Educational Administration: Theory and Practice
2024,30(4), 917-926
ISSN:2148-2403
https://kuey.net/

Research Article

Leader's Emotional Agility And Educational Organization's Performance Through The Six Sigma Ways In The Engineering Service Industry

Marirajan Murugan [1*] , Dr. M.N.Prabadevi[2]

[1 *] Research Scholar, Faculty of Management, Vadapalani Campus, SRM IST, India, mm0589@srmist.edu.in, Orcid id:0000-0002-0622-2179
[2]Associate Professor, Faculty of Management, Vadapalani Campus, SRM IST, India, prabadem@srmist.edu.in, Orcid id: 0000-0003-0926-7329

Citation: Marirajan Murugan et Al. (2024), Leader's Emotional Agility And Educational Organization's Performance Through The Six Sigma Ways In The Engineering Service Industry...*Educational Administration: Theory And Practice*, *30*(4), 917-926
Doi: 10.53555/kuey.v30i4.1580

ARTICLE INFO

ABSTRACT

Our goal was to demonstrate how a few value-adding elements from traditional Six Sigma tools help in reduced the errors in Project deliverables in the engineering service industry. Intension is to have high confidence on the deliverables and how it satisfies the customer that will take in alignment with management expectations through educational industrial training institutes. Six Sigma is a disciplined methodology that uses data and statistical analysis to measure and improve a company's operational performance by identifying and eliminating "errors" in service-related processes. Six Sigma applies in different ways in different companies. For some, Six Sigma is a total management philosophy, for others it is simply a process improvement effort designed to increase productivity and reduce costs. Educational organizations and Industrial training institute have started to understand the Six Sigma and designed to increase productivity and reduce costs. The actual design and construction of industrial systems, buildings and other major infrastructural elements can involve architects, engineers, designers, contractors, suppliers and manufacturers. Adding to the overall complexity of the projects, all the stakeholders are require effective methods for working with deliverables and non-deliverables that often consists of more data in tens or thousands of files. Engineers and Designers are required to manage the complex relationship between engineering data, engineering drawings, related documents within their existing business processes and to make the most current revision of those documents available whenever and wherever they are required with zero error. Over the last few years of studying error reduction in project deliverables that executives and work teams are really out of touch with one another. This is true of both project management and technical teams across the strategic, tactical, and project progress. Executives have a quality deliverable expectation that is almost always dramatically shorter schedule than what their teams say they need to do the job right. Completing a set of tasks correctly and fully is what teams try to do. Management forces these teams to do their work faster than that. The goal of this paper aims and shed light on the Six Sigma, emotional agility and educational organizations performance and have to increase profits, customer in confidence and customer satisfaction by eliminating variability, errors and rework.

Key Words : Emotional Agility, Organization, Performance, Six Sigma, Engineering, Service industry.

INTRODUCTION

Six Sigma methodology [1] provides businesses with the tools to improve the capability of their business processes and focuses on process improvement and variation reduction. Hence, increases in performance and decreases in process variation leads to error reduction and vast improvement in profits, employee morale and

quality of deliverables. As part of the FEED and Detail Engineering projects from oil & gas projects, Six Sigma projects have started with the objective of improving on time delivery, deliverable quality, equipment / instrument quality and cost reduction. Six Sigma provides an effective mechanism to focus on customer requirements, through improvement of process quality 15]. This paper describes the application of the Six Sigma methodology comprising in five phases – Define, Measure, Analyze, Improve and Control, by taking this project to demonstrate the benefits attained to reduce the errors. Dow, Bechtel were the first major engineering and construction company to adopt Six Sigma, a data-driven approach to improving efficiency and quality of the deliverables. Bechtel was the first major engineering and construction company to embrace Six Sigma, a methodology that uses statistics to identify and eliminate errors in work processes. Although it was originally developed for manufacturing companies, it was confident Six Sigma would work in professional services organizations. At present the Six Sigma Program addresses Productivity Improvement and Error reduction in the projects carried out in Oil & Gas companies and industrial training institutes case to case basis. The Six Sigma projects have been identified in the areas of improvement after analysis of the process and product metrics against the centre level specification limits. The approach, methodology and benefits of Six Sigma is explained in this paper by taking the case of a Six Sigma project. This project is on the improvement of deliverable quality compliance carried out from the projects identified.

