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Diagnostic tool for radical improvement in business processes

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Abstract. The present work presents a diagnostic tool applicable in any business sector; it works as a support to managers for decision-making towards the need for a radical improvement of processes. A literary review was conducted to collect case studies in order to identify the problems it addresses and the impacts generated by the process of reengineering application in organizations. Through conceptual modeling and synthesization, some diagnostic questions were formulated related to the problems that reengineering has addressed in the literature, and an evaluation model was built that allows organizations to identify what type of problem the organization has, its processes or departments, which should be approached from a radical improvement approach. Finally a diagnostic tool with an evaluation method was formulated, to recommend initiate process improvement either organization, departments o process, formulated fully integrable with PDCA cycle and evaluation or monitoring phases for systems like business activity monitoring based on IT systems, relevant in today's contexts when most of the nowadays organization are technology-based, and progressive improvements do not become a pragmatic and agile alternative in the business context.

1. Introduction

The organizations should design differentiation policies, be cost leaders in order to obtain competitive margins. In order to achieve these objectives, it is essential that all the personnel of the organization get involved, manage and execute the processes to contribute in this way to the success of the institution. It is widely known that a large number of organizations have ceased to be competitive due to the low productivity that is generally linked to inefficient management of their processes, failures in the traceability of information, processes that hinder the functioning of the organization. This scenario has created the need for organizations to achieve a global change in their processes, by directing them based on market demands through the application of radical improvement methodologies [1], where Process Reengineering takes place seeking to restructure organizations for more effective results. Process reengineering follows the philosophy of taking a process and completely restructuring it in a way that generates a totally new and improved process through actions like decrease in process times, greater knowledge and control of processes, and a better flow of information within the organization [2]. Reengineering seeks results of great impact unlike other approaches that characterized by seeking incremental and continuous results. However, a study conducted found that reengineering is one of the three options to achieve Continuous Process Improvement (CPI) [3]. According to the research of [4], reengineering improves activities and seeks to make the work faster and easier by radical and drastic changes on the existing processes. For a reengineering of processes to be effective, it should be based



on the reexamination of the current process and its objectives, with the aim of achieving spectacular improvements in its realization.

In response to the previous approach, this research takes Process Reengineering as a base methodology for the creation of a diagnostic tool, which will allow organizations to decide whether to the redesign radically their processes, improving the results associated with the performance of the processes.

2. Methodology

Based on an analytical approach from the global to the particular, a three-phase methodology was determined as shown in Figure 1, as followed by [5]. The first phase of the project focused on consolidating a compendium of case studies through a Review of Scientific Literature, which allowed us to see the practical approach to the implementation of Process Re-engineering, the problems it covers, and the impacts it obtain. In the second phase, the studies were modeled taking into account information of interest: problems, activities, tools, and results. In the third phase, the modeled information of the problems covered was simplified and normalized, and the impacts generated by the process reengineering to turn it into evaluation inputs for the diagnostic tool.

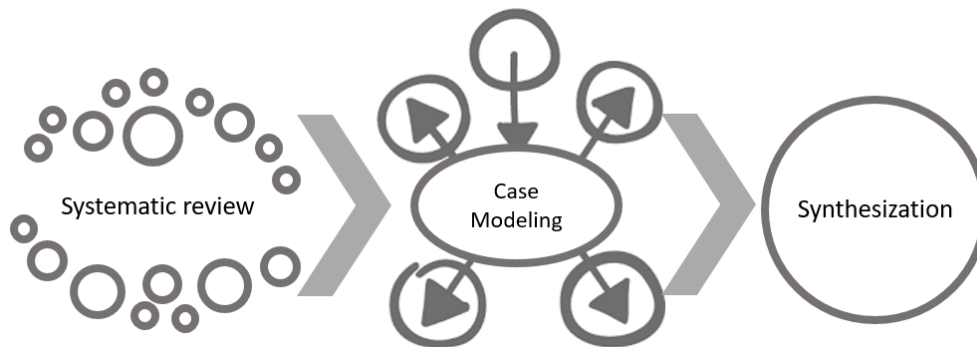


Figure 1. Applied methodology.

The Systematic Review phase (Figure 1) was conducted according [6], the questioning was geared towards identifying “what cases of Process Reengineering application had been documented in the scientific literature and if they had been applied to quality management”. The review conducted in both Spanish and English, with the focus of information being on case studies documented in scientific articles or proceedings, so that information could be extracted from business experiences that enriched information support. The databases used were IEEExplorer, Proquest, Google Scholar, Ebsco and Science Direct. A methodology very similar to that applied by [7], which is evidenced in Figure 2.



