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Research Article

Farm Management Information System for High Productivity in Agribusiness

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Abstract

The focus of this study is to present Farm Management Information System (FMIS) and its application in Agribusiness. FMIS is a software designed for high productivity in farming business (fish farming as a case study) and to assist agricultural farmers to perform various tasks with ease such as operational planning, implementation, documentation, and application for financial subsidies or grants. The study presents the template that could be used for fish farmers in order to ease their tasks. FMIS could be used by different stakeholders such as farmers, government organizations, service providers, and machinery or equipment or tools manufacturers to transfer information among each other. This paper discovered that lack of interoperability, insufficient stakeholder's collaboration and a not clearly defined business model has hampered the proper functioning and adaptation of useful Information Communication Technologies (ICT's) such as the FMIS. Manual approach is limited in the affairs of better farm fish management, one method by which this can be improved is by support system which this work focuses to address. The FMIS software designed uses C#, Visual Studio and SQL Server, will assist the users or Fish or Farm managers in solving their day to day problems such as accurate stocking record, sales/harvesting record, payment record among others. The study concluded that with the application of FMIS in Fish farming, the processing of farm information activities can be automated to a large extent, thereby reducing processing time and

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increasing farm work accuracy. The study recommended that FMIS training should be organized for Fish or Farm Managers in groups at both the Local, State and Federal levels in order to improve their efficiencies.

Keywords: ICT, Agribusiness, C#, FMIS, SQL Server, Visual Studio, Fish Farming.

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Introduction

In most farms particularly fish farm, most of what goes on consists largely are transactions. A transaction is a recorded event having to do with routine business activities (Hyungi Kim, 2014). This includes everything concerning the product or service in which the farm is engaged: production, distribution, sales, order and stock-taking. It also includes the materials purchased, employees hired, taxes paid and so on. Today in most farms, the bulk of such transactions are recorded in a computer-based information system.

Computer-based information systems are systems that tend to have clearly defined inputs and outputs that enable and provide necessary facilities for accurately and efficiently managing an organizational process. It could be sales, order or record keeping of staff. Information system is a collection of people, procedures, software, hardware and data. Connectivity allows computers to connect and share information, thereby greatly expanding the capability and usefulness of an information system. Computer-based information systems are meant to reduce the stress in managing businesses or organizational procedures.

Management Information System (MIS) is one of the major types of computer-based information systems. It uses the database of an organization in producing well-structured forms of reports. Farm Management Information System (FMIS) is designed to assist agricultural farmers to perform various tasks ranging from operational planning, implementation, documentation, and applying for financial subsidies. Different stakeholders such as farmers, governmental organizations, service providers, and machinery manufacturers transfer information amongst each other in FMIS. Precision Agriculture (PA) is a modern agriculture cultivation method which aims at optimizing production in terms of product output, quality, and operation efficiency. Optimization in PA is fully achieved by adopting the use of modern information technology coupled with approved management techniques and engineering technology (Ess *et al.*, 1997). For a fully operational PA farm, there is a continuous need

to maintain a steady information flow to and from the farm environment. Information flow provides the farmer with external knowledge and decision support in order to perform efficient field operations, and it serves as a means of transmitting data about farm and field operations. Presently, large amount of data from field operations are collected by agricultural machines and transmitted using various data storage and transmission media (Nikkilä 2007). As an additional benefit, various stakeholders such as government and legislative bodies, processing industries and private manufacturing industries, tap into this information system of data flow to collect and transmit information, or provide machinery service support for farmers (Sørensen *et al.,* 2010, Wolferta *et al*., 2010).

Information systems have evolved from simple record-keeping software to large Farm Management Information Systems (FMIS) in response to the need of communication between databases of different stakeholders. A FMIS is a management information system designed to assist agricultural farmers to perform various tasks ranging from operational planning, implementation, and documentation to assessment of performed field work. To improve functionality, various management systems, database network structures and software architecture have been proposed to serve the purpose (Beck 2001, Nikkilä 2010). In FMISs, different stakeholders such as farmers, governmental organizations and machinery manufacturers amongst others have an opportunity to collaborate. In practice, collaboration means more than one stakeholders working within the same business infrastructure synchronously or sequentially. The main benefits of IT systems such as FMIS for collaboration are to enhance resource pooling, share risks, and optimize resource usage.

