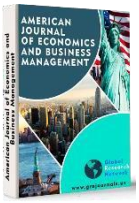

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Article

The Relevance of Using Artificial Intelligence Technologies in The Activities of Fish Farming Enterprises Specializing in Small Business Entities in Uzbekistan

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Abstract: One of the most effective methods for transitioning to a new technological order in successful business management is to expand the use of artificial intelligence and the digital transformation of society. This topic is crucial for conducting research to assess the prospects of implementing artificial intelligence technologies in fish farming enterprises established by small business entities in Uzbekistan. This article discusses the relevance of applying artificial intelligence, which is considered one of the key technologies for developing the digital economy today, in fish farming enterprises specialized in small business entities. It also examines the ongoing efforts in our country in this regard, the main features of artificial intelligence technologies, the challenges of implementing these technologies in fish farming, and their solutions, as well as an analysis of the expected results. The article systematizes the accumulated experience and practices related to the use of artificial intelligence technologies in the fish farming sector and identifies the positive and negative consequences of using neural networks in business processes.

Keywords: Artificial Intelligence, Digital Technology, Small Business, Fish Farming, Machine Learning, Big Data, Sensors, Underwater Cameras

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1. Introduction

In today's world, it is difficult to successfully run a business without utilizing digital technologies. Currently, digital technologies are rapidly evolving and require every sector to keep pace with the times. Digital technologies encompass all sectors, particularly the branches of the economy. The implementation of artificial intelligence technologies is seen as a modern solution for increasing productivity and efficiency in economic sectors and achieving significant profits in business. The capabilities of artificial intelligence are facilitating production and service processes. Artificial intelligence has become a priority area for investments by more than one-third of leading companies worldwide and serves as a foundation for global GDP growth.

At this point, let's briefly touch on the concept of artificial intelligence. Artificial intelligence is a software system capable of transforming human knowledge and skills, engaging in planning, problem-solving, advising, as well as learning and improving its performance during task execution. Human thinking is based on the neurons in the brain, while artificial intelligence operates on neural networks. Utilizing artificial intelligence not only automates any process but also allows it to be conducted in accordance with specific tasks of a person, organization, or production. The use of artificial intelligence becomes

more effective over time. The better a neural network understands the details and needs, the better it performs. Initially, many believed that artificial intelligence could only translate texts, recognize objects, and understand the meanings of human speech. However, by 2020, the list of skills had expanded so much that it took up several pages. Currently, artificial intelligence is being applied in many areas of our lives, including the internet, healthcare, business, agriculture, transportation, etc [1].

According to the professional media resource Techtarget.com, artificial intelligence is the ability of technologies to imitate intellectual activities, such as learning from information and given rules, making logical conclusions, and adjusting their decisions. Artificial intelligence is used for creating expert systems, processing natural language data, speech recognition, machine vision, and others [2].

In fish farming enterprises established as small business entities, the use of artificial intelligence technologies allows tasks that would typically require significant time and effort from humans, and which are sometimes nearly impossible to carry out, to be completed in a short period. Due to the underwater nature of the fish farming process, artificial intelligence technologies enable the possibility of making critical decisions related to this process based on information obtained from underwater sources.

In Uzbekistan, the development of information technologies and the digital economy has been identified as a priority task to secure a place among the leading innovative countries in the near future. Recognizing the importance and potential of artificial intelligence technologies, significant attention is being given to their development in our country. This is because, in the era of technological advancement, artificial intelligence is becoming a key factor influencing the development of various sectors of life.

Therefore, analyzing the results of using artificial intelligence technologies in various fields of business, particularly in fish farming enterprises established as small business entities, and identifying promising directions for implementing artificial intelligence algorithms in business processes are considered urgent issues of today.

Literatur Review

The concept of "artificial intelligence" originated in the mid-20th century (late 1940s to early 1950s), when the English mathematician A. Turing, in his article "Computing Machinery and Intelligence," introduced the idea that in the future, a computer could think like a human. To provide a reasoned proof of his conclusions, he developed an empirical test where a person interacting with both a human and a computer would be unable to distinguish the computer from another person [3].

