APPLICATION OF MODERN MECHANISM ON POULTRY FARMS AND ITS IMPACT ON THE ENVIRONMENT

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Abstract
The modern way of raising poultry is significantly different from poultry farming as it used to be. The development of poultry production and increased profitability was contributed, first of all, by the development of science, which found a number of solutions for the rapid increase in the number of poultry and its productivity. The development and application of mechanization and automation contributed to the industrial character of production. Modern poultry farms are equipped with machinery that, in addition to the welfare of poultry farming, contributes to increasing labor productivity, saving labor and improving the general state of the environment on farms. When designing new and expanding existing poultry farms, guidelines for the application of clean technologies are increasingly being used, which aim to reduce negative impacts on the environment. The equipment is characterized by a high degree of automation, and there is an increasing application of information technologies in poultry farming. A big problem on traditional poultry farms is low energy efficiency and increased energy consumption, which can be overcome by using smart control systems, which is also an advantage from an environmental point of view.

Introduction
Agriculture plays an important role in the economy of many countries. Research indicates that there is a correlation between agricultural growth and economic prosperity. In this context, investment in new technologies in the field of agricultural mechanization is significant in the field of poultry farming. The emphasis is on the use of information technologies in poultry farming, which would include: 3D printers, drones, sensors for individual monitoring, artificial intelligence, virtual reality, robots, Internet of Things (IoT) [1].
Poultry farming is the process of raising domestic birds such as chickens, ducks, turkeys and geese for the purpose of obtaining meat or eggs for food. In the past, poultry farming, starting with eggs for planting, and ending with the final products - meat and eggs for consumption, took place as a single process and in different farming systems [2, 3, 4]. Conventional poultry farming on farms, due to inefficient methods and equipment, can lead to financial losses [5]. When using new technologies on poultry farms, it is necessary to control all environmental parameters that affect the growth of chickens, such as temperature, humidity, ammonia [6].
Some of the leading manufacturers of mechanization and equipment in the poultry industry, such as Big Dutchman AG, have developed automated systems of high technical performance.

Experimental
In the paper, two cases of application of new technologies were observed - a farm with modern automated equipment and a SMART poultry farm.

1. Modern automated equipment on poultry farms
Machines and equipment on modern poultry farms include feeders, waterers, ventilation and heating systems, lighting, equipment and fertilizing machines. The equipment is automated,

with minimal use of human labor. The paper analyzes the equipment manufactured by Big Dutchman AG.

An example of an automated feeding system is shown in Figure 1. It is the AUGERMATIC system - tubular floor conveyor.
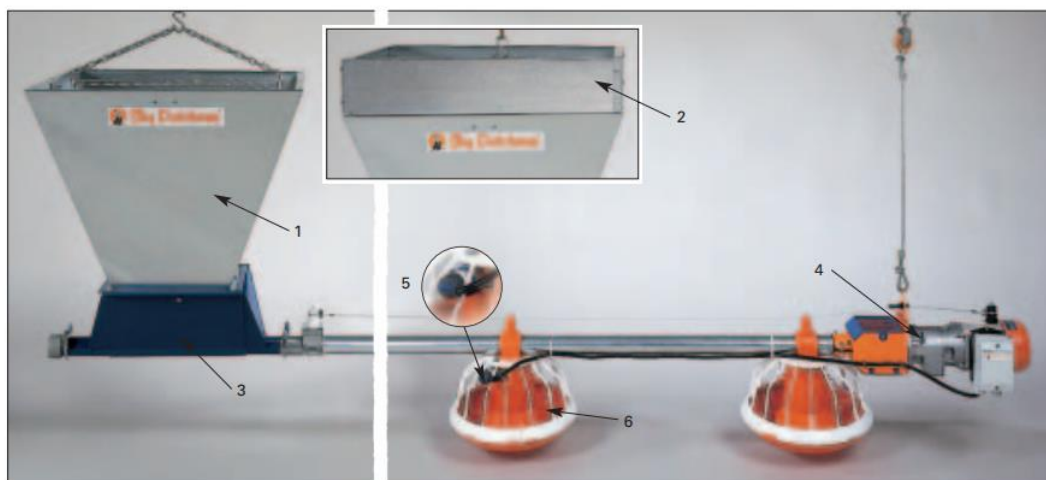

Figure 1. Feeding system AUGERMATIC [7]

Its innovation is reflected in the fact that the upper part of the feeding basket (1) with or without extension (2) is easily separated from the lower part of the food basket (3). In this way, the entire system can be lifted up to the ceiling every time. This makes it possible to reach the maximum height under the feeder during fertilizing. A strong drive unit (4) and a strong spiral allow a transport length of up to 150 m. At the same time all the feeders are filled with food, the sensor (5) and the control feeder (6) automatically turn off the unit.