Developing codes of good farming practice, diversifying markets and production systems as well as European standards of sustainable agricultural production systems require implementation of more elaborate management strategies. These have to respect specific ecological conditions, demands from the rural regions and those from the value-added chains. On top of that, these strategies have to be simple, but flexible enough to be adapted easily to changing economic or environmental conditions and they need proof of their compliance. Beyond that, the demand for information about the production processes is growing, both from the perspective of the value-added chains (traceability) as well as from regional stakeholders in order to fulfill multifunctional objectives by farming. An important prerequisite for farmers to comply with all these different demands is to easily have sufficient and timely information available for decision making or providing documentary evidence. The rapid development of technologies for information and communication, new sensors as well as the vast

potentials for providing georeferenced data (remote-sensing, on-line sensors, public databases etc.) also allows farmers to access new and high quality data and use them as specific information in decision making or process documentation. With automated data acquisition and handling in an on-farm management information system especially in fishery field the farmers can be seen to comply with a rapidly growing demand of standards in the management of the production processes. Fish products going into the food chain must show their certified provenance through a recognized management strategy and subsidy payments to farmers are now linked to respect of the environment through compliance to standards. To this end, an integration of information system is needed to advise managers of formal advice, recommended guidelines and implications resulting from different scenarios at the point of decision making during the crop cycle. This can be achieved by integrating real-time modeling (a crop growth and development model link to sensors within the growing canopy), with expert systems that have been configured with the guidelines from a recommended management strategy (e.g. organic, ICM, IPM, factored risk etc) as well as legal guidance (such as health and safety and environmental protection)

Many new ideas in information collection and management have been tried in recent years and valuable lessons can be learnt from reviewing the experience of others. Not surprisingly, there have been some notable successes and some disappointments. However, many valuable ideas and experiences have not been described in the scientific literature, in part because such systems are a means of achieving results and the findings, rather than the methods of obtaining them, have been reported. In addition, development at present is so rapid and diverse that many people working in the field tend to consider as premature reporting on techniques which they see as still under development. The objective of the study is to present Farm Management Information System and its application in Agribusiness, with Fish Farming as a case study.

Related Work

Although research regarding information systems and their probable impact on agricultural holdings is vital for sound policy recommendation, few studies have addressed the relationship between farms (especially dairy) and information sources. Some of the important research related to and providing support for the current study is summarized below:

One of the early studies conducted by Rolls *et al*. (1994) analyzed the information system for smallholder farmers in Malaysia. They put farmers central to the information system and found their roles as producer, inventor and communicator. There was a

considerable information exchange among the actors in the system and the farmers in particular were active in disseminating innovative information and technology. Similarly, Ramkumar (1995) analyzed the information systems of dairy farmers in two villages of India and found that each farmer's information system was unique. There was little linkage between farmers and non-farmers in and outside the villages. The printed media and the dairy extension workers were rarely used as information sources, but the private veterinarian and the secretary of the milk cooperative were widely used. The farmers functioned as both disseminators and users of information. Decision-making by the farmers was made more complex by inappropriate and inefficient information transfer from research and extension services. This compelled the farmers to capitalize on their working knowledge to find suitable solutions.

On the other hand, Garforth and Usher (1996) reviewed various models of information system processes such as development and transfer. They stressed that these processes showed that information does not simply flow, but is continually being transformed and adapted through communication. Systems models allowed the researchers to move away from unilinear conceptions of information and technology development and dealt more effectively with the diversity of information sources available to potential users. One of the major problems for animal status monitoring and farm-level information system users and developers is to determine farmers' critical success factors and information needs which are generally based on their goals and management strategies. Thus, Huirne *et al*. (1997) analyzed the critical success factors and information needs on dairy farms in the Netherlands and USA (Michigan) and found that they varied widely across regions, but were consistent over time if the farmers were analyzed as a group. However, significant differences were found when the farmers were analyzed individually, and this low level of consistency was mainly due to information supply from farm level. The most important critical factor was finance (i.e., net farm result, margin, costs and net profit) and followed by the production of milk and feed and marketing.