According to S.G. Marichev, the main goal of the digital economy is to enhance the efficiency and competitiveness of each sector of the country's economic system as a whole or of a specific region, which should be facilitated by the implementation of innovations and the optimization of operational processes. A key driver of the digital economy, as a phenomenon that changes the format of society, is digitalization. It enables the transformation of traditional methods and formats of information integration into the digital space, which ultimately contributes to a significant increase in the indicators of efficiency and productivity in socio-economic systems [4].

In the research of V.V. Zhilin and O.A. Safaryan, it is noted that today 37% of companies utilize algorithmic services and artificial intelligence technologies, which indicates a continuous increase in the opportunities for using new high-intelligence technologies in the future [5].

In the research of L.I. Arkhipov, V.N. Babich, and E.A. Kirillova, it is noted that in the last 30 years, the volume of data created by humanity has reached the equivalent of the previous 3,000 years and continues to grow rapidly. This significantly illustrates that it is impossible to achieve results without utilizing artificial intelligence, as it generates vast data sets (Big Data) [6], [7].

According to N.V. Gorodnova, the introduction of artificial intelligence algorithms as assistants with additional capabilities in human life allows for significant advantages in this integration. This not only accelerates the decision-making process but also leads to a substantial improvement in the quality of those decisions [8].

Based on the above, the current demand for the use of artificial intelligence systems in developing business activities, interacting with customers, analyzing each process swiftly, and accelerating decision-making processes is evident.

2. Materials and Methods

The scientific article examines the results of implementing artificial intelligence programs and services in fish farming enterprises established as small business entities. Logical thinking and logical analysis methods have been utilized. The theoretical and methodological basis consists of the overall strategy developed in the republic for the advancement of the digital economy, the decrees issued by our President, Sh.M. Mirziyoyev, and the scientific and methodological literature related to the research topic.

The article extensively employs the comparative method, which is the main method for analyzing the outcomes achieved when using artificial intelligence technologies in fish farming enterprises established as small business entities.

3. Results

A number of initiatives have been undertaken to develop artificial intelligence in our country. In particular, to implement artificial intelligence technologies in various sectors, the Decree No. PQ-4996 of the President of the Republic of Uzbekistan was adopted on February 17, 2021, titled "Measures to Create Conditions for the Rapid Implementation of Artificial Intelligence Technologies."

The aim of this decree is to rapidly introduce artificial intelligence technologies in accordance with the "Digital Uzbekistan – 2030" Strategy and to facilitate their broad application in the country, ensuring the availability and high quality of digital data, as well as creating favorable conditions for training qualified personnel in this field.

This decree outlines the main directions and principles for applying artificial intelligence, as well as the conditions necessary for the comprehensive development of this sector in the near and distant future. It aims to establish a normative-legal framework that defines unified requirements, responsibilities, security, and transparency in the development and use of artificial intelligence technologies in economic sectors, social spheres, and public administration systems. It also focuses on improving the quality of public services provided in the interests of the population and emphasizes the extensive use of artificial intelligence technologies to enhance the efficiency of state bodies in data processing, conducting fundamental and practical scientific research to develop beneficial technological solutions, and creating a local ecosystem for innovative developments in the field of artificial intelligence that encourages commercialization [9].

The decree fully reflects the areas in which artificial intelligence technologies will be applied and the tasks envisioned in this regard.

On October 14, 2024, the President of the Republic of Uzbekistan adopted Decree No. PQ-358, "On Approving the Strategy for the Development of Artificial Intelligence Technologies until 2030."

In accordance with this decree, the "Strategy for the Development of Artificial Intelligence Technologies until 2030" has been approved to ensure the implementation of the goals and objectives outlined in the "Digital Uzbekistan – 2030" strategy.

One of the priority areas for the introduction of artificial intelligence technologies specified in the decree is forecasting productivity in the agricultural sector, managing

agricultural resources, and monitoring the processes of growing crops, poultry, fish, and livestock [10].

