A hybrid methodology based on engineering tools for process standardization in accounting

Metodología híbrida basada en herramientas de ingeniería para la estandarización de procesos en áreas contables

Metodologia híbrida baseada em ferramentas de engenharia para a padronização de processos em áreas contábeis

Diana Carolina Benito Baene[1]
Juan Sebastián Samacá Zamora[2]
Ever Ángel Fuentes Rojas[3]

Received: December 10th, 2018
Accepted: March 20th, 2019
Available: May 21th, 2019

How to cite this article:
D. C. Benito-Baene, J. S. Samacá-Zamora, E. A. Fuentes-Rojas, "A hybrid methodology based on engineering tools for process standardization in accounting", *Revista Ingeniería Solidaria*, vol. 15, n.° 2, 2019.
DOI: https://doi.org/10.16925/2357-6014.2019.02.05

Research article. https://doi.org/10.16925/2357-6014.2019.02.05

[1] Faculty of Engineering, Universidad Libre, Bogotá, Colombia
ORCID: https://orcid.org/0000-0003-1004-8342

[2] Faculty of Engineering, Universidad Libre, Bogotá, Colombia
Email: juans.samacaz@unilibrebog.edu.co
ORCID: https://orcid.org/0000-0003-1302-4629

[3] Faculty of Engineering, Universidad Libre, Bogotá, Colombia
ORCID: https://orcid.org/0000-0001-9671-5884

Abstract

Introduction: This article is the final product for the investigation developed on the case study entitled "Standardization of the accounting process for the "Liga Colombiana Contra el Cáncer". This was performed between 2017 and 2018 at the faculty of Engineering of the "Universidad Libre", Bogotá, Colombia.

Problem: Lack of methodologies based on engineering tools for the standardization of accounting processes or similar fields.

Objective: Propose a methodology based on engineering tools for the standardization of accounting processes.

Methodology: This proposal is based on different engineering tools coupling that allowed to establish the following steps: Characterization, modeling, documentation, time study, indicators and impact evaluation.

Results: Hybrid methodology that allowed to standardize the Accounting process on "Liga Colombiana Contra el Cáncer".

Conclusion: Standardization and coupling of the accounting process to the "Liga Colombiana Contra el Cáncer" management system.

Originality: This methodology is applicable to processes with variable characteristics that are not couplers to traditional standardization tools.

Originality: This methodology is applicable to processes with variable characteristics that are not coupled to traditional standardization tools.

*Limitation*s: There currently exists very little literature and research related to standardization methodologies and engineering tools applied to accounting or similar processes.

Keywords: Standardization, Process restructuring, Accounting process, Methodology.

Resumen

Introducción: El presente artículo es producto de la investigación desarrollada en el estudio de caso Estandarización del proceso contable en la Liga Colombiana Contra el Cáncer en Bogotá, D.C., realizada entre los años 2017 y 2018 en la facultad de Ingeniería de la Universidad Libre, en la ciudad de Bogotá, Colombia.

Problema: Carencia de metodologías fundamentadas por herramientas ingenieriles para estandarizar áreas contables o a fines.

Objetivo: Proponer una metodología basada en herramientas de ingeniería para ejecutar la estandarización de procesos en áreas contables.

Metodología: Esta propuesta está basada en el acople de diferentes herramientas de ingeniería que permitieron establecer las siguientes etapas metodológicas: caracterización, modelamiento, documentación, estudio de tiempos, indicadores y evaluación del impacto.

Resultados: Metodología híbrida que permitió la estandarización del proceso contable de la Liga Colombiana Contra el Cáncer.

Conclusión: Estandarización y acople del proceso contable al sistema de gestión de la Liga Colombiana Contra el Cáncer.

Originalidad: La metodología presentada es aplicable a procesos con características variables que no se acoplen a herramientas tradicionales de estandarización.

Limitaciones: Poca literatura e investigación relacionada con metodologías de estandarización y herramientas ingenieriles aplicadas a procesos contables o de carácter similar.

Palabras claves: estandarización, restructuración de procesos, proceso contable, metodología.

Resumo

Introdução: este artigo é produto da pesquisa desenvolvida no estudo de caso "Padronização do processo contábil na Liga Colombiana contra o Câncer em Bogotá, DC", realizada entre 2017 e 2018, na faculdade de Engenharia da Universidad Libre, em Bogotá, Colômbia.

Problema: carência de metodologias fundamentadas por ferramentas de engenharia para padronizar áreas contábeis ou afins.

Objetivo: propor uma metodologia baseada em ferramentas de engenharia para executar a padronização de processos em áreas contábeis.

Metodologia: esta proposta está baseada no acoplamento de diferentes ferramentas de engenharia que permitiram estabelecer as seguintes etapas metodológicas: caracterização, modelamento, documentação, estudo de tempos, indicadores e avaliação do impacto.

Resultados: metodologia híbrida que permitiu a padronização do processo contábil da Liga Colombiana contra o Câncer.

Conclusão: padronização e acoplamento do processo contábil ao sistema de gestão da Liga Colombiana contra o Câncer.

Originalidade: a metodologia apresentada é aplicável a processos com características variáveis que não são acopladas a ferramentas tradicionais de padronização.

Limitações: pouca literatura e pesquisa relacionadas com metodologias de padronização e ferramentas de engenharia aplicadas a processos contábeis ou de caráter similar.

Palavras-chave: padronização, reestruturação de processos, processo contábil, metodologia.

1. Introduction

Change in terms of continuous improvement is an inevitable aspect for any organization, since the adoption of this culture allows companies to confront the competitiveness of the current market [1].

Topala and Postolache [2], propose that to reach continuous improvement in changing situations, process restructuring and modeling has a very important role. Doing this implies radical and revolutionary reforms in models that are rarely updated or obsolete, and this is one way to increase the institutions efficiency.

To acheive the restructuring of this process, it is important to carry out its standardization, establishing coherence, uniformity and flexibility in its operations, which will be made evident through cost reductions, a higher overall quality, greater competitiveness, and a better adaptablity. In summary, this tool enables organizations to considerably increase productivity and efficiency, reflected, not only internally, but also on the customer [3].

"Despite its great appeal in topics such as engineering and continuous improvement, academics and professionals that work in standardization are absent" [4]. Even though this is a relevant tool, investigation about it has been left aside, creating

significant gaps in information, however, new opportunities have also been opened to continue with this line of study, viewed now from different and novel perspectives.

Ungan [4], also says that most of the information based on standardization has a particularity; it tends to present traditional models that are generalized and adapted for any type of company, without taking account its own characteristics and needs, that may vary depending on their nature.

From that point of view, it can be said that those unique and individual factors are those that create added value to processes, and for that reason, a tool methodology standardization must be executed thinking about necessities and requirements that are generated, in order to obtain optimal final results.

Due to this, one of the objectives of this study is to start filling the information void that exists in the development and application of methodologies and engineering tools for standardized, non-traditional areas that cannot be coupled to classic methods. It is for this reason that the present article proposes a hybrid methodology for standardized accounting processes, implemented to the field of accounting of the "Liga Colombiana Contra el Cáncer". Here, three fundamental phases are proposed, a diagnosis, a documentary and finally a measurement, control and monitoring.

