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CRITICAL SUCCESS FACTORS IN EFFICIENCY PROJECTS

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Resumo

Este estudo focaliza o uso dos modelos Lean, Seis Sigmas e Reengenharia, de aprimoramento de processos. Não há estudos que comparam os fatores críticos de sucesso desses modelos, especialmente nos países em desenvolvimento. Por esta razão, vemos a necessidade de responder à seguinte questão: entre os modelos Lean, Reengenharia e Seis Sigmas, quais têm sido aplicados de forma mais eficaz? O estudo também tem como objetivo identificar, entre esses modelos, quais têm sido aplicados de forma mais eficaz pelos líderes de projeto no Brasil e na Colômbia e identificar os fatores críticos que contribuíram para implementar esses modelos com sucesso. Este estudo foi realizado por meio de uma revisão da literatura e de um *survey*. A principal conclusão foi que entre os principais fatores críticos que contribuem para o sucesso desses modelos, o mais importante é a comunicação. Finalmente, em relação à aplicação destes modelos em dois países (Colômbia e Brasil), de um país para outro, constatamos que a reengenharia é o modelo mais aplicado por líderes de projetos desses países.

Palavras-chave: Projetos de Melhoria de Processos, Fatores Críticos de Sucesso e Gestão de Projetos

Abstract

This study focuses on the use of Lean, Six Sigma and Re-engineering models of process efficiency improvement. There are no studies that compare the most critical success factors between Lean Production, Six Sigma and Reengineering models of process improvement, especially in developing countries. For this reason we see the need to respond to the following question: among the Lean, Reengineering and Six Sigma models, which have been applied most efficiently? The study also aims to identify, among those models, which have been applied more effectively by project leaders in Brazil and Colombia and identify critical factors that contributed to implementing these models successfully. This study was undertaken by means of a literature review and a questionnaire-based survey. Our main conclusion is that the main critical factor that contributed to the successful use of these models is communication. Finally we compared the application of these models in two countries (Colombia and Brazil). We found that the reengineering project is the model that is most applied by project leaders of these countries.

Keywords: Process Improvement Projects, Critical Success Factors and Project management.



1 Introduction

For a long time administrative theorists have been concerned with the development of models to improve the performance of processes in companies in order to make them more efficient and capable of making quality products. Scientific Administration or Taylorism was the first model that studied how to improve the efficiency of processes (Zoe & Barnes, 2007).

Then, in the 1950s, the Japanese developed the Toyota Production System (STP). The Toyota Production System has as its principle the radical elimination of waste. This principle was based in the application of work rationalization techniques created by the movement of scientific administration. The Japanese added other ingredients in their management model, which resulted in a set of solutions that known as the "Japanese industrial arts". These set of these techniques is also known as the lean production system (Maximiano, 2011).

After that, the Six Sigma model was introduced in 1980. This concept was created by Motorola, when an engineer studied the variation of processes as a way to improve their performance. These variations were studied by statistical measures (standard deviation and mean) (Eckes, 2001).

Finally, in the end of the 1980s and the beginning of the 1990s appeared the idea of reengineering processes in enterprises. This model is also known as redesigning of processes. The reengineering has as a principle: design the organizations in terms of processes and analyze the organization horizontally, instead of functionally (Zoe & Barnes, 2007).

Lean Production, Six Sigma and Reengineering are the most important models in the administrative theory because they are one of the pioneers in focusing their studies to improve the performance of organizational processes. The development of processes in companies are very important for them to obtain a speedy economic growth and to determine in large part as the products can be more competitive (Prokopenko, 1992). Nevertheless, the enterprises have been developing these models with a project structure in order to ensure their success due to this structure is very important and strategic to competitive development of companies because the project management allows connecting the results of projects with business objectives (Capitulo São Paulo-Brazil, 2015).

However there are a few researches that analyze these models as projects. It is often difficult to identify the critical success factors needed to develop these models. In addition there are no studies that compare the Lean Production, Six Sigma and Reengineering methods neither studies that analyze between these models which is most used by project leaders, especially professionals in developing countries. Recalling that these models were created in developed countries and their application in developing countries may be different, as shown in this study, which take as a focus professionals from Brazil and Colombia.

Taking into account the previous, this study was based on the need to answer this research question: among the Lean, Reengineering and Six Sigma models, which have been applied most efficiently? In order to answer this question, three specific objectives were set: Identify between are these models (Lean, Six Sigma and reengineering) which are most used by project leaders; (ii) identify between the critical factors of success which have contributed to the implementation successfully of these models (Lean, Six Sigma and reengineering) and (iii) Compare the patterns of adoption of lean, six-sigma and reengineering and their critical factors of success between the projects leaders in Brazil and Colombia.