1 DEFINITION, LITERATURE REVIEW & METHODOLOGY

1.1 Six Sigma – The Basics

Six Sigma is a revolutionary business process geared toward dramatically reducing organizational inefficiencies that translates into bottom-line profitability. It started in the 1980s at Motorola; then, organizations such as GE, Texas instruments, Dow, Allied Signal, and Seagate worked with the initiative during the 1990s and made it the most successful business initiative of the era. Further to this, Bechtel and other few Engineering, Procurement, Construction and Management (EPCM) companies started implementing Six Sigma in the experimental basis with the projects and further continuously, Six Sigma is part of every project.

Six Sigma A philosophy of managing that focuses on eliminating errors through practices that emphasize understanding, measuring, and improving processes. It's based on the statistical concept of six sigma, measuring a process at only 3.4 defects per million opportunities (DPMO) [10].

Defect A measurable characteristic of the process or its output that is not within the acceptable customer limits, i.e., not conforming to specifications. The sigma level of a process is calculated in terms of defects per million opportunities (DPMO). Key to the Six Sigma methodology is a five step process— Define, Measure, Analyze, Improve, and Control (DMAIC). The basis of Six Sigma is measuring a process in terms of defects or errors. In this project, the objective is to reduce the errors and finally with zero error in the deliverables.

Theoretical Basis of Six Sigma: Variation

- Common Cause Variation

– System
– Random

- Special Cause Variation

– Assignable

A one-sigma process produces 691462.5 defects per million opportunities, which translates to a percentage of satisfactory outputs of only 30.854%. That's obviously really poor performance rather three sigma level produces 66807.2 errors per million opportunities, delivering 93.319% satisfactory outputs. Most organizations in the U.S. are operating at three to four sigma quality levels. That means they could be losing up to 25% of their total revenue due to processes that deliver too many errors—errors that take up time and effort to correct deliverables by rework as well as make customers unhappy [14].

1.2 Six Sigma Methodology

A Six Sigma Project consists of the following phases [2]:

***Define*:** The deliverables to be improved were identified. Customer needs were identified and translated into Critical to Quality Characteristics (CTQs). The problem/goal statement, the project scope, team roles and milestones are developed. A high-level process was mapped for the existing process.

***Measure*:** The key internal processes that influence the CTQs were identified and the errors generated relative to the identified CTQs are measured.

***Analyze*:** The objective of this phase was to understand why errors were generated. Brainstorming and statistical tools were used to identify key variables (X's) that cause errors. The output of this phase was the explanation of the variables that are most likely to affect process variation.

***Improve*:** The objective of this phase was to confirm the key variables and quantify the effect of these variables on the CTQs. It also includes identifying the maximum acceptable ranges of the key variables, validating the measurement systems and modifying the existing process to stay within these ranges.

***Control*:** The objective of this phase was to ensure that the modified process now enables the key variables to stay within the maximum acceptable ranges, using Six Sigma tools like Statistical Process Control (SPC) or simple checklists.

1.3 Six Sigma project on quality compliance

This section discusses a Six Sigma in Control Systems Upgrade FEED Project for the improvement of deliverable quality compliance [3] in a short schedule, which is given below the better understanding of the approach, methodology and benefits of Six Sigma.

1.4 Error Reduction in Project Deliverables

Six Sigma Approach is data-driven and Fig-1 shows below. It focuses on reducing process variation, centering the process and on optimizing the process. The emphasis is on the improvement of the control of deliverable quality, which includes the improvement of quality and reduction of cost of quality [4].

One of the major concern engineers have in working with today's non-stop data flow is getting the right materials from the "drawing board" to the "as-built" state. Being able to incorporate a wide variety of technical documentation, specifications, drawings, images, notes and other resources into designs is critical. This means the ability to access both materials anywhere on specific worksite or in geographically remote corners of any organisation, and to collaborate with colleagues to determine needs and track changes.

Fig-1: Six Sigma Process and approach

The Sigma Capability is a metric that indicates how well the process is being performed [5]. The higher the Sigma Capability, the better, because it measures the capability of the process to achieve error-free-work (where an error is anything that results in customer dissatisfaction).