Ortiz (1997) analyzed an agricultural knowledge and information system and researched the dissemination of integrated pest management related information among research, extension and potato producers in Peru. It was found that potato-related pest management is a kind of technology which demanded from farmers the management of more complex types of information and knowledge. This created for farmers the need to understand the technological principles of integrated pest management. The researcher concluded that information dissemination required to be included within a learning system so that farmers could acquire appropriate knowledge

and used it to make decisions in a more flexible way. In addition, the system formation was facilitated by personal and organizational sources with internal and external pressures and between demand for, and supply of, integrated pest management information. Demiryurek (2000) also used agricultural information system theory to analyze the current information systems used by organic and non-organic hazelnut producers and found that the information systems for the two groups of farmers were largely separate. The conversion to organic production clearly demanded changes in the information system to allow producers to acquire the appropriate new knowledge and skills. The organic producers had used more information sources more frequently and more actively than non-organic producers.

Rolls *et al*. (1999) analyzed the information systems in Czech agriculture. The information systems appeared to be the construct of the personal characteristics of the farmers. The farmers appeared to regard information as a social good to be exchanged and discussed within social networks. Printed materials, agricultural shows, and demonstrations were strong sources of agricultural information, and consultants also gained recognition as valued components of the information system. Rolls and Slavik (2003) also investigated changes in information systems in Czech agriculture over time. The actual sources of information were changed although about half remained the same. Printed media remained most important, social sources decreased in importance, and professional sources, such as consultants, research and university sources, increased. The horizontal transfer of information between similar farms remained very important.

The researchers suggest that new information sources were needed relate to agricultural information and predicted that computerized databases will be increasingly used in the future. The farmers were major influences on their management of information. The practices were mainly learnt from family elders. Extension advice was only partly remembered, or rejected as the information from this source was sometimes not useful.

This literature review shows that there have been no or low farm-level studies on information systems, and especially communication networks, for fish production. Thus, this specific case can be considered as a contribution to understanding the management of information systems for farmers and their associations. The research methods and process employed is found to be useful in fishery and in other agricultural area with similar conditions. They can also be used to develop suggestions to solve common problems faced by developing countries, to improve policy programmes, extension and research activities, and to manage information on livestock productions.

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Methodology

The application was developed in the form of a database, using a Relational Database Management System (RDBMS). The decision to implement the application in the form of a database was informed by the consideration that various types of data would need to be held, and a database approach would be more appropriate due to the advantages that the database file system has over other forms of file systems. A database management system permits organizations to efficiently create databases for different applications by Database Administrators (DBAs) and any of other specialists. Database management system allows many users application programs to simultaneously access the same database that is called concurrency. MYSQL (My Structured Query Language), a Relational Database Management System (RDBMS), was used to create the database tables and C# as the programming Language. The Visual Studio was employed to design interface, an Integrated Development Environment, to create the Graphic User Interface and to write the codes, MYSQL to create the database tables (being an object-oriented and a cross platform language). By cross platform, it means that the programs can run across several platforms such as Microsoft Windows and so on.

1. *Method of Data Collection*

   Fish farming business activities were recorded manually. Direct observation thorough investigation of functional requirement of the present system and finding out whether the requirements and objective of the proposed system are being achieved by interviewing the Farm Manager was made in order to obtain detailed facts about and examination of documents were carried out. It was observed that not all management information (like feeding, mortality rate to mention few) on fish farming are documented and the management goal has not been achieved.

2. *Input, Processing and Output Analysis of the Existing System*

1. **Input Analysis**: The system designed has its major inputs as the varieties of fish, quantity, price and take away (Table 1).

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Table 1: Input Analysis

FISH VARIETY	QUANTITY	PRICE	TAKE AWAY
FRY	10	N10	✔
FINGERLINGS	5	N15	✔
CATFISH	5	N800	✔
JUVENILE	4	N25	✔

2. **Processing Analysis**: At the process point, it is the responsibility of the Farm Manager to collect, organize, and arrange the data. After this arrangement, manager can then calculate the subtotal and the total to produce an output.

3. **Output Analysis:** The output is produced inform of sales book/form which contain the processed data.

