Designing a Proposal for ADEICS Operations Chain Using Lean Six Sigma

Alberto Julian, Fabiana Retamozo, Kendra Bernal, Jean Pierre Santillan, Carmen Alvarez and Alejandro Gallegos
Department of Industrial Engineering and Engineering Management
University of Engineering and Technology
Barranco, Lima, Perú
alberto.julian@utec.edu.pe, fabiana.retamozo@utec.edu.pe, kendra.bernal@utec.edu.pe, jean.santillan@utec.edu.pe, carmen.alvarez@utec.edu.pe, agallegos@utec.edu.pe

Abstract

Continuous Improvement systems are being promoted with more intensity in construction sector companies, but not with the expected result due to the high variability and breach of their operations. This project seeks to structure the chain of operations, generating key points of Quality Management using the Lean Six Sigma methodology, to reduce the variability and standardize the processes of the ADEICS company located in the San Miguel district, Lima, Peru. The DMAIC methodology was used for the development of this project. During the define phase, the process map was prepared as the strategic, operational and support processes were documented, having 16 processes at the end. Likewise, a focus group was held to define this service's essential critical quality factors (CTQs). In the measuring phase, it was possible to establish the risk level of the processes (NPR) using the following tools: The process characterization matrix (SIPOC), The Analysis of Failure Modes and Effects (AMEF) and the relationships between areas with the Diagram Lines Notation (DLN). Finally, in the analysis phase, the processes to be improved were prioritized using as a base the inputs of the CTQ's table and the process map through the quality function deployment matrix (QFD), pending the implementation in the improvement phase of the three selected processes.

Keywords
Lean Six Sigma, Process, Quality Management, Construction Sector and Quality Function Deployment.

1. Introduction
Continuous improvement analysis focused on results in the construction-related sectors is very complex to maintain the repeatability of results due to the continuous manual procedures and the high variability they may entail (Czajkowska and Kadłubek 2015). Thus, the study conducted through benchmarking reinforces that companies in this sector that increase their competitiveness, quality, and productivity have developed a continuous improvement study based on process improvement and the PMBOK. By seeking to structure the interrelation between them, raise awareness among employees of the structure as mentioned earlier with the importance of defining it and measuring the efficiency of their processes (Hola 2015). Similarly, the benchmarking study aims to understand the mechanisms to improve and generate productivity metrics through a research process of the significant environmental factors, good practices that may impact the sector, and the strategic objectives that encourage their implementation (Zhang et al. 2017).

In the civil sector, the dissemination of the ISO 9001-2015 Integrated Management System has been promoted through various entities, from a field of exploration of intervention by various stakeholders, factors of excellence, and quality criteria for creating value for customers that drive in the same direction as the company's strategic objectives to generate Multiple Management Systems [4].

Currently, ADEICS is an association that promotes projects involving expansion activities, consultancy, Civil Engineering, environmental monitoring, research, circular economy activities, and others, aiming to generate collaborative work among various entities. In recent periods, operations have focused on the project responsible for recovering land spaces from the sea to generate multi-purpose spaces, where various state entities are involved, as it impacts environmental, social, and economic aspects. Therefore, along with the information mentioned above, the importance of creating a portfolio that contributes to its Quality Policy within the framework of compliance, regulatory, and standard requirements arises so that proposals for improvement can be provided later.

1.1. Objectives

Thus, the project poses the following question:

Which processes are most significant regarding critical quality factors (CTQs), aligned with strategic and mission processes, measuring the impact it generates to focus on the continuous improvement process of an integrated management system?

Likewise, the main objective of the project is to structure the chain of operations, generating key points of Quality Management using the Lean Six Sigma methodology. The specific objectives relate to the following points:

Objective 1: Define the processes involved in the operational, strategic, and support axes that are maintained during project execution. Also, define the stakeholders.

Objective 2: Map the current level of the defined processes.

Objective 3: Design the AS IS diagram of the processes.

Objective 4: Analyze the critical quality parameters (CTQ) of the product and/or service and perform the QFD Matrix.

Objective 5: Develop improvement proposals with the selected processes.

Consequently, the project will focus on documenting and defining administrative support processes, operation processes, and strategic planning processes to generate a portfolio that will complement its Quality Policy. Likewise, the most significant processes to improve will be defined through a characterization matrix of criteria to propose improvement proposals.

2. Literature Review

Sekar et al. (2018) surveyed 360 companies to determine the most relevant factors in the construction industry's performance. The study found that the significant factors are dynamic depending on the type of work and the type of project evaluation, which can lead to budget overruns and an average delay in the delivery of works of 20%. The statistical analysis focused on both the correlation indicators and the level of significance generated in the impact of performance by the factors of the day-to-day processes, which will indicate their performance; factors related to customer/supplier requirements; operational factors; factors related to contract management; organizational factors and others. Definitely, decision-makers in this sector need to understand the difference in factors that influence their performance to optimize project ideation and execution. Mariana et al. (2020) propose implementing a DMAIC manual in the construction sector due to the high variability in its processes and the level of waste it can generate. The author emphasizes that in-depth studies have yet to be carried out on the impact of continuous improvement and the resistance to its implementation in the construction sector; however, she notes the importance of knowing the client and their requirements as a basis for proposing improvements in their process.

