Design of a Web System to Optimize the Logistics and Costing Processes of a Chocolate Manufacturing Company

Richard Arias-Marreros, Keyla Nalvarte-Dionisio, Laberiano Andrade-Arenas
Facultad de Ciencias e Ingeniería
Universidad de Ciencias y Humanidades

Abstract—The research work is focused on the solution to a problem that a company dedicated to the manufacture of chocolates has. This company does not have a computer system to help it improve its management. The information recorded from the logistics and cost processes is stored locally in Excel files, and the information from the operational processes is stored in bond sheets and then transferred to Excel files. Since information is very valuable for a company, it must be orderly, accessible, and secure. Therefore, the Scrum methodology was implemented for the development of a prototype web system for the company. The prototype of this web system was developed with Adobe XD software because it is easy to use and complete for the design of interfaces for web pages. As a result of the development of the prototype of the web system, there is a record of information in an orderly, interactive, easy, fast, and above all safe way. And it was concluded that the management of the logistics and cost area of the company was optimized and improved.

Keywords—*Adobe XD; costing; logistics; scrum methodology; web system*

I. Introduction

The main objective of any commercial enterprise is production, so the aim is to establish trade chains or relationships that will increase its profits [1].But currently, many companies perform their operational processes of production and storage of information traditionally, because they do not have modern machines or an effective computer system that minimizes time and improves the management of processes in most areas. Mainly in the area of logistics, which would help to reduce costs and increase competitiveness. Therefore, the logistics management of the company is important because it is the core of modern supply chain management, and serves as a platform that has in the origin and consumption [2].

As in any company, information is very important; therefore, it must be stored properly so that it does not run the risk of being lost. For example, in the event of a fire, if the information is stored on bond paper, it would be lost when it burns. Concerning saving information in Excel files locally on a computer, there is also a risk of being infected with a malicious virus, generating another loss of valuable information.

CATICAO, a chocolate manufacturing company, has not implemented a computer system that allows it to store the data of its processes (inventory, warehouse). Since it does not want to lose any important information, it saves them in Excel files, and the information of the operational processes is saved in bond sheets.

When you have to perform the process of making chocolate the first thing is to select the cocoa according to its weight, after that you will have to roast, control the time that is done, and so on all the processes. All this is done manually, so in this process it takes a lot of time to pass the information from the bond sheet to Excel, therefore, you are wasting time. In addition, they do not have an inventory and stock control software in the logistics area, therefore, it always takes more time to perform this process, which is very important to verify the availability of products, inputs, and supplies.

In business logistics, there are different activities and costs. The amount of these costs and the percentage of the total cost, where requires the magnitude of the company and the activity it performs [3]. In addition, different factors require companies to incur cost overruns, for example, storage, inventory, purchasing, distribution system, and transportation. As time goes by, these factors will represent a problem, especially when the company's management does not have planning, programming, and control of activities [4].

In the same way, the company has problems in cost management, it wants to know the direct and indirect costs in the production of the product to see how it could reduce them and adapt a competitive selling price of the product. But there are some differences in logistics costs across companies in multiple industries [5]. And some studies claim that the share of company sales revenue ranges from 6 to 25%

On the other hand, if the company does not have all the information ordered and available at all times of the logistics and cost processes, it will not be able to generate reports with which to make important decisions for self-improvement. Therefore, the importance of this web system is focused on the improvement of the company's management in the logistics area, to analyze the company's direct and indirect costs to reduce them, as well as better management of the company's stock.

The objective of this article is to design a web system to optimize the information management of the processes of the logistics area and reduce the costs of the company CATICAO.

The article is composed of sections. In Section II, the Scrum methodology will be developed, in Section III, the case study will be developed, in Section IV, the discussions will be developed, in Section V the results will be developed and finally, in Section VI, the conclusions will be developed.

II. Literature Review

The author [6], explains that currently, companies do not perceive the price increases of energy sources or fuels for heating, cooling, and air conditioning. Therefore, companies are concerned about energy issues and will have to analyze their logistics to reduce costs and increase their competitiveness. He also says that logistics is a process-oriented business and therefore proposes a measurement system that supports decisions for the evaluation of costs to each logistics process. The system allows the calculation of social, environmental, and economic costs to ensure sustainable logistics.

The environment is increasingly competitive and, that includes companies, and that better management of the logistics chain must be adopted, with the main objective of increasing profits, maximizing benefits, and minimizing costs, such as transportation and storage. In his work, he proposes a cloud platform for this supply chain process to support decision-making. Also, he describes the structure of the platform that has multiple layers and contains it in a set of web services that provides a link between the applications of the technologies, and with that manages to enable the transfer of data by protocols understandable to others [7]. As a scenario in this project, a delivery process problem was formulated, and a packaging algorithm was proposed to improve vehicle loading as explained by.