Two tools were used for this work: bibliographic review and a survey applied to professional from analysts to top managers, who have experience in the development of models to improve efficiency in the processes and in the management of projects. Theses professional are from Brazil and Colombia.



This article is divided into five parts: (i) the first introduces the reader to the object of the research; (ii) the second presents a brief literature review about the concepts of these models: Lean, Six-sigma and Reengineering and of the critical factors of success; (iii) the third describes the problem and the research methodology; (iv) the fourth, analysis of the results and the main findings; and (v) the fifth part comprises the discussion, final considerations, the study limitations and indications for future studies.

2 Theoretical reference

In this section, we review the three models that revolutionized the management thinking and the critical factors of successes that takes into account in the management of projects, mainly in these models.

(i) Lean

The Lean production refers to a integrated social-technical system, whose main objective is to eliminate waste. The Lean is the tools that produce finished products in the rate of customer demand, with little or no waste (Kull et al., 2014). However, to apply the Toyota System should first be considered it as a set of principles, reminding that the most important principles are: elimination of waste and manufacture with quality (Maximiano, 2006), and so choose the right tools, adapting or modifying them according to the needs of the organization (Lander & Liker, 2007).

In recent decades, companies developed Lean projects in order to improve their processes and generate added value to the customer, for example in the health sector, where many of them apply Lean projects with success, as is the case of Beth Israel Reference Medical Center Project (Canacari & Simon, 2012). Other sectors also have developed projects Lean as Energy Systems (Weloa, Bjørset & Rølvåga, 2013). However, the economic sector where these projects are more developed is in the industry; remember that it was in this sector that this methodology arose. For example, in Mexico, companies as GE Mabe Quantum, Lear Corporation and Motorola, have applied this model of production in order to reduce costs and improve competitive position (Reyes, 2002).

In other countries such as Colombia, experiences were also made with Lean tools in different economic sectors, for example: automotive, metallurgy, food, and health services (Arrieta et al., 2011).

Additionally, some studies indicate that the business not only develop Lean projects, they also apply the Six Sigma projects, in which in many cases are integrated with Lean, as mentioned Pinto and Tenera (2014). This integration proposes improving management processes for projects that must support continuous results and improvement of business processes.

(ii) Six Sigma

The name of Six Sigma was introduced by Motorola at the beginning of the 1980 to designate its program of excellence in quality and this word is associated with a statistical level of capacity of processes that provide a superior quality performance (Maximiano, 2006). Taking into account the results of this model, other companies adapted it such as General Electric (GE), which realized that this focus not only promotes continuous improvement but also contributes to the revenue growth and increased productivity in the enterprises. In a few words, GE mentions that the essence of this method is the improvement of process efficiency and effectiveness (Eckes, 2001).



Other authors complement the definition of Six Sigma, who mentions that it is a tool to reduce variations in organizational processes, using specialists in improving, a structured method and performance metrics. The main characteristics of the Six Sigma system includes focus on processes as fundamental building blocks of construction of the organization, the adaptation of project teams which using an approach to resolve their troubles in a structured way and so gain knowledge and improve the processes (Easton & Rosenzweig, 2012).

Also there are authors who argue that the six-sigma projects can balance the effective application of the methodology provided (for example, tools and techniques, such as control of quality) and the context (for example, leadership and organizational culture) (Parast, 2011).

(iii) Reengineering

Reengineer emerged in the 1980s, but was recognized with the article of Hammer "Reengineering work: *don't automate, obliterate*", published in 1990. The key point is the need to break the rules and assumptions inherited from previous management business models, as a result of the extension of the work and the creation of levels hierarchical that are formed in organizations (Champy & Hammer, 1994, p. 8-9 apud Trad, 2006, p. 21).

According to Hammer apud Trad (2006) reengineering is starting over. This does not mean to reformulate what already exists or to make a little change while leaving the basic structures intact. This mean to leave the procedures in place and review the work that is necessary to create products and services that the company offers to customers.

For other authors, such as Klein and Manganelli (1995) reengineering is the rapid and radical redesign of strategic business processes that add value to enterprises and also is the redesign of the system rules and organizational structure that maintain these processes in order to optimize the workflow and productivity in an organization.

However, it should not be confused with reorganization because reengineering is to do new things (processes, products and services), it is to replace something traditional for something new and better. It also cannot be confused with incremental improvement programs because it does not give emphasis to small, incremental changes. Reengineering seek innovations and multifaceted goals for improvement, i.e. search improve several items of the process such as, quality, cost, flexibility, speed, precision and customer satisfaction, all the things simultaneously (Klein & Manganelli, 1995).

