Article **ECORFAN Journal**
December 2016 Vol.2 No.3 44-52

Systems Reengineering using the Cyclic model. Practical Case: The Financial University System (SUF) of the Universidad Autónoma del Carmen

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Received January 7, 2016; Accepted June 15, 2016

Abstract

The Universidad Autónoma del Carmen has an application called the Financial University System (SUF), which administers budgetary control in the institution, being a fundamental part of the daily activities. Due to the urgent needs to have this program, in its beginnings skipped several phases of development. This system was growing, so it was a priority to complete the parts of it. For this, an analysis was made of the main models of reengineering that exist, which identified the Cyclic Model as the one most suited to the SUF. In this way, the work of identifying, documenting and modeling the phases that marked this tool was carried out, which is presented in this article, resulting in the documentation of the analysis, the system model and the implementation of two new modules that are currently Functional, allowing an improvement in the administration of the current components and in the growth of the system without complex structural problems.

Cyclic model, Reengineering systems, analysis and design, Financial University Systems

Citation: PEREZ, José, REDING, José, TASS, Benjamin and AKE, Marisol. Systems Reengineering using the Cyclic model. Practical Case: The Financial University System (SUF) of the Universidad Autónoma del Carmen. ECORFAN Journal-Republic of Cameroon 2016, 2-3: 44-43

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Introduction

The Autonomous University of Carmen (UNACAR) has implemented a software called Financial University System (SUF), this program began in the Department of Computer Systems Development Administrative Coordination in the institution. It was designed to meet the administrative and financial needs of the different departments that make up these areas. This system allows the budgetary allocation of the University based on four catalogs that make the accounting by funds, these are the following:

1. Catalog of responsible units.

2. Catalog of programs.

3. Subfund catalog.

4. Account catalog.

These catalogs are the basis of the system, which allow to feed it from the different departments of the University as can be seen in figure 1.[Ake,2015]

Figure 1 Catalogs and activities of the Financial University System

Several factors have led to the lack of documentation of analysis and design, based on the need for a functional system, which has been supported by the experience of the initial programmers of the system to support the growth it has had in this years. Due to this, work began on the revision of the main models of Reengineering Systems that exist for which the following points were defined, which allowed to find the model of Reengineering that more adapted to the type of system that has:

1. Extraction of the requirements of the system based on the modules of the same.

2. Extraction of the requirements based on the interviews with the final user.

3. A stage of documentation or re-documentation of the legacy system, making a modeling of the requirements.

4. A stage for the migration and restructuring of system data.

5. Contemplate the redesign of the architecture on which the application will be developed.

6. Consider a testing stage.

Taking into account the above, Table 1 was elaborated, which allows identifying the Cyclical Model as the one that meets the needs to develop the analysis and design of the Financial University System [Pérez, 2015].

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Etapas que debe tener el modelo	OAR	Herradura	Cíclico	Sommerville
Extracción de los requerimientos del sistema con base a los módulos del mismo.			X	X
Extracción de los requerimientos con base a las entrevistas con el usuario.	X	X	X	
Una etapa de documentación o re documentación del sistema legado, realizando un modelado de los requerimientos.			X	X
Una etapa para la migración y reestructuración de los datos del sistema.		X	X	X
Contemplar el rediseño de la arquitectura sobre el cual se desarrollara la aplicación.		X	X	X
Considerar una etapa de pruebas.			X	
Porcentaje de Compatibilidad para el SUF.	16.66%	50.00%	100%	66.66%

Table 1 Evaluation of Systems Reengineering Models

In this way, once the Reengineering Model was identified, the development work was started, which allowed us to obtain the analysis and design of the SUF, as well as the implementation of two new modules in the system.

Problem Statement

UNACAR receives each year a significant amount of economic resources from both the State Government and the Federal Government, which is known as state subsidy and federal subsidy respectively. To these 2 amounts is added a third one that is obtained by the own UNACAR, known as Own Income which is obtained by collecting tuition to the students of the various levels to each educational programs, as well as audiovisual room rent, among other activities.

The sum of these three concepts integrates the University Budget. Within the Finance Department specifically the Budget Department, is in charge of carrying out the control between all the responsible units that make up the Universidad Autónoma del Carmen.

