

WEB SYSTEM OF PRODUCTION COSTS CALCULUS AND ANALYSIS IN THE AGRICULTURAL MECHANIZATION SECTOR USING YII FRAMEWORK

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Abstract. *Researchers in the agricultural mechanization indicate that Ecuador has a deficiency in the use and maintenance of agricultural machinery, although MAGAP “Ministry of Agriculture, cattle raising, Aquaculture and Fishing” created the Directorate of Agricultural Mechanization on 2011.*

The objective of this project is develop a web system of production costs calculus and analysis in the agricultural mechanization sector using the Yii framework tool.

The actual project intervenes directly in the agricultural mechanization, and it means an urgent solution to problems that result from mismanagement of agricultural machinery, including the production costs analysis in their use.

Keywords

Agricultural mechanization, MAGAP, web system, production costs.

1. Introduction

Actually, some countries have trying to raise their agricultural mechanization level by buying and/or distributing harvesters and tractors. The FAO motivates their member countries to identify their situation and to analyze the farmers difficulties, also, to review their different agreements where these needs are involved. [1]

In Ecuador, the Ministry of Agriculture, cattle raising, Aquaculture and Fishing, with the objective of contribute to productivity, it runs several projects where agricultural supplies are given, like sowing, threshing and cheese making machinery, inter alia. Of these projects, there is one that

approaches the agricultural mechanization topic, it is an agreement between MAGAP and National Development Bank that it consisted to give 10 tractors and 10 power tillers to five agricultural associations in Imbabura province.

In this agreement, MAGAP subsidizes the machinery costs by 70% and the other 30% is assumed by beneficiary entities, also, MAGAP give technical assistance so that machinery stay un optimal use conditions. [2]

To ensure the land productivity, is necessary to apply technology and a sufficient level of knowledge and agricultural systems management, so, the computer system implementation that its realize necessary process by producers, is considered as a great agricultural mechanization advance.

1.1 General Objective

Develop a web system of production costs calculus and analysis in the agricultural mechanization sector using the Yii framework tool

1.2 Specific Objectives

Analyze and define the calculus process of agricultural machinery production costs.

Apply XP methodology with their all phases in the system develop.

Develop the computer system and a graphic reports model of obtained results in the costs analysis.

Validate the software use quality in use, applying ISO/IEC 25022 standard.

1.3 Scope

The Project is directly related with agricultural engineering and this will apply in companies in this area, specifically in entities where the study branch called agricultural mechanization is involved.

Also, it covers the economic part where total costs that implies the use of machinery in some agricultural production activity will be calculated and evaluated.

Areas that the system will be involucrate are:

Technology. The system will be implemented in web platform, so, it will require Internet for its use.

Economic. Show the tractors economic valuation as their price, fixed and variable costs.

Physics. Identify the power, strength, speed and tractor characteristics, as well as its volume and weight.

1.4 Functionality

The web system functionalities developed in benefit of agricultural activities are:

Machinery search: Before start a productive activity, the system will provide tractors information that farmer can use.

Machinery costs detail: System will calculate depreciations, fixed and variable costs of machinery used in some agricultural production activity and the user will can evaluate these.

Reports: It's possible to generate a current status report or one of history type of machinery used in an activity.

Costs analysis: System will generate the supplies costs, machinery and labor in accordance with parameters that user enter in an agricultural activity.

PROJECT MODULES

The system structure will contain the following register modules and processes:

Users Management: In this module, the system allows to manage roles creation and update and users assignment. Also, in this module it is possible Operations, tasks and roles management that system is registering as controllers and views are created. All these operations only can be realized by an Administrator user.

Catalogs: This module is for catalogs management stored in database, these are system constant data and only

in special cases these will be updated. Views are located in an administration menu and these are accessible by Clients and Administrators.

Catalogs are: Machinery types, brands, tractor pieces, agricultural activities and tractors.

Costs: In this module it's possible make and view all cost calculus that client needs to know in web system related to machinery, depending the permissions he has. Costs are organized in different views:

Depreciations. System shows to user an initial form after a tractor has been entered, this form has the respective fields to make calculus of 3 depreciations types: Linear depreciation, Depreciation per Balance and Depreciation by Digits Sum.

Once depreciations have been calculated, the user can view a detail of these in tabular form and lineal graphics (reports). Also, according permissions user has, he will can make an exportation in PDF format of this report.

Fixed costs: To get the tractor fixed costs according its characteristics, the system shows to user a form similar to the depreciations with necessary parameters to respective calculus.

Fixed costs are divided in 4 types: Insurance Costs, Capital Recovery Costs, Housing Costs and Interest Costs for balance on financed capital.

Similar to depreciations, once fixed costs have been calculated, user will can access to complete report, detailed in tabular and graphical form. The user will have the chance to export the report depending his permissions.

Variable Costs: To the variable costs calculus and report, it's required that depreciation and fixed costs are calculated. Also, it is required the labor hours of different agricultural activities, because these data are calculus parameters. If this first requirement is fulfilled, the system will show to user two forms where it's realized a calculus process of machinery variable costs that these are organized as follows: Theoretical costs, Costs per tracking, and costs per tracking by disc harrow.