(iv) Critical Success Factors

An effective project team has certain attributes called critical success factors which are (Pinto & Slevin, 1986):

- a) Project Mission: clear definition of project goals, which have been understood by all team members.
- b) Top Management Support: provision of the necessary resources.
- c) Project Schedule/Plan: a detailed specification of the individual action steps required for project implementation.
- d) Client Consultation: team and customer agreement on project requirements. In this point, the project team should begin to list the functional specifications and investigate what the client expects from the final product.
- e) Team Work: recruitment, selection and training of the necessary personnel for the project team.
- f) Technical Support: availability of the required technology and technical steps to accomplish the specific technical action steps.



- g) Client Acceptance. the act of "selling" the final project to its ultimate intended users.
- h) Monitoring and feedback: timely provision of comprehensive control information at each stage in the implementation process.
- i) Communication: to succeed in the design of the project is important to have an exchange of information between all the parties involved.
- j) Troubleshooting: ability to handle unexpected crises and deviations from plan.

3 Research Methodology

The aim of this section is to explain the procedures adopted to develop this study. The approach is quantitative and the main research instrument is the questionnaire applied to professionals from Brazil and Colombia experienced in models of process improvement (Lean, Six Sigma and Reengineering or process redesign) and also in project management. Charts 1 to 5 depict the sample.

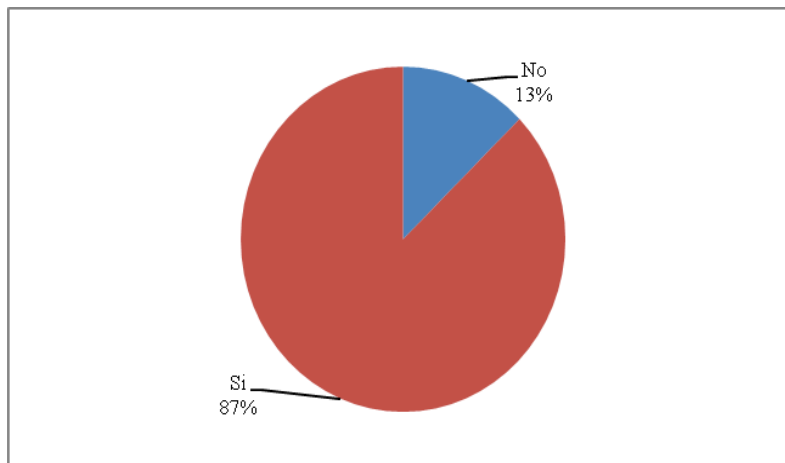


Figure 1: Participation of respondents in Lean – projects, Six Sigma –projects or Reengineering – projects