Likewise, the authors Remon et al. (2013) and Thuy et al. (2016) reviewed the literature on Lean Thinking and Industry 4.0, respectively, to validate the feasibility of their implementation in the construction sector. These research papers claim that these two approaches can generate considerable impact in the industry but leave pending further exploration of other factors such as implementation resilience, reproducibility and repeatability in this sector. Lately, a study has been developed to look for the relationship between Lean thinking and BIM tools to structure and use a methodology that relates Lean BIM in the construction sector. The research work is in a validation process. However, it has managed to perform the analysis in 5 construction projects, locating three focus groups: communication, visualization and production, using the ANP tool in conjunction with eight civil engineers to determine the factors of the relevance of the relationship in this methodology, defining an implementation path that involves precision and standardization that facilitates the agents that make decisions in the construction sector to define their priorities of focus to evaluate their commercial and operational strategies (Hazan et al. 2021).

3. Methods

3.1. Research Methodology

3.1.1. Characterization of the Research

The research carried out is applied, because it represents solving a problem of the Association of Ecological Studies and Sustainable Civil Research (ADEICS). The approach presented is quantitative, as interviews were conducted to build information statistically, and qualitative, because stakeholders' points of view based on their emotions and experiences were sought to prioritize ADEICS processes.

The design presented is non-experimental with a descriptive and exploratory scope, since to identify the main factors that intervene in the prioritization of processes by the ADEICS team, it was necessary to understand how the processes and stakeholder groups were developing.

3.1.2. Research Design

The Lean Six Sigma methodology was employed to fulfill each specific objective outlined. This methodology consists of the following DMAIC phases: Define, Measure, Analyze, Improve, and Control, according to their acronym. Socconini et al. (2020) indicate that the define phase consists of identifying the problem and factors that generate value for the company and customers with the help of the process map and SIPOC. On the other hand, Jones, E. (2014) mentions that the design phase consists of establishing the metrics for the methodology, determining the ability to quantify the data and the success criteria accurately with the help of hypothesis testing and flow charts, among others. Finally, Pande et al. (2007) define three stages in the analysis phase: exploration, hypothesis generation about causes, and verification or elimination of causes, which aim to identify the causes and influencing factors of the problem with the help of the FMEA tool.

The present study focused on the development of the first three phases of the Lean Six Sigma methodology, along with their respective tools. Table 1 below shows a more detailed explanation of the mentioned methodology.

Table 1. Research methodology

<table>
<tr><th>Phase</th><th>Objective</th><th>Tool</th></tr>
<tr><td>Define</td><td>Define the processes involved in the operational, strategic, and support axes that are maintained during the execution of the projects. Also, define the stakeholders.</td><td>Process Map
Focus Group
CTQ Table</td></tr>
<tr><td rowspan="2">Measure</td><td>Map the current level of the defined processes</td><td rowspan="2">SIPOC Matrix
DLN</td></tr>
<tr><td>Design the AS IS diagram of the processes.</td></tr>
<tr><td rowspan="2">Analyze</td><td>Analyze the critical quality parameters (CTQ) of the product and/or service and perform the QFD Matrix.</td><td rowspan="2">Statistical Analysis of the Focus Group
QFD Matrix
FMEA
Ishikawa Diagram</td></tr>
<tr><td>Develop improvement proposals with the selected processes.</td></tr>
</table>

3.1.3. Data Collection

The documentation provided by ADEICS, the meetings held to interview the team, and the Focus Group are part of the primary sources of this research.

4. Results and Discussion

4.1. Define

In this phase, the support, operational, and strategic activities were defined through interviews with the responsible persons of each process. A total of 16 processes were identified, as shown in Figure 1.