The distribution of this resource is done by capturing activities that are scheduled to be carried out next year. Each of them is allowed a certain amount of money. The authorization is made in consensus by the H. University Council, later approved and allocated the budget that each area or department will exercise next year. Thisisshown in Figure 2.

Figure 2 Creation, approval and allocation of the university budget

Currently this department is made up of two people: the person in charge of the department and an assistant. On the basis of the little staff that counts there are occasions that only have time to focus on the attention of assignment requests, advances and extensions of budget, as these arrive in large quantities daily.

To carry out these tasks mentioned above there is a program called Financial University System, known in UNACAR by its initials as SUF.

This system arose because of the need of UNACAR to meet the requirements requested by the National Association of Universities and Higher Education Institutions (ANUIES), which requested all universities to work with accounting by funds or matrix, as well as the unification of The three most important areas, the Institutions, based on:

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1. FinancialArea.

2. SchoolArea.

3. Area of Human Resource.

The University Financial System has its origins in the SAIES software that emerged in the 90's as a solution to the requirements of ANUIES. The Universidad Autónoma del Carmen acquired this software and tried to adapt it to its processes. Subsequently and due to the number of delays and problems to customize the system, the development of the Financial University System (SUF) was started and in this way, a system fully adapted to the needs of the Institution was created.

Due to the urgency of UNACAR to start the operations registry under the new requirements established and the limited staff of the Department of System Development, the SUF program, which allows controlling the purchasing operations of all the departments of The Autonomous University of Carmen began to develop without being able to carry out an analysis of the needs of the departments involved in this project. Nor was it possible to count on the necessary processes and the support of the people responsible for each one of the great processes that would be covered in this system, since they could not suspend the activities in order to be able to attend to the developers of the system.

Based on the above, the system does not have the necessary analysis and model that is indispensable in the development of any system. This causes the presence of the person in charge (programmer) of the system to be indispensable when any situation and / or doubt on the part of the users is presented since no one knows the background of the same.

This also causes delays in the development of the new implementations to the system since not having a model of the system at hand can not make decisions at the moment in which a user requests a new report or development since it has to be consulted first As the information stored in the database is stored in order to know if it is necessary to introduce new tables or if it is enough with those that are found.

With the new requirements that must be applied in the system due to the obligation to apply the criteria established in the General Law of Government Accounting (LGCG) is that the decision is made to carry out a reengineering with the purpose of complying quickly, Efficient and transparent changes that are requested.

Methodology. The Cyclic Model

The Ciclíco Model consists of 6 activities which are carried out in a sequential and linear manner, having the characteristic that in some occasions these can be modified, starting at any of its parts or repeating any of them as often as needed. In Figure 3 you can see the components of the model, having as a classic start the inventory analysis.

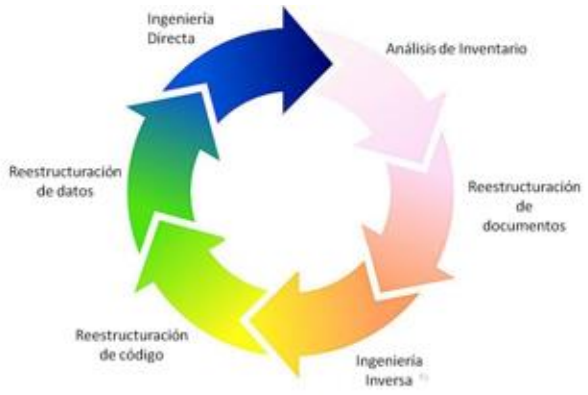

Figure 3 The Cyclic model and its main components

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Based on the parts indicated in the model, activities began to be developed taking into account the six components that were mentioned at the beginning and that complement the work of the cyclic Renigeneria.

In the inventory analysis two tasks of the six considered initially were carried out:

- Extraction of system requirements based on existing modules.
- Extraction of system requirements based on interviews with users.

A considerable advantage is that currently one of the developers of the start of the SUF is working, which is in charge of programming and adaptations.

In order to collect the information and obtain the current inventory that the Financial University System has, a file search was carried out.