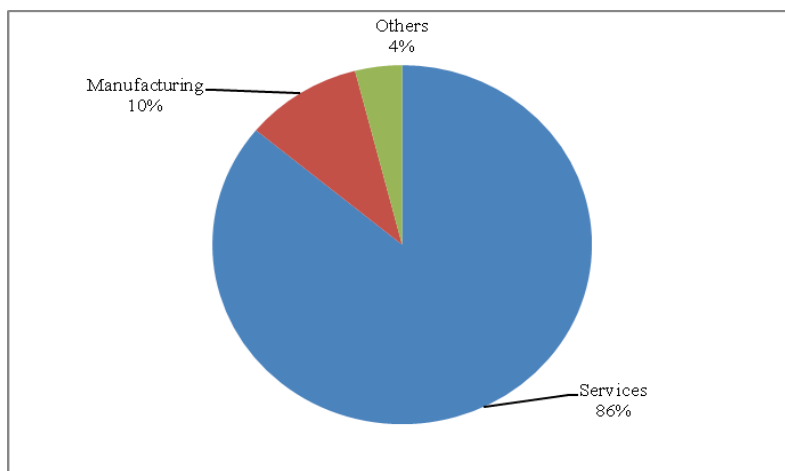


Figure 2: Industries where the respondents work

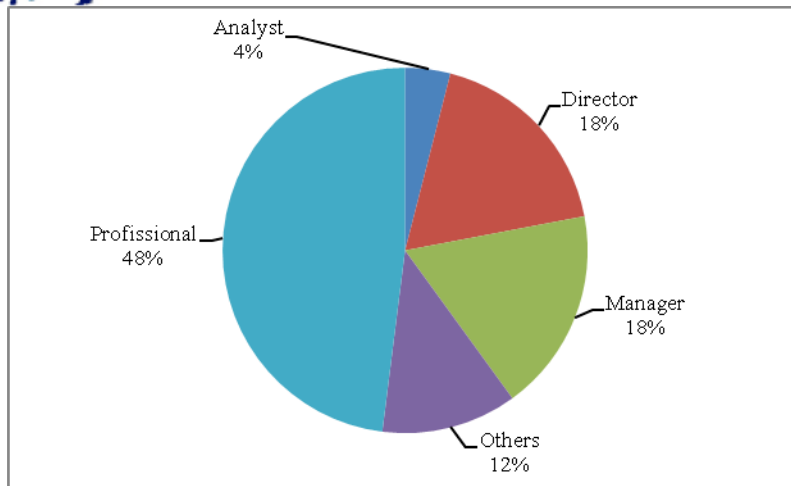


Figure 3: Profile of the respondents

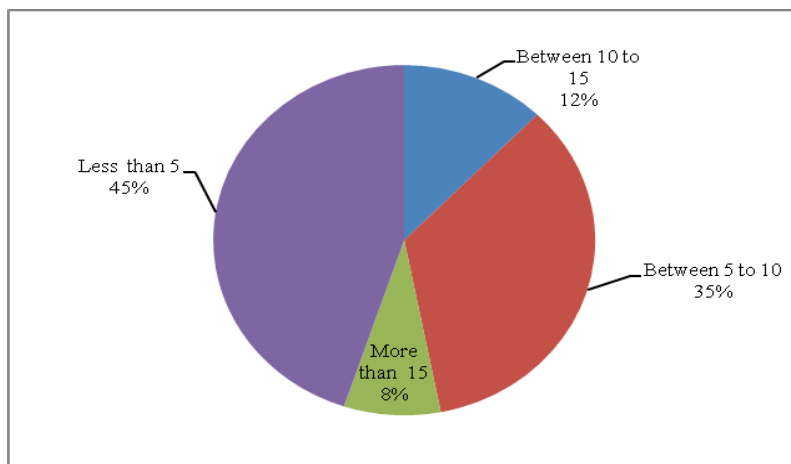


Figure 4: Years of experience of the respondents

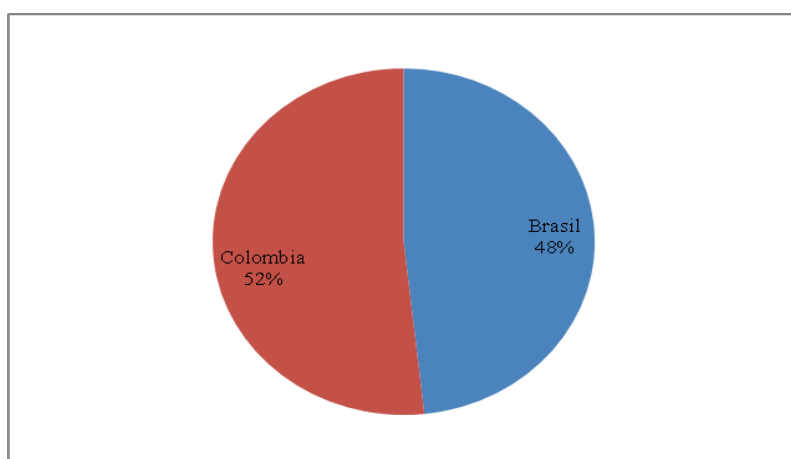


Figure 5: Country of the respondents

- (i) Most of the respondents work in companies of the service sector with a rate of 86% and the lowest percentage of the participants work in others sectors (4%)



such as public sector. The participants who work in service sector, 57% are from Colombia and the 43% are from Brazil. It can be mentioned that only 10% of respondents who work in manufacturing and here the most of professionals are from Brazil (9%) and just 1% are from Colombia.

- (ii) Most of the respondents have a position in the company as a professional (48%) and the less are analyst (4%).
- (iii) Only 12% of respondents have more than 15 years in experience with projects.
- (iv) Most of them are from Colombia, 52% and 48% are from Brazil. The difference between this countries is very small.

Finally, it should be note that respondents could choose more than one type of these projects (Lean, Six Sigma and Reengineering).

4. Analysis of Results

Results show that the first model, that is applied more efficiently, is Reengineering, followed by Lean model and finally the Six Sigma.

Figure 6 shows that Reengineering has the highest percentage between the three models with 60%; then the project of Lean, 29% and finally Six Sigma has the lowest percentage, 11%.