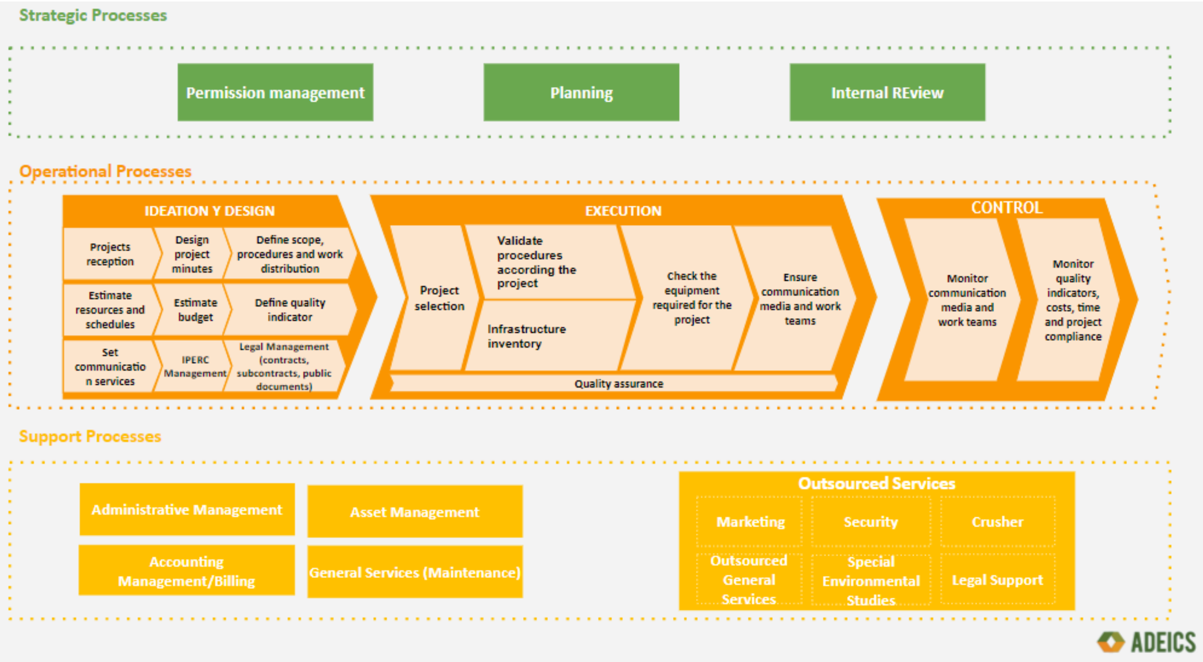

Figure 1. ADEICS Process Map.

Similarly, through the Focus Group, the most valued CTQs for the service were obtained, of which 5 are the most valued by the stakeholders in the context of the ADEICS association as shown in Table 2.

Table 2. List of Most Valued CTQs

CTQ
Safety
Order and cleanliness
Communication
Public project information
Environmental impact assessment

4.2. Measure

Subsequently, the processes were characterized through the SIPOC tool to define the input flow, output, process, requirements, responsible party, and whether the activity adds value to the process or not. A total of 10 SIPOCs were made for the processes that would have a greater interrelation with the company, as shown in Figure 2.

S	I		P			O		C
Supplier	Input	Request	Process	Value	Description	Output	Request	Customer
Internal or External, provides inputs to the process	Inputs (material, information, equipment, manpower, data, etc.) C - Controlled (there is a control mechanism), NC - uncontrolled (it is impossible to control it), and E - experimental (we do not know the optimal level)	-Quality -Chance -Characteristics -Service agreement in force	Large blocks explaining the entire process (5 - 6 boxes total max.) Start	Does it generate value? Yes or no	- Who executes the process? - What is done in the process? - Normative documents used in the execution of the process.	Process output	-Quality -Chance -Characteristics -Service agreement in force	Internal or External, receives output from the process
General Directorate ADEICS (C)	List of indicators for the project monitoring and follow-up	Adequate indicators for project operation	Directorate General 1: Ensure quality	Yes	The transversal quality process assigns those responsible and contacts the third parties involved.	List of entities (third parties) and monitoring plans for indicators	Indicators must be correctly assigned to those responsible for measuring them.	Environmental Resident
Environmental Resident (C)	List with prioritized projects	The project is within the strategic objectives	Environmental Resident 2: Select the Project to Execute	Yes	The project status is put into the process, allocating resources and contacting the entities involved.	Assignment of activities	The allocation of activities should follow the project's Action Plan.	Chief of Operations
Chief of Operations (C)	Project procedures list	List of procedures according to the revised activity assignment	Chief of operations 3: Validate procedures and Infrastructure Inventory according to the project.	No	The list of procedures is contrasted with the assigned activities and the infrastructure inventory required by the project.	Checklist to validate project implementation	The checklist should cover the total number of procedures required for the project.	Partners
Chief of Operations (C)	List of procedures requiring outsourcing	Correct mapping of procedures requiring outsourcing	Chief of operations 4: Verify and procure the equipment required for the project.	No	The entities that could perform the outsourced activity and the procurement of the required equipment are listed.	Checklist to validate of equipment required and to be contacted for the project	List of companies to outsource that are legally constituted	Partners
Chief of Operations (C)	List of procedures involving communication & follow-up	The means of communication & monitoring must be appropriate to the project's impact.	Chief of operations 5: Securing media and communication equipment	Yes	Effective reporting process of projects to the stakeholders involved, as well as follow-up operations with the team.	Checklist to validate media teams and monitoring of teams	The media & monitoring have to fulfill their informative purpose and keep the partners in the operation.	Chief of Operations
Chief of Operations (C)	List of monitoring indicators by third parties and own indicators	The indicators must have been within the required environmental and operational standards.	Directorate General 6: Ensure quality	Yes	Indicators are consolidated in a portfolio as support, record, and evidence of the work according to the required standards.	Indicator Monitoring Summary	The consolidated indicator monitoring must be validated and signed by the relevant entities.	General Directorate ADEICS (C)
			Stop	66,67%				

Lean Indicator (Yes/Total columns)

Figure 2. SIPOC Matrix of the Execution Process.

