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Feasibility Study of Management Information System and Application of it in Dairy Industry

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Abstract: **Various sensors, automatic machines and intelligent technology (IT) applications available to the agriculture today makes it possible to manage a dairy industry on a more detailed level than before. The farm manager can make more rational decision through acquiring amount of information, but there is a major obstacle in using more IT in dairy production is that most of IT solutions provided have non-compatible software, thus the farm manager has to operate several computers each day and manually transfer data from one unit to another. The paper aims to analyze information feasibility and the application of Intelligent Communication Technology(ICT) in modern dairy industry, the ICT system as dairy farm management tools to describe, document and control all processes on dairy production, especially the multi-purpose and multi-agent ICT system application support management of the farm and provide documentation for entire dairy supply chain members.**

Keywords: Information Feasibility; ICT system; dairy industry

1. INTRODUCTION:

1.1 Background information:

It is well known that primary agricultural production is managed on a rather crude level, plant pesticides and nutrients are applied equally over fields, stocks and poultries are fed and treated according to standards defined by simple, easily observation or sensation, experience (Lindstrøm,2008). Especially nitrogen quotas in milk or eggs are regulated on a farm level, because only farms purchasers and sales are available for the requiring supervision. ICT systems' potential of providing significant amount useful data and information for process management and process documentation expedited its application in many fields. With technical innovations, like GPS, GIS, various sensors etc., Agricultural production should be managed on a primary crude level to a elaborate and high level. Whereas, most of modern IT solutions in agricultural are non-compatible and isolated, thus the farmer must operate computers (IT unit) or manually transfer data each day, the advantage that application of the IT controlled machines can't be brought into play. With the development of intelligent communication technology and new standards for data transmission along with high bandwidth wireless internet connections it is possible to construct and maintain a complete management tool for modern farm management. In the process of dairy production, various sensors and automated machines can control indoor environment, monitor feed storage, access milk quality, perform the milking, detect nutrient of feeds, mix feedstuff and feed it to the cows etc.. As information management system is required to unite all the parts of precision agriculture.

1.2 Outline of the article

This paper is attempted to analyze information feasibility and provide the methodology to construct and organize system architecture for an ICT management tool for dairy industry, This ICT system tool is a multi-purpose and multi-agent system. The term multi-purpose refers to the use of the facilities in the network by dairy farmers, advisers, authorities, feeds supplier and etc., at the same time it's a multi-agent network system which the nodes in the network being humans, various sensors, automated machines, software programs, etc.

2. MATERIALS AND METHODS

2.1 Basic function

The dairy industry is very dynamic thus the system cannot be properly depicted by pure tool-systems or by normal linear models. In order to describe production dynamic natural data more comprehensive and more exactly, the object-oriented analyses and design (OOAD) is used. OOAD is a software engineering approach that models a system as a group of interacting objects. The feed mixers, tractors, cows all are definite objects and characterized by its class, its state (age, yield etc.) and its behavior (eating, heat etc.). Various models can be created to show the static structure, dynamic behaviors, and run-time deployment of these collaborating objects.

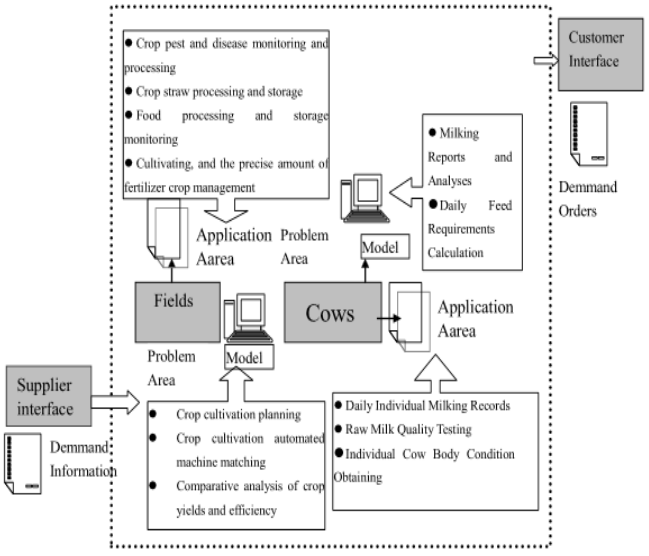


Figure 2.1 Main Construction of the Multi-purpose and Multi-agent ICT System Based on Supply Chain and the Four Components.

2.2 Construction description

Figure 2.1 shows the main functional construction of the multi-purpose and multi-agent ICT system based on supply chain and the four components.

