital in the recreation area ( $D_k$ ), which depends on the risk of the project and is defined as:

$$D_k = D_o + r(I) - inf, \quad (3)$$

$D_k \rightarrow max, \text{ where}$

$D_o$  is a risk-free (alternative) rate of return on the market, which can be illustrated by investments in areliable bank of the country,  $r$  is a reward for the risk in the percentage equivalent that increases with the number of services provided,  $inf$  is the inflation rate in the country.

In turn, the increase in investments (I) will improve the quality of services, investments in advertising campaigns, infrastructure development, etc., which will positively affect profit indicators, i.e., the reward for the risk.

The change in the investment level and its effect over time  $\frac{dI}{dt}$  can be calculated as a derivative given the interval required for production and marketing actions that will lead to the increasing demand for tourist services.

When diversifying the business that can be seen by combining aquaculture production with the provision of tourism, consulting, educational services, there are additional profits due to the increasing number of services, which can be shown in the model.

In the production of goods (services), let the cost of  $i$  products ( $i = [1..N]$ ) be equal to the sum of the costs of each direction, taking into account the coefficient of unit costs ( $a_{ij}$ ) in the structure of aggregate expenditures of business at  $V_j$  amount of gross products by segment and investments in the development and implementation of the marketing strategy (mar).

$$W(t) = \sum_{j=1}^N (a_{ij} v_j(t) + mar), \tag{4}$$

At the same time, the final consumption of business customers ( $c_i(t)$ ) depends on the sum of the investments in each business segment.

$$\frac{dc_i(t)}{dt} = \frac{dI(t)}{dt} \frac{c_{0i} + c_i(t)}{I(t)} + k_i, \tag{5}$$

Where  $c_{0i}$  is the minimum consumption required for  $i$  products,  $k_i$  is the growth of consumption by increasing the activity among consumers of other segments.

This increases the net cash flow (NPV), which is directly proportional to the total profit at the company, the volume of products sold, the profitability of sold products within a certain period and inversely proportional to the discount rate and the net profit from sold products.

Analyzing the above-mentioned model, we can conclude that to increase the profitability of the recreation point, one should expand the range of services and goods sold, provide conditions for long-term investments and develop a strategy for meeting the customer demand, which can be achieved by diversification and continuous operation of the recreation point producing aquaculture.

Changing investment parameters, it is possible to attract profits from other business segments and create favourable conditions for increased cash flow (Yankovyi et al., 2021). Meanwhile, one reduces advertising costs for each business segment by creating a common marketing strategy and complementary effect. We can see a situation where increased investments in aquaculture production and creation of a contemporary enterprise applying natural resources will increase investments in business diversification and expansion. One of the options to increase profitability is the establishment of a recreation point, contributing to the development of ecotourism in the region. The establishment of a competitive enterprise combining ecotourism and aquaculture production will increase the demand among consumers, which will encourage an additional cash flow (Fig. 4).



Fig. 4. Scheme of further activities of the aquaculture production enterprise



Besides the marketing synergy, we can see the logistic one, which positively affects the financial performance and allows fulfilling better the potential of the recreation area. There is also a synergetic effect in the marketing – ecology section, which also has a positive effect.

Having common points of the marketing strategy, we can draw up long-term plans of interaction with counterparties based on constant cooperation, minimizing seasonal risks and other unfavourable situations. In the context of globalization and increasing competition, it is the synergetic business that has a better chance of entering the global market and involving foreign investors, better meeting consumer needs. At the same time, we can see the increasing amount of marketing tools (advertising services, social media and the Internet, activities, promotional offers, constant updating of offers, booking and availability of distance services, educational services, development of apps, regular updating of design, constructions, range of products, improvement of the service level, particularities of staff behaviour (uniqueness), eco-friendly direction, management of the value chain, technological innovations and their promotion on the market, optimization of marketing services, etc.) for promotion of goods and advanced resource productivity. On the other hand, one reduces administrative costs that can properly combine all aspects of the recreation and production enterprise.

Increased investments in ecotourism of the region and the increase in its competitive ability can solve such problematic issues for Ukraine as the quality of infrastructure, requiring large investments. Since the responsibility for economic activities of the ecotourism enterprise falls on its owners, and control over compliance with the rules and legislation falls on local communities interested in the regional development, the reconstruction of territories and improvement of the infrastructure is possible by attracting private investments, which are more efficient in Ukraine than public financial resources (Mazur, Kubai, 2019).