Similarly, the interrelationships between areas, information flows, systems, and others were defined through the DLN tool for 3 processes, as reflected in Figure 3.

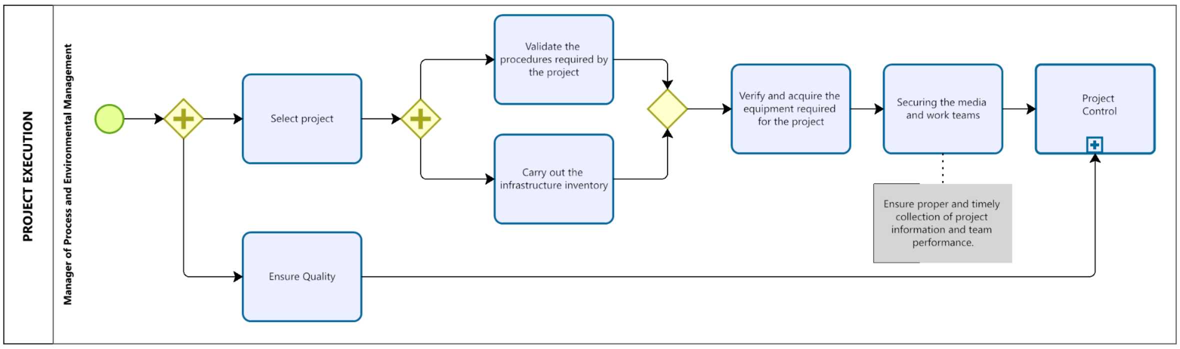

Figure 3. DLN of the Execution Process.

Thus, these two tools were used to define the failures, effects, controls in the activities, and quantify the current NPR of the 3 evaluated processes. For Ideation and Design, 8 activities with a high NPR were found; for Permissions Management, 5; and for Execution, 4 as shown in Table 3

Table 3. NPR of the Execution Process.

PROCESS	ACTIVITY	POTENTIAL FAILURE	CURRENT PROCESS CONTROL	DETECTION	NPR SxOxD
Execution	Ensure quality	That the appropriate indicators are not chosen in operational excellence, quality of operation, environmental monitoring, etc	Review through a team and/or reminder by email	4	256
	Conduct the inventory of necessary infrastructure	Inadequate inspection of available infrastructure.	Review of the responsible area	5	200
	Ensure communication media and work equipment	Failure in communication media or equipment	Review of the responsible area	7	210
	Project Control	Inefficient control	Review by the team responsible for the project	5	175

4.3. Analyze

In this section, the level of satisfaction was selected as the performance indicator variable of the implementation. For this purpose, the data collected from the Costanera de San Miguel community regarding satisfaction and importance of the CTQs mentioned in Table 2 were analyzed through the Focus Group. The statistical normality test helps us to validate whether the distribution of the data collected is normal and whether it is more appropriate to use parametric or non-parametric statistical tests (Kishore and Surendra 2014). For this purpose, the normality test was performed and the following results were obtained from Figure 4.

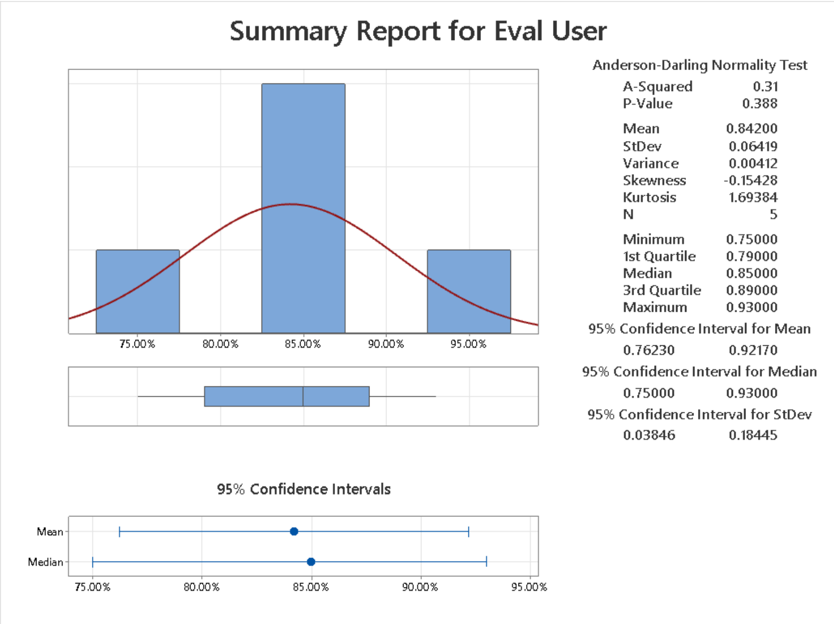

Figure 4. Statistical Test Normality.