In short, the Six Sigma Approach focuses on:

- Customer needs
- Data-driven improvements
- The inputs of the process

And this results in:

- Reducing or eliminating errors
- Reducing process variation
- Increasing process capability

In this context, the customer requirements for our centre are –

- On-Time, Accurate and Complete Customer
- Deliverables
- Customer Responsiveness
- Marketplace Competitiveness

To achieve these goals the Six Sigma approach was adopted in this project to pinpoint sources of errors and ways of eliminating them in the top corporations. [6] [7].

- Wrong design information in a document attributable to bad judgement

Or ignorance or a misconception resulting from incorrect information.

- Slips and lapses due to lack of proper attention to address the information, clarifications received through e-mails and correspondences from different sources, mistakes resulting from picking an inappropriate rule, specification, code or standard or mistakes due to incomplete/inaccurate understanding of the system.

1.5Emotional Agility and Organizational performance

Leaders approach them in a mindful, values-driven, productivity way to achieve and develop through emotional agility. Leader's ability to assess the risk and taking right decision at the right time [17]. Leader's ability to manage one's thoughts and feelings are essential to business success. During pandemic period and other

complex situations, leader's emotional agile handling situations and businesses strives the success of educational organizations [20]. Researchers predict that if employees feel strong organizational support, the negative impact of surface acting on job performance will be reduced, and the positive impact of deep acting on job performance will be increased, similar to the effects seen with perceived supervisor and co-worker support [9]. Organizational commitment fosters job involvement, resulting in engaged and motivated employees who contribute to organizational success and service quality [21].

1.6 Research Problem

Researchers observed that the educational organization and institutes needs to be improved through six sigma applications in social and behavioural sciences [11]. Researchers observed that various six sigma methods can be implemented to improve the educational organizations and industrial training institutes [12]. Researchers understood that current model need to enhance for the engineering service industry organizational performance by focusing on leaders emotional agility and six sigma methods and its process. The Capability Maturity Model identifies the characteristics of an effective software process, but the mature organization addresses all issues essential to a successful project, including people and technology, as well as process [16]. Six sigma applied the wide variety of processes and methodologies mostly in manufacturing industries rather in service industries [18]. Educational institutions and industrial training institute's faces enrolment delays and issues, maintaining inventories and inventories of books and records [19].

1.7 Research Gap

While researchers noted a dearth of studies in general, the educational organization and industrial training institutes appear particularly neglected. Given that contemporary work is increasingly organised around teams, our study advocates for additional investigations of unethical leadership at the group level [8]. Researchers observed that six sigma and quality management [13] are hardly ever utilized in educational organizations and industrial institutes. Researchers identified gaps in previous studies in the engineering service industry worldwide and have conducted more exploration to address these shortcomings.

1.8 Research Methodology

Researchers utilized descriptive research studies for their investigation. Researchers created a detailed questionnaire and conducted interviews with project deliverables considered between 2022 and 2023 from running projects from MSME entrepreneurs to gather data. Researchers employed convenient sampling to gather data from participants.

This study utilized Minitab as the statistical tool to analyze the data.

This study article intends to explore the leaders emotional agility and educational organizational performance through six sigma in engineering service industry. Figure 2 displays the proposed model for the educational organization's performance.