Table 2: Output Analysis

FISH VARIETIES	QTY	PRICE	TAKE AWAY	SUB-TOTAL	TAX	TOTAL DUE	GRAND TOTAL
FRY	10	N10	✔	100	10	110	110
FINGERLINGS	5	N15	✔	75	7.5	82.5	82.5
CATFISH	5	N800	✔	4000	400	4400	4400
JUVENILE	4	N25	✔	100	10	110	110

Discussion of Results

The computer software application is required to be independent of any platform. It is designed to have three four sections, namely: the login window, the Administrator menu, sales menu and payment menu. The login window requests a valid user name and password from the Administrator to be able to gain access into the software.

The Administrator is any staff that is authorize by the management of the farm to be in charge of fish stock updating, sales and payment records (e,g. the Farm Manager), hence he should have a valid user name and password created by him to be able to login to the software.

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1. The Login:

The login form/window enables the user to enter his\her password. If the password entered is valid, the software will then display the main menu. But if the password is not valid the user will be denied access to the program.

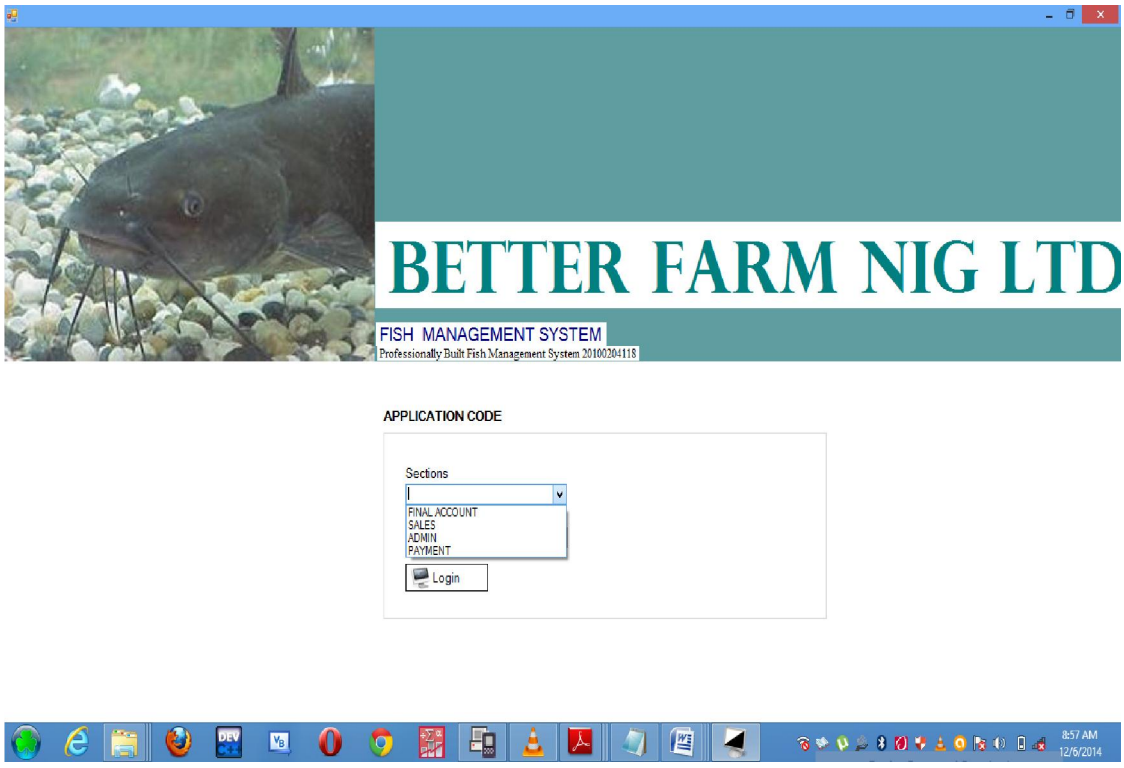

Figure 1: Login Menu

2. The Administrator menu:

The Administrator menu contains dashboard and panel, on the dashboard is the sub menu which serves as a link to all other modules in the program. The sub menu is stock selection, opening and closing stock, view stock, farm records, while the panel holds the forms for capturing data and display query result.