The integration approach allows better applying control tools, promptly identifying the problem and coordinating activities of each branch of the enterprise, which leads to the increase in personnel responsibility, creation of a multidisciplinary recreation complex, as well as helps to correct strategies according to the life cycle of the goods or services produced. Analyzing the external environment of the recreation and production point, it is viable to use benchmarking, which allows to analyse better the company operations compared to competitors, finding unique offers that are not presented by any competitor, increasing the possibility of becoming a market leader.

This concept including the construction of a branched, synergetic recreation enterprise with the possibility of increasing the number of services has

an integral structure and supports the development of European society, which is aimed at the rational use of natural resources and maximum automation of production, making this business competitive on the foreign market and increasing the tourist potential of Ukraine.

## Conclusions

Ukraine has a huge natural potential for aquaculture production and tourism development, which is promising for the industry growth and has competitive advantages compared to other countries worldwide. However, insufficient investments in the industry, the absence of state interest in the development of synergetic entrepreneurship, political and economic instability, as well as the undeveloped infrastructure set up barriers to the establishment of an innovative recreation and production enterprise with a possibility of aquaculture production and development of the tourism sector.

The production of recreational aquaculture is regional and uses existing regional resources, which should be controlled by local communities interested in the improvement of the infrastructure, ecological and economic territorial indicators, as well as realizing the direct impact of enterprise activities. The impact of both external and internal factors on ecotourism development makes this system combined and isomorphic. We can draw a chart of interrelations between each branch of the recreation enterprise and see the synergetic effect of their activities, which will have a positive economic impact.

The establishment of the recreation and production aquaculture enterprise increases the cash flow due to the increasing demand for the set of services, reduces marketing and logistic costs, gains the synergy and integration effect, which enhances the potential of the region due to the increasing competitive ability of the enterprise.

Innovative automated systems in aquaculture production will allow using rationally the existing natural potential of the region and attracting investments in the industry by providing eco-friendly recreational services and developing sustainable ecotourism, which is now widely supported by grant programs and is consistent with the European course aimed at eco-friendliness.

Designing the branched system of innovative recreational services combined with Ukraine's rich natural potential and improvement of ecological culture and responsibility by enhancing the quality of control systems and providing conditions for eco-friendly farming, one creates conditions for improving the economic potential of both a certain region and Ukraine as a whole, increases a possibility of entering external competitive markets, enhances the tourist and production potential, provides additional jobs, as well as improves conditions for attracting foreign investments on beneficial terms for Ukrainian enterprises.