Within the framework of the decree, what economic efficiency can be achieved through the use of artificial intelligence technologies in the fish farming process, especially in fish farming enterprises established as small business entities[11]?

When artificial intelligence technologies are utilized in fish farming enterprises established as small business entities, tasks that would typically require significant time and effort from humans, and which may sometimes be difficult to accomplish, can be completed in a shorter time frame. Given that the fish farming process occurs underwater, the use of artificial intelligence technologies allows for the possibility of making important decisions related to this process based on the information obtained [12].

The primary goal of using artificial intelligence technologies in fish farming enterprises established as small business entities is to provide entrepreneurs operating in the sector with practical recommendations for making important decisions related to the fish farming process based on precise calculations and data provided by these technologies [13].

The application of artificial intelligence technologies in fish farming enterprises helps minimize potential errors and enhances efficiency by providing entrepreneurs with vital and objective information through the analysis of various factors that influence the growth processes of fish [14].

The main components of artificial intelligence technologies used in fish farming include feeding devices, a sensor recording system, an underwater camera network, and direct artificial intelligence technologies.

The sensor recording system measures water temperature, determines the levels of dissolved oxygen and carbon dioxide in the water, and also performs alerting functions through certain sensors. The information transmitted by the sensor recording system is automatically stored until the identified problem is resolved or subsequent analyses are conducted.

The devices of the sensor recording system are connected via the internet to the smartphones or tablets of employees responsible for the fish farming process, allowing entrepreneurs to access information regardless of their location.

Artificial intelligence technologies are also used in fish farming enterprises established as small business entities to effectively diagnose fish diseases. The early detection of pests and fish diseases that may arise in the water basin is crucial for entrepreneurs, as the sooner a disease is identified, the more positive the outcome of combating it. This significantly reduces the economic losses for entrepreneurs operating in the sector [15].

In fish farming enterprises established as small business entities, artificial intelligence technologies are mainly used in feeding processes. Fish feed is a critical factor in the fish farming process, and even small savings achieved daily can lead to substantial economic benefits throughout the entire growing period. Every entrepreneur in this sector aims to reduce feeding costs and increase their profits. The artificial intelligence technologies used in the feeding process are equipped with programs that detect feed pellets and determine when the fish are satiated [16]. Highly accurate underwater cameras capture images to effectively organize feeding and assess biomass accurately. With the help of specialized underwater cameras, the exact amount of feed to be given to the fish in the ponds and the timing of feeding can be determined with high precision [17]. Furthermore, the underwater camera network can advise operators to slow down or completely halt the feeding process based on the fish's feeding behavior. As a result, feed wastage and excessive spending are prevented [18].

In fish farming enterprises established as small business entities, we will analyze the feeding standards for a single carp during the growing period using both traditional methods and artificial intelligence technologies (Tables 1 and 2).

Table 1. Feeding standards for fish using traditional methods.

Fish Weight (grams)	Daily Feed Consumption (grams)	Feeding Period (days)	Total Feed Consumption During Feeding Period (grams)
35	1.75	60	105
110	4.40	50	220
230	8.05	30	242
350	11.20	30	336
450	13.95	40	558
700			-
Total	39.35	210	1461

Table 2. Feeding standards for fish using artificial intelligence technology - programmed feed dispenser.

Fish Weight (grams)	Daily Feed Consumption (grams)	Feeding Period (days)	Total Feed Consumption During Feeding Period (grams)
35	1.12	60	67.20
110	3.08	50	154
230	5.75	30	172.5
350	8.05	30	241.5
450	9.90	40	396
700			-
Total	27.9	210	1031

The table was created by the author using scientific literature related to fish farming.

In Uzbekistan, the fish weighing 35 grams released into the water basin in April will grow to a mass of 700 grams by the end of October.