To reach digital management for milk production and cattle nutrients, the cows' production subsystem function is designed as follows:

- ❖ Daily individual milking records: to record milking data of different dates and different times according to individuals; to add up the monthly production or a specific duration of each cow and generate graphical analysis.
- ❖ Raw milk quality testing records: it is necessary to record the quality testing data of raw milk for cows that take part in dairy herd improvement(DHI),quality indicators include dry matter, milk protein, milk fat, and lactose, in addition to sanitary indicators include somatic cell count (SCC)and bacteria count(BC); The Ministry of Health has rolled out the new dairy safety standards draft, currently somatic cells count in raw milk testing implementation less, if the implementation of the new rules, most of the dairy enterprises must be technological upgrading;
- ❖ A herd milking detail reports and analyses: to gain statistic report and figures for milk production based on daily, monthly, or a specific duration for a herd are necessary. To analyze dynamically total milk production of the last 12 months distribution in terms of different parities and different milking levels.
- ❖ The daily feed requirements calculation: to balance the feed requirement, the daily amount of compound feed is simulated through a linear programming optimization for each day. A least cost composition fulfilling the energy and protein requirement is determined for each cow based on the individual cow body condition. A cow–dependent compound mixture is composed by a feeding computer program.
- ❖ The individual cow body condition obtaining: The individual cow body condition obtaining information-based science and fine breeding is the modern dairy farming the main research directions.

2.2.2 : The crop production subsystem of the farm:

The crop production subsystem design is both a physical model is a simulation model, by which the impact of management on the nutrient stocks and flows of the farm can be analyzed. The spatial scale of the model is a dairy farming system with optional size with regard to area as well as number of cows.

The simulation system enable the user to analyze the performance of the dairy farming system a particular year, over one crop rotation or several. The main functions include:

- Crop cultivation planning
- Comparative analysis of crop yields and efficiency Crop cultivation automated machine matching
- Crop pest and disease monitoring, analysis and processing Cultivating, and the precise amount of fertilizer crop management
- Crop combine harvester Soil nutrient sample analysis
- Crop straw processing and storage
- Food processing and storage monitoring

2.2.3 Supplier and customer interfaces:

- For most of suppliers and customers, their concern is mainly that of convenience; By using of modern Internet technologies, the adoption of the technology platform to accomplish:
- Livestock experts remote diagnostics and online consulting
- Management's monitoring and supervision of milk production
- Cattle, seed, feed, equipments demand information publishing and e-procurement
- Agricultural products, milk transmission of electronic data transactions

Advisors are utilized by several farms for various purposes. There are significant difference in extent of this utilization and the purposes for it, but common reasons include application for farm subsidiaries and even soil management advisors require obtain farm data similar to that of farmers for any given matter as they are expected to provide expert advice based on the data.

Authorities monitor the adherence to regulations, such as restrictions on the use of chemicals, milk quality insurance, and require farms to report regularly on their activities. It is convenient and therefore a concern of both the farmer and the authorities if the necessary information can be transferred automatically, reliably and with the least amount of human effort.

Customers of the farm who in the context of this article are considered to consist of companies and other entities greater than an individual consumer, have concerns related to the product they are purchasing. The farm documentation can be used to prove the quality of milk or other production and to prove that the product was produced according to the agreed farming practices.

Suppliers of the farm are not stakeholders, but information on the chemical, seeds, feed and equipments of farm required needs to be known to the farmers to reduce costs and ensure quality. Hence, the convenient transfer of this information is important as most calculations, especially in operational planning or economic analyses, require detailed information on the composition and availability of chemicals.

Service providers provide the external services that farms require, such as those for calculating field characteristics like the PH value or analyses and detection of milk production .It is in the interest of the service providers to have this data conveniently and reliably transferred to the farmer. Also services that require farm data and further process it need a convenient access to the data.

Manufacturers of equipment need to provide certain technical details for their products that are important for the calculation of the operational plans. For reliability and convenience, these characteristics should be provided by the manufacturer of equipment and stored in the management database before their eventual transfer to the equipment proper. Depending on the form of this transfer, the same information channel could be used to transfer

software-updates and other information relevant for the users of the equipment.