The previous showed organization is applied to most tractors; in special cases the user will only consider costs per tracking for analysis. When calculus is ok, system shows to user the variable costs current status in tabular form and if user needs add more report data, it's depends of him.

Calculus: The current module registers all calculus with stored values in costs module. It provides the final costs analysis per tractor that it is shown in Reports module.

Also, this module has the functionality to realize the tractor tracking by labor hours, in order to keep the user with up-to-date information of tractor activities.

The current module is organized to store the following data: Labor hours parameter calculus by agricultural activity and tractor activity registered by labor hours.

Reports: It is considered as module because the reports amount is extensive and it has functionalities that need to be organized independently in the system. All reports provide the user the exporting possibility and using them as he considers appropriate.

The reports that system shows to user are: Depreciations, Fixed costs, Total fixed costs, machinery analysis, unit costs break-even point, total costs break-even point, analysis and costs variation.

1.5 Justification

The development of computer system that optimizes the costs calculus process in agricultural mechanization, resolve common problems that happen in this area, like human mistakes, reports delivery slow and information security.

The system implementation strategy in web is essential because currently, the Internet access include most people in the world, so, the system will be accessible to people who use it.

With this, it's concluded that the agricultural machinery efficient use, considering land characteristics and financial resources availability that integrate to other rational production technologies, it promotes the economic growth, avoiding a considerable climate impact. [3]

2. Methodology

The Web System is developed in PHP language, using Yii framework that includes Javascript and CSS libraries (jQuery and Bootstrap).

All languages and technologies are open source, so, these allow future improvements and a system constant maintenance without restrictions.

To Project development, XP Methodology was used.

The product is a web system, so, it requires resources to Internet access like hosting and availability (web server).

Regarding final user requirements, is not of greater importance, because is only necessary a web navigator with Internet access.

MODEL – VIEW – CONTROLLER ARCHITECTURE

It is a design pattern that is based in separate the programming code in three different layers (models, views and controllers) with the objective of create most robust software that allows code reuse and easy maintenance. [3]

Control flow:

1. User make a request in the view.
2. Controller get the request and try the entry event.
3. Controller request to model the user action and this response the required information.
4. Controller generate a new view that uses model data.
5. Finally, the view waits other user request to repeat the process.

Below is shown a MVC architecture flowchart:

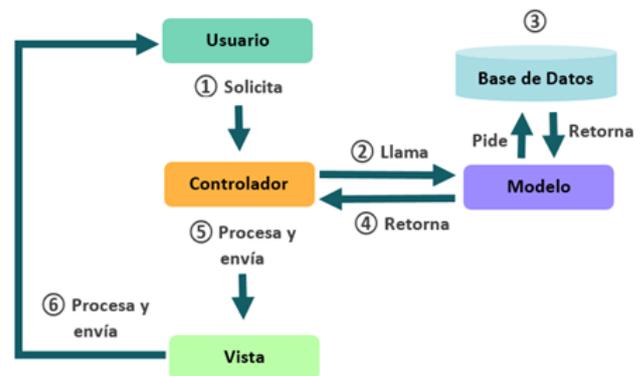


Figure 1: Architecture MVC

2.1 Planning Phase

The client requirements were grouped in iterations, which have their respective user stories.

ITERATION	DESCRIPTION
Iteration 1	Tractors information entry in the system, their characteristics and depreciations calculus.
Iteration 2	Fixed costs calculus and parameters to tractor analysis.

Iteration 3	Variable tractor costs calculus and results analysis.
Iteration 4	Reports generation and tracking register.

Table 1. Iteration planning.

2.2 Design Phase

In this phase, the system processes are detailed using diagrams and the general system architecture of agricultural mechanization.

Also, it's describe process actors next to possible activities of each one in system.

PROCESS ACTORS

Client: The client is defined as a user with possibility to administrates his agricultural machinery and then it's showed to people. He has knowledge about his machinery basic costs and entry it to system with the objective of recommend to farmers that will use the application to search machinery for their agricultural activities. He has access to principal forms for his machinery and has special permissions to update each machine.

Administrator: He has the maximum users level in web system, so, he will can realize all application processes. This person will be willing to provide support users with low roles in the system and provides necessary help for avoid data inconsistency. Also, he will perform system and database maintenance in periods of time determined by an estimate that the administrator considers.

Guest user: Is the lowest system role and will only have permissions to view calculated information and previously entered by a client. This user will have access to costs reports and details of one machine(tractor). This person will use the information as he deems necessary so that he can perform his agricultural activity without restrictions.

