Exploration of a New Model of Pig Circular Economy Breeding under Intelligent Agriculture

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Abstract. In order to solve the problems of single mode and serious pollution of large-scale breeding, random site selection, unreasonable layout, neglect of information technology update and development, low technology content and other issues in the traditional pig breeding mode, through exploring circular economy, intelligent agriculture mode and analysing data, the optimal breeding mode-pig circular economy breeding mode under intelligent agriculture was finally explored. The whole new model is based on the sales analysis of "internet +" to obtain the number and scale of cultivation. After scientific and reasonable site selection and layout using "3S" technology, a new model of organic circulation unification of intelligent pig cultivation, intelligent waste treatment, and intelligent cultivation of feed crops. It has opened up a new way for pig breeding mode.

1. Introduction

In recent years, China has continuously issued the policy of "strengthening agriculture, benefitting farmers and Enriching Farmers", which has accelerated the pace of rural revitalization, and the rural development and reform are changing with each passing day. Some opinions on the work of "agriculture, rural areas and farmers" clearly point out that the implementation of the digital rural strategy. The company, government and other institutions followed the policy to explore the innovation of digital village - a new model of pig circular economy breeding under intelligent agriculture. Looking up the relevant literature and studying the current situation of pig breeding, the research found that although most of the breeding models have entered the information phase: feed nutrition ratio, scientific breeding and seed selection, etc. To some extent, the progress of the breeding model has been accelerated. However, there are also some problems in the development of breeding model: (1) there are single scale aquaculture model, serious pollution of scale aquaculture [2]; (2) the local conditional is arbitrary, the layout setting is unreasonable [3]; (3) ignoring the information technology update and development [1], low technology content [2], etc. The new model of pig circular economy breeding under intelligent agriculture is a solution to the above problems. It uses intelligent technologies such as sensors, Internet of things, mobile communication, cloud computing, etc. and analyses the market demand through big data technology to build an environment-friendly circular economy breeding model with organic supporting combination. The following is the exploration of the new model through pig circular economy and intelligent pig breeding mode:
2. The Model of Pig Circular Economy Breeding
In short, circular economy refers to following the 3R principle of reduction, reuse, and recycling to reduce and reuse the waste generated by products into resources, and then convert resources into required products. A closed-loop feedback circulation mode is established among products, wastes and resources. The increase of "turning waste into treasure" changes the single production of traditional "resource products". The structure is conducive to improving the use of materials, rational development of resources and maximizing product benefits, as shown in Figure 1 the circular mode of circular economy:

![Figure 1. Circular economy mode](image1)

![Figure 2. Breeding mode of pig recycling economy](image2)

According to the circular mode of circular economy in Figure 1, it can be seen that the whole mode is in the form of closed-loop. The substance circulates in the whole system, and there is no pollution waste output to make the whole circular environment friendly, which is conducive to environmental protection, economic promotion and resource reuse. The application of production mode to the circular economy of pig breeding also has the same magic. Based on the 3R principle, explore the establishment of large-scale pig breeding mode of circular economy, as shown in Figure 2.

According to Figure 2, the waste produced in pig breeding process is treated with nutrients needed in the process of feed crop planting, and the feed crop grows and matures to obtain fruit, rhizome and so on for the preparation of feed, and the feed obtained feed obtained for pig feeding. The whole process is a closed-loop cycle, greatly improving the material availability Sustainable utilization, minimizing pollution, in line with the concept of sustainable development of environmental protection. But the practice shows that the simple pig recycling economy breeding model has the disadvantages of low management efficiency, low information transparency and high cost. These disadvantages force the relevant personnel to innovate. The emergence of intelligent agriculture makes people refreshing, and then starts the exploration of intelligent pig breeding model.