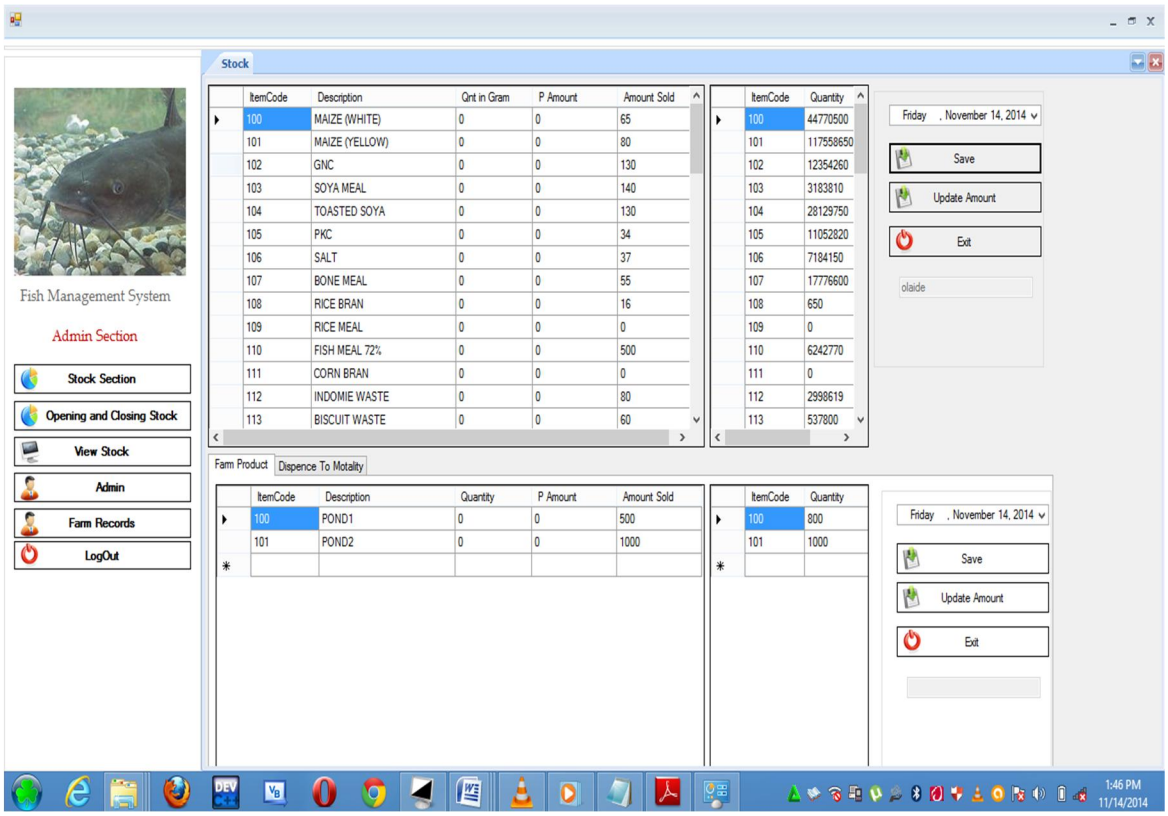

Figure 2: ADMIN MENU

3. Sales/Harvesting Menu:

This sales menu is used during the harvesting of fish. The data to be recorded into the data base are customer name, item description (i.e pond that fish was harvested from), quantity of fish to be sold. The fish sales information is all captured into this menu.