Figure 2. Flow of information selection in the Systematic Review of the sources.

The exclusion of articles done throughout the review process to arrive at the selected case studies following the methodology implemented by [6], as evidenced in the previous figure in five stages. The first stage proceeded from the accounting of the results of the 24 search strings inserted in each of the six databases, seeking to identify which of them were effective to review. The second stage consisted of reading the title, and keywords seeking to identify whether or not the result was relevant to the study in a preliminary way. The third stage consisted of identifying, selecting and downloading case study documents. In the fourth stage, the case studies were analyzed in depth, in order to identify that they were effectively related to process improvement through the concept of reengineering. The fifth stage consisted of a deeper review of the case studies, selecting for the present work those that described the information of interest: the application process, tools, problems and results/impacts obtained. This debugging method, together with reading and navigation methods, helped to reduce the information considerably. The amount of results classified in Figure 2 it established, allowing us to find 21 documented case studies of the Reengineering implementation with the study variables needed for the construction of the tool.

In the Case Modeling phase (Figure 1) in order to abstract and relate the information of interest from the case studies (problems, activities, tools and results), Cmaptools was used as a conceptual modeling tool that would allow us to have a global a visual and centralized overview of all the information to generate the variables of interest. An example of the modeling of a case study can be seen below in Figure 3.

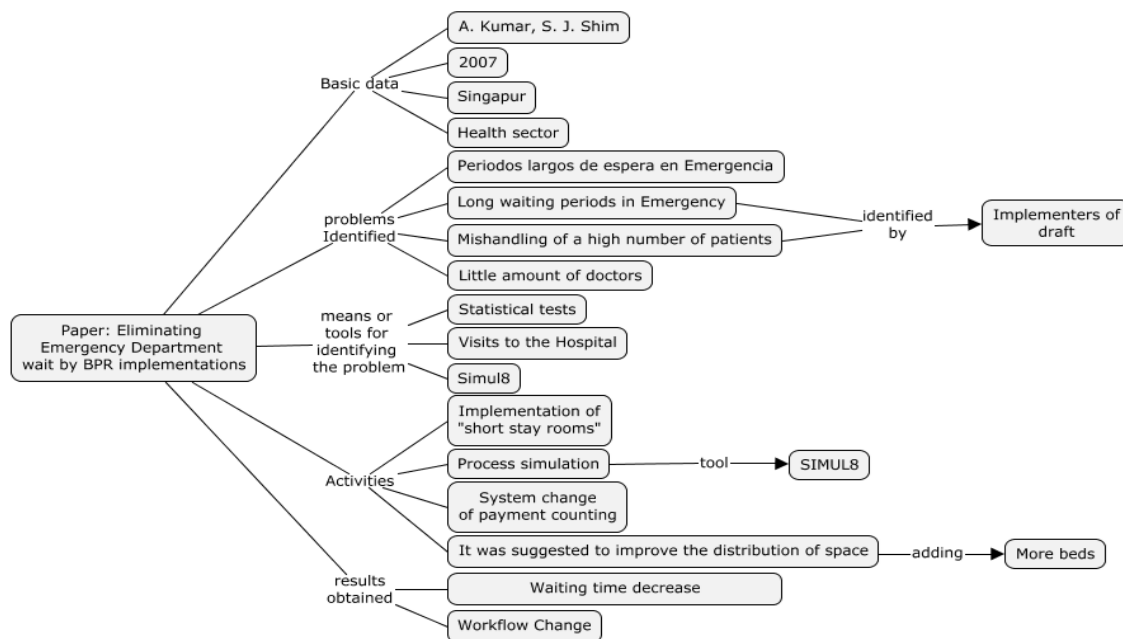


Figure 3. Conceptual case model of a study and information of interest: problems, activities, tools, and results.

In the Synthesization Phase (Figure 1), each case study modeled on the tool, initially simplified into a model by sector (Figure 4), the simplification consisted of methodically grouping the information of interest (problems, activities, tools, and results). Afterwards, the terms or concepts commonly found between the results of the different cases standardized so that a general and standardized overview of the types of problem, tools, activities, and results obtained could be obtained. Once the information of interest was standardized by sectors, they were synthesized into a single model in order to proceed to identify a deeper level of classification and detail of the problems and impacts of the Process Reengineering application, so that the resulting info allows the transformation of the information of

interest extracted from the cases of studies analyzed, into diagnostic variables for the construction of the diagnostic tool.