The "Liga Colombiana Contra el Cáncer", is a nonprofit, private law association, founded on October 23, 1960, that was created with the purpose of carrying out actions of education, prevention and early diagnosis of cancer with participation of volunteers.

Over the last 58 years, more than 30 chapters —autonomous in their own conformation—, support, and provision of services have been created, in order to contribute with the integral control of cancer, through educational programs that promote healthy lifestyles, improve patient life quality, and provide specialized services [5].

1.1. Background

Authors like Aburub [6], Serrano and Ortiz [7], Cronin, Ryan and Coughlan [8], among others, propose literature reviews as a fundamental step in establishing the necessary bases when justifying the importance and novelty of any study, and properly centralizing the work problem.

It is for that reason, so as to build well-structured bases, that the decision was made to analyze tools and methodologies used in different contexts of engineering, and couple them to this study.

To achieve this goal, a literature review protocol was done, focused on subjects like process restructuring, and the application of engineering tools like standardization, time study, characterization, management indicators, and impact evaluation, among others.

Phiphopsuthipaiboon and Boonsiri [9], use BPR (Business Process Reengineering) as a tool for operational improvement in computer services centers. In this methodology, a cycle composed for the identification and analysis of current processes is proposed, and the construction of a characterization framework that allows the approach of redesign and improvement strategies.

In the same way, Uysal, Halıcı and Mergen [10] in their investigation present the principle phases for the development of a reengineering model applied to EA (Enterprise Architectures). This one considers and attends to the necessities of interested parties, and it proposes, from a quality management approach, tools, techniques, and experiences that may belong to additional knowledge bases, for example, as design, development and process characterization.

On the other hand, Topala and Postolache [2] in their paper "Re-engineering of business processes as a bank efficiency method", propose a reengineering methodology for processes optimization in a bank. They base their study on integrated business models that allow for the analysis, synthesis, comparison and modeling of different process activities. This model is presented like an efficient tool for continuous improvement, which generates added value to customers, and supports the fulfillment of company strategic objectives.

The restructuring and redesign of processes within companies have been commonly used as effective tools when maintaining their up-to-date and competitive nature. These tools are usefully in identifying factors that are not generating value, and allows organizations to reorganize themselves to obtain an optimal development in their operations.

In view of the above, authors like Cahyono and Wessiani [11] present research whose main objective is to redefine the processes of the Department of Food Security and Agriculture of the Surabaya Government, Indonesia. For that purpose, they adapt the CIMOSA model, which is a computer support system that allows for working under a business modeling framework. Here, processes are divided into sub levels according to their complexity. As a result, a new business model is presented to the government, which will have the power and necessary bases to assign and manage the resources optimally.

At the same time, Tamošiūnas [12] states in his article that "The integrative management model for restructuring Small and Medium-sized Enterprises" is one integral model for management of SME (Small and Medium Enterprises) restructuring programs, in which a methodology is developed to implement strategies for a process redesign program.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

Adesola, Baines and Darlow [13] present a document where the methodological proposal "MIPIM" is developed. It integrates process improvement with modelling techniques. Thanks to this, organizations will be able to understand and implement actions to perfect their processes and successfully start a continuous improvement program.

Finally, Aburub [6] developed a new restructuring methodology that was validated at the cancer registry service in Jordan. This is based on processes modeling through Role and Activities Diagrams (RAD), which allows for the establishment of continuous improvement, through the analysis of both functional and not functional activities.

Within the restructuring and redesign of processes, one of the most commonly used techniques is standardization, as its implementation enables a permanent stability in processes and, at the same time, an increase in productivity and quality in the final product.

Authors like Ungan [4] and Teece [14] are specialized in standardization, and they highlight the importance of detailed documentation and effective process development, since they allow companies to better understand their inner workings and how they can be better managed; all this, in order to achieve reductions in variation of the results of activities that are carried out.

Likewise, Ek [15] in his study, proposes as its main objective, the standardization of the process for purchasing production equipment in a Swedish company, in order to achieve an improvement in its efficiency. Through the application of an engineering tool, he found the optimal point in the company's operations.

On the other side, Espinosa, Loera and Antonyan [16] develop in their research, one methodology to evaluate and improve productivity in two Mexican companies, dedicated to carrying out construction projects, with non-routine activities that cannot be analyzed with common techniques. Because of this, they propose a time study with random samples using the technique "Work sampling". Once the sample is made, results are standardized through control of standard deviations, decreasing variations in operations and increasing productivity.

Mota, Brito and Mourão [17] show the results obtained in the implementation of a methodology used for standardizing work in three construction projects of a company in Fortaleza, Brazil. Its main objective was to identify activities that added (or not) value to processes so as to increase company productivity, and standardize the work sequence to decrease project variations.

Also, Saliba [18] carried out a standardization project in a construction company in Sweden, whose main problem was the variation in processes, due to lack of

documentation and standardization. It is for this reason, that he decided to implement a methodology that would stabilize the process and avoid possible variations for continuous improvement.

The research done by Varasquin, Vaz and Balbinotti [19] showed some additional benefits of standardization in companies. They carried out a study on a car company in Brazil, whose objective was to evaluate the efficiency of a "Structured method" in documentation and standardization processes. After its development, the method proved to be an efficient tool in standardization. It increased company productivity, improved customer satisfaction, decreased in occupation accidents, and raised the quality life for workers, among others.

In the same way, in their investigation, Fuentes and Rojas [20] developed the standardization of the Post-sales service operations of a Colombian automotive brand. Within their methodology, they used engineering techniques for the diagnosis and evaluation of workshops, sampling and standardization times, and performed a competitive comparison study, which enabled the company to reduce time operations and generate improvement opportunities.

Finally, with the purpose of highlighting the importance of standardization, demonstrating its ability to guarantee continuous improvement and total quality in operations, Jagusiak [21] presents a study that was carried out in a model company. Through the application of a BOST questionnaire, keys factors coupled to the company environment were identified and evaluated. After analyzing the results, he affirms that employees consider that having clear and concise documents in each work stations, and having a detailed description of processes, are fundamental for the standardization, since these facilitate the execution of each item.

2. Methodological development

2.1. Characterization

2.1.1. Diagnosis

Not all processes can be standardized. They must have common characteristics focused on inputs, operations, and outputs [4], [22].

The diagnosis phase, based on the proposals presented by Ungan [4] y Mella [23], began with the implementation of a focus group, whose objective was to find a solution to the question "What is the structure of the accounting process?". It was

carried out with the purpose of collecting necessary information for the preparation of a question bank that was the requirement on the second diagnosis tool.

This focus group was done with 10 employees belonging to the fields of Accounting, Quality, Internal Control, and Administrative and Financial management, in the "Liga Colombiana Contra el Cáncer". The objective and question of this exercise was posed to this group, and a general questionnaire was carried out for its further discussion, until the group converged on a joint solution.