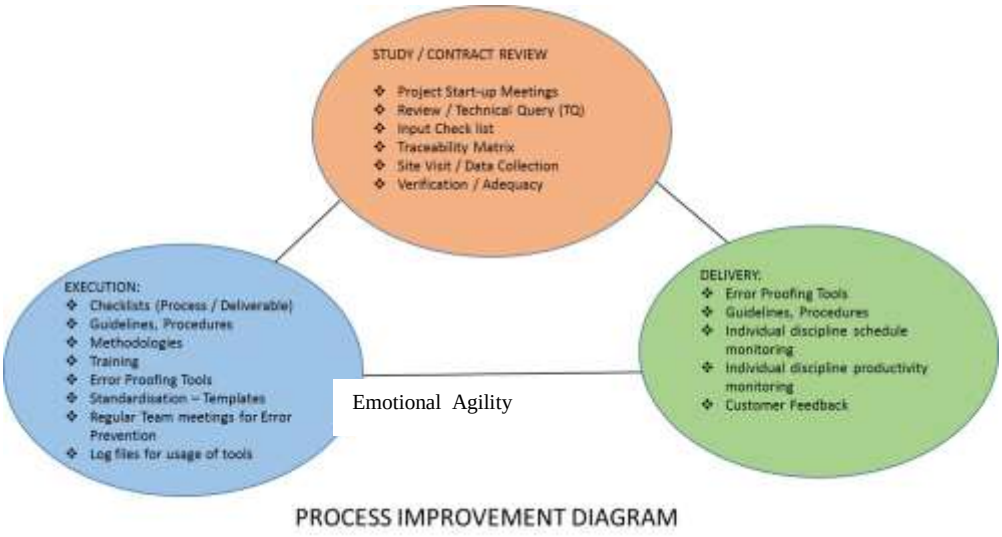

Fig-2 – Proposed Model for process improvement program through Six Sigma

2 ANALYSIS AND FINDINGS

2.1 Define phase

The project team had the problem of field errors being reported in the deliverables. Based on the metrics for 2023, the long-term process capability for deliverable quality was at 2.7, while the short-term capability was at

4.2. A Six Sigma approach was initiated to improve the quality of deliverables. The goal of the project was to improve the long-term process capability to more than 4 and to reduce the DPMO by more than 50%. A simple high level process mapping of the existing process is given below. The project started the Define Phase with the identification of deliverable Quality as the CTQ. Team members from different levels namely Project Managers, Lead Engineers, Engineers & Designers and the Quality Team were identified for the Six Sigma project.

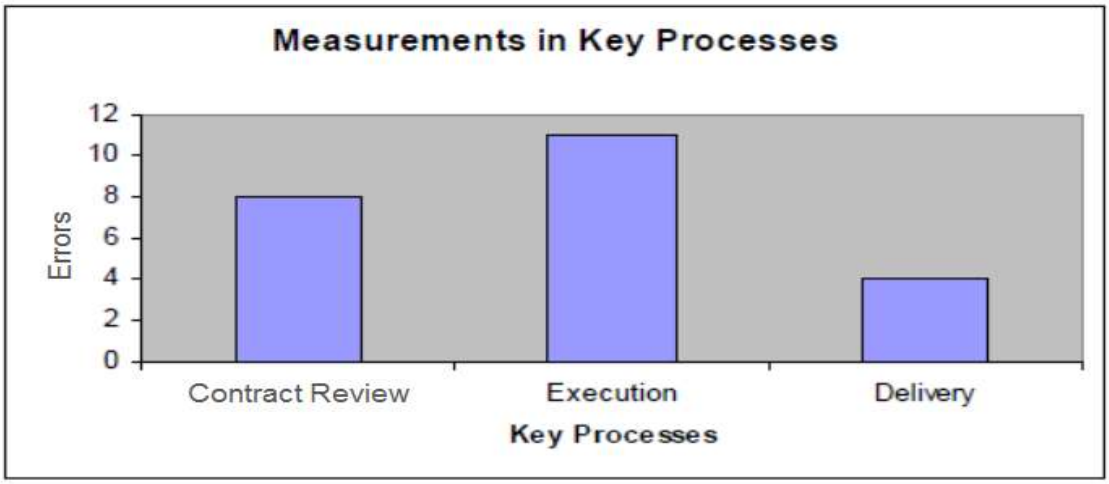

Fig-3: Measurement in Key Processes

The next step was to define the measurement system. Fig-3 shows the measurement in key processes. Any data in the deliverable sent to the customer, which does not meet the customer's requirements, or which was not as per the Customer's Standards & Specifications was defined as an error. For the purpose of calculating DPMO, the opportunity, which was a deliverable or process characteristic that adds or deducts value from the package, was identified, based on the opportunity definition by the client.

2.2 Measure phase

During this phase, the key processes in the project lifecycle that affect the CTQ (in this case, deliverable quality), were identified to be Contract Review, FEED execution and Project delivery. Measurements related to the CTQ were made in these phases. The field errors reported by the client were classified as errors that have occurred in each of these processes as shown below with the indicators. In each of these processes, the input process variables (controllable or critical-those that show statistical significance) that affect the CTQ were identified as shown in above Figure. The Input Variable — Quality of Inputs, had various attributes namely, clarity of scope definitions, completeness of inputs, and conformance of inputs to standards. This variable became a critical variable that affected the deliverable quality, since the inputs for the projects were obtained from the customer. The projects that were affected by poor quality of inputs were measured. As depicted in below figure-4, a substantial number of projects were affected by poor quality of inputs in 2023.