SYSTEM ARCHITECTURE

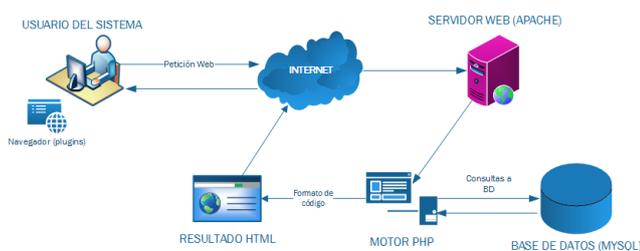


Figure 2: Web System Architecture

2.3 Coding and Implementation Phase

In this information coding phase, inside XP methodology, the database model that was used for web system of production costs calculus and analysis in the agricultural mechanization sector using Yii framework is presented.

This design is organized by tabular modules, separating what is operative from catalogs and security.

The database modules are:

Users (Crugs): This module is destined to users control and roles in Yii Framework and will allow to user makes: Roles, tasks and operations update, register, login, lost password, advanced users management, customizable profile fields online and advanced mail use based in views.

This module is part of a full API for used framework, so, makes possible to perform advanced Object-Oriented Programming controls to manage sessions, monitoring, control events and more.

Catalogs: In this module we have constant information provided by agricultural companies, which can be modified in only special cases.

Costs: In the present module, it's will handle all related with machinery costs (tractors), organizing tables as it was done in system modules description.

Calculus: This module presents calculus parameters that tractors require for its costs analysis, also, the final costs that resulted of previous modules are registered.

3. Results

Results are organized as a set of functional tests that are described as iterations.

TRACTOR INFORMATION ENTRY IN SYSTEM AND DEPRECIATIONS CALCULUS

Description: The user, once entered in system, he will access to "Tractors" menu item and he will create a new tractor with its technical specifications, then he will enter necessary parameters for 3 depreciations types calculus.

Execution conditions: User must have Internet Access in his computer or mobile and must have credentials (user & password) to enter System with a role that allow him to add tractors.

Entry: Credentials (user & password), Technical tractor specifications, Purchase and Insurance values.

Result: If user had create permissions, it's showed principal tractor form, which validated that required information be right, once he entered, other form appeared with necessary fields for depreciations calculus, when he accepted, it was shown a tractor information window.

FIXED COSTS CALCULUS AND PARAMETERS FOR TRACTOR ACTIVITIES.

Description: The user, once entered in the system and when he is in tractor information view, he will select "Generate Fixed Costs" option, which will redirect to a necessary parameters form to calculate fixed costs that tractor has. Also, in tractor information windows, user will select "Calculus Parameters by Activity", then he will add agricultural activities next to corresponding coefficients or he may import these parameters from other tractor previously entered. To add calculus parameters, the user must previously add agricultural activities as catalog, acceding to catalogs management, selecting user icon and then the administration menu.

Execution conditions: The user must have web system access, also he must have previously entered the tractor parameters for depreciation calculus, otherwise, he will not view the "Generate Fixed Costs" button. For "calculus parameters by activity", is necessary to have data in agricultural activities catalog.

Entry (generate fixed costs or calculus parameters): Credentials (username & password), click in "Tractors" menu, click in tractor "View info", click in "Generate Fixed Costs" or "Calculus Parameters by Activity" and required information.

Entry (agricultural activity): Click in User button, click in Administration menu, click in catalogs – agricultural activities.

Result (generate fixed costs or calculus parameters): It was checked that user has permissions of enter data for calculus fixed costs or calculus parameters. The system validated the data entered in forms are ok, if so, it was shown a confirm message and in main tractor screen, more options depending on entered information were activated.

Result (agricultural activity): It was checked that user has access permissions of catalog management. It was validated that required information is ok, then it was stored in database and user could view the register.

TRACTOR'S VARIABLE COSTS CALCULUS AND RESULT ANALYSIS

Description: The user will enter theoretical costs and tracking costs to get the total costs analysis.

Execution conditions: The user must have permission to enter theoretical and tracking costs, also, tractor must have calculated its fixed costs and calculus parameters by agricultural activity.

Entry: Market prices, calculus parameters for theoretical costs and tractor maintenance detail.

Result: Once theoretical and tracking costs are entered, the user could view in main tractor screen the break-even point reports.

REPORT GENERATION AND TRACKING REGISTER

Description: The user will can view two graphical reports: Break-even point by Unit Costs and Break-even point by Total Costs, also he will can register daily tractor activity and then see it.

Execution conditions: The user must have report visualization permissions and tractor must have registers of fixed and variable costs.

Entry: Tractor activity (in labor hours), dates filter for tracking report.

Result: In the main tractor screen, the user could see and export the break-even point graphics, when acceded to Register Activity and enter data, he could see an activity report in "Activity Tracking" section.

4. Conclusions

It was analyzed and applied the production costs calculus process of the agricultural machinery.

It was realized the depreciations calculus, fixed and variable costs of the agricultural machinery from machinery technical specifications and calculus external parameters.

It was applied successfully XP methodology and all of its phases in web system.

It was developed a web system of production costs calculus and analysis in the agricultural mechanization sector using Yii framework of PHP, also a statistical report model of results obtained in calculus.

After apply ISO/IEC 25022 SQuaRE standard to measure the software quality, it was determined that web system is acceptable with 88.43% because it fulfills the tasks which it was designed.

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About the Actor

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