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Technological solution for the productive management of banana crops

Solución tecnológica para la gestión productiva del cultivo de banano

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Abstract

For the study of the technological solution for the productive management of the banana crop was based on the need of farmers seeking to improve the productive management of the banana crop post-harvest, since using a manual method to record the productive management of the crop are not of great help, due to ignorance of the evolution of technological solutions for the processes of the crop, posed as a general objective to develop a web system through the

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use of free software tools for monitoring the productive management of the banana crop, the methods used were: descriptive, non-experimental and applicative research, interview and surveys were also used, the same that helped the information gathering that allowed to obtain all the necessary information to establish the requirements in the development of the technological solution, also used the XP methodology the same that allowed to carry an orderly programming that avoided errors in the system, it resulted in a system that has modules such as: Security module, production control module, shipment control module, inventory module, farm control module, advertising and reports. As a conclusion and recommendation, it can be said that the implementation of the web system contributes to improve the management of resources in organizations and increase their productivity, in this case in the banana crop.

Keywords: Free software tools, implementation, XP methodology, web system.

Resumen

Para el estudio de la solución tecnológica para la gestión productiva del cultivo de banano se partió de la necesidad de los agricultores que buscan mejorar la gestión productiva de la postcosecha del cultivo de banano, ya que el usar un método manual para registrar las gestiones productivas del cultivo no son de gran ayuda, debido al desconocimiento de la evolución de las soluciones tecnológicas de los procesos del cultivo, planteándose como objetivo general desarrollar una sistema web mediante el uso de herramientas de software libre para el seguimiento de la gestión productiva del cultivo de banano, los métodos empleados fueron: descriptivo, no experimental e investigación aplicativa, también se utilizó entrevista y encuestas, las mismas que ayudaron al levantamiento de información que permitió obtener toda la información necesaria para establecer los requerimientos en la elaboración de la solución tecnológica, también se utilizó la metodología XP la misma que permitió llevar

una programación ordenada que evitó errores en el sistema, se tuvo como resultado un sistema que cuenta con módulos como: módulo de seguridad, módulo control de producción, módulo control de embarque, módulo de inventario, módulo de control de hacienda, publicidad y reportes, como conclusión y recomendación se puede decir que al implementar el sistema web aporta al mejoramiento del manejo de los recursos en las organizaciones y aumentar su productividad, en éste caso en el cultivo de banano.

Palabras clave: Herramientas de software libre, implementación, metodología XP, sistema web.

Introduction

The research is based on the need that in most of the farms the banana crop production management is carried out manually, carrying out an analysis that allows the determination of the technological needs focused on the productive management for the follow-up of the productive management.

Ecuador has a high demand for banana cultivation in international markets, because its production is of high quality, thanks to the climate and soil characteristics, which is why it is positioned among the world's leading banana exporters. This is where the importance of the implementation of a web system that follows up the management of banana crop production lies. The research seeks to develop a web system through the use of free software tools to monitor the production management of banana crops on farms.

The farms lack the use of technology to help monitor banana crop production, because they do not have accurate information for decision making. The monitoring of banana crop production activities are as follows: field work, phytosanitary work, fruit processing and finally fruit transportation, all of which are carried out by means of manual notes that are of no practical use.

The research aims to know the applications of Information and Communication Technologies (ICTs), because they offer multiple

benefits in the different daily tasks becoming less complex and faster for the management of owners, managers and workers.

Methodology

The type of research that was used was descriptive; through this type of research the technological needs of the farms were detailed, thanks to this it was possible to create the web system that solves the technological need.

The research design is non-experimental, because all the information on banana production management in the farms was used for the development of the web system, achieving the adjustment of needs and requirements and proceeding to establish which modules would be integrated for the development of the system.

Extreme programming is a new software development discipline that has been causing a great stir in the world of programmers, gaining the support of the software creation industry (Sepúlveda, 2020).

Extreme Programming or XP aims to produce higher quality software that provides better efficiency to the development team, whose objective is to promote the application of good engineering practices suitable for building software (Rosado, 2019).

In this research the use of XP programming was used, because it is adjusted to the correct creation of software with the least possible errors, in addition, it allows to know the needs of the banana crop production management for the correct phases of the development of the system.