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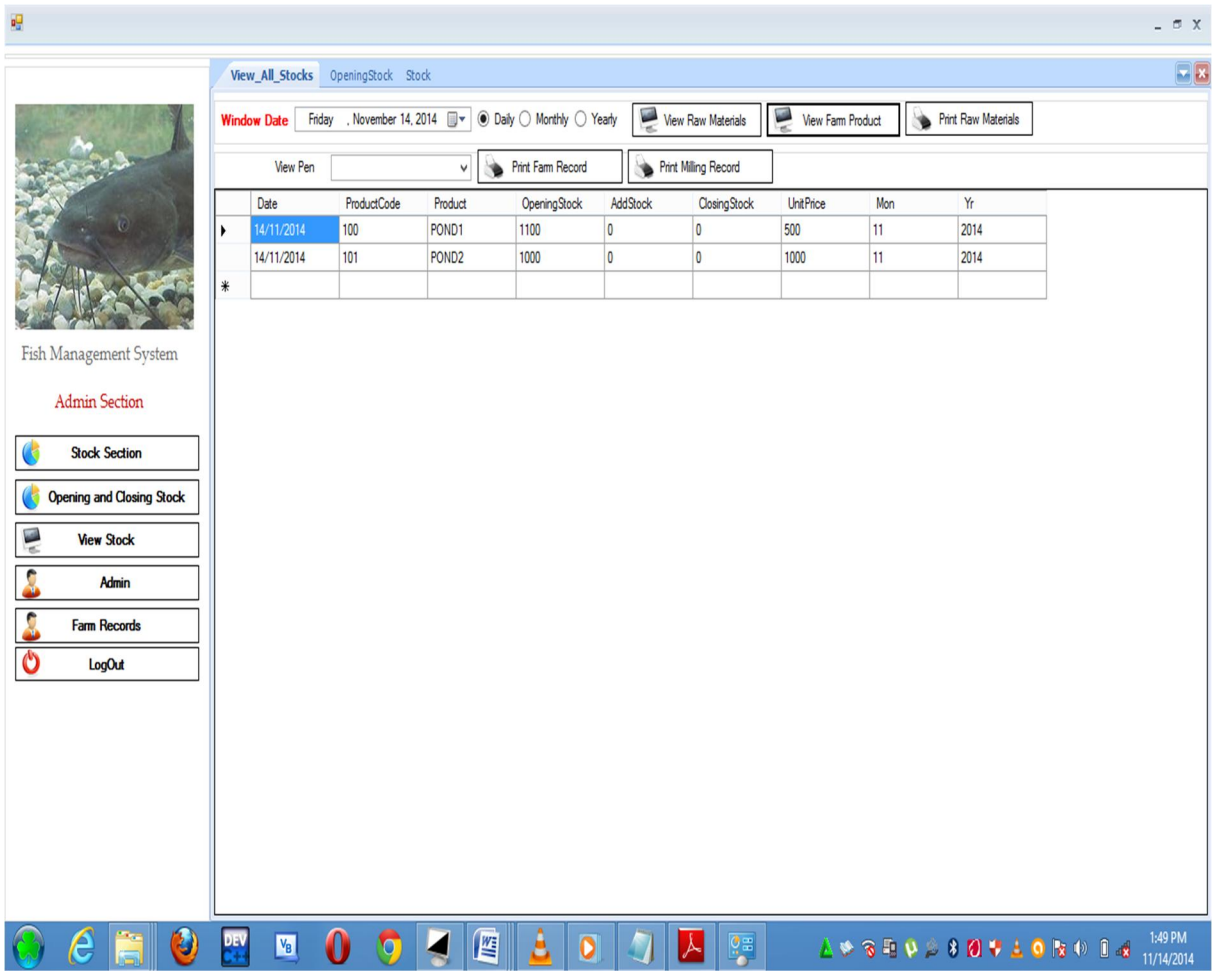

Figure 3: Harvesting Menu

4. The payment Menu:

This Payment menu contains customer names and amount to be paid. Clicking save will automatically store the data to the financial sector of the application

(e) User validation: To be able to use the software, staff are to be registered by the Administrator with a default username and password on the first login to the software.

Conclusion

The paper culminated in the design and implementation of a software application, meant to ease the processing of Farm information activities (Fish). The application was successfully developed, tested, and found to be working as expected. It is capable of

storing and processing Fish farm activities with high speed and accuracy, and presenting output in certain required forms. It has some qualities such as reduction in the cost of processing; reduction in time spent in computing harvesting/ sales record, generating and elimination of duplication of effort which makes it overshadow the manual system of Fish farming activities. The new system is flexible and can be modified to suite any kind of record keeping and data processing. It uses graphical user interface (GUI) rather than command-line approach, hence is easy to use, reasonably secure, and enforces data integrity resulting from the use of a relational database management system. With this application, the processing of Farm information activities can be automated to a large extent, thereby reducing processing time and increasing accuracy.

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