The choice of a poultry watering system depends on the type of poultry, the area of use, the conditions in the rearing area and the special requirements of the user. One of the solutions are nipple-drinkers, as a reliable and hygienic solution for supplying drinking water (picture 2).
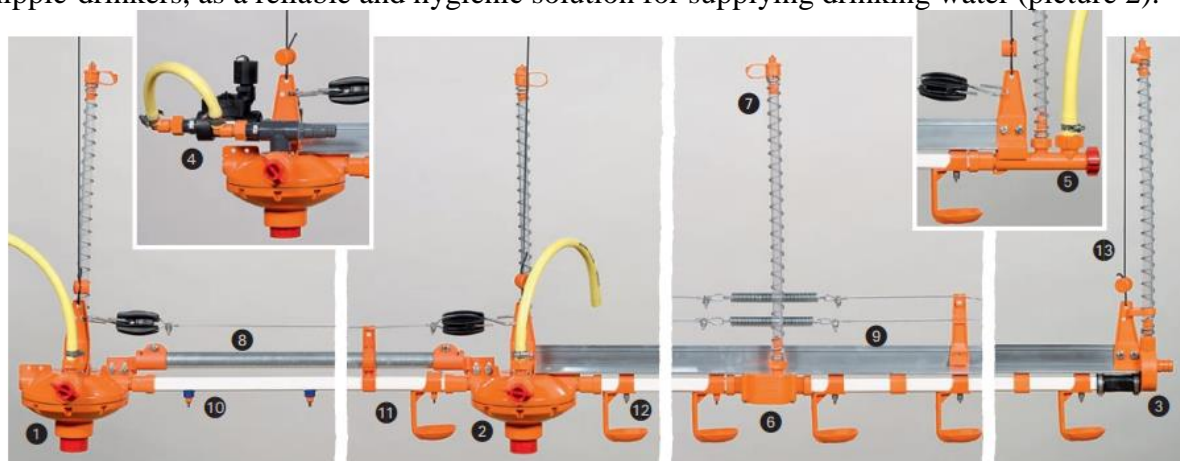
Picture 2. Nipple of the drinking bottle [8]

Van - the ventilation system is an intelligent climate regulation system on the farm. Two different ventilation systems (side and tunnel ventilation) are combined in one facility to ensure stable climate management and optimal ambient conditions for poultry. The application of this solution is recommended in regions where the climate is characterized by large temperature fluctuations (Figure 3).
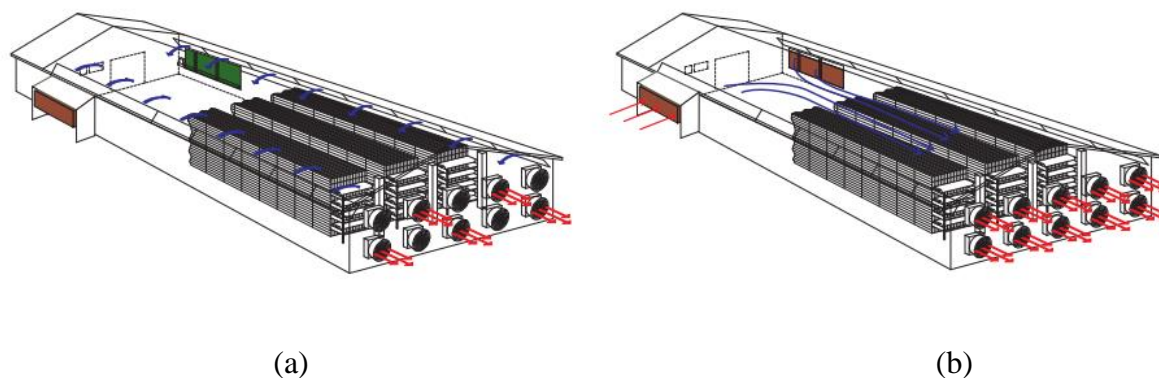
(a) (b)

