

The current situation and development strategies of large-scale pig farming in Henan Province

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ABSTRACT

The study focused on large pig farms in China's Henan province. Through the method of literature research, questionnaire survey, interview, observation and group focus discussion, the present situation and main problems of pig industry in Henan Province were studied. On the basis of quantitative and qualitative analysis, a machine learning model for large-scale pig farms was established. The dependent variable was farm productivity, core technology and artificial intelligence were independent variables, biosecurity, production management, disease prevention, environmental control and data management system were intermediate variables, core technology and artificial intelligence affected intermediate variables, and intermediate variables affected productivity. Based on the model, this study attempts to explore whether the model conforms to the actual situation of large-scale pig farms, and according to user feedback, identify important factors affecting productivity, as well as new standards for large-scale pig farm management based on the application of machine learning and AI technology.

Key words:

Large-scale pig farm, Core technology, Artificial intelligence, Current situation, Development strategies

1. Introduction

The pig industry accounts for 43.2 percent of the total output value of China's livestock industry. China accounts for more than 50 percent of the world's pork production and consumption. Pig farming has become a pillar industry in China's animal husbandry (Yun Peng, 2017). Pork alone accounts for 2.5% of the CPI weight. Currently, China's pig farming industry is transforming from labor-intensive to technological automation. China's intelligent pig

industry has experienced the following four stages (Zhou Xingfu, 2021): The first stage is the stage of automatic equipment. The second stage is the management software system stage. The third stage is the lower stage of artificial intelligence (AI). The fourth stage is the advanced stage of artificial intelligence (AI). The use of data in these four stages is different.

Henan Province is located in central China, agriculture is relatively developed, is a large population province, grain province, agriculture and animal husbandry province. The pig industry has always been a traditional advantageous industry in Henan, with a solid foundation and a complete chain. There are many pig farms of different sizes in Henan province. By the end of 2020, Henan had about 17,000 pig farms with more than 500 pigs. The study population was 554 pig farms that slaughter more than 10,000 pigs per year. (Data from Rural Agriculture Department of Henan Province). By September 2022, Henan had produced 42.66 million pigs, stored 40.72 million pigs and produced 3.35 million tons of pork, up 0.7%, 3.5% and 3.9%, respectively. Breeding sows in the stock of 3.92 million; The export volume was equivalent to 20.2 million live pigs, ranking among the top in China in all indicators. (China Rural Network)

Starting from the current situation of the pig industry in Henan Province, this study reviewed the core elements of production management, breeding management, health management and biosafety in the construction and management of traditional pig farms, and analyzed the main factors affecting the management ability of pig farms and their influence degree. The deficiencies and drawbacks of simple pig farm management were found out, and digital breeding industry was studied. To innovate the management mode of pig farms, study the acceptance degree of pig farm users, and help pig farms improve management and optimize decision-making. Through this model, large-scale farms can reduce the cost of breeding and increase and improve the efficiency of raising pigs.

2. Literature review and research model

2.1 The application of intelligent pig-raising equipment and core technology in large-scale pig farms is not high.

At present, artificial intelligence-based data collection technology and equipment are mature, but the actual application effects of core technology have not been tested and tested,

and there are not enough successful cases to support the popularization of core technology and equipment in large-scale pig farms. As the technology is not mature enough and some technologies are still in the laboratory verification stage, they cannot be directly applied in pig farms. The popularization of digital technology and equipment in large-scale pig farms is not high enough (wang, 2021).

2.2 The depth and breadth of data development need to be further improved.

The informatization construction of the pig industry in my country started early and used a pig data system suitable for the management level and technical requirements at the time. However, with the development of new technologies such as Internet technology, mobile communication technology, and cloud computing technology, Mature and widely used, the functions and details of the traditional data management system cannot be updated and optimized in time, and it is difficult to adapt to the current and future-oriented pig management needs.

There is no unified data platform. There are a lot of pig raising software, but there is still no industry data platform. The government still relies on the statistics of observation points or the uploading of electronic forms of various large-scale Pig Farms when conducting macro statistics. Without a unified data platform, it is difficult to conduct industry data benchmarking analysis, so that macro statistics of the industry can only be inferred from the national annual output and the estimated number of breeding sows, and there are large errors (wang, 2019).

2.3 The application of artificial intelligence technology and core technology in pig farms is restricted by capital and technology.

At present, my country has a large number of Internet professionals and a large number of breeding practitioners. However, as the Internet has become the new infrastructure of the industry, cross-border talents with both Internet and breeding experience are still extremely scarce.

Artificial intelligence large-scale Pig Farms require a large number of AI intelligent technical workers to be trained and then employed, and sufficient intelligent technical talents are reserved to build intelligent large-scale Pig Farms. It is a wise move (xiao, 2019).