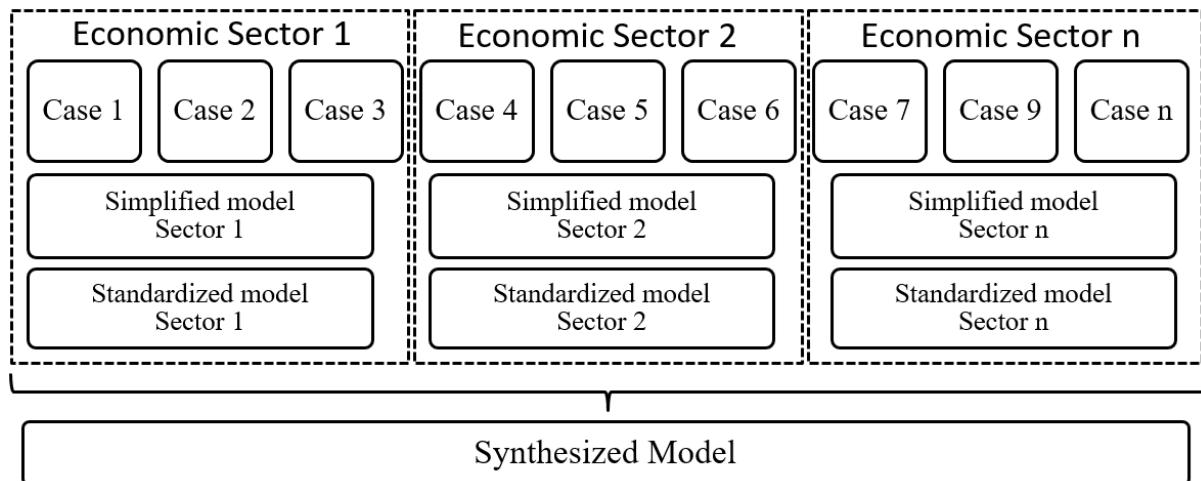


Figure 4. Simplification and standardization process in the characterization of the case studies.

3. Cases of re-engineering process studies

The literature review showed that Process Reengineering is widely focused on business restructuring in many sectors, due to the impact in productivity as well as serves as a starting point for looking excellence in business process [8, 9]. In the industry sector, [10] published an article in which he implemented a Reengineering process in the Rank Xerox (in the printing sector), in response to customer complaints regarding its products at a high price and its inefficient management. [11] Built collaborative teams, one of it, specialist in Process Reengineering and another in the management of the company. They carried out the modeling of the client management process, a subsequent analysis for improvements application, and then a completely new and improved model design; it applied as a pilot test and adjusted according to the feedback received. In India [12], decided to document the case study of Piped Natural Gas, a company within the oil sector that presented critical problems such as the slow billing to its customers, which led to the possession of a very inefficient small customer payment system. In order to address the problem, it decided to implement Process Reengineering and in this way, interviews first carried out with the company members and clients of the firm to gather as much information as it could contribute to the project objective. After that, the organization's payment system was completely changed, an executive committee in charge created and a device called Handled Billing Device implemented, with all this leading to reduction in the time it took to complete the process from 35 days to approximately 13 days, the billing was almost instantaneous and the error was minimized during the process. The application of reengineering in a construction company in China was documented [13], they addressed problems with payment in general, many repetitive jobs and problems with prevalent measures. As part of the Reengineering implementation process, the cause and effect figure carried out in previous steps, was analyzed and the process matrix was reorganized based on a lot of theory and the GB50500 standard of 2003, with this the processes were redesigned and unnecessary work was eliminated. The investigation of [14], a cereal company where the greatest inconveniences arose in customer dissatisfaction (low credibility of the company), insufficient marketing, poor strategic processes, and late billing. In the [15], documented the process of implementing Reengineering in an automotive company in Ecuador with lack of a system of information to control the inventory and to monitor the processes, in addition to the absence of indicators in the operation with many bottlenecks. To tackle these problems, the organization entered a stage of complete redemption of the activities, an indicator called OITFWQ, implemented. That allowed not only control the processes, but also to improve their

quality, complementing with the application of an information system that allowed the restructuring of the company's information but in particular that of the suppliers, resulting in the elimination of bottlenecks and workload growth by 39%.