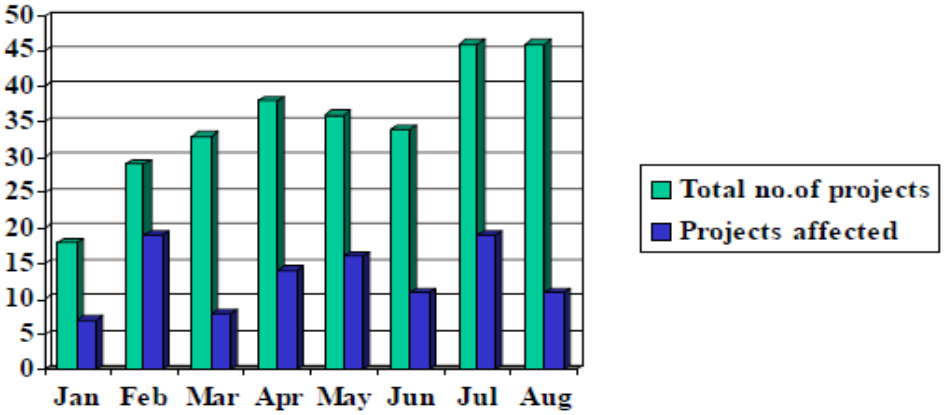

Fig-4: Number of projects considered and affected during 2023.

2.3 Analyze phase

As part of the project, workflow process was worked out for review process of each deliverables and non-deliverables in each stage of the project. Deliverable review through self-check (Discipline Check), Lead Engineer check, Technical Authority check, client check were carried out. The below work flow process (Fig-5) was followed for the checking the deliverables in each stage of the deliverable submission.

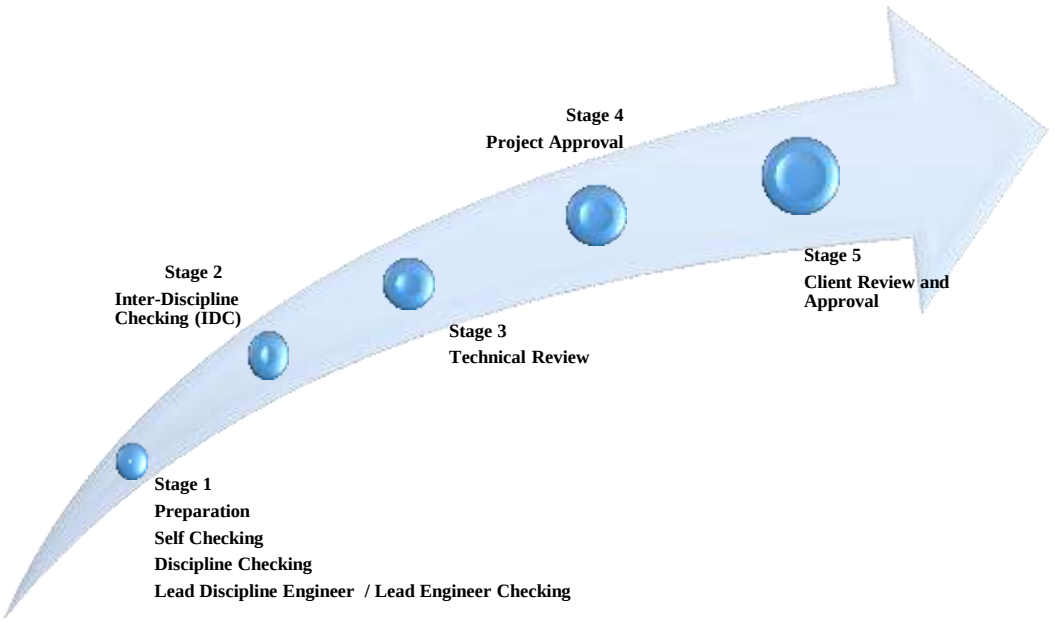

Fig-5: Work flow processes

During the above review process, the following errors were identified against each disciplines and deliverables(Fig-6). Self-check was enforced and given training and development and directed team members to take ownership of the deliverables and carry out the self-check properly.