The statistical test for normality was carried out, obtaining a P-value greater than 0.05. Therefore, the levels of satisfaction show a normal distribution and the same was done for the CTQ importance level data.

In this part, we will take as a benchmarking reference value the satisfaction evaluation of Graña y Montero's clients in the construction sector, which is 92.5% (Graña y Montero 2019). This reference value was used as a comparison to the satisfaction level of the company using one sample - T statistical test was carried out, obtaining a P-value of less than 0.05, indicating a problem.

Test

Null hypothesis H_0: $\mu = 0.925$
Alternative hypothesis H_1: $\mu > 0.925$

T-Value	P-Value
-2.89	0.978

Figure 5. P-Value of Statistical Test of Normality of Satisfaction Level

Likewise, the statistical test is related to the boxplot visualizing that the data collected on the level of satisfaction is below 90%, generating a gap as an opportunity for improvement.

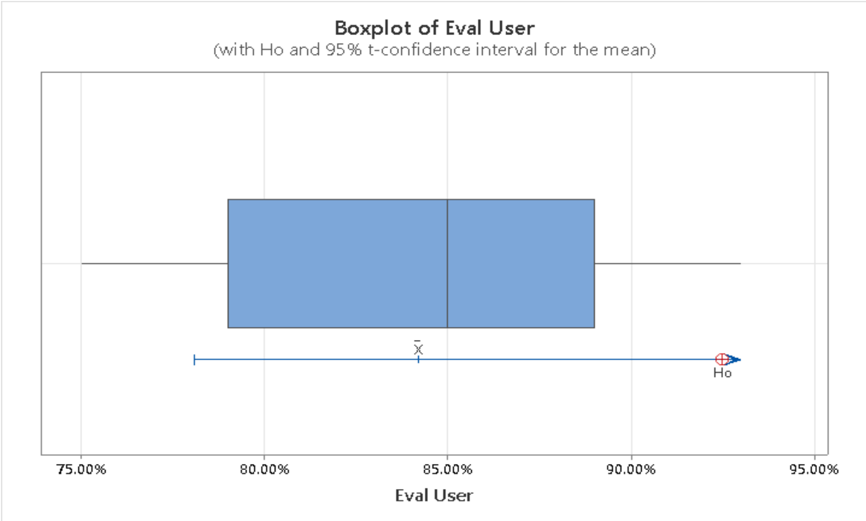

Figure 6. Boxplot of the Satisfaction Level Normality Statistical Test

The Capacity Analysis aims to measure the entity's capacity to fulfill the evaluated process or indicator. To do this, it uses the calculation of the mean, standard deviation, limits, and other values to evaluate the performance of the same, providing features of the current state with the variables of Cp, Cpk, CPL, CPU, and other additional variables (Kishore and Surendra 2014).

Thus, the capability test for normal distributions of the level of satisfaction was performed, finding a Cp of 0.17 is less than 1, which would indicate that the company cannot meet the necessary level of satisfaction by the stakeholders. This is also reflected in the negative equality of the Cpk and CPL values, indicating that the data has a lower trend than the required 92.5%.

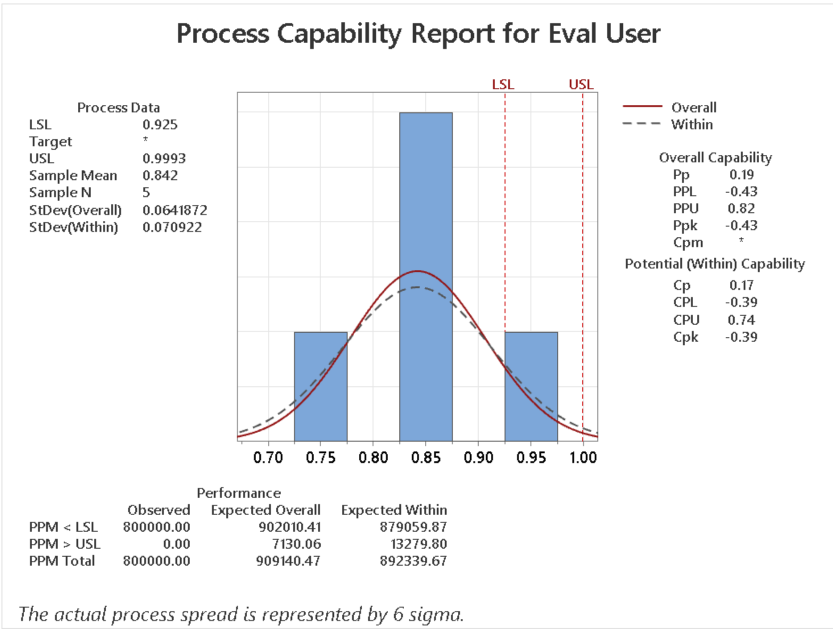

Figure 7. Satisfaction Level Capability Analysis.