To do a more meticulous diagnosis, a second tool was adopted; the "semi-structured interview". This tool offers the necessary flexibility and precision required for the collection of information through questions that were adapted to the requirements of the project and the specific field of accounting [24]. For the execution of these interviews, a format with questions that were structured during the first diagnosis tool (focus group) was designed, and it was given to the same employees as in the initial phase.

Finally, "direct observation" was used to corroborate information previously obtained, and to fill possible gaps in the diagnosis phase in the accounting process of the "Liga Colombiana Contra el Cáncer".

2.1.2. Modeling

Based on methodologies [4], [6] and [13], the modeling phase was started. This phase consists in identifying and classifying the fundamental parts of the process using a characterization scheme that was designed by the research group. The key factors that were classified for the accounting process were: Objectives, responsibilities, scope, inputs, outputs, resources, actors (suppliers and customers), and activities classified according to the phases of PHVA cycle, stages and limits [25].

Once the process information has been collected, it is useful to represent it graphically, where activities, information flows, and essential characteristics are shown, thereby providing greater clarity during its analysis [13].

Phases, actors and activity processes were represented in a flow chart, as shown in Figure 1.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

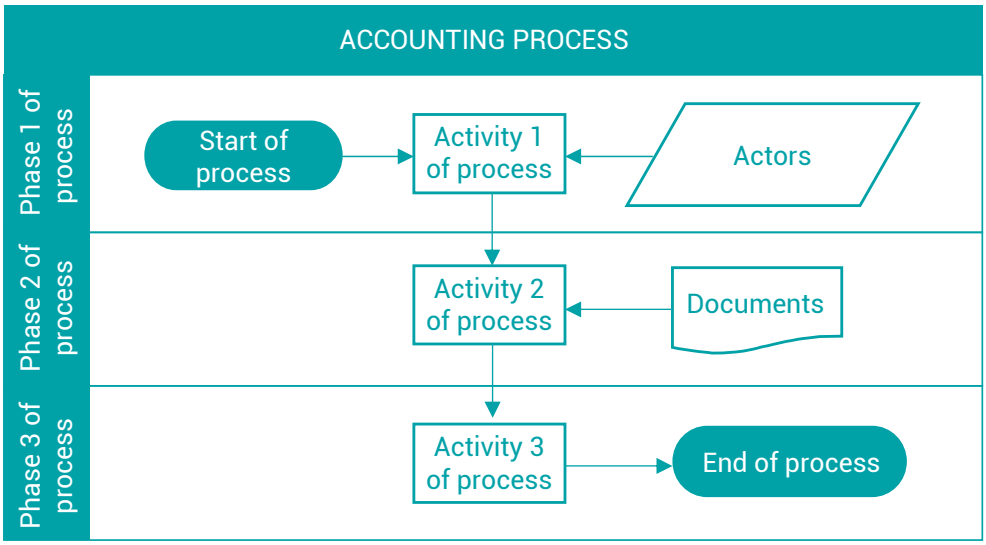

Figure 1. Model for process mapping
Source: own work

2.1.3. Process analysis

In this stage, the previous process was analyzed from an engineering point of view, using the standardization tool. As already mentioned, not all processes can be standardized, and it is necessary to evaluate which activities comply with characteristics required for standardization [4], [22].

For this purpose, the proposed method presented by Lillrank y Liukko [22] was adopted, who suggest analyzing the process via the metaphorically termed "Quality Broom". This technique consists in classifing the process activities into three categories that are represented on a broom, as shown in Figure 1. The left side consists of the standard activities, represented by the handle, in the center are the routine activities illustrated by the support, and finally, on right side are the non-routine activities, represented by the brush.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

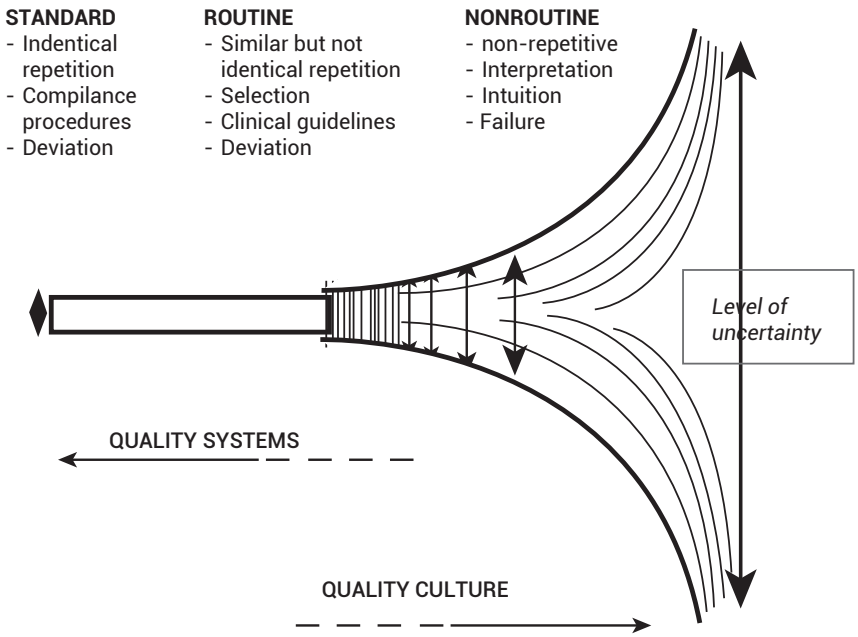

Figure 2. The Quality Broom
Source: Lillrank and Liukko [22]

The "standard activities" can be completely standardized, because they are repetitive and their uncertainty is low. "Routine activities" differ from the standard ones, since these are more variable in their development, and in general, they are not as operational. Finally, the "non-routine" activities are completely variable, and their certainty is very low [22].

Due to the nature of the accounting process, its activities were classified as mostly routine and non-routine, since, although these are made in the same way, its development can change depending on external factors, and the process may be performed only occasionally.

2.2. Documentation

Companies should document their activities in order to standardize, improve or redesign them. Performing these three activities through documentation can help to achieve consistency in operations, decreasing variations, and identifying those activities that do not generate value. It is for that reason, that documental standardization can be considered as a tool for the detection of problems and useful when searching for improvement alternatives [4], [26].

For this project, and based on ISO 9001 (which establishes that relevant information must be documented for the effectiveness of a management system) the accounting process documentation was made using templates that were designed by the research group, together with the institution [25]. Within this documental standardization were included: Procedures, instructive documents, formats, annexes, external documents, indicators and the characterization of the process.

2.3. Time study

According to methods proposed by Mejia [27] y Gómez [28], the one that best adapts to the accounting process of the "Liga Colombiana Contra el Cáncer" is "Subjective standards". This one can be useful for measuring administrative or intellectual jobs, in which it is not feasible to apply conventional techniques like measuring times by chronometer, system of predetermined times, or work sampling [29]–[31].

This method consists in determining a time-based procedure on estimates given by experts in that field. This person must give a minimum, an average, and a maximum time for the completion of each activity. This estimate must be given considering ideal conditions, where additional times are not taken into account.