2.4 The research results and equipment applications of new technologies are not

shared to a high degree.

Research on the design principles, resource allocation and development prospects of artificial intelligence pig raising technology believes that the resource allocation of artificial intelligence pig raising technology in China needs to be further integrated. The government arranges special funds to encourage technological innovation, achievement identification, technology integration and demonstration and promotion of artificial intelligence pig raising, and guide more social resources to invest in joint research (Xiao, 2019).

3. Research contents and methods

This study had two steps. Step 1 is to use a questionnaire survey to study the current situation of production and management of large-scale pig farms in Henan Province. Step 2 to use interviews and focus groups to build a machine learning model.

3.1 Investigation for the current situation of pig farm management

By reading a large number of literatures on pig farm management theory and research and the application of modern technology, the status quo of pig farm management is investigated through questionnaires and observations. Cluster random sampling was used to select a certain number of pig farms in Henan Province for data collection. The survey investigated the current state of pig farm management through online and paper-based questionnaires. Randomly select large-scale pig farms in 18 prefectures, counties and cities for on-site observation. The purpose of this research step is to collect and analyze data on the current situation and major issues of pig farm management based on the application of modern technologies, including core technologies, machine learning, and Internet of Things.

3.2 Interviews and focus group meetings

Focusing on the current situation of large-scale pig farms in Henan Province and the main factors affecting the productivity and management efficiency of pig farms, I selected 15 experts in three majors: pig farming, information technology, and management, and conducted a survey on them. Interviews and two group focus meetings were organized. The first focused on the pig farm construction and management, focusing on the problems that should be paid attention to in the pig farm mode, production management and modern large-scale pig farm construction

in line with the current situation. The enterprise's industrial chain and scale management. The second is to study the application of the core technology of the pig farm in each link, the main factors affecting the management efficiency of the pig farm, and the problems in the management of the pig farm.

3.3 Establishing a machine learning model for large-scale pig farms

According to the previous research results, I explored and established a large-scale pig farm machine learning model, aiming to explore the key performance indicators of modern technology applied to pig farm management, used to measure independent variables and dependent variables, as shown in Figure 1.