Continuous improvement focused on processes is related to the Six Sigma methodology by giving importance to the quality of the service or process provided, for which it emphasizes market competitiveness, customer satisfaction, and quantification of customer characteristics and relates it to tools such as the Quality Function Deployment (QFD) Matrix, AMEF, Ishikawa and Statistical Data Analysis to generate improvements to the performance of the process evaluated with the significant criteria found in the analysis (Zhan and Ding 2016).

Subsequently, the current gap found in the service CTQs was calculated to identify the factor that will verify improvements in the process. In this case, an opportunity for improvement was found in the communication CTQ, resulting in a gap of 5.3%, as reflected in Table 4.

Table 4. Percentage of Gap in Most Valued CTQs.

No	Client's need	Weighted Weight	Weighted evaluation	Weighted absolute gap	Relative absolute gap
AA	Order and Cleaning	21,3%	18,1%	3,2%	19,5%
2	Public information on the project	21,3%	17,6%	3,7%	22,7%
3	Environmental Impact Assessment	19,1%	16,3%	2,9%	17,5%
4	Comunication	21,3%	16,0%	5,3%	32,5%
5	Security	17,0%	15,7%	1,3%	7,8%
		100,0%	83,6%	16,4%	100,0%

Subsequently, weighting was performed in coordination with the association's management team and employees, obtaining three processes with the highest weighted score: Execution (7.7), Ideation and Design (3.5), and Permit Management (2.4), as shown in Table 5.

Table 5. Processes with Highest Weight in QFD Matrix.

Asociación Latinoamericana de QFD

Relationship matrix			2 7,2% Planification	3 7,5% Internal Review	4 18,7% Ideation and Design	5 41,7% Execution	6 12,1% Control
Greater need	**No**	**Client's need**					
7,00	AA	Order and Cleaning	0	3	1	9	3
10,00	2	Public information on the project	0	0	9	3	1
8,00	3	Environmental Impact Assessment	1	3	1	9	3
9,00	4	Comunication	3	0	3	9	3
	5	Security	3	1	3	9	1
			1,3 Planification	1,4 Internal Review	3,5 Ideation and Design	7,7 Execution	2,2 Control

After having selected the processes with the highest weights, we performed the root cause analysis using the Ishikawa diagram to determine the root causes of the activity with the highest NPR, which in this case, shows the highest NPR of the FMEA of the execution process "cannot continue with the project."

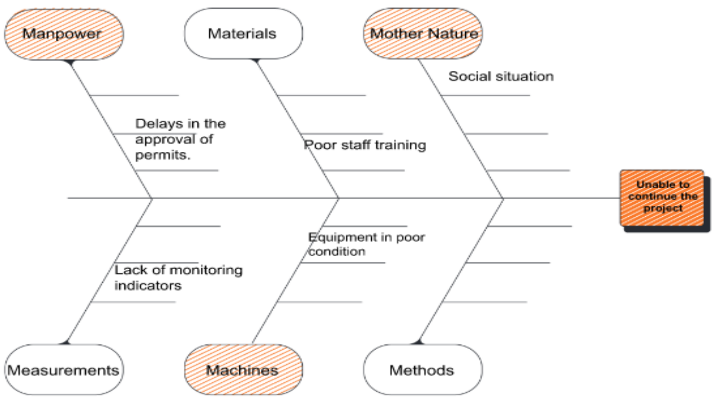

Figure 8. Ishikawa Diagram

Finally, with the prioritized processes, we proceeded to define the recommended activities to reduce the NPR of the activities with the highest level of risk, as can be seen in Table 6, generating a list of nine improvement actions.

Table 6. Proposal of Actions to Reduce the NPR of the Execution Process.

PROCESS	ACTIVITY	POTENTIAL FAILURE	DETECTION	NPR SxOxD	ACCIONES RECOMENDADAS	Severity	Occurence	Detection	NPR SxOxD
Execution	Ensure quality	That the appropriate indicators are not chosen in operational excellence, quality of operation, environmental monitoring, etc	4	256	Training in PMI Project Management and the definition of Project Control Indicators	8	5	4	160
	Conduct the inventory of necessary infrastructure	Inadequate inspection of available infrastructure.	5	200	Develop a database of equipment/components/tools. Develop a check list for recording entry/exit according to the project requirements	8	5	3	120
	Ensure communication media and work equipment	Failure in communication media or equipment	7	210	Training in PMI Project Management and the definition of Project Control Indicators	6	5	4	120
	Project Control	Inefficient control	5	175	Perform a benchmarking analysis of indicators according to the scope of the project	7	5	4	140

The actions should be scheduled and prioritized by the management team in order to improve the selected processes, as listed in Table 7. This will impact the selected CTQs.

Table 7. Recommended Actions Table.