In the health sector, the investigation of [16] obtained a 44% improvement in the delivery of results by making changes in the assignment of shifts to the workers of a pharmaceutical laboratory. In the work of [17], the organization and its processes completely restructured, bringing the company to a more customer focused approach and implementing information technologies that would make it easier to manage the amount of data that should entered every day, in addition to improved internal communication in the organization. Even has been applied in public's hospitals [18].

In the financial sector, an insurance company [19], implemented reengineering in internal process; problems related to inefficiency of the development of information technologies; during the implementation, an information strategy planning project was developed to revolutionize all the processes that were up to that moment, this was carried out with excellent results due to the commitment of management during the process. Also [20], implemented reengineering within a process in an insurance company to be able to change internal problems such as the inefficiency of the development of the technologies of information; During the implementation, an information strategy planning project was developed to revolutionize all the processes that were up to that moment; This was carried out with excellent results due to the commitment of management during the process. In a trading company in Singapore, process reengineering is applied in response to the need to increase competitiveness and the elimination of such complex processes.

In the education sector, [21] reports the application of Process Reengineering in a private school due to the need for restructuring by departments and lack of documentation of the processes. Prior to the start-up of the Process Reengineering, it was ensured that all departments were committed to the project since they considered it of the utmost importance, after this, the organization was restructured in an integral way, and through the feedback, the policies were reviewed from the institution to not only eliminate unnecessary expenditure of resources but to improve the processes of each of the departments, reduce operating costs and make processes simpler.

Within the telecommunications sector, several articles on the implementation of Process Reengineering were published in a variety of organizations. [22] published a case study of a Korean company facing an economy changing at a dizzying pace at that time, and the costs of maintaining were increasingly high. In addition, the competition lurked and the staff was not committed to management decisions; during the implementation period of Reengineering, the organizational culture was redesigned, and efforts were focused on employee welfare, schedules were changed, employees were given training and family time was encouraged. [23] Documented a reengineering project in an Irish company that was a victim of quality policy failures and was facing a new type of market in which its competition was much stronger. The way in which the application of the Reengineering was approached was through the document drafting of the company's processes. The company was reorganized and the ISO 3001 and BS5750 certification was achieved. In addition, a quality council was created to guide the processes of company improvement. Many processes were automated and a management layer was eliminated, a release scheme was created for employees to leave the company voluntarily, roles were eliminated and a team was created to attack organizational problems in the future. With all this, this Irish company achieved a masterful adaptation to the market. In the

Logistics Sector in Aeronautics, [24], published an article describing the implementation of Process Reengineering in response to the need to improve the process of loading and unloading packages since it was a process too late. As part of the implementation, the limits of the process were defined due to the nature of the business; the process was restructured through data collection, observation, information analysis, and a subsequent improvement design. And as an added bonus a customer service thread was created generating considerable simplification in the company's activities. Continuing with the same economic sector [25], documented the application of Process Reengineering in a Spanish company that faced customer service problems and poor management of claims. To address the situation, the process to work was broken down and diagrammed separately, then a brainstorm was carried out with the

members of the organization to materialize the improvement. After that, were documented 577 ideas for the process improvement. Then, a technique called "Knowledge transfer" was applied as a method to communicate the results to the entire organization. An overview of the case studies of Process Reengineering application reviewed can be seen in Figure 5 below.