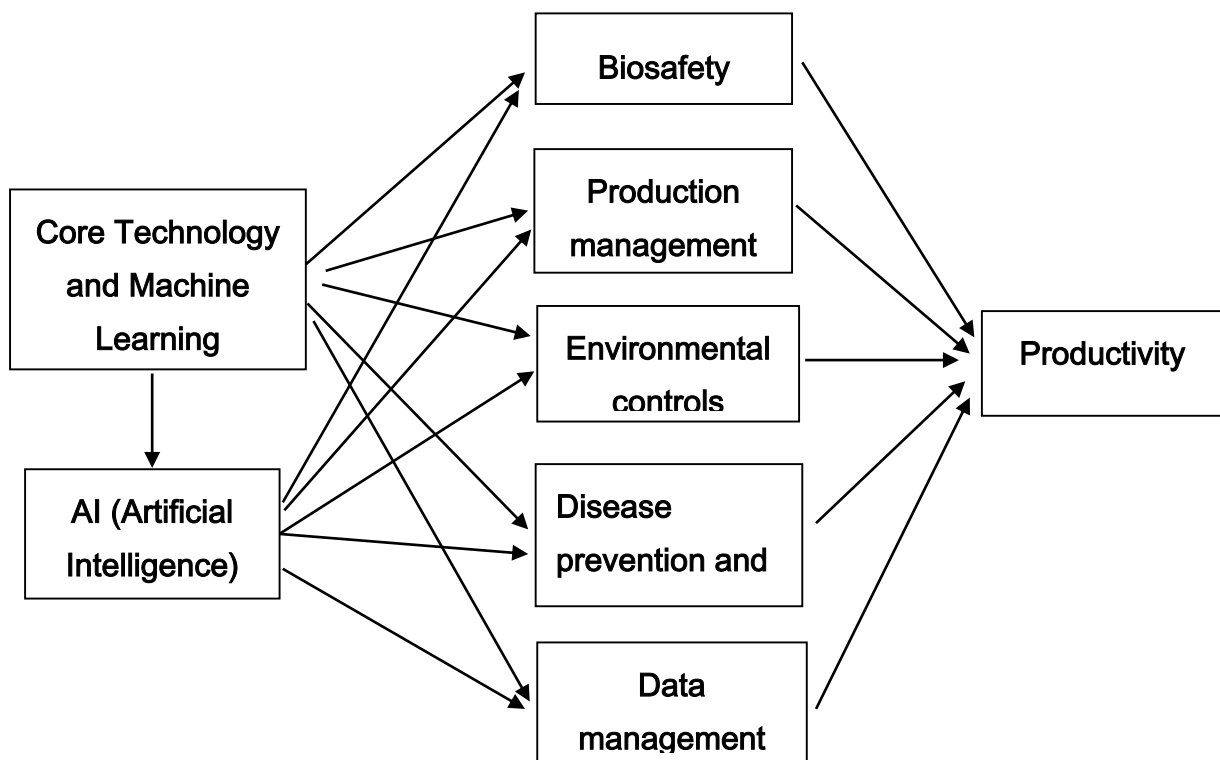


Figure 1 Conceptual framework

3.4 Model Development

Based on this model, we will conduct the quantitative and qualitative research to explore whether this model is consistent with the actual situation of large-scale pig farms, and based on user feedback, we will identify important factors that affect the productivity and new criteria for large-scale pig farm management based on the application of machine learning and AI technology.

4. Discussion, implications and limitations

In the past three years, due to the impact of COVID-19, the flow of people and goods has been greatly reduced, and pig farms are in a relatively independent environment. China's pig industry has gone through a relatively stable period, pork prices have been kept at a high level, and pig farms have gained high profits. Since 2023, with the adjustment of epidemic prevention and control policies, people travel greatly convenient, and the large-scale movement of people and goods also brings the risk of epidemic to pig farms. This spring, African swine fever broke out again, Henan Province is the hardest hit area, resulting in a large number of pigs infected with ASFV died, some pig farms or even the whole pig farm all died. Many of the small and medium-sized pig farms that have been particularly affected by the epidemic have no pigs in stock.

Since 2022, the price of soybean meal, as one of the main raw materials for feed, has increased the cost of raising pigs. On the other hand, the price of pork is at a low level, the profit margin of pig farms is very low, some pig farms have losses, and most of the contract fattening pig farms are vacant.

At present, the development of pig industry in Henan Province is not balanced. One type is large-scale pig farms, such as: Muyuan Stock, Shuanghui Development, Xinda Animal Husbandry, Yinfa Animal Husbandry and other companies have a high degree of application of core technologies. They have mastered the core technologies in breeding pigs, and adopted intelligent equipment in biosecurity, Internet of Things platform, environmental control and disease prevention, which reduces the direct contact between workers and pigs and reduces the risk of disease. For example, in Muyuan intelligent Equipment industrial Park, some pig houses are called "building pig houses". The "small high-rise" of the six-story building has different functions: the fifth to sixth floor is used for breeding pigs, and the fourth floor is a "nursery" where piglets aged 70 days grow up. When the pigs get bigger, they are sent to the 1st to 3rd floor. According to the different stages of pig growth, equipped with different intelligent devices. In each pen, there is also a vent, different column air does not cross, can avoid a large area of infection. At the same time, the air exhaled by the pigs is extracted through the negative pressure ventilation of the top return air window. After sterilization, deodorization and

elimination, the air is further guaranteed to be safe and clean. In this case, the productivity of pig production is greatly improved, while reducing the risk of large-scale outbreaks. On the other hand, these pig farms also have a high level of management and scientific decision-making team, to ensure that they get better profits in a bad market. For example, most of these enterprises have their own animal husbandry equipment production plants, feed processing plants, pig slaughterhouses, food processing plants, which extends their own industrial chain and enhances their ability to cope with risks. The other type of pig farm is a small to medium sized pig farm, usually less than 200 sows, self-breeding and fattening pig farm, as well as small fattening pig farms. Their core technology is still applied to a low degree, and there are few intelligent technologies and equipment. For example, in feed supply, they mainly rely on their own processing or purchase of feed at full price. Production is also mainly dependent on workers and technicians, it is difficult to ensure biosafety, the ability to resist market risks is low, labor productivity is not high, and profit fluctuates greatly.

The sow farm is the main place to apply the core technology, with the most advanced technology, the most intelligent equipment and the most standardized data management. In the core breeding pig farm, piggery planning is scientific, functional zoning is clear, and the digital level is high. For example, batch breeding control techniques for sows can improve sow productivity and reduce disease risk. In the delivery room of sows, there are constant temperature equipment, temperature and moderation detection equipment, air quality inspection equipment, video monitoring equipment, and sow information system. Through these technologies and equipment, accurate feeding and health management of sows can be realized. In the core sow farms, the government has actively implemented the pig genetic improvement plan, supported the establishment of an efficient and intelligent breeding pig performance measurement system, established a new pattern of coordinated development of "combined breeding + large-enterprise breeding", and accelerated the revitalization of the pig seed industry.

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