PROCESS	RECOMMENDED ACTIONS
Permits Management	Elaboration of an indicator of % of responses received
Permits Management	Permit checklist (BD that is according to certain categories of the project), which permits would be required
Permits Management	Procedure of its work to document and streamline the process
Permits Management	The procedure of its work to document and streamline the process
Ideation and Design	Elaboration of an Indicator of % of Entity Responses
Ideation and Design	Draw up a Checklist of the communiqué and its content
Ideation and Design	Training at IPER and Supervision of the Head in Charge
Ideation and Design	Training in PMI Project Management. Elaboration of indicators of % compliance with time and cost.
Execution	Training in PMI Project Management. Development of Project Control Indicators

4.4. Results

Thus, the two-sample-T statistical test was performed to validate the significant improvement in the NPR, defining as method variables to μ_1 as population mean at the current NPR and the μ_2 as the population mean of the improved NPR, as we can see in Figure 9.

Method

μ_1: population mean of NPR NOW
μ_2: population mean of NPR IMPROVEMENT
Difference: $\mu_1 - \mu_2$

Equal variances are not assumed for this analysis.

Figure 9. Method for the Two Sample-T Statistical Test

Then, Figure 10 defined the hypotheses to be validated in the Two Sample-T statistical test to determine if there is a significant improvement in the results, obtaining a P-value of less than 0.05, indicating that there is not enough statistical evidence to accept the null hypothesis, so the alternative hypothesis is accepted. These results indicate that there is a significant difference between the mean difference between the current NPR and the improved NPR.

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 > 0$

T-Value	DF	P-Value
3.87	4	0.009

Figure 10. Hypotheses for Two Sample-T Statistical Test

This result can also be verified and reflected in the BoxPlot in Figure 11, noting the significant difference between the means of the two samples.

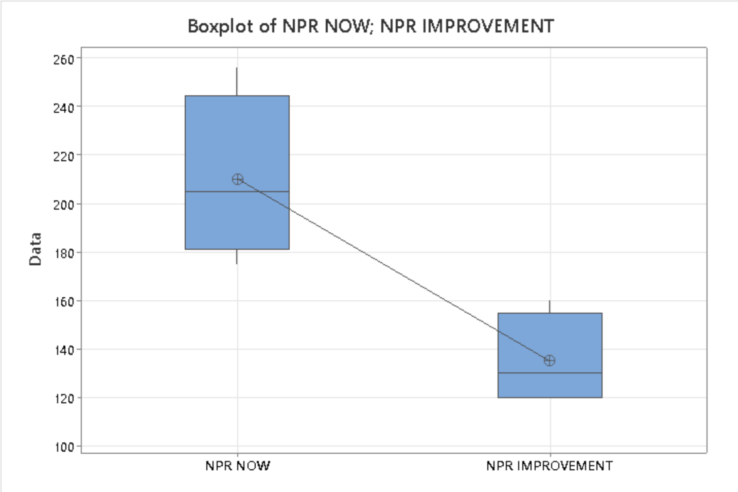

Figure 11. BoxPlot of Means of the Two Sample-T Statistical Test

Finally, we will be able to verify this improvement in increasing customer satisfaction and reducing the Communication CTQ gap in a forthcoming survey of the company's stakeholders.

5. Conclusions

The general objective was achieved by developing the operations chain of ADEICS company through the Process Map, documentation, and improvement proposals, generating key points in Quality Management.

The three types of processes were identified: operational, strategic, and support, through interviews, the PMBOK model, adapted to a project management company. Likewise, the stakeholders of ADEICS association were identified.

The As-Is diagram of the identified processes was mapped and designed, using the SIPOC matrix, the DLN, and the FMEA.

The processes to be improved were identified using the QFD Matrix, selecting the three processes to be improved: Execution, Ideation and Design, and Permission Management.

Finally, improvement actions were proposed for the three selected processes, remaining their scheduling and prioritization with management. Likewise, we recommended including the Quality Management and Internal Review process to the current Process Map of the organization.

We recommend implementing these improvement actions in the short term to measure the positive impact in the control phase of the satisfaction level expressed through the CTQs, achieving that all gaps are less than 5%.

Lastly, we recommend that all companies and associations in the civil construction sector adopt these best practices of quality management in their organizations.

References

Czajkowska and M. Kadłubek, Management of Factors Affecting Quality of Processes In Construction Enterprises, *Polish Journal of Management Studies*, vol. 11, no. 1, pp. 28-38, 2015.

Hoła, B., Identification and evaluation of processes in a construction enterprise, *Archives of Civil and Mechanical Engineering*, vol. 15, no. 2, pp.419–426, 2015. https://doi.org/10.1016/j.acme.2014.11.001

Universidad de Lima, Calidad de Gestión en la Construcción (ISO 9001), agosto 4, 2020.