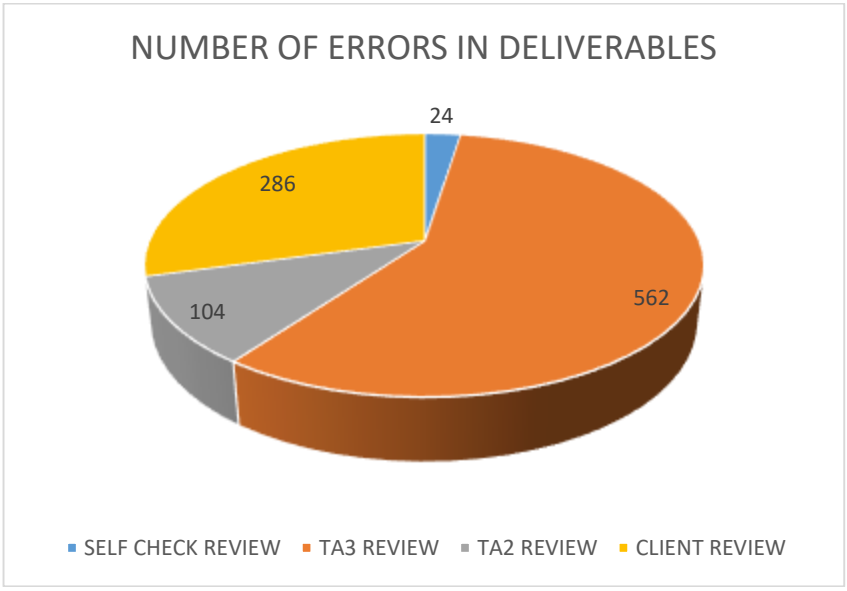

Fig-6: Number of errors in deliverables

Overall process capability was assessed based on the above exercise (Overall errors including Self Check, TA3, TA2 and Client Review) and assessed in Minitab 17 and report was issued. Overall DPMO was observed as 360866. Overall % was observed in terms of errors as 36.09% (Fig-7).

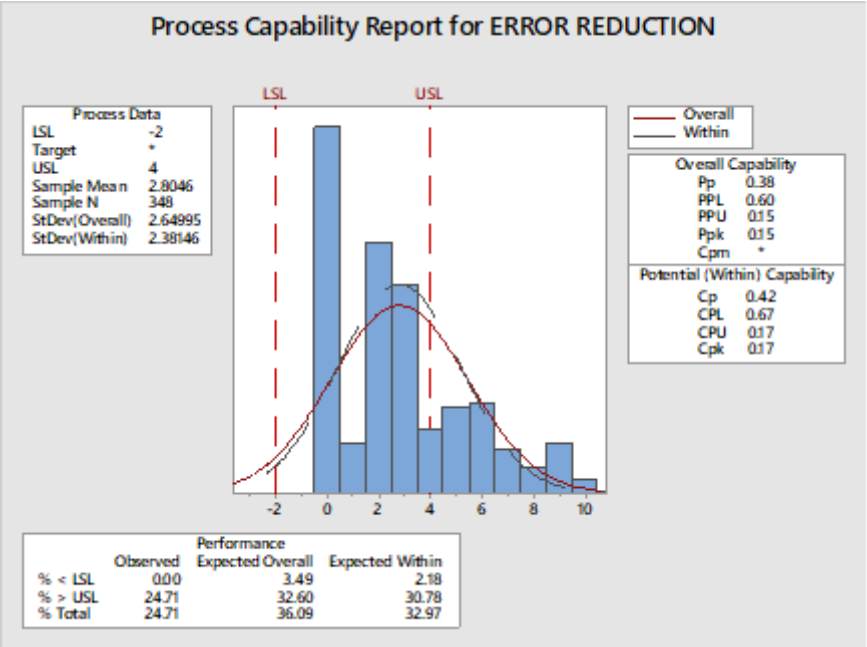

Fig-7: Process capability report for Error reduction

Client Review errors were assessed and produced the report (Fig-8) in Minitab 17 to minimize the client comments. The following graph shows only client comments

.