Once information has been obtained, the formula (1) must be developed, whose variables comply with a Beta distribution [32]:

$$T = (Tm + 4Tp + TM)\ /6 \qquad (1)$$

T: Resulting time
Tm: Estimated minimum time
Tp: Estimated average time
TM: Estimated maximum time

For the development of this formula, the authors [27] y [28] give a weight four times higher for average time, in order that the resulting time tends to this one, and they divide the sum of all times by six, because they are trying to establish the average of these six times.

To adapt this model to the accounting process of the "Liga Colombiana Contra el Cáncer" some adjustments were made, accounting for factors like size, type of economic activity, volume of transactions, among others, since these can vary according to the conditions of each organization.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

This adaption begins by increasing the number of experts consulted, due to the fact that it was considered that only one estimate would be skewing the result of the study. In this way, three experts (referenced as "External experts" in this study), related to the accounting process of similar organizations to the institution, were consulted. A group of employees from the field of accounting of the "Liga Colombiana Contra el Cancer" was also consulted —referenced as "Internal experts" in this study—.

To facilitate the collecting of recorded times, a format was designed with the respective activities detailed for each procedure, and for each activity the five required times were distributed as follows: Minimum and maximum time, as established by the "Internal expert", and the average time, obtained by the estimates of each of three "External experts".

Finally, in the same format, calculations were made to establish the final times process. Once the results were obtained, they were recorded in operations diagrams for each procedure.

2.4. Indicators

Currently, one of the most important resources in organizations is information, and for that reason, in comparison with traditional systems where only financial and accounting indicators have been measured, it has been necessary to consider new approaches like "KPI" to evaluate not only financial criteria, but also non-financial, that are aspects that reflect how effect a company is. Lastly, it is important to highlight that it is completely necessary to standardize all processes to be able to adapt to these new approaches [33]–[36].

Adesola, Baines and Darlow [13] propose, as an important phase within standardization, the measuring of key procedures that are relevant to achieve a company's strategic objectives. This analysis will indicate where the institution should focus its efforts in order to obtain significant improvements.

For this reason, some complementary indicators were established, apart from those that the department had already been working on. These will allow for the evaluation of , not only the financial performance of the "Liga Colombiana Contra el Cáncer", but also the performance of the current accounting process.

To begin with the structuring of these indicators, the objectives were first set up through a focal group [23] with members of the field. Two approaches were established, one, performance management, and the other one, related to financial aspects. Based on these objectives, the following joint bases were established for the development of indicators: name, objective, variables, formula and sources.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

Finally, an indicator summary was designed between the research group and the "Liga Colombiana Contra el Cáncer", which was completed for each one of them.

2.5. Impact evaluation

Some needs or factors cannot be assessed with cost analysis because some variables need to be evaluated from different perspectives. The "Multicriteria Matrix" is a technique that allows for working with different criteria at same time, regardless of their nature [37].

To evaluate the project impact, a "Multicriteria Matrix" was applied, due to the fact, that it was considered that this one should be assessed with different factors of a qualitative nature. First, a common objective was established [38] focusing on the standardization of the accounting process. Then, the necessary criteria and their weighting were set up, and finally, variables or alternatives to evaluate it were defined. This is shown graphically in Figure 3.

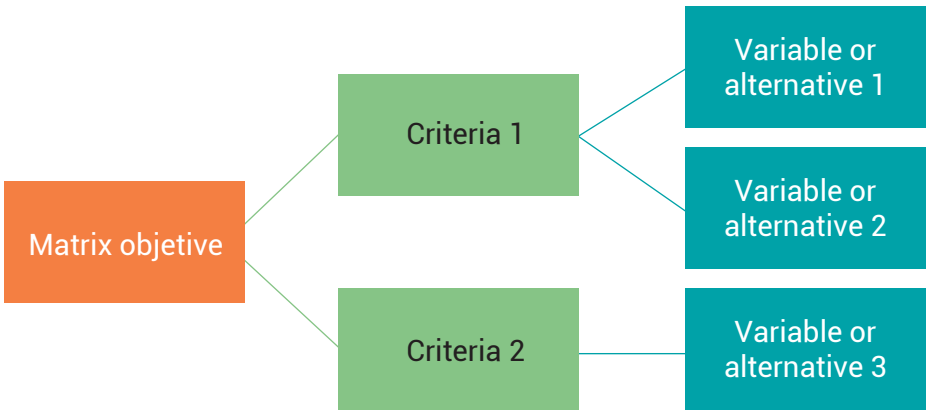

Figure 3. Structure for multicriteria evaluation
Source: own work, based on Cohen and Martínez [29]

This matrix were designed and executed in a focal group composed of experts from the field of accounting and some External experts, as proposed by Stirling [39]. He says that its construction is more complete when different experts are linked to the evaluation, and not when it is done only by researchers, since, thanks to this, more aspects can be covered, and its comprehension can be more accurate.

3. Results

The results obtained are presented below for each developed stage of the methodology proposed for the accounting process standardization in the "Liga Colombiana Contra el Cáncer".

3.1. Characterization

After the diagnosis made by a focal group, composed of members of the field of accounting, and interested parties from the institution "Liga Colombiana Contra el Cáncer", and after having applied the interviews and direct observations to the department, a general diagram of the accounting process was obtained. In this, the information flow, resources flow, objectives, inputs, suppliers, outputs, customers, activities, responsibilities, and possible risks for each procedure where identified.

From this information, a modelling of the accounting department was carried out, in which four accounting stages where established to ensure compliance with the requirements defined by ISO 9001, in terms of the process approach based on the continuous improvement cycle PHVA [25]. Also, 10 procedures were identified along with the 44 activities which belong to each one of them. In Figure 4, a sketch of the characterization can be observed.

PROCESS	Accounting									
STAGE	Planning		Recognition of economic fact			Elaboration and analysis			Report and management	
PROCEDURE	1	2	3	4	5	6	7	8	9	10
ACTIVITY	44									

Figure 4. Accounting process characterization
Source: own work

Next to this, and in accordance with what was proposed by [14], who says that it is very useful for companies and process analysts to translate it in a graphic way so as to have greater clarity about it, a flow chart of the previous characterization was done. In Figure 5, a fragment of this mapping process is shown.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

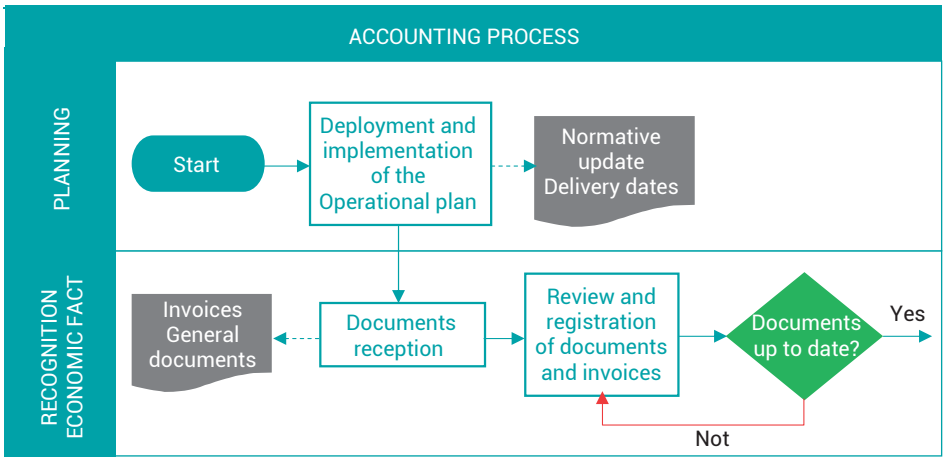

Figure 5. Fragment: Flow chart of the accounting process
Source: own work

Finally, according with the method proposed by [22], the analysis and evaluation of process activities was carried out in order to establish, which of these comply with the necessary features to be including into the standardization process, which of these should be left to the discretion of experts from the field of accounting and who will be the ones who establish the criteria necessary to develop it in the best way.