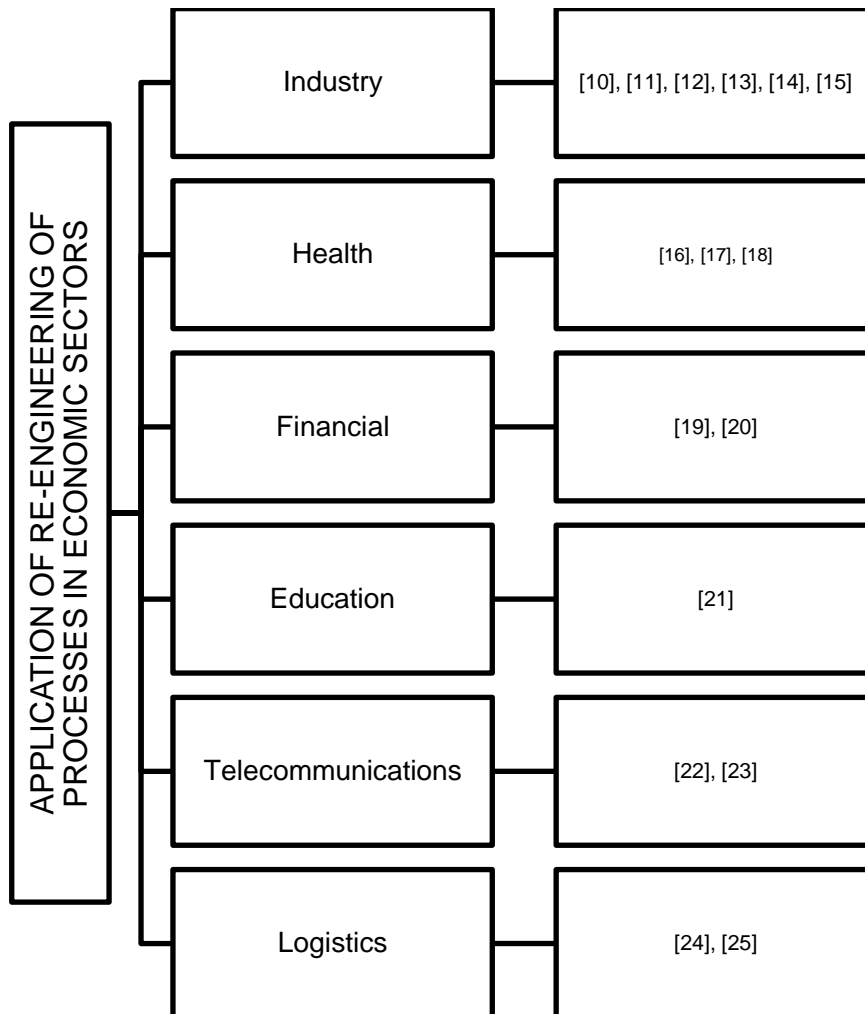


Figure 5. Economic sectors in which Process Reengineering has been applied, and its documented case studies.

4. Results and Discussion

The process of simplification and synthesization of the modeled cases classified by sectors, allowed to identify the problems that through the Process Reengineering were addressed in the case studies (Table 1), likewise, the overall positive impacts that the Reengineering implementation had overall in the organizations were identified (Table 2).

Table 1. Problems addressed in each of the sectors.

PROBLEMS ADDRESSED BY THE RE-ENGINEERING PROCESSES IN DIFFERENT ECONOMIC SECTORS	Health	Financial	Telecommunications	Industry	Logistics	Education
Customer service / equipment warranty			X			
Lack of quality policies			X			X
High operating costs	X	X	X	X	X	
Staff commitment			X			
Lack of organizational culture			X			
Information systems			X			X
Inefficient processes				X		
Inefficient resources	X	X		X		
Obsolete resources	X	X	X	X		
Complex processes	X	X		X	X	
Reprocesses	X	X		X	X	
Excess staff	X	X	X	X		
Lack of staff	X	X		X		
Indicator failure	X			X	X	
Little follow up processes	X	X				
Poor documentation	X	X		X		
Poor communication with the client	X	X			X	
Delayed processes		X		X		
Uncoordinated processes	X	X			X	
Little organizational culture		X				
Lack of quality policies / manuals		X		X		X
Breach of customer requirements	X	X			X	
Changes in the market		X				
Weak information system / Failures in physical infrastructure		X				
Supplier administration				X		
Market transformation			X			
Strengthening competition			X			
Changing economy			X			

Table 2. Positive impacts reported in the case studies by economic sector.

POSITIVE IMPACTS ACHIEVED BY THE REENGINEERING OF PROCESSES IN DIFFERENT ECONOMIC SECTORS	Health	Financial	Telecommunications	Industry	Logistics	Education
Improvements in service quality	X	X	X	X		
Customer increase	X	X	X	X		
Generation of customer benefits		X	X	X		
Staff reduction	X	X	X	X		
Less work each	X	X	X	X		
Efficient staff	X	X	X	X		
Increased motivation and commitment of staff	X	X	X	X		
Shorter response times	X					
Improve operating times		X	X	X	X	X
Process automation	X	X	X	X	X	
Effective and quality processes	X	X	X	X	X	X
Less complex processes	X	X	X	X	X	X
Shorter waiting times for the customer	X					
Reduction of operational costs	X	X				X
Better information and documentation management	X	X				
Occupational risk reduction	X					
Information traceability	X		X	X		X
Improvement in the indicators	X		X	X		X
Competitiveness and productivity improvements			X			

The problems were synthesized in eight groups: problems of processes, quality, costs, documentation, competitiveness, organizational culture, and resources, as can be seen in Table 3, and the documented causes of each in the case studies, which laid the foundations for the construction of this diagnostic tool.

Table 3. Classification of the problems addressed.