The author [8], explains about the administration of a farm that will be able to register all the costs that there is in the production, in a format manually that the company has, in addition, the versatility does not contribute too much in the management, for that reason, the execution of the web system that will allow improving the costs that this of chronological, organized and systematic form is going to be very necessary for the execution is being realized.Therefore, the research methodology is adequate, since the techniques that are in data collection, apart from the survey that has the customer requirements, based on which is developing the web system that can calculate the cost of production that has. ProCCSys, will suitably allow managing the process that is being productive, at the same time that it is facilitating in the registry, according to what is happening in the field, for the obtaining of the production cost that is formally and suitably.

The project consists of the creation of a cost system for the Industrial Accessories Company, which focuses on the production, marketing, and assembly of products [9]. The project analyzes and organizes the corresponding information that occurs in the production process, taking into account the considerations and aims to develop one of the tools that allow not only to focus on knowing the costs but also to monitor the areas where there is more cost invasion so that it can improve the strategies as explained by.

Finally, it was concluded that in order to optimize the information management of the logistics area processes and reduce costs, a web system has to be designed.

III. Methodology

This section will describe the methodology and tools that will be used to develop the design of the web system that will optimize the processes of the logistics and cost area of the company CATICAO.

A. Scrum Methodology

This methodology was selected because it brings together a cross-functional team, which means that members must have a minimum of experience that can perform different functions. They should also be responsible for self-management as a team [10].

One of the most important features of Scrum is that it initiates the collaboration you have with consumers in place is not very flexible for contract business. Therefore, it is essential to have enough capacity in one of the possible results for the alteration to follow strictly with what will be planned, starting at the beginning of the project since it is very changeable [11]. Keeping in mind as the objective that the customer will observe as a result that will be able to make decisions in the whole project.

1) Roles:

- Product Owner: This is the person who will be in charge of making decisions and will recognize the client's business and vision.

- Scrum Master: The person in charge of verifying that the Scrum models and methodology work.

- Development Team: They are grouped by 5 to 9 people who have the power to organize and take the proper objectives to achieve a common goal.

2) Meetings:

a) Backlog Planning: The system requirements will be defined and the sprint 0 will be planned, since the objectives will be defined.

b) Sprint Follow-up: In this phase, daily meetings will be held in which 3 questions must be answered.

c) Sprint Review: At the end of the sprint, it begins with the increase that was made and it will be generated, then the final result will be displayed [12].

3) Phases:

a) Sprint Planning: It will be allowed to establish objectives of the product backlog, that is, the list of tasks that will be developed in our project in a certain time [13]. In addition, the meeting will define what function the planned increase will have and how it will be executed in the increase and at the end it will be defining the objective that the Sprint will have.

b) Sprint development work: In the execution of the methodology, the Sprint Backlog tool will be used and each person part of the team will inspect the work that the rest will be developing [14] also, When our sprint work is being carried out we must observe that it has no changes last minute, because it could affect the objectives proposed in the project.

c) Sprint Review: It will be allowed to analyze and evaluate the results that were developed in the sprint, due to this, it will be determined if it has been done well or it will be necessary to return to the planning phase to improve the sprint [7]. In the execution, it will be carried out at the end of each Sprint that will be developed in 3 hours, to be able to supervise the increases in detail.

d) Sprint Retrospective: In the three-hour meeting of the Scrum team in which they will begin to analyze how the communication was between the system, the process, and the set of tools [15].

In Fig. 1, it will be represented in the orders that are in process, how it will be developed, and the use that the Scrum methodology tools will be having.
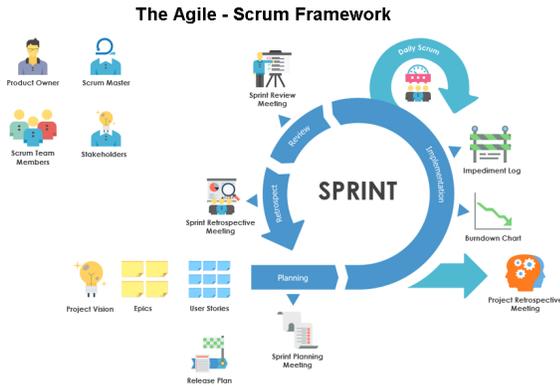
Fig. 1. Scrum Methodology Processes.