As a result of this classification, it was identified that only 3 of the 44 activities developed by the department can be considered as standard. On the other hand, 15 of this activities —corresponding to 34 % of the total activities—, were considered as routine, since, although these are made constantly within the institution, there is some variability during their development due to factors such as: the type of transaction performed, their volume, and external factors that can influence them. Lastly, 26 activities —representing 59 % of all the activities— were considered as non-routine because these are done occasionally, and their measuring and standardization cannot be done through standards methods. In Figure 6, the percentage ratio between these types of activities is shown.

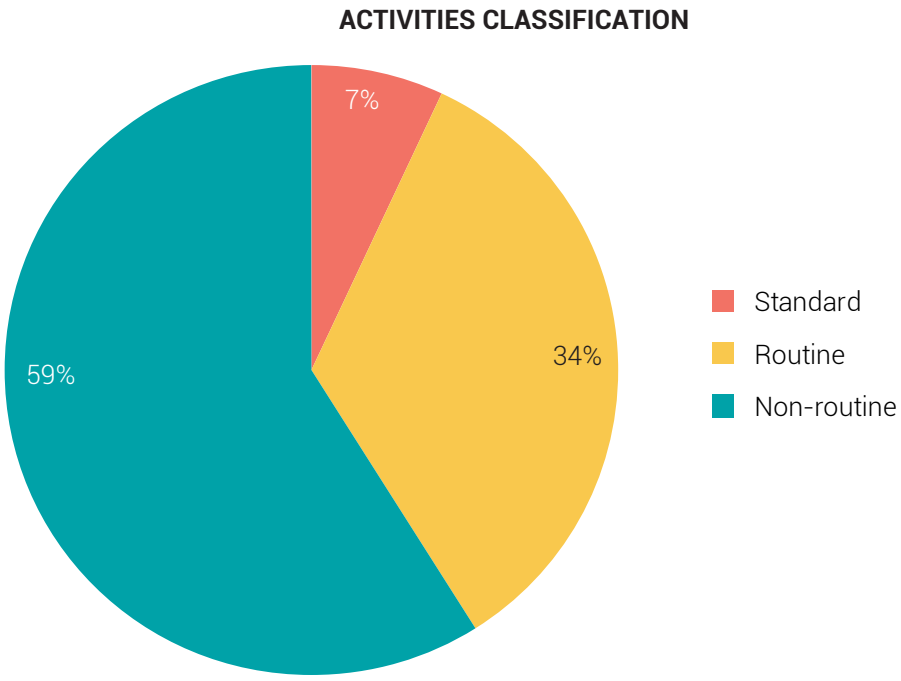

Figure 6. Classification of standard, routine, and non-routine activities
Source: own work

3.2. Documentation

Once the standard, routine, and non-routine activities were classified, their documentation and codification were done. In this process, the necessary formats to carry out the documentary phase were designed between the research group and members of the "Liga Colombiana Contra el Cáncer".

Within this stage, the following three categories were established: "New" for those documents that should be created, since these did not have any kind of background; "Updated" for documents that were already created and active, but required modification, and finally, "Removed", for documents that should be eliminated, since these were not part of the current process. Below is Table 2, where the relationship between the number of documents and their corresponding classification is established.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

Table 2. List of Accounting department documents

Document type	Category	Number of documents
Procedures	New	3
	Updated	6
	Removed	18
Total documents		**27**
Instructive documents	New	44
	Updated	0
	Removed	0
Total documents		**44**
Formats	New	36
	Updated	4
	Removed	3
Total documents		**39**
Annexes	New	16
	Updated	0
	Removed	1
Total documents		**17**
External documents	New	9
	Updated	0
	Removed	0
Total documents		**9**
Total processed documents		**140**

Source: own work

Taking into account the importance of the information within the last table, the articulation that was carried out on the documentary phase represents a great impact on the institution. It was possible to couple the accounting process to the management system of the "Liga Colombiana Contra el Cáncer", since, due to changes that have emerged in recent years, and due to the constant increase of the volume of activities, it had not been possible to execute a program focused specifically on that purpose.

3.3. Time study

To perform the time study within the department, a format was designed for data collection. Table 3 details, by way of example, the times recollected for some activities of the accounting process. The following are specified: The Resulting time (T), Minimum time (Tm), and Maximum time (TM), as established by the "Internal expert"; the Average internal and external time given both, by the internal expert, and by the

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

three external experts, respectively; and the Average total time (Tp), for each one of activities done.

Table 3. Timekeeping format applied to procedure "Accounting parameterization"

*Times are presented in minutes									
Activity	T	Internal Expert			External Expert				Tp
		Tm	TM	Average internal time	Company 1	Company 2	Company 3	Average external time	
Accounting parameterization									
Identify news	1409	480	2400	1400	1920	960	1280	1387	1393
Activity 2									
Activity 3									
Procedure Total time	**xxx**	**xxx**	**xxxx**	**xxxx**	**xxxx**	**xxx**	**xxxx**	**xxxx**	**xxxx**

Source: own work

As a result of the previous analysis, the final time for each of the procedures done in the accounting process was obtained. In Figure 7, the time procedures distribution of the current process, in contrast with the time standard that was calculated after the study, is shown.