This was done on the computer of the system developer, which provided us with a user manual, some minutes of agreements for changes and new implementations that have been made. It is worth mentioning that the provided user manual is obsolete and several adaptations have been made that are not embodied in it.

Interviews were also conducted with the developer through which the following information could be obtained.

The Financial University System meets the software development environment Delphi using as ORACLE database manager, which is used by most if not all departments that make up the Universidad Autónoma del Carmen.

- Process administrators.
- Departmental or final users.

These users are identifiable through the rights and / or actions they perform within the system. The system has 4 large modules, which have been identified according to the department that owns the processes. These are:

Figure 4 SUF modules

These modules are subdivided into submodules in the following way:

1. Budget
   - Budget Allocation
   - Budget Control
2. Material resources
   - SupplierCatalog
   - MaterialsCatalog
   - PurchaseQuoteRequest
   - Purchaserequisition
   - PurchaseOrders
   - Reception of Materials

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3. Expenses

- Per Diem
- Invoice
- Otherpayments
- Payments

4. Accounting

- Accountingpolicies
- Checking
- Financialstatements

With this information, the second phase of the Cyclical Model, Document Restructuring, was started: where the existing documentation described above was revised and based on the reengineering of systems, the information for the construction of the Technical Manual of the system is available, an important part that will allow The necessary components to be able to search for errors, make improvements or insert new modules, as well as update the user manual.

The Reverse Engineering stage allows us to work on an important part of what is needed. The documentation or re-documentation of the legacy system, making a modeling of the requirements.

This point consists in obtaining the greatest amount of information through a finalized system, in order to know its operation and how it was done.

So in this section will concentrate the documentation obtained from the Financial University System. Having as a resultthefollowingelements:

- SystemAnalysis
- Systemarchitecture
- User manual

Phase four Code Restructuring and five Data Restructuring of the Cyclic Model allowed to carry out the migration and restructuring of the data of the sistema.Ten as a result identify the modules that would be able to implement the requirements of new modules in order to have in The SUF government accounting. The following are the names of the components that already existed in the system and were used for this development:

The SUF had:

- Requestforquotation.
- Requisition of purchases.
- PurchaseOrders.
- Bills.
- Per Diem.
- Checking.
- Otherpayments.
- Pendingpayments.
- Payments.
- Accountingpolicies.
- Financialstatements.

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Taking as references this restructuring and having correctly identified the processes that are affected with the documentation that has of the system at that time two new components were developed:

- Budget policies
- Budget statements

Figure 5 shows the relationship diagram that was designed for the budget policy module. By having the programming of the components mentioned above, and the missing documentation of the SUF, a safe, simple and uncomplicated implementation was developed.

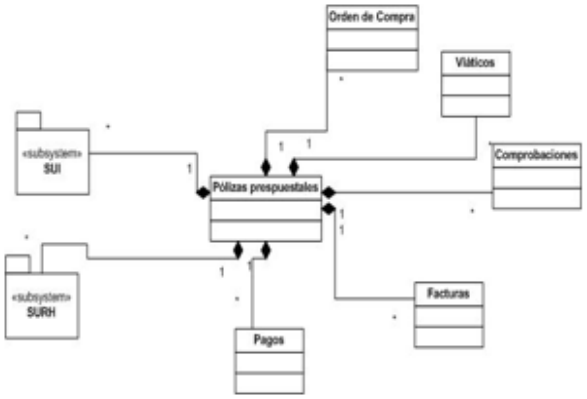

Figure 5 Relationship diagram of budget policies

Once you have the SUF model you can implement new functionalities in this way the task of Contemplating the redesign of the architecture on which the application will be developed is fulfilled. Based on the last component of the Cyclic Model. Direct Engineering.

At the moment the two new modules developed of the architecture have been implemented being of the following form:

Budget policies: this is one of the new modules, which will allow you to visualize each of the budget policies that are created according to the accounting moments that are generated in the transactions of the institution's daily activities (purchases, per diems, etc.).