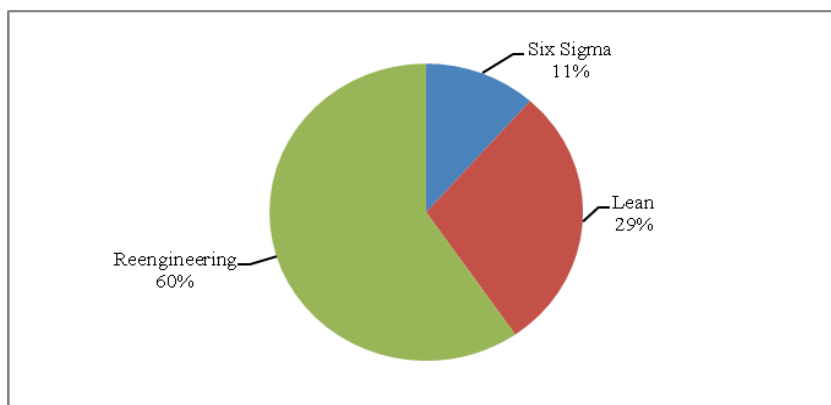


Figure 6: Type of project was applied more efficiently by leaders of project

When we analyzed the secondary objectives of the study, all findings could be identified.

- a) Identify between are these models (Lean, Six Sigma and reengineering) which are more used by project leaders.

With regard the models of process improvement which is more used by Project Leaders, it was found that most of the respondents develop the model of reengineering with 60%, followed by Lean model 29% and only 11% corresponds to Six Sigma. Note that the sum of two last models is less than 50 percent above the total of the answers. The mean is the leaders prefer to apply the reengineering project and besides none of the respondents took into account other models as presented in figure 6.

- b) Identify between the critical factors of success which have contributed to the successful implementation of these models (Lean, Six Sigma and reengineering).



It was found that for Lean the three most important factors are: communication (25%), troubleshooting (19%) and top management support and client consultation (11%). For Reengineering are: communication (26%); troubleshooting (23%); technical support (14%) and finally for Six Sigma, the three more important factors are: technical support (24%); team work (20%) and Project Schedule/Plan and communication (18%). It may be noted that only one factor is common for these models: team communications, which has the following rates; in Lean, 25%; reengineering, 26% and 18% Six Sigma.

Here are the least important factors. Only one is common for the three models: monitoring and feedback. However, the order of importance is different between them. This factor to Six Sigma was the least, with Client Acceptance, Troubleshooting and Monitoring and feedback (0%). Monitoring and feedback to reengineering is the third less relevant with a rate of 4% and this factor to Lean is the second less relevant, with 4%, as shown in figure 7.

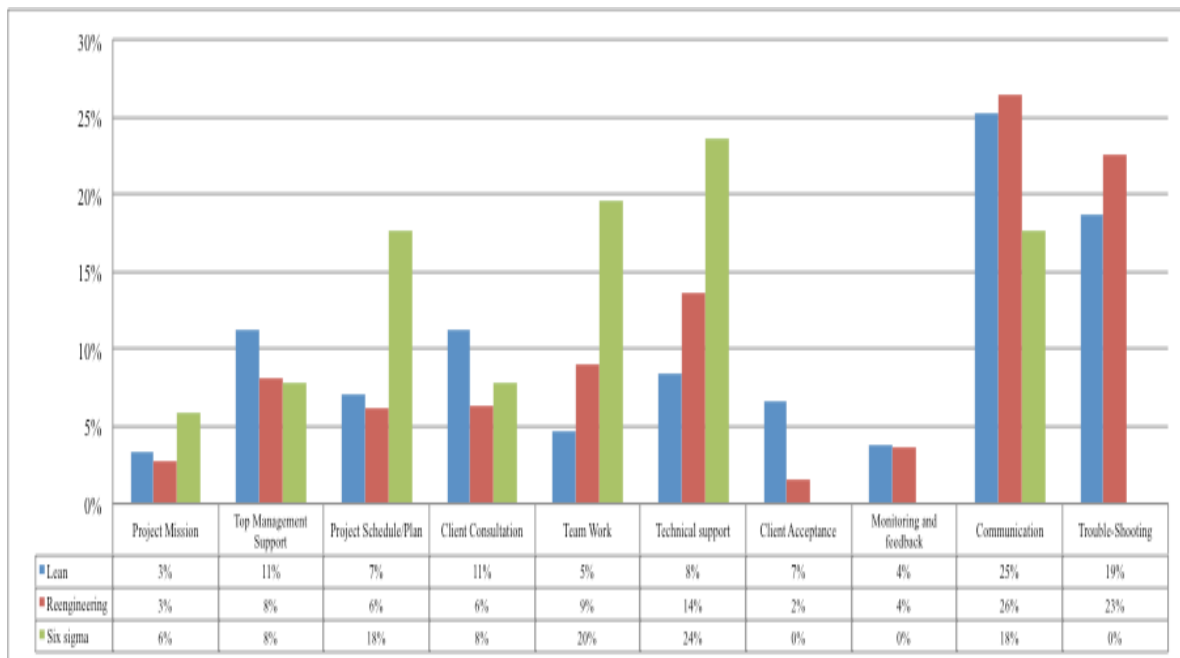


Figure 7: Critical Factors Success vs Models which looking for improve process

- c) Compare the patterns of adoption of lean, six-sigma and reengineering and their critical factors of success between the projects leaders in Brazil and Colombia.