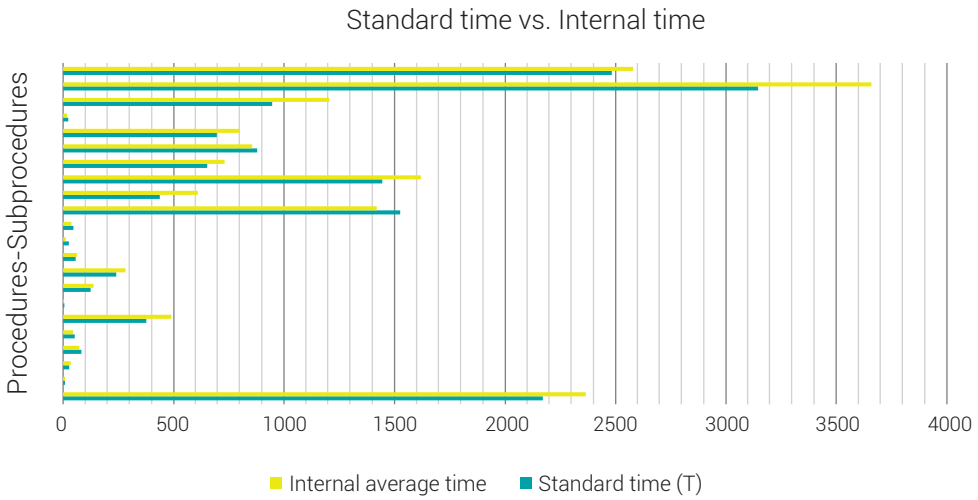

Figure 7. Standard time vs. Internal time
Source: own work

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

It is important to clarify that some procedures involve sub-procedures, which were also taken into account for this study time.

Of the 22 procedures and sub-procedures done by the "Accounting department", 60 % of them, that is to say, 13 procedures, are performed faster than the defined standard time, which means that more than half of activities done by the department are being carried out effectively. The remaining 40 % are above the established parameters. This suggests that the institution must propose strategies to manage critical activities, to couple them to the final times of this study.

Lastly, and using the concept proposed by [14] —who insists on presenting the results in a graphic way, in order to have a wider and clearer vision of the performed analysis—, it was decided to show the resulting times in operations diagrams. These schemes were designed for each procedure, whose purpose is to show how much time it takes the department to carry out each task for the optimal development of the accounting activity. In Figure 8, by way of example, the operations flow posed for the "Bank reconciliation" procedures can be observed.

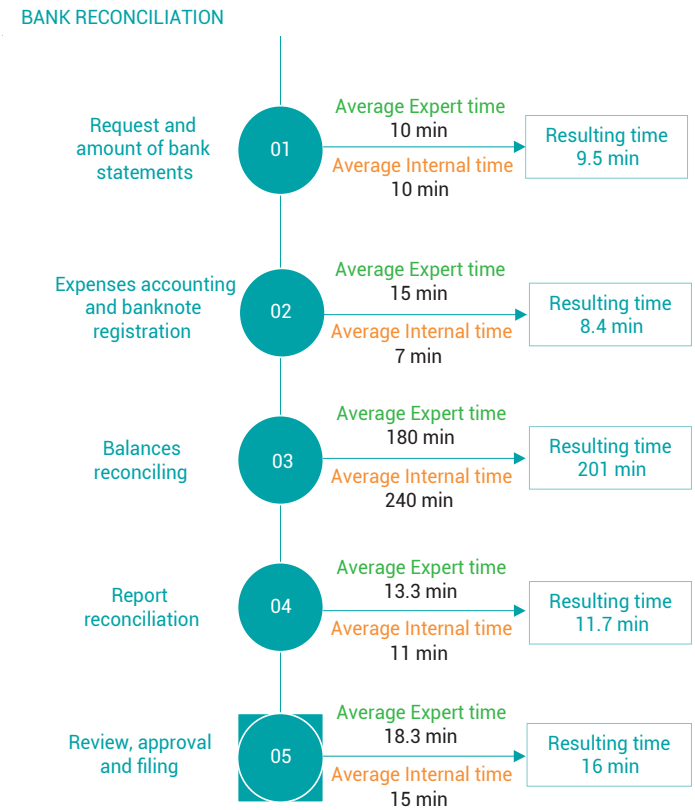

Figure 8. Operations diagram for "Bank reconciliation" procedure
Source: own work

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

3.4. Indicators

Even though the "Liga Colombiana Contra el Cáncer" had implemented an evaluation methodology that was done through semi-annual management reports, these documents did not cover enough information to be able to establish strategies for the continuous improvement of the Accounting department.

It is for that reason, and in order to create an ideal tool for splicing the area with the improvement processes of the Institution, that some indicators were established.

In Table 4, an example is shown of the completed format for the development of some indicators created for the department. The following are specified: the procedure that was measured, the indicators name, variables, formula, unit of measure, and the source where the information will be obtained for its measurement.

Table 4. Format to establish indicators

Name	Variable	Formula	Unit of measure	Source
Reason for liquidity	Current assets, Current liabilities	(Current assets / Current liabilities) * 100%	(%)	Financial statements, Software
Presentation of taxes	Timely date, Final date	(Timely date for the presentation - Final date of the presentation)	Days	Financial calendar, tributary

Source: own work

Once all indicators were established, the next step was to fill out its summary and technical specifications, which were elaborated between the research group and the "Liga Colombiana Contra el Cáncer".

In addition to previous information, in the summary, the following were also included: the indicator objective, macro-process and process to which it belongs, periodicity of its measurement and report, interested parties, its type and level, the person responsible for data collection and analysis, and goals —represented both numerically and graphically—.

The indicators that were established will allow the Accounting department to take control of its performance within the institution, to establish performance traceability, and to determine goals and strategies for the same area. Finally, it is important to highlight that the implementation of indicators will allow the department to identify which are the critical points within its operation, in order to propose improvement actions for their solution.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

3.5. Impact evaluation

Lastly, it was considered necessary to measure the impact, related to the established needs, that this project would have on the Accounting department and on the institution. It is for that reason, that it was decided to implement a multicriteria evaluation matrix in this methodology.

Table 5 shows the four criteria established for this matrix. In addition, the variables used in this evaluation, for which a percentage of importance from 0 to 100% was established, are also detailed. Finally, the assigned value is indicated, which was established by means of a numerical rating scale from 1 to 5, 1 being the lowest rating, and 5, the highest rating with respect to the positive impact that this variable could have on the interested parties.

Table 5. Impact evaluation

Criteria	Variable of evaluation
Institutional	1. Articulation
	2. Participation
	3. Institutional coherence
Technical	4. Pertinence
	5. External coherence
	6. Internal coherence
Capacity	7. Sustainability
	8. Performance
	9. Effectiveness
	10. Traceability
Impact	11. Economic
	12. Social
	13. Institutional
Total	**4.05**

Source: own work

As can be seen, the total qualification for the project against the accomplishment of expectations raised by the Institution was 4.05, which means that the process standardization had a positive impact. This allowed for the articulation of the accounting activities to the integrated systems that work for the "Liga Colombiana Contra el Cáncer", always maintaining the necessary coherence to be consistent with its policies.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

4. Discussion and conclusions

As was mentioned at the beginning of this article, the lack of specialized references in accounting or similar standardization processes was one of the main limitations for the development of this project. Due to this, the necessity to couple some tools, techniques, and methods from different authors arose and despite being used in different contexts and conditions, these contributed enough of a foundation upon which the proposed methodology in this paper could be built.

This study was primarily based on investigations carried out by Ungan [4], Adesola, Baines and Darlow [13], and Aburub [6], from where required tools and theories were obtained. Also, to complement the ideas presented by these authors, methods proposed by Mejia [27], Gómez [28], and Pacheco and Contreras [37], were used which enabled all necessary aspects to be covered whilst carrying out a complete standardization of the area.