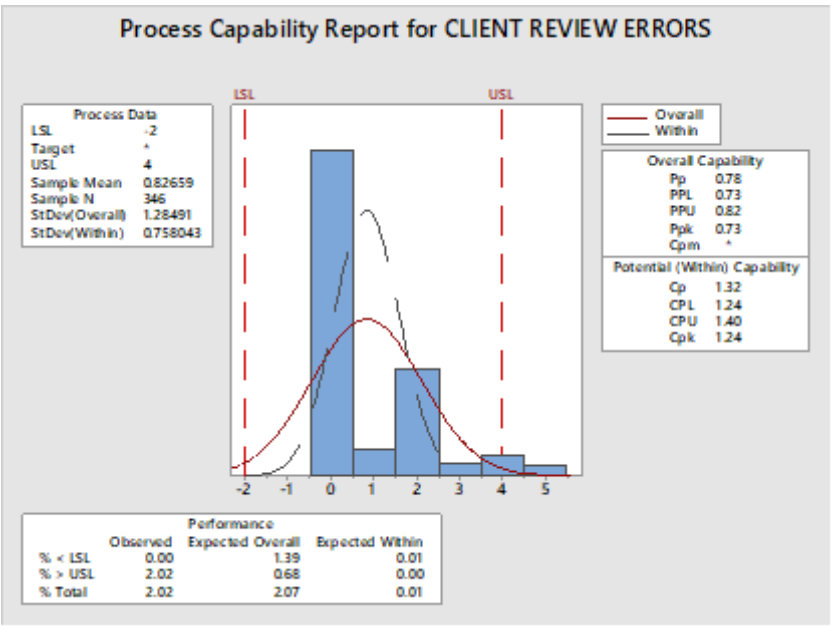

Fig-8: Process capability report for client review errors

2.4 Improve phase

Several process improvements were introduced in the phases of Contract Review / Project Study, Execution and Delivery. These improvements include developing process control and error proofing tools amongst others. Below Figure shows some of the improvements carried out in different Phases. In addition to this, a customer feedback form was introduced. The various quality attributes of the deliverables were rated by the customer on a 1 to 5 scale. Rating of the deliverable were given by client was 4.5. Engineering Error Log was used for recording an error. Project TDR had formed the basis for the deliverables listed in the Engineering Error Log for this project. The count of errors in deliverables were recorded at each applicable checking stage using the Document Review stamp. Color coding was introduced for checking the deliverables in different stages.

2.5 Control phase

The process improvements that were introduced resulted in the reduction of field errors. The process capability for quality of deliverables improved from 2.7 to 4.2 in the long-term by the mid of 2023, and the DPMO reduced from 360866 to 3865. This trend continued in 2023, resulting in the improved trend in the quality compliance.

The best practices and lessons learnt in this Six Sigma project for engineering design were applied in other projects. Since the field errors were reduced and the process capability for quality deliverables have increased to more than five sigma, the emphasis shifted to improvement of in-process quality. The project life cycle has a phase for Quality Assurance (QA). As a continuous improvement initiative, many initiatives have done, to reduce the rework cost after QA. Self-Check review was improved and Client review comments were reduced. Objective of this project was achieved by reduced the client errors more than 50%. Fig-9 shows the number of error reduction in deliverables.

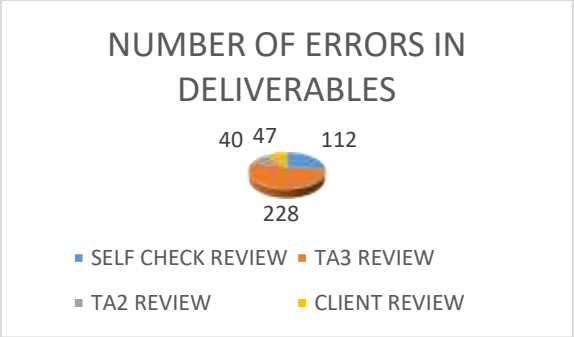

Fig-9: Number of errors in deliverables

A number of Error Prevention practices were identified in these activities and were built into the processes of the project life cycle. To measure the quality cost, a metric called "Error log" index was used. This metric was calculated as percentage project effort. spent in rework. Control charts (I-MR) were drawn to track the process level (process characteristic within projects) and process variation (process characteristic between projects) simultaneously and also to detect the presence of special causes.