The planning phase is a phase of utmost importance because it was possible to know what the technological needs were through an interview with a farm owner, using the Word tool in which questions were formulated to learn about the management of banana crop production. A customer-oriented survey was also carried out using Google Forms, which allowed us to observe different points of view for the development of the web system.

In this phase a user friendly system was designed, where all the interface and structure of the system was developed in UML diagrams,

also the design of the database and all the processes with which it has according to the tables that were made in the software, the XP methodology helped a lot in this phase provided simplicity, solutions and recodifications that had the web system.

In this phase the coding of the web system was carried out, through the programming of each of the modules that were integrated, in addition, free programming tools such as PHP were used. PHP is an object-oriented programming language and is easy to use, with respect to the data was used MySQL, where modules were obtained that allow interacting according to the function of each of them play.

In this phase several tests are carried out which allowed to know if the developed software has errors and can be corrected thus avoiding that they become unwanted defects, in addition, white box tests were performed since they allow to make unit tests avoiding errors in the execution of the system, whether these instructions, commands, routes that lead to each module, also proceed to perform the black box test this test helped to validate that each field contains the system starting from the beginning of section and the integration test that helped to know if the modules have been integrated or joined correctly. The implementation of the web system was done once with the system tests, then the configuration of the domain and hosting to upload the system to the web.

The data collection is fundamentally based on the systematic approach, that is to say, all the resources that were helpful for the development of the technological solution, thanks to which it was possible to correctly establish the conclusions and recommendations.

The Human Resources that participated in the research were three people in charge of the elaboration and development, bibliographic resources used as foundation and support, as well as the software and hardware resources that were indispensable for the development and finally the cost table was used to know the investment made.

The Hardware Resources were an LG desktop computer with Intel(R) Core (TM) i5-10400 CPU @ 2.90GHz 2.90 GHz; 8GB Ram memory, 913GB hard disk storage, EPSON ET-4550 printer and 8GB flash drive.

The software resources were Windows Operating System: Windows 10; office tools such as Microsoft Word, Power Point, Excel, Project; Hypertext Preprocessor (PHP) programming language and a database management system: MySQL.

The cost of the project for the development of the technological solution (web system) for the productive management of the banana crop was $ 570.00 (five hundred and seventy U.S. dollars).

The analytical method was used because it is applied in large investigations of different levels of complexity, in addition, it helps to break down the information in a thorough, detailed and understandable way, in this case this method was used directly because it allowed observing each and every one of the productive processes of the banana crop post-harvest.

Research techniques were also used, which were: observation sheet, survey and interview.

The observation sheet was elaborated with questions about the management of banana crop production, gathering information that allowed us to know the technological needs.

The interview was directed to a ranch owner, in this interview questions were established establishing the necessary requirements for the development of the web system, this interview format was developed in the Word tool because it is an easy and simple tool to use.

An interview was conducted with an agricultural technician. The interview format was prepared in Word and consisted of five questions that were posed to learn, explain and analyze in more detail the use and benefit of technology in the agricultural area.

The survey was conducted to the customers of the Hacienda "La Suerte" because they are the ones who buy the product, thanks to the application of this survey it was possible to know the requirements that were taken into account for the development of the web system.

The customer survey was conducted using the Google technology tool and the customer population was considered, according to

information provided by the owner of the farm, who indicates that she has 35 customers.

The basic information for the development of the technological solution was obtained from interviews and surveys. The owner of the farm was interviewed to outline the requirements of the web application. Likewise, the farm has a population of 35 clients and the finite statistical sample formula was not applied because the population is finite and the entire population was considered for this study, which is why it is not necessary to elaborate a sample. Descriptive statistics were used to interpret the results obtained in the survey through tables and graphs. The information was processed and displayed through pie charts and tables showing the percentages of responses obtained in the alternatives presented.

Results

The analysis of all the productive management of the banana crop as regards the post-harvest carried out on a farm was proposed. For the analysis of the current situation of the farm, research techniques were applied to determine the requirements for the development of the system, which are detailed below:

The observation technique made it possible to know the technological equipment existing in the farm, which were two desktop computers, office supplies such as notebooks, pens, among others, two printers, cameras for the security of the farm, all this is in the office of the farm, it was also possible to observe the technological need that the farm had because all their records for the management of banana cultivation are kept manually and therefore there is no proper control of the productive management of banana cultivation.