From the investigations presented by Ungan [4], Adesola, Baines and Darlow [13], and Aburub [6], it was possible to establish a set of base stages that included common elements necessary for the correct development of the first phases of this methodology, which consisted of:

- Start with the recognition and identification of current process through interviews and focal groups carried out with experts on the subject. This stage helps in the understanding of how the Accounting process was developed, and what were the actors and flows that interacted with it.
- Followed by this, the modelling process was proposed through mapping tools that enable its visualize it in a graphic way, making this complex process much more understandable for the research group.
- Lastly, in order to have a physical register of the standardization process, the information obtained in previous steps was documented and codified. Initially, only 7 % of the department's documentation was active, which, after implementing the standardization, was updated. In the same way, for the remaining 93 %, the necessary documents and codes were generated.

Even though these authors built a foundation for the process of standardization, their proposals were based on studies carried out for works that are usually done under normal circumstances, which means that these are always done following the same pattern and with little variability in their development. Due to this, it was necessary to incorporate tools and techniques that would allow for the implementation of a methodology that could be used in a more complex process like accountancy.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

Due to the nature of the process of accounting, a time study was included using the "Subjective standards" technique, which was done not only with one expert, as the original one says, but with several experts so as to improve its accuracy. It was chosen because it allowed for the standardization of the routine and non-routine activities of the area.

This stage, not only standardized the time required for performing activities, but also established a measure of comparison, between time of current process and the average time estimated by the external experts, in order to evaluate the Accounting department against other institutions, and establish improvement strategies.

The creation of performance indicators, as one of the final stages proposed within this methodology, will allow the "Liga Colombiana Contra el Cancer" to establish goals, controls and traceability on its results, that will be reflected in a better management of the Accounting department.

On the other hand, and according to the standardization objective of the Accounting department —whose purpose was not only to generate an economic effect on the institution, but also to improve the effectiveness, the activities method and the coupling of the area to institutional policies—, a "Multicriteria matrix" was used to evaluate the variables with most impact on these purposes.

Taking into account that the evaluation obtained in the matrix was 4.05 out of 5, it can be concluded that the standardization had a considerable impact within the area and on the institution, which is reflected in the process improvement, and in its articulation with the Management systems of the "Liga Colombiana Contra el Cáncer".

In the same way, it is necessary to highlight the value that the implementation of this methodology could have when standardizing any process, because, as was mentioned throughout this article, the main purpose of this study was to fill the information gap that existed, proposing a baseline that was useful as a guide for future research.

Finally, an integral proposal was developed, based on engineering tools that standardize the accounting process of the "Liga Colombiana Contra el Cáncer", in order to optimize the working methods used, and to identify activities that add —or not— value to itself. In the same way, it was also possible to articulate the area to the Quality management system of institution, and venture it into a culture of self-assessment and continuous improvement.

e-ISSN 2357-6014 / Vol. 15, n°. 2 / mayo 2019 / Bogotá D.C., Colombia
Universidad Cooperativa de Colombia

References

[1] A. Hegade, S. G. Rajkumar, and S. Murthy, "Standardization of Continuous Improvement Process", *Imp. J. Interdiscip. Res.*, vol. 3, núm. 1, pp. 2435–2437, 2017. [On line]. Available: https://www.researchgate.net/publication/313651429

[2] P. Topala and V. Postolache, "Re-engineering of business processes as a bank efficiency method", in *Conf. Series: Materials Science and Engineering*, vol. 400, no. 6, pp. 1-11. 2018. [On line]. doi: http://dx.doi.org/10.1088/1757-899X/400/6/062029

[3] Knowledge@Wharton, "Why Companies are Increasingly Moving towards Standardization", *Knowl. Whart. – Wipro Futur,* pp. 1-6. 2013. [On line]. Avaliable: http://knowledge.wharton.upenn.edu/article/wipro-technologies-why-companies-are-increasingly-moving-towards-standardization/

[4] M. C. Ungan, "Standardization through process documentation", *Bus. Process Manag. J.*, vol. 12, no. 2, pp. 135–148, 2006. [On line]. doi: http://dx.doi.org/10.1108/14637150610657495

[5] A. Cuadros, "Quiénes somos", *Liga Colombiana Contra el Cáncer*. [On line]. Avaliable: http://www.ligacancercolombia.org/nosotros/quienes

[6] F. Aburub, "Business process improvement methodology based on business process modelling: Case study from healthcare sector", in *WEBIST 2014 - International Conference on Web Information Systems and Technologies improvement*, vol. 1, pp. 310–307, 2014. [On line]. Avaliable: https://www.researchgate.net/publication/288117928

[7] L. Serrano and N. Ortiz, "Una revisión de los modelos de mejoramiento de procesos con enfoque en el rediseño", *Estud. Gerenciales*, vol. 28, núm. 125, pp. 13–22, 2012. [On line]. doi: https://doi.org/10.1016/S0123-5923(12)70003-7

[8] P. Cronin, F. Ryan, and M. Coughlan, "Undertaking a literature review: a step-by-step approach", *Br. J. Nurs.*, vol. 17, núm. 1, pp. 38–43, 2008. [On line]. doi: https://doi.org/10.12968/bjon.2008.17.1.28059

[9] S. Phiphopsuthipaiboon and S. Boonsiri, "Business Process Reengineering – A Case Study on Computer Center", *ICTTE 2016*, vol. 6006, pp. 1–4, 2016. [On line]. doi: http://dx.doi.org/10.1051/matecconf/20168106006

[10] M. P. Uysal, A. Halıcı, and A. E. Mergen, "Re-Engineering Enterprise Architectures", in *Federated Conference on Computer Science and Information Systems*, vol. 11, pp. 1015–1018, 2017. [On line]. doi: http://dx.doi.org/10.15439/2017F17

[11] H. Cahyono and N. A. Wessiani, "Redefining the business process of Department of Food Security and Agriculture in Government of Surabaya City", in *Conf. Series: Materials Science and Engineering,* vol. 337, pp. 1-11, 2018. [On line]. doi: http://dx.doi.org/10.1088/1757-899X/337/1/012056

[12] A. Tamošiūnas, "The integrative management model for restructuring Small and Medium-sized Enterprises (SME)", *Ekon. a Manag.*, vol. 3, pp. 36–51, 2017. [On line]. doi: http://dx.doi.org/10.15240/tul/001/2017-3-003

[13] M. S. Adesola, T. Baines, and N. Darlow, "MIPIM : Framework for Business Process Improvement", *Cranfield University*, pp. 1-8, 2006. [On line]. Avaliable: https://pdfs.semanticscholar.org/96f4/544fb1cb8886c327eeba25ada43e5cc7b640.pdf?_ga=2.16234997.235293364.1552335390-906265960.1542860840

[14] D. J. Teece, "Capturing Value from Knowledge Assets: The new Economy, Markets for Know-How, and Intangible assets", *California Management Review,* **vol. 40, no. 3,** pp. 3–26, 1998. [On line]. doi: http://dx.doi.org/10.2307/41165943