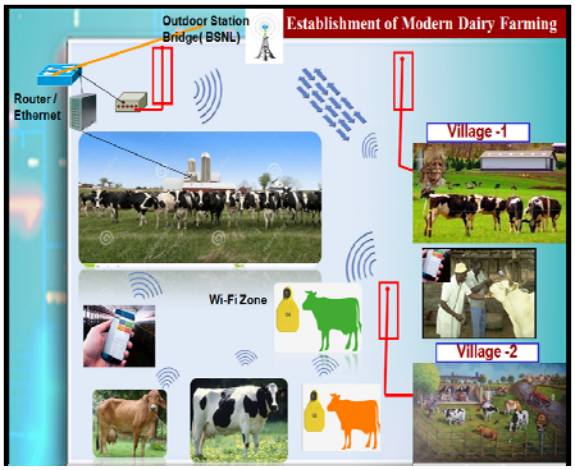


Figure 2.2 Cow Individual Information Collection

3. CASE: TECHNICAL DESCRIPTION OF THE COW INDIVIDUAL INFORMATION COLLECTION

The application of radio frequency identification technology (RFID) collects information on individual animals. Cows because of their species, weight, physical at different stages, environmental temperature, feeding method, the number of pregnancies, fetal weight and others determined distinct nutritional needs difference. Cow collar type passive transponders are used for individual identification, the target object's data is stored in the transponder, and very easy to change from one animal to another, the subsystem is used milk production, weight weighing and automatic feed ration of cow individual. Reader antenna with goal posts, sending frequency, data transfer rate, RF interface complies with the ISO15693 standard. When

the cow passing weighing or milking goal post, the reader will automatically read the collar-type radio frequency card information, at the same time through the pressure sensors the cow weight and milk weighing information, together with the acquisition time are sent to the site servers through a wireless local area network, the digital culture platform data were supplied. Sensor node integrated sensor module, controller module, communication module and power supply modules, they are a wireless communication through the layered network communication protocols and distributed algorithms can quickly build self-organizing network system, with good collaboration. Cow individual identification, weighing systems, milking systems, and wireless network transmission technology program as shown in figure 1.2.

4. DISCUSSION:

Farm management information system have steadily increased in their level of sophistication as they have included new technologies with internet connectivity being the latest addition, the application of ICT system in Dairy industry is becoming a necessary requirement accompanied technologies and sciences development. These new functionalities will probably be leveraged by the expected reduction in the cost of sensors and by the increase at low energy expense, in the sensor ’s memory and processing capabilities Precision livestock farming(PLF) is the principal means by which smart sensors will be used in livestock farming, whereas we can draw a conclusion that PLF is an embryonic technology with great potential to transform intensive livestock production by efficient utilization of nutrients, early warning of ill health, reduction in pollutant emissions and provision of useful information to skilled stock-men.

Through the use of information technology means, according to the individual dairy cow body condition information control feed and raw milk quality, to achieve the fine dairy cattle breeding is feasible, and it is a necessary requirement of gradual transition from traditional animal husbandry to the modern information husbandry. In addition the rational application of information technology can become the main elements of the productive forces. As this study and propose solutions to those used in radio frequency technology and a computer with wireless LAN technology to transmit data, enabling real-time, rapid acquisition of information possible; Through the computer and the corresponding model to process the information collected, and to optimize a series of programs to reflect the individual differences, together with the application of automatic control equipment, the automated dairy farming is becoming a reality This study is in accordance with "information collection - information processing – information application" route through the simulated data of the test, the effect of design of the platform is expected to fully meet the objectives.

Role of Management Information System in Dairy Business:

Information system solutions to dairy industry problems are a responsibility of any business professional today. As a business end user you will be responsible for proposing or developing new or improved information systems for your company. As a manager, you will also frequently manage the development efforts of information systems specialists and other end users. This section builds on the problem-solving concepts in the previous section to show you how information system solutions that meet the business needs to end users and their organizations can be developed.

The System Development cycle:

When the systems approach to problem solving is applied to the development of information system solutions to business problems, it is called information systems development. Most computer based information systems are conceived, designed, and implemented using some form of systematic development process. In this process, end users and information specialists design information systems based on an analysis of the information requirements of an organization. Thus, a major part of this process is known *system analysis and design.* However, as Figure 3.0 shows, several other major activities are involved in a complete development cycle.

Figure 4.0 illustrates if we start any agriculture business or any dairy farming system we need to adopt each stage of

this process, which includes the steps of (1) investigation, (2) analysis, (3) design, (4) implementation, and (5) maintenance. All of the activities are highly related and interdependent. Therefore, in actual practice, several development activities can occur at the same time, so different parts of a development project (Agricultural / Dairy Farming) can be at different stages of the development cycle. In addition, project developer/farmer may recycle back at any time to repeat previous activities in order to modify and improve a system they are developing.