Type of problem addressed by process reengineering	Cause
Processes	<ul style="list-style-type: none"> • Delayed • Expensive • Inefficient • Uncoordinated • Complexes • Reprocesses • With little follow-up • Problems with the indicators
Quality of service Customer satisfaction	<ul style="list-style-type: none"> • Poor communication • Breach of requirements
High costs	<ul style="list-style-type: none"> • Organizational • Operation
Documentation	<ul style="list-style-type: none"> • Lack of information systems • Function's manual • Processes / Requirement • Quality Policies
Competitiveness	<ul style="list-style-type: none"> • Changes in the market
Lack of Organizational Culture	<ul style="list-style-type: none"> • Lack of staff commitment
Resources	<ul style="list-style-type: none"> • Obsolete • Inefficient • Lack or excess of staff

Likewise, the positive impacts that in general the reengineering implementation achieved in organizations are identified fields like: service, organizational structure, processes, and management. Table 4 below allows seeing a panorama of results that any organization might be in need, and use it's as guidelines for the decision-making of process improvement projects within the organization, for purposes of continuous improvement.

Table 4. Classification of results, positive impacts obtained.

Impacted area	Type of impact achieved by process reengineering
Service improvements	<ul style="list-style-type: none"> • Customer Increase • Generation of customer benefits • Increase in the perception of quality • Decreases in customer waiting times
Organizational structure	<ul style="list-style-type: none"> • Staff reduction • Decrease in workload • Efficient staff • Increased motivation and commitment of staff
Process improvement	<ul style="list-style-type: none"> • Decrease in response times • Improvement in operational flow • Effective and less complex processes • Reduction of operational costs • Improvement in information and documentation management
Management improvement	<ul style="list-style-type: none"> • Occupational Risk Reduction • Information traceability • Improvement in the flow of information • Indicator improvements

Based on the problems addressed and their causes (Table 3), diagnostic questions formulated based on the opinion of the members of an organization about the processes, or departments of a company. In the same way, said diagnostic questions can be applied to an organization. During the correlation, we sought to synthesize the relationships in order to reduce redundancy and facilitate the analysis of the respondent, finally was generated three categories of diagnostic questions: Management and Operation, Resources, and Response Capacity. This resulted in a total of 15 diagnostic questions, which can be seen in Table 5 below. Each of these questions is correlated with the identified problems that an organization may present, and that were documented throughout the scientific literature.

Table 5. Diagnostic questions for the implementation of process reengineering, and its relation to problems.

	Diagnostic question	Associated problem
MANAGEMENT AND OPERATION	1. In the processes, there are moments in which results are not delivered in the required time?	Delayed processes
	2. Do you consider that the processes have problems with the planning of the activities?	Uncoordinated processes
	3. Do you consider that studies are carried out in the processes to see the effectiveness of the results according to the initial planning?	Processes with little follow-up
	4. Do you consider that activities are repeated, or that many of them do not add value to the processes?	Reprocesses in the organization
	5. Do you consider that the processes ask many requirements to carry out your activities?	Complex processes
RESOURCES	6. According to what is observed in the market, do you consider that the processes have a high expenditure of resources such as: money, time, personnel or machinery for example?	High operating costs
	7. Does management commit sufficient resources to the development of processes?	Insufficient resources in the processes
	8. Does the company have the resources required for the development of all its activities?	Insufficient resources in the processes
	9. Do you consider that the documentation of quality policies, function manuals, procedures and instructions for the development of daily activities in the organization, is deficient?	Bad documentation in the processes
	10. Do you think you have obsolete and/or inefficient resources?	Obsolete resources
	11. Do you think there is a lack of organizational culture and staff commitment?	Staff Commitment
ANSWER'S CAPACITY	12. How often are complaints or claims, made in the organization's processes?	Breach of requirements
	13. How often do you fail to comply with the requirements requested in the processes?	Breach of requirements
	14. Do you think there are failures in the internal communication of the processes?	Poor communication
	15. Do you consider that complaints and claims in the processes generally managed?	Low quality of service

Diagnostic questions can handle multiple answers such as Always, Sometimes, Never, Yes, No and N/A, which should be applied to all concerned according to the domain of the analysis: The organization, or processes or departments. When evaluating the entire organization globally, given that each question diagnoses a type of problem present in the organization that can be addressed from a reengineering approach, for each answer is given a weight. As can be seen in Figure 6, for "always" is given a weight of 1, for "sometimes" is given 0.75, for "never" is given 0, and for N/A is given 0,5. This weighting of each percentage of response is totaled and compared with a reference point that will indicate whether or not to do reengineering, as is illustrated in Figure 6.