[15] M. Ek, "Standardizing purchasing processes – Increasing purchasing efficiency for production process equipment at Höganäs Sweden AB", Master thesis in Industrial Engineering and Management*, Lund University*, 2013. [On line]. Avaliable: http://lup.lub.lu.se/student-papers/record/3631521

[16] G. Espinosa-Garza, I. Loera-Hernández, and N. Antonyan, "Increase of productivity through the study of work activities in the construction sector", in *Manufacturing Engineering Society International Conference 2017*, pp. 1003–1010. [On line]. doi: http://dx.doi.org/10.1016/j.promfg.2017.09.100

[17] A. D. B. Saggin, T. R. Mota, F. L. Brito, and A. M. A. Mourão, "Standardized work: Practical examples in a Brazilian construction company", in *25th Annual Conference of the International Group for Lean Construction,* pp. 713–720. [On line]. doi: https://doi.org/10.24928/2017/0128

[18] N. Saliba, "Standardization of a production process. A case study at Husmuttern AB", Bachilor thesis, *Mälardalen university*, 2018. [On line]. Avaliable: https://pdfs.semanticscholar.org/0846/9e5a9e043ec4ffa3d65f4df4d43ad142ee1a.pdf

[19] A. Varasquin, L. V. Vieira, and G. Balbinotti, "Use of work routines of observation tool to promote continuous improvement in a production line", *Procedia Manuf.*, vol. 3, núm. Ahfe, pp. 5800–5805, 2015. [On line]. doi: https://doi.org/10.1016/j.promfg.2015.07.830

[20] E. Fuentes and A. Rojas, "Estandarización de Operaciones en el Servicio Postventa de una Empresa Automotriz para la Marca Principal", *Inf. Tecnológica*, vol. 29, núm. 4, pp. 189–196, 2018. [On line]. doi: http://dx.doi.org/10.4067/S0718-07642018000400189

[21] M. Jagusiak-kocik, "Ensuring continuous improvement processes through standardization in the automotive company", *Prod. Eng. Arch.*, vol. 2, núm. 1, pp. 12–15, 2014. [On line]. doi: http://dx.doi.org/10.30657/pea.2014.02.04

[22] P. Lillrank and M. Liukko, "Standard, routine and non-routine processes in health care", *Int. J. Health Care Qual. Assur.*, vol. 17, núm. 1, pp. 39–46, 2004. [On line]. doi: https://doi.org/10.1108/09526860410515927

[23] O. Mella, "Técnica De Grupos Focales: Técnicas de investigación cualitativa", *Cide*, vol. 3, pp. 1–27, 2000. [On line]. Avaliable: http://files.palenque-de-egoya.webnode.es/200000285-01b8502a79/Grupos%20Focales%20de%20Investigaci%C3%B3n.pdf

[24] L. Díaz, U. Torruco, M. Martínez, and M. Varela, "La entrevista, recurso flexible y dinámico", *Investig. en Educ. Médica*, vol. 2, núm. 7, pp. 162–167, 2013. [On line]. doi: https://doi.org/10.1016/S2007-5057(13)72706-6

[25] *Quality management systems - requirements,* Norma Técnica Colombiana NTC-ISO 9001:2015.

[26] M. Ungan, "Towards a better understanding of process documentation", *TQM Mag.*, vol. 18, núm. 4, pp. 400–409, 2006. [On line]. doi: https://doi.org/10.1108/09544780610671066

[27] E. Mejía-herrera, "Guía para el diseño de estructuras salariales en las empresas", *Ediciones Univ. Coop. Colomb.*, vol. 8, 2015. [On line]. doi: http://dx.doi.org/10.16925/greylit.1080

[28] L. Gomez, "Medición de cargas de trabajo. Guía metodológica para el sector público". *Departamento Administrativo de la Función Pública*, pp. 1–41, 2002. [On line]. Avaliable: http://www.ceppia.com.co/Documentos-tematicos/TERRITORIAL/medicion-cargas-trabajo.pdf

[29] E. Cohen and R. Martínez, "Manual: Formulación, evaluación y monitoreo de proyectos sociales". *División de Desarrollo Social, CEPAL,* pp. 1-173, 2005. [On line]. Avaliable: https://dds.cepal.org/redesoc/publicacion?id=242

[30] A. Freivalds, "Work Measurement in the 21 st Century", in *IIE Annual Conference Proceedings*, pp. 4130-4133, 2013. [On line]. Avaliable: https://search-proquest-com.sibulgem.unilibre.edu.co/docview/1471958433?accountid=49777

[31] E. Gagnon, "How to measure work", *Material Handling Management*, vol. 55, no. 2, pp. 71-77, 2000. [On line]. Avaliable: https://search-proquest-com.sibulgem.unilibre.edu.co/docview/213402869?accountid=49777

[32] K. Adepoju, A. Chukwu, and M. Wang, "The beta power exponential distribution", *J. Stat. Sci. Appl.*, vol. 2, pp. 37–46, 2014. [On line]. Avaliable: https://www.researchgate.net/publication/267867925

[33] D. Velimirovi, M. Velimirovi, and R. Stankovi, "Role and importance of key performance indicators measurement", *Serbian J. Manag.*, vol. 6, no. 1, pp. 63–72, 2011. [On line]. doi: https://doi.org/10.5937/sjm1101063V

[34] E. Cardinaels and P. M. G. Van Veen-dirks, "Financial versus non-financial information: The impact of information organization and presentation in a Balanced Scorecard", *Accounting, Organ. Soc.*, vol. 35, pp. 565–567, 2010. [On line]. doi: https://doi.org/10.1016/j.aos.2010.05.003

[35] A. Uyar, "Development of non-financial measures as contemporary performance measurement tools", *World Account. Sci.*, vol. 12, no. 1, pp. 209–248, 2010. [On line]. Avaliable: https://www.researchgate.net/publication/303687793

[36] I. Kotane, "Use of financial and non-financial indicators in evaluation of company's performance", in *CBU International Conference Proceedings*, pp. 224–233, 2015. [On line]. doi: http://dx.doi.org/10.12955/cbup.v3.605

[37] F. Pacheco y E. Contreras, "Manual metodológico de evaluación multicriterio para programas y proyectos", *Instituto Latinoamericano y del Caribe de Planificación Económica y Social (ILPES)*, vol. 58, pp. 1-111, 2008. Avaliable: https://repositorio.cepal.org/bitstream/handle/11362/35914/manual58_es.pdf?sequence=1&isAllowed=y

[38] A. Salo and R. Hamalainen, "Multicriteria Decision Analysis in Group Decision Processes", in *Handbook of Group Decision and Negotiation,* vol. 4, pp. 269-283, 2010. [On line]. doi: http://dx.doi.org/10.1007/978-90-481-9097-3_16

[39] A. Stirling, "Analysis, Participation and Power: Justification and Closure in Participatory Analysis", *Land use policy*, vol. 23, no. 1, pp. 95–107, 2006. [On line]. doi: http://dx.doi.org/10.1016/j.landusepol.2004.08.010