Starting the Systems Development Process:

Do we have a business problem? (or opportunity). What is causing the problem? Would a new or improved information system help solve the problem? What would be a ***feasible information system solution*** to our problem? These are the questions that have to be answered in the ***systems investigation stages***- the first step in the systems development process. This stage involves consideration of proposals generated by an information systems planning process. Using the systems approach to develop information system solutions involves a multistep process called the Information System Development Cycle. The following Figure illustrates what goes on in each stage of this process, which includes the steps of (1) investigation, (2) analysis, (3) design, (4) implementation, and (5) maintenance. If we develop new project, we will follow MIS rules and regulations like SDLC, that all of the activities involved are highly related and interdependent. Therefore, in actual practice, several developmental activities can occur at the same time, so different parts of a development project can be at different stages of the development cycle. In addition, analysis may recycle back at any time to repeat previous activities in order to modify and improve a system they are developing.

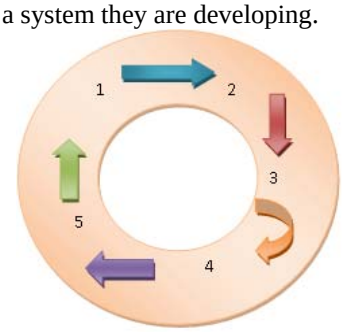
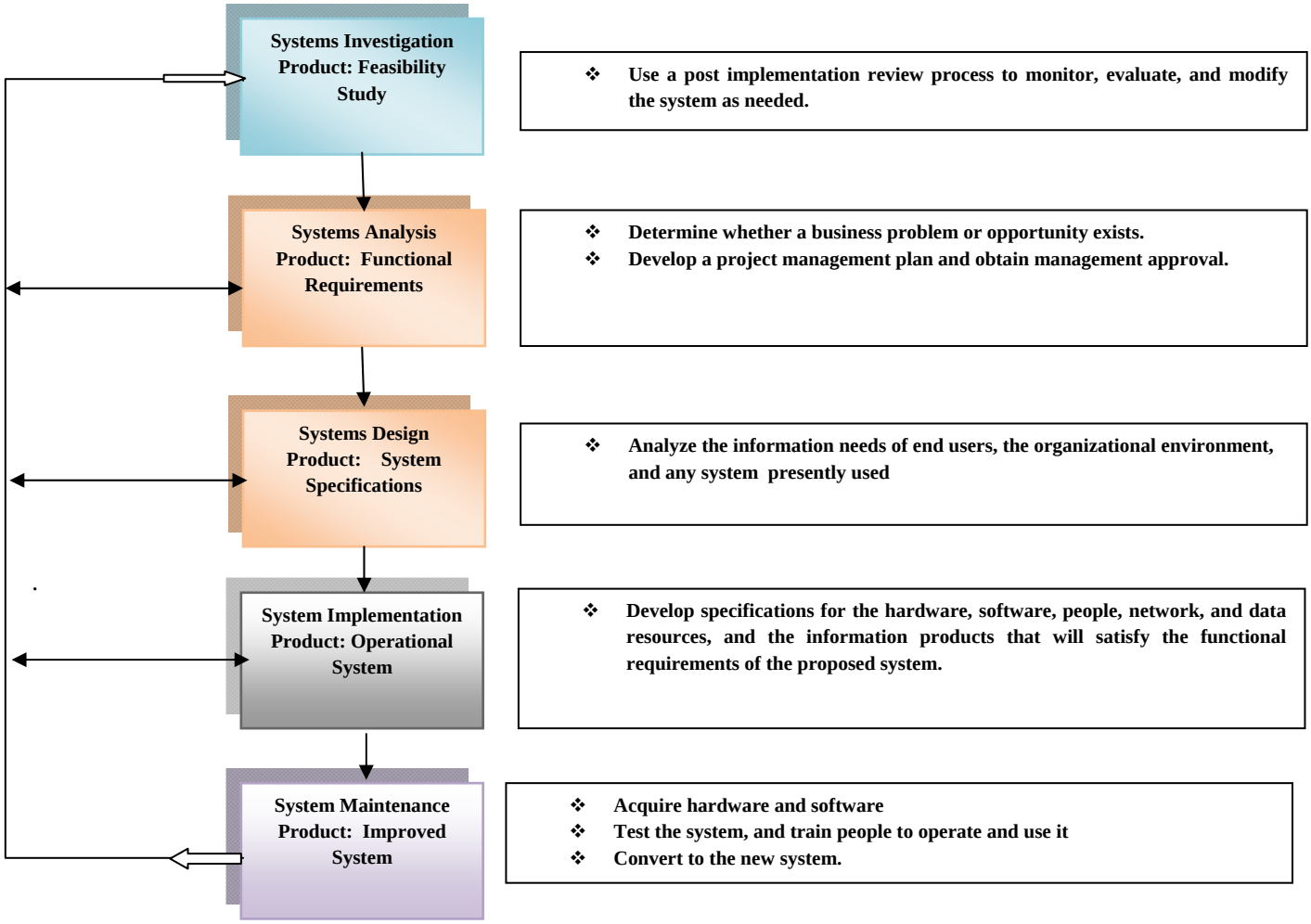


Figure 4.1 Complete development cycle.