Table 6. Illustrated case of diagnostic evaluation for an organization.

Diagnostic Question	Results Distribution								Weights				Reference point: 50%	
	Always		Sometimes		Never		N/A		1	0,75	0	0,5	Total	Recommendation
1. In the processes, there are moments in which results are not delivered in the required time?	5	25%	5	25%	6	30%	4	20%	25%	19%	0%	10%	54%	APPLY RADICAL IMPROVEMENTS

Diagnostic Question	Results Distribution								Weights				Reference point: 50%	
	Always		Sometimes		Never		N/A		0	0,75	1	0,5	Total	Recommendation
3. Do you consider that studies are carried out in the processes to see the effectiveness of the results according to the initial planning?	7	35%	3	15%	4	20%	6	30%	0%	11%	20%	15%	46%	ANY

Responsible for the analysis, should parameterize as they consider the weights for each answers, the importance of deciding the percentages of each question is because, although the types of answers may be common, these do not apply in the same way for each diagnostic question. As evidenced in the illustrated case in Figure 6, the weights of "never" turn to 1 due to is negative this answer considering the question 3, and the weigh of "always" turns to 0 due the positive consequence that always evaluates the process checking effectiveness in the process. The Reference Point evaluates if it is recommended to apply or not Radical Improvements, serving as a measuring gate of the level of a certain problem in each diagnostic question. Varying reference point, is due to a continuous evaluation strategy over time into the organization, where the diagnostic tool is applied periodically, improvements are achieved, so the problems should be less and less through time, making every time harder to identify some problem. So the requirement for initiate reengineering should decrease, increasing the sensibility to explore the need of process improvement (Figure 7). In this projected scenario, just start a deep study of the problem identified should be considered to activate a reengineering improvement process.

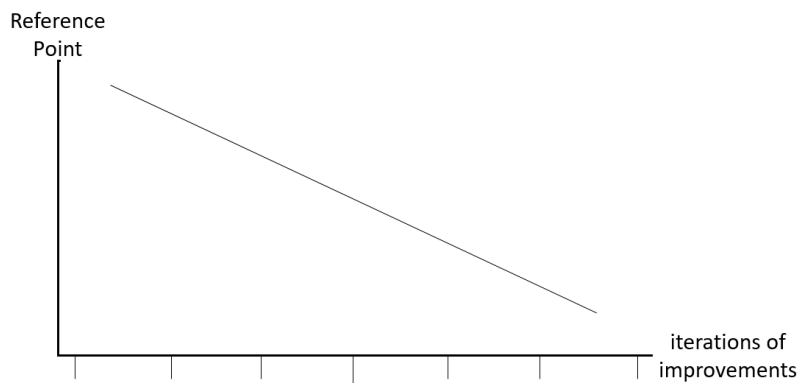


Figure 6. Behavior of the reference point over time for evaluating reengineering implementation.

If necessary, that the diagnostic tool be applied to processes or departments, executing the evaluation model explained above respondents must associate the responses to one or more processes or departments as they are being evaluated, in order that the application recommendation of reengineering be associated process through a Pareto Analysis as illustrated in Figure 7 below, where purchases and storage are the candidate departments to start a reengineering processes, seeking to address a possible problem of uncoordinated processes according to the relationship of the diagnosed question and the associated problem (Table 5). In this way, through this tool product of the described research, it can be determined if the processes or departments of an organization need to be intervened or at least analyzed under the optics of process improvement according to need.

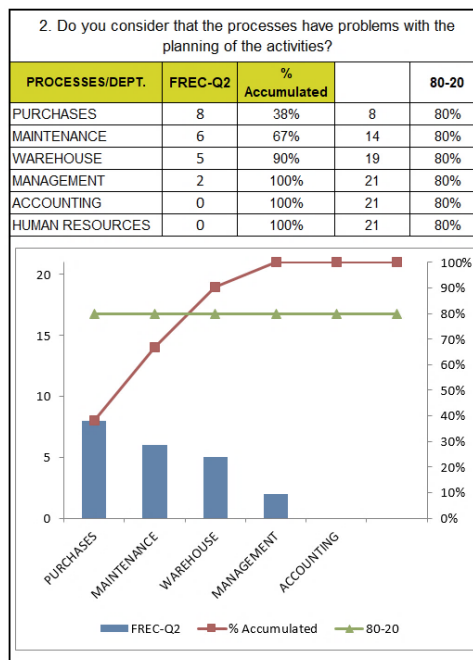


Figure 7. Illustrated case of diagnostic evaluation for an organization.