In fish farming enterprises established as small business entities, when fish are raised using traditional methods, 2 workers are needed for a 1-hectare water basin. For a 10-hectare water basin, the entrepreneur requires 20 workers. If each worker is paid a salary of 2,000,000 UZS, the total labor costs amount to 40,000,000 UZS. When artificial intelligence technologies are utilized, the time and effort spent by humans on various tasks can be significantly reduced, leading to a 30% decrease in the labor force requirement, meaning only 14 workers are needed. Consequently, the labor costs are reduced by at least 30%, amounting to 28,000,000 UZS.

4. Discussion

Considering that 4,000 fish are kept in a 1-hectare water basin in fish farming enterprises established as small business entities, 5,844 kg of fish feed is consumed using traditional methods. However, when using artificial intelligence technology, specifically programmed feed dispensers, only 4,124 kg of fish feed is consumed. If the price of 1 kg of fish feed is 4,000 UZS, the total cost using traditional methods is 23,376,000 UZS, while the cost using artificial intelligence technology is 16,499,200 UZS.

The analysis shows that utilizing artificial intelligence technology via programmed feed dispensers saves 6,876,800 UZS, thereby achieving economic efficiency. If fish farming enterprises established as small business entities operate in 10 hectares of water basins, they can save a total of 68,768,000 UZS in one growing season. Furthermore, this prevents the deterioration of water quality due to excess feeding. When artificial intelligence technologies are utilized, human intervention in the work process is reduced, leading to a

30% decrease in labor costs. This, in turn, ensures the economic sustainability of fish farming operations.

Since fish farming occurs underwater, it presents various challenges for farmers in managing and monitoring aquatic processes. Sensor recording devices and underwater cameras enable farmers to assess the growth of fish and accurately count the remaining fish in the water basin at the end of the growing season. This is crucial for fish farming enterprises established as small business entities to calculate the available fish stock for the upcoming year. As the fish reserves kept for wintering mature quickly, this ensures the continuity of working capital as they are sold to customers.

However, there are several challenges in the widespread implementation of artificial intelligence technologies in fish farming enterprises established as small business entities. These include the high costs associated with purchasing artificial intelligence technologies, a shortage of qualified specialists to use these technologies, disruptions in energy supply, and the incompatibility of water basins with artificial intelligence technology applications.

Conducting scientific research in this area is a necessity. Government support for the use of advanced intellectual technologies in various sectors of business, especially in fish farming enterprises established as small business entities, is an urgent issue today. The introduction of artificial intelligence technologies in these enterprises represents a modern solution to enhance fish farming productivity and achieve labor efficiency.

5. Conclusion

To address the challenges of implementing artificial intelligence technologies in fish farming enterprises established as small business entities in Uzbekistan, the following measures should be undertaken:

1. The state should focus on training qualified specialists in the field of artificial intelligence, particularly by establishing laboratories in universities for practical work in developing artificial intelligence schools. Only when students have the opportunity to apply their learned knowledge practically will the sector develop.
2. There should be comprehensive support for the creation of national artificial intelligence technologies used in fish farming so that all types of fish farming enterprises can benefit from these modern technologies.
3. The establishment of small-sized water basins for intensive fish farming should be increased.
4. Problems in energy supply should be addressed using alternative energy sources.

In conclusion, artificial intelligence technologies today serve to enhance economic efficiency for fish farming enterprises established as small business entities. Monitoring underwater processes, collecting information with sensors and cameras, and making important decisions based on analyzed data play a significant role in the development of fish farming.

Modern aquaculture technologies based on the use of artificial intelligence provide a crucial set of advantages that allow producers to elevate their fish farming operations to a new level. Among these advantages are:

a. Real-time alerts about non-standard situations and anomalies reduce risks, minimizing losses and lowering insurance costs.
b. Passive data collection minimizes stress on fish stocks, improving feed conversion rates, and freeing staff from the responsibility of data collection.
c. Wireless data transmission decreases the likelihood of cable failures.
d. Centralized management and control, combined with artificial intelligence, allows staff to perform a broader range of duties in a comfortable environment, increasing operational efficiency and accuracy.

Thus, it is evident that the application of artificial intelligence technologies in aquaculture will expand operations and improve overall performance, which will be essential as the industry grows over the coming decades.

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