The interview with the owner of a farm was able to obtain the post-harvest processes of banana cultivation, from harvesting the fruit and caring for it for twelve weeks until it reaches its final process, banana cultivation is hard work every day, the fruit requires many nutrients for the plant, the necessary care of pests and others, all this very necessary for banana cultivation. The process of banana cultivation in the post-harvest is a very important process because thanks to this it is possible to grow quality bunches. The monitoring of the

management as products, materials and tools used on the farm is carried out by means of manual records. The visualization of the information records of the processes carried out on the farm is done by means of manual notes. With the implementation of the technological solution, reports such as inventory control or production control will be visualized in a timely manner and, in turn, will contribute to improve the monitoring of production management on the farms.

In the interview the agricultural technician was asked about the use of technology to manage the productive activities of the banana crop, he mentions that the use of technology is of great benefit, also that thanks to the implementation of the web system the records will no longer be made manually, in addition, the agricultural technician is willing to train and learn about technology for the benefit of their daily work on the farm, and helps to have a better management in the order of the processes in terms of the post-harvest of the banana crop.

The survey was directed to the farm's clients who purchase products such as banana boxes, banana trimmings and rachis. In addition, it was very important to know the days of production of the farm to make the purchase of the product. The farm's customers frequently use technology to find information about bananas, which is why it is very important for the farm to implement the use of technology to provide better service to its customers. The farm's customers agree that a web system should be used to offer the products. The web system should be manageable, simple and user-friendly. At the end of the survey, the clients were very satisfied to know that the farm will implement a web system; these results were tabulated and presented in pie charts for better understanding.

Requirements for the development of the web system.

The requirements provide a path between the customer and the developer to achieve a good system.

User requirements.

- Simple
- Friendly
- Insurance

- Reliable
- Manageable

Web system requirements: What the system must do to improve the productive management of the banana crop.

Detailed description of the services and what the web system should do:

Security: The web system has two functionalities as a principle, the internal user who enters with a password and user, external user will only be able to visualize the informative part of the web page.

Production control: This module will have the functionality to control production tasks, materials, bunches harvested, sleeved, rejected and among others.

Shipment control: This module will do the following will have guide registration, route control, export quota, transportation and drivers.

Inventory: This module will maintain the stock of inputs, input and output of inputs.

Farm control: This module will keep all the farm data and will also keep control of banana sales, shrinkage and rachis.

Advertising: The advertising page will allow the external user to know information about the farm, such as: about us, the care of the farm's bananas, the services it provides and the inputs it uses to provide healthy fruit.

Reports: This module will issue reports in PDF and by date.

We learned in detail about the technological needs of the farms, including inventory control management and the activities that are carried out for the management of banana crop post-harvest production. Thanks to the answers obtained, we were able to improve the farm's management by improving the organization and management of its post-harvest activities.

The elaboration of diagrams made it possible to see the functionality and design of each module that the web system would have, in this

way it was possible to appreciate the logical behavior that the system would have in the farms.

By means of the use case diagrams, the functions, the specification of the interaction and the respective procedures that the system has for the benefit of the user were made in detail so that he/she has knowledge of the operation of all the modules developed for the system.

The class diagrams helped to see all the relationships that the different entities have with the attributes and methods that are all those actions that the web system performs, the fields and keys are related to the tables and the database that will be used to feed all the modules that the hacienda's web system has.

The database diagram was developed in XAMPP designer option, it allowed to observe in a logical way the behavior that the web system was going to have, it also allowed to observe the respective structure with the tables, fields, keys and all the processes that the system has. Finally, the elaboration of the data dictionary was carried out, where the fields and the type of data that were used for the construction of the system are detailed and specified.

The web system was programmed in Open Source tools such as PHP, this helped the development of the lines of code, also facilitated the programming of text with the editor sublime, also for data storage was used MySQL and XAMPP server. The test cases were performed in order to avoid failures or errors that may occur in the web system, thus helping the easy implementation of the web system, 13 test cases were performed to the different modules that make up the system.