3. Intelligent Pig Breeding Mode
Intelligent pig breeding refers to the analysis of technical support and demand for intelligent pig breeding in all aspects. By building a sensor system to monitor the breeding environment, the environmental monitoring equipment, automatic manure cleaning equipment, and automatic feeding line of the farm can be adjusted [4-6]. At the same time, develop the web page and software version of smart agriculture and IOT cloud service platform. The aquaculture personnel can remotely view the environmental data and visual monitoring data of the farm through computers and mobile phones, and set up the environmental regulation and defecation operation in the farm according to previous experience [7]. With the information-based management mode, but the structure is relatively single, the whole material flow is in a state of non-circulation and non-environmental protection, resulting in the unreasonable use of natural resources, which is not in line with the concept of sustainable development. Combined with the environmental protection concept model under the circular economy, the intelligent pig breeding and circular economy breeding can be combined to develop into a new breeding model - the new model of pig circular economy breeding under the intelligent agriculture.

4. Exploration of a New Model of Pig Circular Economy Breeding under Intelligent Agriculture
The new model of pig circular economy breeding based on circular economy and intelligent agriculture should give full play to the advantages of the sustainable development concept of circular
economy, transparent information, intelligent management and operation, high efficiency, precision and refinement. It should make rational use of natural resources, reduce labour costs and solve economic problems. The current "3S" technology can be used for site selection and planning of farms. The mature pig of farm undertakes "Internet +" sale obtains farm economy source. Waste is sent to the intelligent waste treatment department for scientific treatment and becomes into biogas slurry and organic fertilizer. Biogas slurry is used to generate electricity for power supply throughout the farm. Organic fertilizer enters the feed department as the fertilizer source for intelligent planting of feed crops. Feed crops are processed and proportioned into feed by intelligent feed processing department, and then output to intelligent pig breeding as feed for pigs. The whole process is a cycle closed process, almost to achieve "zero emission" of pollution. Sensors monitor the collection of raw data, transmission of communications equipment, cloud computing processing and analysis of data in their respective departments. The function of the Internet of things to manage and analyse the data of each department is applied in the whole cycle.

4.1. Site and Circular Layout Planning based on "3S" Technology
Using "3S" planning, site selection and layout of the farm, relevant personnel should make overall plans, use the cloud computing technology in intelligent agriculture, and adhere to the principle of "centralized investment, construction and scientific layout" [8]. Unreasonable location and scale will lay a great hidden dangers for the breeding activities of a farm while reasonable site selection will reduce its risk. According to the method for examination the examinational method of animal epidemic prevention conditions, the qualified results only accounted for 13.89% of the survey samples and 86.11% were unqualified. The construction of a pigsty shall be selected according to relevant animal epidemic prevention laws and regulations, pollution prevention and control requirements, comprehensive consideration of the surrounding environment, and comprehensive consideration of environmental protection requirements [10]. For pig farms, comprehensive factors and conditions should be considered, such as legal provisions, environmental factors and site selection conditions [11]. GIS, GPS and RS are organically integrated into the integrated information management platform to provide the company, management departments and other institutions with the technology of building the integrated information management platform for agricultural resource management and decision-making, so as to improve the scientificity, safety and green environmental protection of pig farm plan and site selection as a whole [12].

4.2. "Internet +" Hog Trading and Sales Model
The development prospect of intelligent agriculture is good [13]. "Internet +" sales are mainly manifested in the more intelligent and information-based sales system. The "Internet +" has established a relationship between intelligent pig farming and intelligent circular economy, forming a smart marketing system. After the implementation of the "Internet +" sale, the production of live pigs will become more systematic and data oriented. Farms can collect data, customer service and contract execution level from the Internet to pick up the quantity, variety and marketing of the breeding pig. The farm manager can also collect the data through mathematical modelling, continuous analysis and development of detailed breeding plan to meet the needs of customers and maximize the benefits at the same time.

4.3. Intelligent Pig Breeding
In the "Internet +" computing and modelling, the best scale of intelligent breeding is obtained, and then the best number of pig is raised. In the intelligent pig breeding, adopting the feeding of the best number of pigs, and combining the design of relevant hardware and software to get the intelligent control breeding mode will be shown in Figure 3 hardware structure of the control system.
Figure 3. Hardware structure of control system