## References

- Arktikfish, 2021. Svitovi tendencii rozvitku akvakultury [World trends in aquaculture]. Retrieved from: <http://arktikfish.com/index.php/stati-po-akvakulture/26-mirovye-tendentsii-akvakultury> (In Ukrainian)
- Burgaz, M., Matvienko, T., Bezik, K., & Soborova, O., 2019. The current state of fish market in Ukraine. *Ukrainian Journal of Veterinary and Agricultural Sciences*, 2(3), 6–10. <https://doi.org/https://doi.org/10.32718/ujvas2-3.02>
- Burkynskyi, B., Martienko, A., Khumarova, N., Prokopiuk, A., 2018. Property Management Dominants for Recreational Natural Resources. *Economics. Ecology. Socium*, 2, 77–90.
- Chai-Arayalert, Supaporn, 2020. Smart application of learning ecotourism for young eco-tourists. *Cogent Social Sciences* 6(1), 1772558.
- De Schryver, P., Crab, R., Defoirdt, T., Boon, N., Verstraete, W., 2008. The basics of bio-flocs technology: the added value for aquaculture. *Aquaculture*, 277(3–4), 125–137.
- Derzhavna sluzhba statystyky Ukrayiny [State Statistics Service of Ukraine]. 2021. Retrieved from: [ukrstat.gov.ua](http://ukrstat.gov.ua) (In Ukrainian).
- Dickson Adom, 2019. The place and voice of local people, culture, and traditions: A catalyst for ecotourism development in rural communities in Ghana. *Scientific African* 6. e00184.
- Dyudyaeva, O.A., 2021. The state of the harmonization of Ukrainian legislation with European norms in the field of the production of organic aquaculture. *Water bioresources and aquaculture*, 1(9), 62–85.
- Faostat, 2021. Derzhavna sluzhba statystyky Ukrayiny [State Statistics Service of Ukraine]. Retrieved from: <http://www.fao.org/corp/statistics> (In Ukrainian).
- Forrester, J. W., 1995. The beginning of system dynamics. *The McKinsey Quarterly*, 4, 4–16.
- Grant, J., & Pastres, R., 2019. Ecosystem models of bivalve aquaculture: implications for supporting goods and services. *Goods and Services of Marine Bivalves*. 507–525. Springer, Cham.
- Gui, J. F., Tang, Q., Li, Z., Liu, J., De Silva, S. S., 2018. *Aquaculture in China: success stories and modern trends*. John Wiley & Sons. Wiley Blackwell. 720 p.
- Harbar, Z., Selezneva, O., Litvinov, O., Kaptalan, S., Gonchar, V., 2020. Strategic Marketing Management Of Innovative Activities In Ensuring Enterprise Economic Security. *REICE: Revista Electrónica de Investigación en Ciencias Económicas*, 8 (15), 298–313. <https://doi.org/10.5377/reice.v8i15.9961>
- Kostetska, K., 2018. Trends of Development of Administrative Management of Recreational and Tourist Nature Production in Domestic and International Practice. *Economics. Ecology. Socium*, 2, 111–121.
- Laktionova, O., Harbar, Z., Melikhov, A., Slobodianiuk, O., Gevko, V., Desiatskyi, S., 2022. Financing the greening of enterprises in industrial regions of Ukraine in the context of sustainable development. *Management Theory and Studies for Rural Business and Infrastructure Development*, 43(4), 574–584. <https://doi.org/10.15544/mts.2021.52>
- María Camila, Sánchez-Prieto et al., 2021. Planning Ecotourism in Coastal Protected Areas; Projecting Temporal Management Scenarios. *Sustainability*, 13(14), 7528.
- Matheus NP Henares, Mateus V. Medeiros, and Antonio FM Camargo, 2020. Overview of strategies that contribute to the environmental sustainability of pond aquaculture: rearing systems, residue treatment, and environmental assessment tools. *Reviews in Aquaculture*, 12, 453–470.
- Mazur, A., Kubai, O., 2019. Scientific-methodological and practical principles of regional economic systems integration. *Baltic Journal of Economic Studies*, 5(2), 117–123. <https://doi.org/10.30525/2256-0742/2019-5-2-117-123>
- Mikhno, I., Koval, V., Shvets, G., Garmatiuk, O., Tamošiūnienė, R., 2021. Green economy in sustainable development and improvement of resource efficiency. *Central European Business Review (CEBR)*, 10(1), 99–113.
- Outeiro, L., Byron, C., Angelini, R., 2018. Ecosystem maturity as a proxy of mussel aquaculture carrying capacity in Ria de Arousa (NW Spain): A food web modeling perspective. *Aquaculture*, 496, 270–284.
- Upravlinnya Derzhavnogo agentstva melioraciyi ta ry'bnogo gospodarstva u m. Kyevi ta Kyivskij oblasti [Department of the State Agency for Land Reclamation and Fisheries in Kyiv and Kyiv region]., 2021. Retrieved from: <https://kv.darg.gov.ua/> (In Ukrainian).
- Upravlinnya Derzhavnogo agentstva melioraciyi ta ry'bnogo gospodarstva u m. Kyevi ta Kyivskij oblasti [Department of the State Agency for Land Reclamation and Fisheries in Kyiv and Kyiv region], 2022. Interactive map of aquaculture enterprises of Ukraine. Retrieved from: [https://kv.darg.gov.ua/\\_interaktivna\\_karta\\_0\\_0\\_0\\_2020\\_1.html](https://kv.darg.gov.ua/_interaktivna_karta_0_0_0_2020_1.html) (In Ukrainian).
- Varga, M., Berzi-Nagy, L., Csukas, B., Gyalog, G., 2020. Long-term dynamic simulation of environmental impacts on ecosystem-based pond aquaculture. *Environmental Modelling & Software*, 134, 104755.
- Vergara-Solana, Francisco, Marcelo E. Araneda, German Ponce-Díaz. 2019. Opportunities for strengthening aquaculture industry through multicriteria decision-making. *Reviews in aquaculture*, 11, 105–118.
- Weitzman, J., Filgueira, R., 2020. The evolution and application of carrying capacity in aquaculture: towards a research agenda. *Reviews in Aquaculture*, 12(3), 1297–1322.
- Yankovyi, V., Koval, V., Dudka, T., Bykhovchenko, V., 2021. Statistical assessment of project economic priority in company's investment management. *Revista Gestion de las Personas y Tecnologia*, 42, 98–119. <https://doi.org/10.35588/gpt.v15i42.5284>