Comparing the adoption of Lean, Six Sigma and Reengineering between professionals of project management in Brazil and Colombia, it is interesting to note that the pattern of behavior in relation to the application of these models is similar only when they apply the reengineering model, which it had the highest percentage rate in both cases; 72% in Brazil and 48% in Colombia.

But when we analyze the result of the application of Lean and Six Sigma, there have been differences in these countries. In Brazil, the second model which is more developed is the Six Sigma with a 16% and finally Lean with 12%. There is a difference with Colombia, where the Lean model has the second position with a rate of 44% and finally the Six Sigma model with a rate of 7%.



Moreover, it is interesting to see that Lean and Six Sigma present a significant difference between the two countries: Brazil and Colombia (Lean with a difference of 32% and Six Sigma, 9%), as show figure 8.

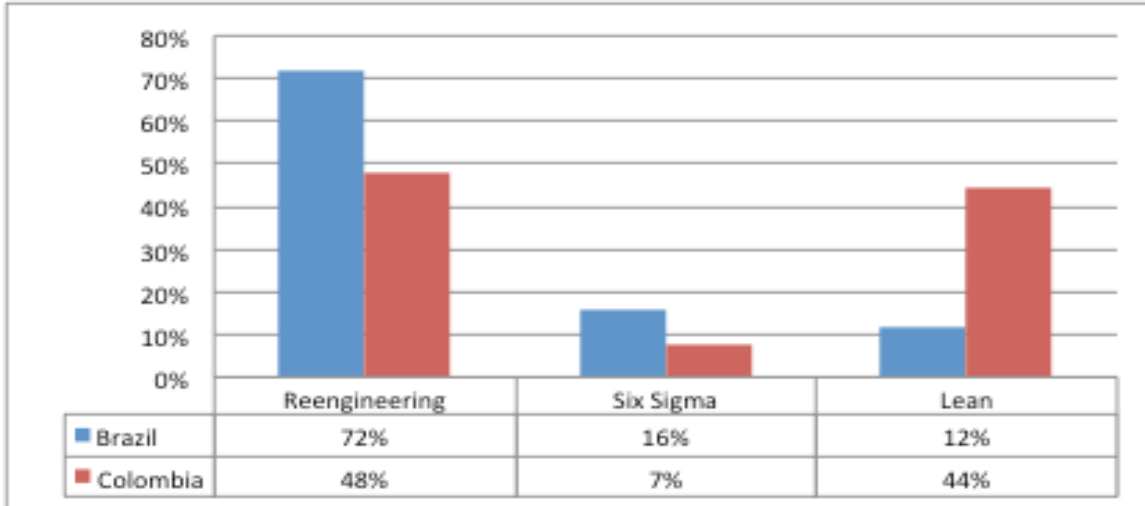


Figure 8: Developing the kind of Project vs Country

Also in this study was analyzed what are the three most important critical factors for success for each countries and found that in Colombia, the three most important factors are: Top Management Support is the most important factor with 24%, followed by Communication with 14% and finally the Mission Project, Project Schedule / Plan and Client Consultation with a rate of 11%.

When we compare these results with Brazil, the study shown that there are two critical factors of success that are considered within the three most important like in Colombia: Mission Project and Top Management Support but the first factor to Brazil is the ,most important with 20% and Top Management Support is the second factor with 16% and the third factor is Technical support with 13%; This one, unlike of Colombia, is not considered as one of the most important factors by the leaders of project to guarantee the successful implementation of these models. This is showing in figure 9.