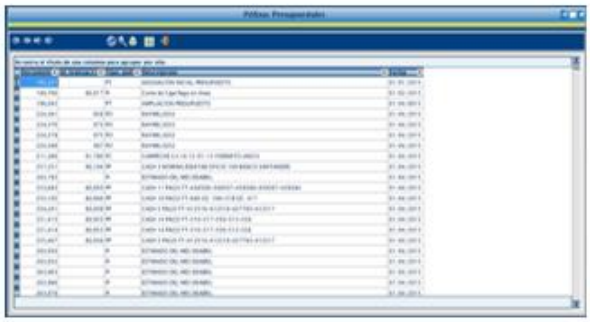

Figure 6 Budget Policies Module

Budget statements: new module in which the impressions and / or exports of the budget reports that are delivered to the public account will be made, as well as the reports that allow the supervision of the allocated, spent and available amounts of the responsible units.

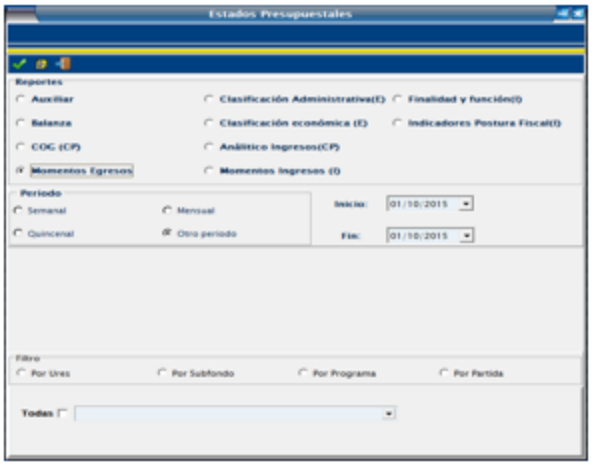

Figure 7 Budget Statements Module

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The generation of the reports for the public account that is obtained from the diagram in figure 5 and is implemented in the form of budget statements presented in figure 6 will generate as a complement the issuance of seven reports, which are:

- Budget assistant
- Balance
- Classification by Object of Expenditure (COG)
- Checkout
- AdministrativeClassification
- EconomicClassification
- AnalyticalIncome

To conclude this stage tests were generated for the new modules, in order to identify errors in some of the phases when implementing these new tasks of the SUF due to the importance of them.

For the budget policy module, direct tests were carried out called black box, which is based on the generation of a set of cases to verify if the result is the expected one.

- Capture of invalid transactions by the user to achieve the generation of a budget policy.
- Printing of the budgeted budget generated to verify if the correct movements were affected.

For the generation of the budget statements, direct tests were also carried out, as well as modular tests to corroborate the correct visualization of the formats and the information reflected in reports.

- Verification of the correct generation of budget policies, which is where the information will be obtained.
- Comparison of displayed formats with those provided by the process administrator.
- Comparison of total amounts between reports to corroborate that the information in them is correct.

Results

At the beginning of this work, we intend to develop the analysis and design of the Financial University System taking 6 components defined based on the needs of the current application. In order to do this, we had done the work of analyzing the most important models of Reengineering that exist having as a result the Ciclico system being the most compatible to achieve this task.

Once you understand the limitations of and the need to have documentation, the re-engineering of the SUF is started, based on gathering the necessary information, developing the analysis of the system, the architecture and the user manual with the updates that have been made Made to the application during these years. In order to develop these tasks the cyclic model is used, allowing to relate the 6 needs of the system with which they were identified with the phases of the reengineering model selected.
Given the need to implement the General Law on Government Accounting (LGCG) as a new functionality to the application, two new modules were developed:

- Budget Policies
- Budget Statements

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It generated 7 reports for the same that were measured as well as a battery of tests to complete this activity which allowed to solve this important need and to use for the first time the new model that was finished to design and document.

Conclusions

Having the experience of one of the initial programmers of the SUF is an important part of this implementation in the same way the ability of the system development team to understand the need to complete the documentation phases and the system model, Improving the SUF and allowing the basis for a migration to a new programming platform, having resolved with this activity to have the necessary documentation for it. Finally, mention the task of selecting the reengineering model, having in the Cyclic Model the tool to carry out the necessary activities to complete the Financial University System of the Universidad Autónoma del Carmen.

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ISSN-On line: 2414-4959