B. Prototype Tools

In the designs of web systems, Adobe XD will be used, it is a graphical editing tool that will serve as an aid for the development of design interfaces and prototypes of web applications. It allows designers to work much better so that they can navigate with a minimum error and in less time and one of the advantages is that it has pre-visualization tools that will allow you to look at the project when it is completed [16].

C. Technological Tools

1) PHP: The main reason for the famous PHP, which is a programming language that performs scripting for a web system [17], is its broad support for various databases, making it easy for developers to create database-driven web pages quickly and efficiently without much complexity.

2) MYSQL: It allows database developers or data architects to be able to visually design, generate, model, and modify databases [18], including those that have a data modeler required to create database models .

IV. CASE STUDY

In the research part, it will be explained in a way that it will be detailed as this carried out in the prototype for the web development of the company CATICAO, with the Scrum methodology, because, that all the execution will be carried out in a manner that is accepted in the requirements to have the new prototype. Since, then, the planning in the Sprint of each one that has the modules that is going to be exercised and the estimation of the times that is going to be used in each of the stages that it has will be finishing I develop them.

A. Sprint Planning

In the section, the User History that will be in the specification of the functions that the systems will have and will have the system that will have finalization of the contribution that the clients will have and will have The team that is going to increase the processes that the project has, consequently, they are in fast ways that will supervise the requirements that will be without executing the large documents that they have, then the following will be placed formats that will have the user's story As I want and for; that will be developed in the case study will be shown in Table I.

TABLE I. USER STORY

Description	N°	Priority	Story Points
As a User, I want to enter the web system through a login to access the software.	1	3	7
As a User, I want to register to log in to the system.	2	3	11
As a User, I want a stock sub-module to be able to register the quantity of the products.	3	2	10
As a User, I want an input stock sub-module to record the quantities and movements of production inputs.	4	2	8
As a User, I want a sub-module to calculate indirect costs such as indirect labor, materials, and elements to know the selling price of the product.	5	3	15
As a User, I want a sub-module to calculate direct costs such as raw materials, inputs, and direct labor to know the selling price of the product.	6	3	16
As a User, I want a sub-module to report stock and movements of inputs and finished products to control the warehouse.	7	5	18
As a User, I would like a reporting sub-module for direct and indirect cost queries of the company according to the period to have better control.	8	6	19

1) Time Estimates: In the section, the entire duration that will be approximated of each one that has the Sprint will be displayed [19], for them, the entire Table III will be indicated. The good methods that will be used in a way that will be better known than they are in the Scrum methodology are the Poker planning since it will be used as the arbitrary size dimension to be able to supervise and correct the difficulties that have in the amount of size of the story and that it has as that of a value that makes sense because they have the team of a good execution .

The estimate of the project had as a result of the 3 months since they have user stories since they were estimated between 1 and 2 weeks according to Table II.

TABLE II. PRODUCT BACKLOG

Interface	Duration
Mobile application for learning development	3 months and 2 weeks
Sprint 1: Login Interface	1 week
Sprint1: Registration Interface	1 week
Sprint 1: Home Interface	1 week
Sprint 2: Requisition Interface	2 weeks
Sprint 2: Stock interface	2 weeks
sprint 3: Direct Cost Interface	2 weeks
Sprint 3: Indirect Cost Interface	2 weeks
Sprint 3: Stock Reporting Interface	2 weeks
Sprint 4: Cost Query Report Interface	2 weeks

2) Product Scope: It is understood that the product is taken as the result of a project. Due to all functions since it is going to be having that originate from many requirements that the client or the company that is going to be executing have because they are indicating how what they are going to be wanting from the product [20]. Therefore, if you are going to be wanting, you must know that the scope must have the products that are going to be fulfilled, to be verifying and evaluating that all the requirement is planned so that they can be included within the product that will be the results, that is, it will be as it will be requested.

Fig. 2 will show the estimates of the time it will take for the team to have the user history points so that the scope estimates are noted down to the smallest detail.
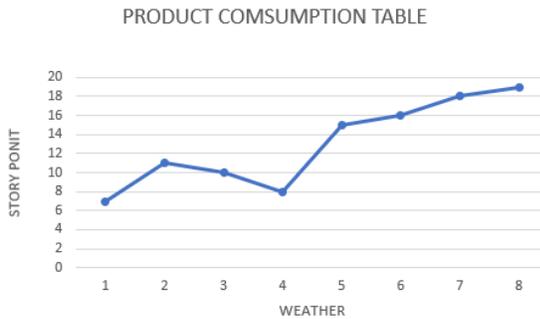
Fig. 2. Product Scope.