The web system was implemented at the farm, and the administrator was explained how to use the system and access it from any browser with internet access.

The technical manual was made with the purpose of providing the technical reader with each and every one of the guidelines of the configuration and logic with which the web system was developed, the technical manual is very important because the programming that was done is unique to the author, which is why it is important that it is

documented thus facilitating the understanding of other programmers and technicians.

The user's manual is the document of constant communication that exists between all the people that are going to make use of the web system, it is very important because it will show each one of the functionalities of the system, also thanks to the user's manual it will be possible to give solution on some common problem that is presented to the user.

To analyze the productive management of the banana crop, we proceeded to know the main problems existing in the production of the banana crop of the farm, for the development of the web system, the methods of descriptive research and applied research allowed to know in detail the existing technological need in the farm since they are key methods, elementary and of great benefit for the construction of the requirements (Serabia, 2020). Within the interview and survey this same can be directed and applied in many ways since it consists of the detailed description of the most relevant procedures of an organization, these same provide clear and coherent information and is easy to understand (Malhotra, 2019).

We proceeded to conduct surveys and interviews to learn in detail the post-harvest processes of the banana crop on the farm, thanks to which we were able to establish the requirements for the development of the web system.

Open Source tools such as MySQL, PHP, XAMPP were used to design the structure of the farm's web system. Loor (2019) indicates that through the use of free tools can be managed agile projects and solve those technological problems that arise, either through software in the cloud or from external media, free tools are based on the user can modify, create or delete the code at their convenience as for example the PHP language this allows the creation of web pages, the database allows the storage of large amounts of data avoiding redundancy which allows easy data management, by making use of the correct computer tools for the design of the web system helps to understand and understand in a simple way the work. Ruiz (2019) mentions that by means of the tools that the UML language has, it is possible to propose database diagrams and also the use cases that allow to know the logical behavior of the system. The PHP language was used for

the design and development of the web system, MySQL was also used as the database manager since it allows the storage of large amounts of data without any interference.

We proceeded to the development of the web system using all the free tools mentioned above, which allowed the satisfactory development of the system, once the system was completed we proceeded to perform the tests that allowed us to know if the system had any problems, followed by the implementation of the system on the web.

Conclusions

The use and implementation of information technology is very noticeable, because in the future it will be possible to observe the significant contribution to the Agroindustrial sector of the country for the benefit of small and large producers. Since through the implementation of web systems it will be possible to automate the different processes that are carried out in the different farms, which leads to have the productive management in a faster and more efficient way, avoiding manual notes, saving time and generating greater productivity.

An analysis of the productive management of the banana crop, through the multiple techniques and research methods, was of great help because thanks to this, the problem and the requirements for the development of the web system for the benefit of the farm were known.

The use of the structure design through Open Source tools and UML languages is very good because it helps to build the necessary modules to solve the problem, since they are the representation of the system detailed by one or more series of actions.

The development and implementation of the web system oriented to the follow-up of the banana crop production management is a great contribution to an orderly and safe management, with reliable and real time information on the farm.

Reference

Loor, R. A. (2019). Extreme XP methodology. Manta: Technological publications. Retrieved from SEDECI Repositorio institucional de la unlp.

Lopéz. (2021). Process automation for information management. Ambato, Sierra, Ecuador: .NET Web Applications - Vol.2: ASP. NET Core. MVC Model.

Malhotra, N. (2019). Marketing research an applied approach. Mexico: Marketing research, fourth edition.

Rosado, A. (2019). Summary of the internet of things and its application in agro-industrial production. Francisco de Paula de Santander University. Retrieved from Universidad Francisco de Paula de Santander.

Ruiz, M. (2019). Production technologies and agribusiness for development. Machala: Engineering applied to development cooperation, Volume 4.

Sepúlveda, J. C. (2020). Extreme Programming (XP): Application in a case study. Cuenca: Nordic Council of Ministers, 2011. Retrieved from suriweb.com.ar.

Serabia, J. (2020). Metodología para la investigación en marketing y dirección de empresas. Spain: Colección economía y empresa series.