It can be seen from the figure 3 that the intelligent pig breeding is mainly composed of pig house controller based on PLC [7], and the subsystem includes three major systems, such as environmental management system of house, intelligent cleaning system and intelligent feeding system. The management of house is built on the sensor network, which can obtain the monitoring information of other breeding environment such as pig house. The intelligent processing and analysis can get the data of environmental factors such as temperature, humidity and light of the breeding environment. According to the situation, the feedback control subsystem is carried out. The environmental management system regulates the air circulation, humidity and temperature of the pig house by the air conditioner, humidifier and temperature control equipment, the intelligent defecation system regulates the scraper to clean the environment of the pig house, and the intelligent feeding system regulates the feeding situation by the intelligent feeder. The feeder can guide the feeding of feed through "pig face recognition" technology, reduce waste, and improve the digestibility and absorption rate of food through scientific nutrition ratio. In the intelligent pig breeding, the environment of the farm is kept in the optimal state, and fine management is realized. When pigs become mature after a certain growth stage, they entered the "Internet +" market after treatment. The automatic defecation equipment will collect the waste of live pigs, dead pigs and other wastes. Simultaneously, it will discharge them into intelligent waste disposal.

4.4. Intelligent Waste Treatment
With the rapid development of Internet technology, information transparency has been widely used in different fields. At present, China's integrated livestock and poultry breeding model continues to be promoted, and the illegal discharge of breeding waste has seriously damaged the ecological environment. In combination with the environment-friendly development mode, the intelligent supervision strategy and the corresponding monitoring model of pig breeding waste treatment analyse the real-time data, and feedback the control equipment to implement the sustainable development breeding mode has been improved [14]. It carries out real-time monitoring of waste, informatization and regulation of the waste after reaching the standard, and transports that to the intelligent planting Department of feed crops for use. The waste disposal department can also compare the information obtained with the actual situation and then intelligently dispose the waste from intelligent pig breeding.

The waste produced in pig breeding can be divided into solid, liquid and gas by simple separation of equipment. The specific intelligent treatment of each part after separation is shown in Figure 4.

Figure 4. Intelligent waste treatment
The organic fertilizer obtained by composting, fermentation, returning to the field and other methods is the source of nutrient input for each growth stage of feed crops. Therefore, the organic fertilizer can be input into the intelligent cultivation of feed crops.

4.5. Intelligent Feed Processing and Proportion
The tubers and leaves of feed crops produced by intelligent cultivation of feed crops were treated with different treatments to obtain biogas slurry and feed ratio to provide full nutrition for pig growth and development, which improved feed utilization rate and reduced cost. Intelligent feed processing and proportioning is carried out by weighing and proportioning, raw material mixing and feed transmission through PLC hardware design and software design. The specific operation is shown in Figure 5 intelligent feed processing and proportion:

![Figure 5. Intelligent feed processing and proportion](image)

It can be seen from the figure that the intelligent feed processing and proportioning process mostly adopts the technology of intelligent feed processing and proportioning control based on PLC hardware design and software design for automatic equipment such as proportioning weight, raw material mixing, feed transmission, etc. The batching weight information can be monitored by a weighing instrument composed of PST-500kg weighing sensor and GM8802 weighing instrument in order for the raw material to be automatically mixed by contactors, time relays, and control buttons [15].

In the treatment of intelligent feed processing and proportioning, biogas slurry, biogas residue and crops are mixed and weighed by a computer. The prepared feed is transmitted to the pig breeding place, then information is transmitted to relevant departments through mobile communication equipment, so that the analysis capability of the intelligent feed can be improved. Managers make decisions according to the information, in order to pigs at different stages can get reasonable nutrition supplies and the growth of pigs can reach the optimal.

5. Conclusion
After the above exploration, a relatively complete new model of pig circular economy cultivation under smart agriculture is obtained, as shown in Figure 6,
According to the figure, the whole new model is based on the sales analysis of "internet +" to obtain the number and scale of cultivation. After scientific and reasonable site selection and layout using "3S" technology, a new model of organic circulation unification of intelligent pig cultivation, intelligent waste treatment, intelligent cultivation of feed crops, intelligent feed processing and proportioning for circular cultivation is constructed through sensors, communication equipment, Internet of Things and cloud computing technology. The exploration of a new model of pig circular economy cultivation under smart agriculture is a process of perfecting the cultivation model. It not only conforms to the expectation of the people for a good ecological civilization, but also is the best development mode for the harmonious unification of human beings and nature. It also improves economic benefits and realizes the virtuous cycle of environment.

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