Information Systems for Monitoring Animal (Cow) Welfare

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Abstract: *The paper covers theories and literature for starting the development and implementation of an information system for monitoring the welfare of animals (cows) in the Bitola region, in the Republic of Macedonia. The aim of the paper is to show, through the example of the implementation of hardware parts and software components, the meaning of information systems, the importance of their use, through digital monitoring of the welfare of animals (in our case cows), as well as a complete digital analysis of the work of cows on the farm. Starting from the fact that the Republic of Macedonia is an agro-producing country, the implementation of this type of digitalization through an information system will help a lot in monitoring the welfare of animals on farms, and most importantly, what steps to take to improve production and maintain their welfare. The paper graphically presents the hardware components that can be used to monitor the welfare and digitalization of the cow farm, with the capabilities they have, with a previous detailed analysis of similar information systems in countries where the main activity is agriculture.*
Keywords–*Information system, Digitalization, Farm.*

I. Introduction

Information systems are places where information is stored, processed, and transmitted electronically. There are numerous information systems that differ in type and the work to be performed. In the field of farming, the process of modeling, designing, and creating an information system is the development and creation of e-farming tools that provide easy access to information, which is a necessary need for growth and development.Starting from the fact that the Republic of Macedonia is an agro-producing country, the need to present the role and benefits of modern information systems is great. The information that is obtained is a very important factor that can be interactive with other production factors. The productivity and functionality of other factors such as land, capital, labor, knowledge can be improved if relevant and useful data are used. Therefore, it is necessary to understand the purpose, advantage and functioning of information systems in order to be able to manage them and improve them. The new agro-technologies that are used are generated by research institutions, universities, private companies and the like. Agricultural information systems together with knowledge sharing services, together with new technologies enable the connection of end users and the exchange of information. The main role in the search for information is to obtain highly precise, relevant and accurate data to end users. The purpose of this connection is to assist users in making their decisions and to provide appropriate knowledge in order to obtain the best results.

II. Methods And Material

Following the rapid growth and development of information and communication technology, there is no industry that can function without the implementation of ICT technologies. Information systems are also included in the ICT technologies section.The creation and implementation of the information system is a larger process that takes place in several parts. It is necessary to conduct a case study on the necessary information that is necessary to start modeling the information system.The development of the information system model and life cycle can be divided into different stages and can be presented graphically or using a diagram. The most popular principle from which to start when creating and modeling the information system is the principle of waterfall where the phases in creating the model are: specification, planning and implementation. All phases include quality assurance measures such as checks and tests. The purpose of these phases is to detect system errors. At the end of each phase, has a review of a status-oriented session, and it is review whether the expected results are achieved. Each of the phases of activity consists of input, processing and realized output. The result of each stage of development has its own results, which are verified as input for the next phase. If the previous phases does not display the results is not successful, the next phase can not start. Accordingly, the next phase can only start if the previous phase is completed with success.There is a large number of information systems that can be

used for various purposes and tasks. Starting from the fact that the Republic of Macedonia is an agro-industrial country, the implementation of information systems in the field of monitoring the welfare of animals (cows) is of great importance, where end users (farmers) will have access to information and monitoring the condition of the animal in real time. Which type of information system will be used depends on what type of data needs to be obtained. In our specific case, our research addressed the problems that farmers have due to the lack of information and additional analyses related to the welfare of the animal (cows), so an attempt was made to electronically monitor the activities of the animals (when they eat, when they sleep, when they are fed), and thus to make a detailed additional analysis of what to pay attention to when raising animals and their welfare, where the benefit will be for farmers, veterinarians, researchers and other parties. In order to make such an analysis, it is necessary to install an information system consisting of hardware and software components where the information will be obtained in real time and will be available in real time.

When choosing a solution, it is necessary to pay attention to the following:

* Choosing a hardware part;
* Choosing a software part.

The communication of the parts is shown in Figure 1.
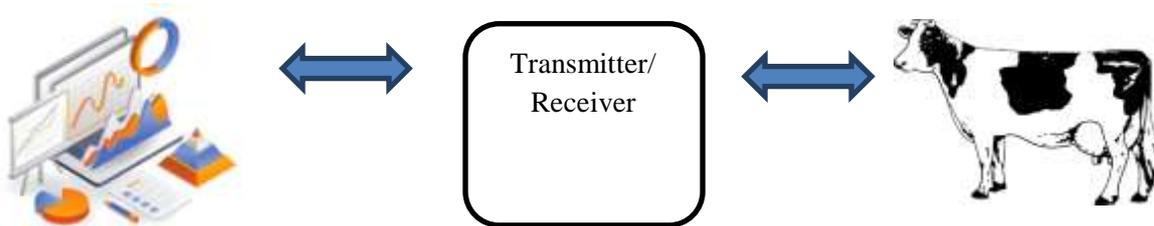
The communication of the parts is shown in Figure 1

Figure 1 shows the method of communication and connection to obtain information in real time. This requires the installation of hardware and software components. When selecting and installing, it is necessary to pay attention to which hardware components will be used, starting from the fact that some of the hardware components should be installed on an appropriate part of the animal's body in order for the hardware part not to be damaged on the one hand, and on the other hand to be unnoticeable to the animal and, most importantly, to be functional for collecting the necessary data for the appropriate animal (cow). On the hardware side, a Transmitter and a Receiver are required to establish communication. The Transmitter is the part that is installed on the side of the animal (cow), where its role is to collect the activities of the animal and forward them to the receiver. The communication between the receiver and the transmitter needs to be wireless. On the other hand, for good communication between the receiver and the computer for collecting data, the best solution is for it to be wired. In order for the hardware components to function, it is necessary to install appropriate software that will perform multiple operations. The choice of a software solution depends on what needs to be done and the method of communication. The data from the receiver to the computer is transmitted using software, which will save the same data through the database management system. It is good to save and analyze the data on a daily, weekly, monthly basis, in order to be able to compare them later. Also, the software should have the ability to connect and access data in real time, generate reports, and monitor the welfare of animals (cows).

III.   Conclusion

This paper presents the role of information systems and their need and role in implementation in the field of agricultural production. Theoretically, the part and steps that should be observed when constructing the functioning of the information system in the field of farming for monitoring the welfare of animals are presented. The paper explains in detail the part of functioning when implementing it in practice. Future steps that would be taken are the practical implementation of the information system, and the presentation of the results of its implementation as soon as possible.

Macedonia. The project focuses on the development of innovative dairy products with added functional value, as well as the application of smart technologies for monitoring cattle welfare and milk quality.

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