B. Sprint Development Work

In this phase of the methodology, 4 Sprints were developed and they are the following:

1) Sprint 1 (Login, Registration and Home): In this Sprint the prototypes of the login, registration, and user start interfaces were developed, the user will be able to enter his account with an email and a password as shown in the login interface in Fig. 3.

Fig. 3. Login.

If you do not have an account you can register, as shown in the registration interface in Fig.4, the user has to enter his data such as name, email, and password.

In the Home interface, the user can see the summary of some system processes such as the list of requisitions, costs, activities performed, and notifications as shown in Fig. 5.

Fig. 4. Registration.
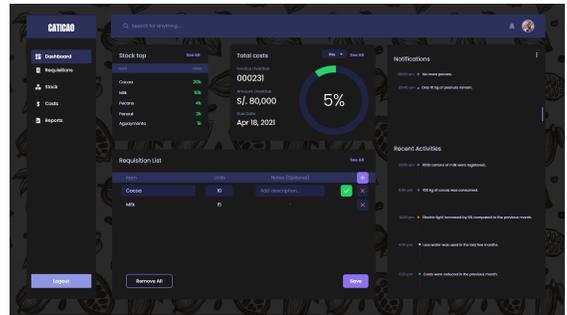
Fig. 5. Home.

2) Sprint 2 (Requisitions and Stock): The interface designs for the requisition and stock interfaces were developed. Fig. 6 shows the Requisitions interface where the raw materials and supplies needed for production are recorded.
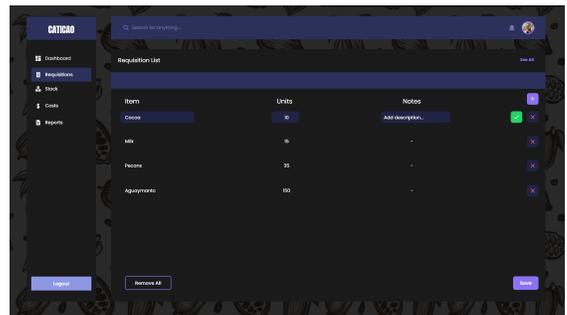
Fig. 6. Requisitions.

Fig. 7 shows the Stock interface where the user can see the raw materials and inputs that are available.

In the interface of adding a new item to the Stock, the name of the item and the quantity will be added as shown in Fig. 8.

3) Sprint 3 (Direct and Indirect Costs): The designs of the direct and indirect cost interfaces were developed, the user can visualize in the direct cost interface, the costs of the month of raw material, inputs, and workers as shown in Fig. 9.

Fig. 10 shows the indirect costs interface, the user can see the costs of water and electricity supplies, as well as other costs such as rent and transportation.

4) Sprint 4 (Reports): The report interface designs were developed, the user can see the stock report in a bar chart with a date filter as shown in Fig. 11. Fig. 12 shows the cost report interface where a dot chart of the total costs with a filter by year is shown.
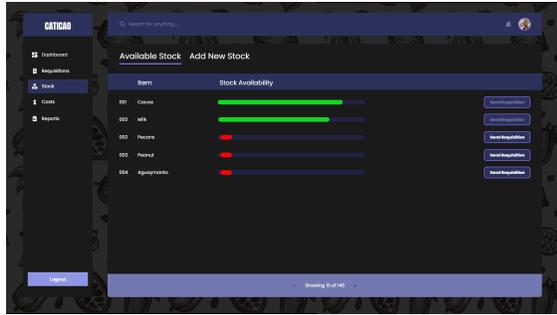
Fig. 7. Stock.
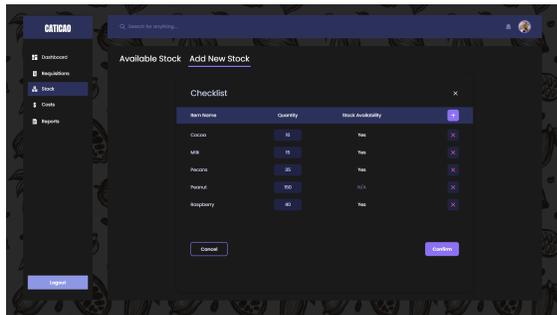
Fig. 8. Add Stock.
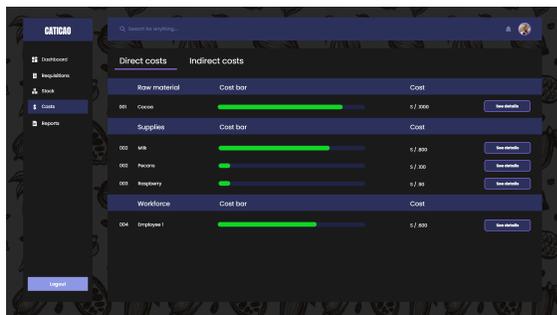
Fig. 9. Direct Costs.