DEVELOPING INFORMATION SYSTEM SOLUTIONS

The developments such as prototyping, computer-aided systems engineering (CASE), and end user development are automating and changing some of the information systems development. These developments are improving the quality of systems development and making it easier for IS professional, while enabling more end users to develop their own systems

Figure 1.3 Developing information systems solutions to business problems is typically a multistep process or cycle.



The Traditional information systems development cycle. Note how the five steps of the cycle are based on the stages of the systems approach. Also note the products that result from each step in the cycle, and that you can recycle back to any previous step if more work is needed.

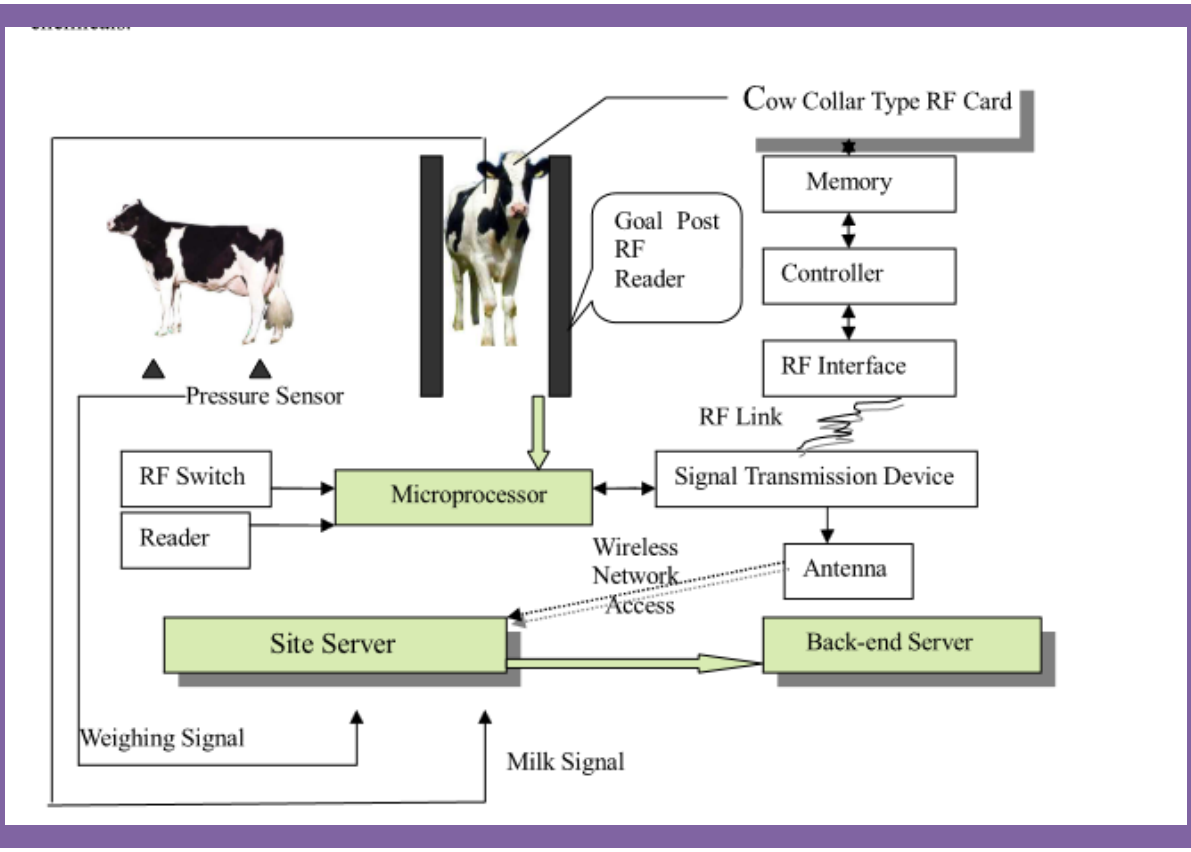


Figure 1.4 Cow Individual Identification, Weighing Systems, Milking Systems, and Data Transmission Technology Program

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