Zhang, D., Nasir, H., & Haas, C. T., Development of an internal benchmarking and metrics model for industrial construction enterprises for productivity improvement, *Canadian journal of civil engineering*, vol. 44, no. 7, pp. 518–529, 2017. https://doi.org/10.1139/cjce-2016-0274

Sekar, G., Viswanathan, K., & Sambasivan, M., Effects of Project-Related and Organizational-Related Factors on Five Dimensions of Project Performance: A Study Across the Construction Sectors in Malaysia, *Engineering Management Journal*, vol. 30, no. 4, pp. 247–261, 2018. https://doi-org.bibliotecautec.remotexs.co/10.1080/10429247.2018.1485000

Bravo, M., Euphrosino, C. A., & Fontanini, P. S. P., DMAIC manual for an Integrated Management System: application in a construction company. In Proc. 28th Annual, 2020.

Aziz, R. F., & Hafez, S. M., Applying lean thinking in construction and performance improvement, *Alexandria engineering journal*, vol. 52, no. 4, pp. 679-695, 2013.

Oesterreich, T. D., & Teuteberg, F., Understanding the implications of digitisation and automation in the context of Industry 4.0: A triangulation approach and elements of a research agenda for the construction industry. Computers in industry, vol. 83, pp. 121-139, 2016.

Socconini, L. and Reato, C., LEAN SIX SIGMA Sistema de gestión para liderar empresas, 1.ª edición, Marge Books, 2019.

Pande, P., Neuman, R. and Cavanagh, R., Las claves prácticas de Six Sigma, 1.ª edición, Mc Graw Hill, 2007.

Pochampally, K. K., & Gupta, S. M., Six sigma case studies with Minitab®. CRC Press, 2014.

Graña y Montero, Consolidamos el Compromiso. *Reporte Integrado 2019,* 2019.

Van Aartsengel, A. and Kurtoglu, S., Handbook on Continuous Improvement Transformation The Lean Six Sigma Framework and Systematic Methodology for Implemetation, 1.ª edición, Springer, 2013.

Jones, E., Quality Management for Organizations Using Lean Six Sigma Techniques, 1.ª edición, CRC Press Taylor & Francis Grupo, 2014.

Zhan, W., & Ding, X., Lean six sigma and statistical tools for engineers and engineering managers, ser. Engineering management collection. New York, NY: Momentum Press, 2016.

Biographies

Alberto Julian is a member of the Colaboratorio UTEC and student of Industrial Engineering at the University of Engineering and Technology (UTEC), specializing in Manufacturing and Maintenance. With experience in supply chain projects (distribution, warehouse management, purchasing), project management, hydrocarbon-related asset management, and integrated management systems (ISO 9001; ISO 14001; ISO 45001, and ISO 37001). Interest in continuous improvement, investigating how various factors can impact the design, profitability, and acceptance of a product, process, or service, and how to quantify it to generate a predictive structure in operation, either to assess its performance or its long-term viability. Coordination of projects for applying Lean Six Sigma framework tools, training, and collaborative events. Member of IISE.

Fabiana Retamozo is a member of Colaboratorio UTEC and student of Industrial Engineering at the University of Engineering and Technology (UTEC), specializing in Services. With knowledge in project management under different frameworks and methodologies such as Scrum, Design Thinking, Kanban, PMI, and Lean. Interested in project management and the implementation of continuous process improvement. She is the secretary of Institute of Industrial and Systems Engineers of UTEC. Member of IISE UTEC.

Jean Pierre Santillan is a member of Colaboratorio UTEC and student of Industrial Engineering at the University of Engineering and Technology (UTEC), interested in Services and Finance with experience in continuous improvement projects using Lean Six Sigma tools. Interested in continuous improvement and in controlling financial ratios for the validation and implementation of projects. Focused on doing internships in the automotive and banking sectors. Member of IISE.

Kendra Bernal is president at Colaboratorio UTEC and student of Industrial Engineering at the University of Engineering and Technology (UTEC), interested in continuous management, innovation and product and service design. She has experience in continuous improvement projects using Lean Six Sigma tools and knows how to use different methodologies such as design thinking, shadowing, service blueprint, journey maps and among others. She is founder of Yanapawki, a startup dedicated to connecting caregivers and patients with Alzheimer or dementia. Member of IISE, EMBS and treasurer at IEEE UTEC.

Carmen Alvarez is a member of the Colaboratorio UTEC and a student of Industrial Engineering specializing in Supply Chain Management at the University of Engineering and Technology (UTEC). With experience in supply chain projects and continuous improvement. Member of the Data Analysis area at IISE UTEC. She is co-founder of Ciencia Feliz, a startup dedicated to science outreach to be an essential element in the learning of children and adolescents by providing innovative workshops and kits to inspire them to be agents of change.

Alejandro Gallegos is a Master in Strategic Business Administration from CENTRUM of PUCP. Industrial Engineer from the National University of Engineering and certified Black Belt by GPS Consulting. Professional with 27 years of experience in the areas of Quality, Processes and Operations Management in leading service and industry companies. He currently serves as Partner director of the company CODEGES SAC.