Fig. 10. Indirect Costs.
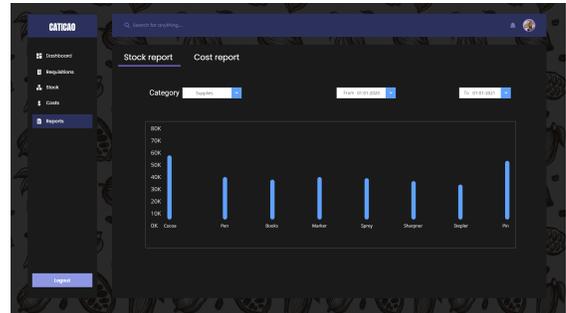
Fig. 11. Stock Report.

Fig. 12. Cost Report.

C. Sprint Review

At the end of the Sprint, it is reviewed by all team members, the inspection time is between 2 and 3 hours, also a member of the group will evaluate each task to be developed and decide the need for any change. Finally, the team members will explain each of the processes at a detailed level and the implemented solutions.

D. Sprint Retrospective

The team member will supervise each process and technique that will be implemented during the execution of each Sprint. For example, the use of PHP as a programming language, MYSQL as database manager, or the Adobe XD a tool that was used for the design of the web system interfaces. In addition, new methods are suggested to improve in each Sprint development of the project.

V. DISCUSSION

In this section, a comparative analysis will be made with other research works and other agile or traditional methodologies.

A. About Case Study

The prototype design was done with Adobe XD software, because it is a tool specialized in the development of web interface prototypes. There is other software for the design of the prototype such as Balsamiq which is easier to handle, but it is limited to a basic design. On the other hand, comparing the design of the modules of the [21] research work, their modules do not have a complete design compared to the elaborate design of the web system, which is well elaborated, and with its detailed modules. Although there were not many similar types of research on logistics and costs in a web system, the design was made by referring to several types of research with little similarity.

B. About the Methodology

The best-known methodology among the Agile family is Scrum. This methodology does not explicitly define development practices, so it offers researchers the opportunity to adopt and adapt practices from other models [22].In addition, Scrum is recognized for overcoming certain shortcomings of traditional software development methods [23].

Scrum, RUP, and XP methodologies are the most adapted for agile development [24]. When compared, each has many positive features as well as shortcomings. For example, Scrum has limitations in engineering practices, XP does not provide much in the way of management, and RUP has drawbacks for small projects, slow responses to changing requirements, and tends to spend more budget.

VI. RESULTS

Next, we will show the results that will be expected concerning what is being planned in the development of the research work within the case study and the Scrum methodology, taking into account the web system that is being developed and implemented.

A. About Case Study

The objective of the case study was to develop a web system to optimize the area of logistics and costs for the company CATICAO, improving the speed of the processes so that they can reduce the time spent on developing each employee.

According to the implementation of a web system in Chimbote that was applied to the workers, the following question was asked: Is it necessary to have a web system to manage the warehouse process both internally and externally? 90% of employees voted that it was necessary to have a web system to streamline the processes, and 10% voted no, according to Table III [25].

TABLE III. SURVEY GRAPH

Graphix No.		
yes	18	90%
not	2	10%
total	20	100%

In addition, it can be seen in Fig. 13. the need for improvement of the current processes that are in a web system for the company.

NEED FOR BETTER OF THE CURRENT WAREHOUSE PROCESS UNDER THE WEB ARCHITECTURE
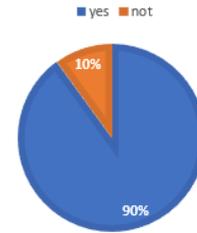
Fig. 13. Need for Improvement of the Current Warehouse Process.

B. About the Methodology

Implementing the Scrum methodology has generated better efficiency. In addition, the project will help to streamline the data processes in a warehouse system with technology at the end of the projects can be expected to have the modules of warehouse controls, where operators will be able to perform basic activities [9].

VII. CONCLUSION

In conclusion, the design of the web system interface was carried out to improve the processes of the logistics and cost area of a company that is dedicated to the production of chocolates, in order to solve the loss of time in each process they performed when they did it manually. It was developed with Adobe XD tool which is popular for interface design. In addition, the Scrum methodology was included, which allows for better teamwork, in an orderly manner and with anticipated results in the project.

VIII. FUTURE WORK

As future work is required to increase more modules to provide solutions for different areas, for example, the sales to make invoices and sales slip for better functioning of this area.

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