Figure 3. Combi ventilation system (a-ventilation in side mode, b- ventilation in tunnel mode) [9]

For heating on poultry farms, it is possible to apply different heating systems that can be gas, oil or hot water. The choice depends on the size of the farm and the climate of the area where the farm is located. The goal is to achieve maximum energy efficiency. Big Dutchman offers: JetMaster heaters, devices with flue gas exhaust, gas heaters, recirculation fans for improved hot air distribution, hot water convection heaters, finned tube heaters and infrared heaters [10].

LED lighting is taking precedence on modern farms. There are different types of LED lighting such as: flexible tube lamps (FlexLED, FlexLED HO, FlexLED eco), professional LED ceiling lamps (ZeusLED).

(a) (b)

Figure 4. Use of LED lighting (a- FlexLED, b-ZeusLED) [11]

Such heating and lighting solutions on farms are more favorable from an ecological point of view and in accordance with the principles of sustainable development

1. SMART poultry farm

A smart poultry farm is characterized by features such as automated feed and water supply, egg collection and maintenance of precise poultry environmental parameters. The techniques used are data storage via IoT, GSM - Global System for Mobile Communication, the use of applications on mobile phones that enable the protection of the farm in real time by notifying the farmer via SMS about any alarming situation [12, 13, 14].
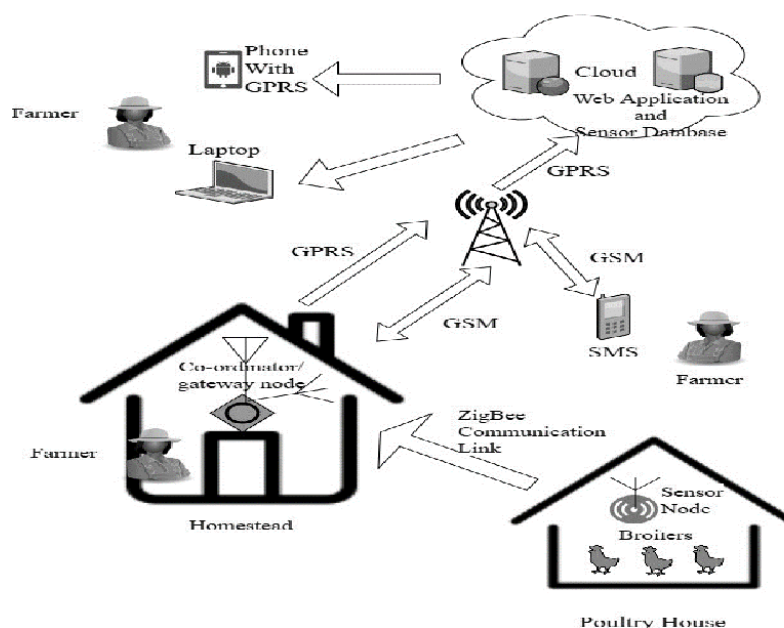
Figure 5. An example of a SMART poultry farm [11]

Results and discussion

Modern poultry farms are characterized by the use of modern mechanization and equipment, which enables higher productivity, better conditions for poultry and easier work for farmers. Processes are automated with the increasing implementation of information technologies. Energy and ecological heating and lighting systems are used. In the world, SMART poultry farms with the implementation of IoT, artificial intelligence systems, drones and robots are extensively used in the segments where it is applicable. Apart from procuring the appropriate software and hardware components, farmers must be trained in the proper use of the applications.

Conclusion

The progress of science, technical inventions and information technologies affects changes in all segments of modern agriculture, including mechanization on poultry farms. These changes bring greater productivity and economic profit, but attention should also be paid to better environmental protection in order to reach the fundamental goals of sustainable development. This paper presents only some innovative and environmentally justified solutions related to the application of modern mechanization - new technologies on poultry farms.

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