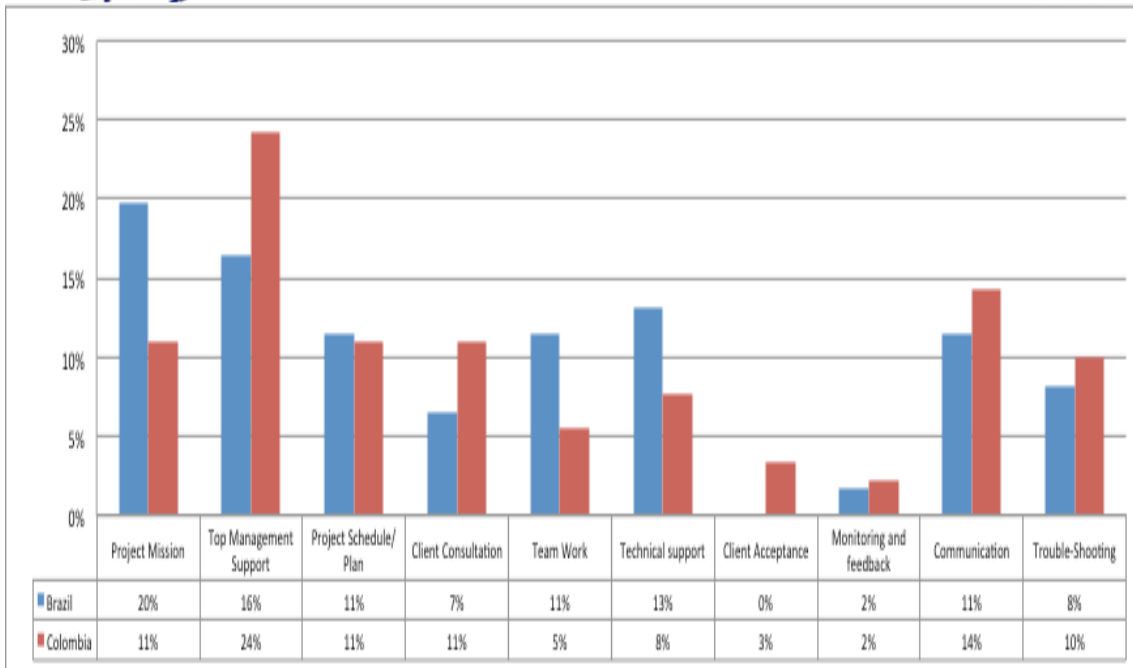


Figure 9: Critical Factors of Success vs Countries

5. Discussion and Conclusions

The aim of this study was to identify among the Lean, Six Sigma and Reengineering models that focus in improving processes, which have been applied more efficiently by project leaders. This study demonstrates that the project implemented more efficiently is Reengineering, followed by Lean, and finally, Six Sigma.

Reviewing the literature, we can see that reengineering projects are unusual because their success depends on certain organizational factors, technological and strategic elements and that the object of reengineering is making big changes that sometimes some elements in organization such as the culture which is too difficult change because people do not like turn around and this can do that the companies do not always start this project (Teng, Fiedler & Grover, 1998). In addition, Reengineering is a high risk project and difficult by resistance to change (Martin, 1997).

On the other hand Lean and Six Sigma, which are more common projects and the companies invested more in their development, over the last decade the interest in applying Lean manufacturing projects has increased dramatically because companies have seen increasingly the importance of adapting this model to be more competitive in the global market (Arrieta et al., 2011). Canacari and Simon (2012) complement this idea when they expose that not only manufacturing companies have applied Lean projects, but also service companies such as the health sector, where many leaders have realized that if they apply Lean projects, they can identify problems easily, prioritize the troubles and also identify opportunities for improvement in their processes.

Construction is another sector where Lean is very important because it can remove all waste of time and other resources that do not add value to the product or deliver customer service (Issa, 2013).



When we analyzed the application of the six-sigma projects, there are authors who emphasize in that this project is applicable in industry and services sector; however, a little less than the Lean project. As mentioned Cariño (2002) the six-sigma projects involve considerable effort because they must produce measurable benefits or profits, recalling that its premise is focused on the benefits and the reduction of more than 50% in processing costs, greater execution time, reduction of wasted material, understand of customer needs, increase customer satisfaction and greater reliability in the products and services that are offered by the companies. Moreover, these projects are usually developed in a short time. , Lean projects need deliberate learning and their success depend a lot of the formation of the team (Parast, 2011).

When we see what are the most important critical factors of success for the application successful of these models, this study show that one of the three most important factors is communication, for all models. For the reengineering project, communication is very important to guarantee that everybody has clear the goal and the objective of the project. In this kind of project is important that communication flows at all levels, starting with the strategic direction to lower levels (Teng, Fiedler & Grover, 1998). So that there a good communication in the reengineering project, their team should focus in a few processes, not at all because if they should focus in a lot of process, there may be higher probability that communication problems arise and that they cannot control it.

In accordance with the literature another important factor for the reengineering project to see the operation from the point of view of the customer and also the results of the process (Martin, 1997), this mean that is important for these project pay attention to the voice of the customer (client consultation), but it is interesting to see that in our interviews that this critical factor of success is not considered among the three most important critical factors.

For Lean projects, one of the most important critical factors of success is to consider the opinion of customers (Tenera & Pinto, 2014). Here, it should be noted that in many sectors such as industrial and health services firm, managers and analysts fail frequently in communicating with customers and in understandings their needs (Canacari & Simon, 2012). This important critical factor agrees with this research where one of the most important critical factor for Lean is the client consultation.