Tools such these represent a contribution to the business process management since new technologies and information systems have facilitated the capture and evaluation of information for making effective decisions. The authors of this paper propose process diagnosis tools use in improvement strategies which perceive organizations as a chain of events organized in process, whose performances are causes of bad or good results, determinants to reach business goals [26]. Quality Management Systems (QMS) or disciplines as Business Process Management (BPM) are fully integrable with tools like these. This diagnostic tool can also assist QMS based on a PHVA cycle, with a point of view external assessment in order to identify aspects to make an improvement beyond just the process assurance. BPM looks at the entire organization as a process network that must be managed to impact the organization aims; because of the magnitude, complexity, and quantity of tasks that it must handle, BPM must rely on IT technology resources that support an organization, or software platforms such as Business Activity Monitoring, to identify risks and improve opportunities in which diagnostics tools play an important role (Figure 8).

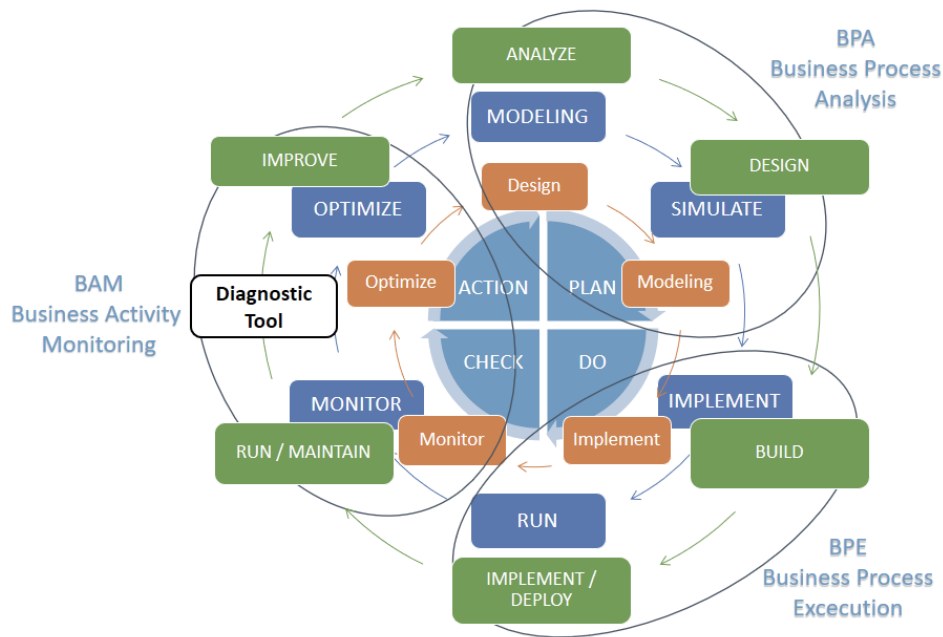


Figure 8. Diagnostic tools

5. Conclusions.

This research generated a diagnostic tool that will allow organizations in decision-making for the implementation of strategies for process improvement. The tool seeks to contribute to align processes performance with organizational goals and customer satisfaction, both internal and external, especially in those cases where incremental improvements are not enough and a radical change in the processes of organizations is necessary. The tool is based on 15 diagnostic questions that evaluate according to the level of the opinion of the members of an organization if it or its processes or its departments present some kind of problem, which has been documentarily addressed by a radical improvement of processes.

The problems on which the diagnostic tool is based were identified from a review of the literature that sought to collect case studies of the application of the methodology. Through the review, it was also possible to identify that reengineering has been applied in the financial, health, telecommunications, industrial, logistics, and education sectors and that many of the problems were common in all sectors. The review also allowed the identification of a consolidated benefit that was commonly achieved in many case studies in different economic sectors.

Reengineering is based on documenting as little as possible and focusing its objectives on redesigning one or more processes by completely recreating them, in order to achieve processes that (product of the redesign), truly tune the organization to its growth. Based on this, the proposed diagnostic tool indicates the need to improve processes from a radical approach either throughout the organization, departments or processes. Also is fully integrable with PDCA cycles, and disciplines like BPM which has IT-based systems like Business Activity Monitoring. This is relevant in today's contexts when progressive improvements do not become a pragmatic and agile alternative in the business context, and most of nowadays organization are technology-based.

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