Another critical factor important for Lean is the Troubleshooting (second place), which is also mentioned by authors Canacari and Simon (2012) who exhibit that for Lean is important have a problem solving process because this let that the team can be able to prioritize troubles, manager the actions to give a solution for their troubles, monitor the progress of the actions and transmit the learning after develop of the Project.

On the other hand, is interesting to see that in Lean projects one of the critical factors evaluated as less important is the mission of project, at the difference of the literature which mentioned this critical factor like one of the most important because if the goals and objectives of project are not clear, the team of the project do not understand the project and they do not accepted it (Canacari & Simon, 2012).

Finally, when we analyzed six-sigma project, one of the three most important critical factors is teamwork. This coincides with the evaluation of our study, although this has been assessed as the second most important factor. The project team brings knowledge of different areas and individual members learn with each other and the knowledge is widely shared between the members through several techniques such as DMAIC (Arumugam, Antony & Kumar, 2013). Sharing learning becomes possible by



good communication, and this is possible if the purpose which efforts are oriented is clear. In brief our research is complemented with the literature when shows that teamwork such as one of the most important critical factor for this projects.

The research project described here, although limited to a particular situation in Colombia and Brazil, achieved all of its objectives satisfactorily, as was evidenced in the previous section. Thus, the research allowed evidencing among the models Lean, six-sigma and reengineering which is more applied by the professionals of projects and which is more efficiently applied. Also we can check among the critical factors of success which are more important and less relevant to each of these models and which was common to the three kinds of projects.

This research also allowed us to compare the application of these models between two countries (Colombia and Brazil), which although they are emerging countries, their economic development is a little different, since that the Brazilian economy is more developed than the Colombian economy, in spite of Brazil's economic crisis. From one country to another, we found similarities and differences in the application of these projects. The similarity is that the project more applied is reengineering and the differences presented for implementation of six-sigma and Lean projects.

Additionally this study let us to analyze the most three important critical factors for Brazil and Colombia and it is interesting to see how the culture of each country can influence in their organizational culture and in assessing the critical factors of success for the implementation of these project.

One of the most important factors for both countries is the supported by top management, and this is because the two countries are characterized for to have an hierarchical organizational culture (Grupo de Investigación Gestión Humana y Cultura Organizational, 2014) which make that all decisions are taken by senior management and the power is concentrated in the top managers. For these reason is very important that the projects have their support to ensure their success. Besides they are who approve the performance of the project and provide the necessary resources. This research show that the respondents from Brazil and Colombia agree with the theory that the support of senior management is key to the success of a project.

The other factor that was evaluated as one of the most important factors by the two countries as well as in the literature is the mission of the project, because this is the initial step of the implementation process and it responsible to clarify the goals of the project, thus ensuring that the team of the project can know which are they roll and their assignment in the project (Slevin & Pinto, 1986).

As regards the third factor evaluated by each country is interesting to see that there was no coincidence between Brazil and Colombia, while Brazil the third most important factors is the technical support, on the other hand for Colombia is the communication. This difference may be due to the organizational culture for each country, for example, for Colombia according to study by Morales (2010) one of the most important aspects and that has a major impact in the organizational culture is the leadership and one of the characteristics to be a good leader is the ability to communicate ideas to your team. While for Brazil this factor is evaluated as the fourth important factor.

However, like one of the objectives of the article is to compare the behavior of the application between these two countries, it would be interesting to analyze in future studies the reason for Colombia, the communication is one of the three most



important factors of success of these projects and what is the reason for Brazil mark the technical support as one of the three most important critical factors.

It should be noted that this study does not have as objective analyze the reasons why the project leaders apply more of these project than others, neither study reasons why one or more critical factors were more important than others for the development of these three models, generating differences between them and also does not aimed to analyze the reason for the differences when comparing the use of these projects among professionals in Brazil and Colombia.

Taking into account the above it would be interesting to future studies the reason by which the Lean is more applied by project leaders in Colombia in contradiction with Brazil where Six Sigma is more applied for project leaders. In addition, other indications for future studies is to validate the reasons for which the leaders of projects evaluated as first model reengineering, as the most project that applied more efficiently.

This article generates two academic contributions for the academic field. One of them is show the comparison of the application by the leaders of projects between three models that look for the efficiency of processes, mainly between two countries that has a different economic development. Here let to notice a pattern of organizational behavior into two developing countries.

Another contributions is to show to leaders of projects what are the three most important critical factors of success to successfully implement these projects.

In the field of practice, this study allowed to observe a pattern of behavior in two developing countries when they develop these kind of projects, let the managers identify other practice that help them apply this projects successfully taking into account the context of each country.

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