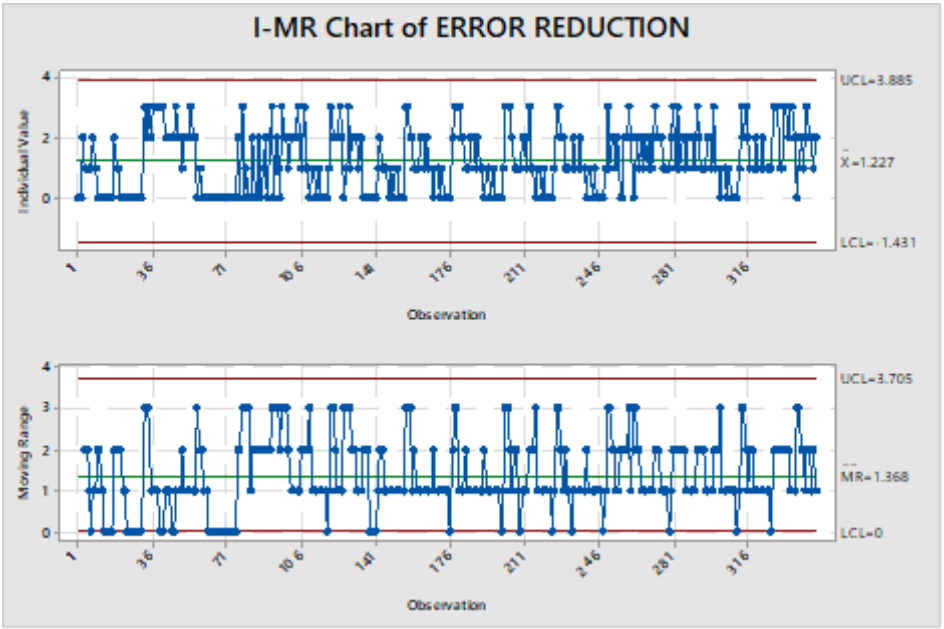

Fig-10: I-MR chart for error reduction

Figure-10 shows the Control charts drawn over a period of time for reducing the rework by reducing the errors. The assignable causes for variations from the target values were analyzed, and corrective actions were initiated to remove the causes and to prevent them from occurring again. From the control charts, it was evident that the process improvement initiatives had been effective in reducing the errors. This was indicated by the converging control limits in the individual's chart and the reduction in process variation as seen in the moving range chart. Using these values, process capability studies were also undertaken. Below figure shows the process capability study for error reduction. This study could be used to assess whether the process is centered on the target and whether it is capable of consistently meeting process specifications. For the metric — Error reduction, the specification limits were set at 4% to –2% of the project effort as error reduction after QA. As seen from the chart, the expected overall performance has a DPMO of 3865, which is equal to 4.2 (Fig-11 and Fig-12).

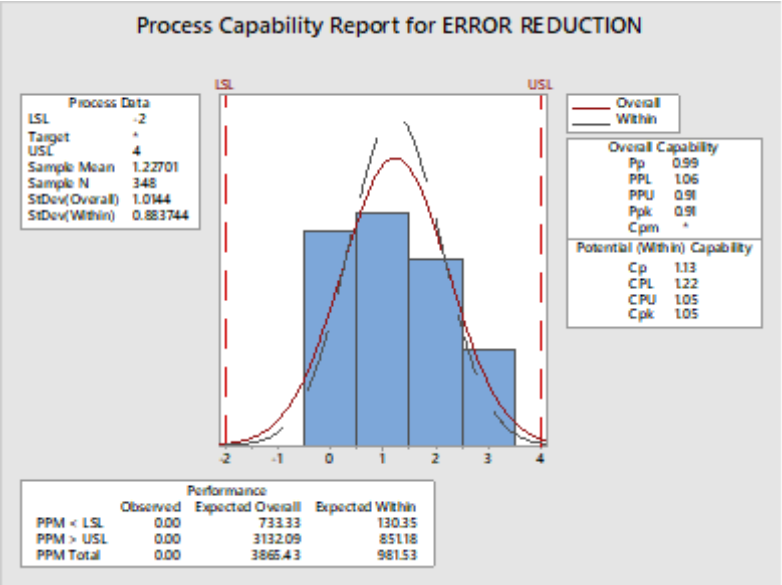

Fig-11: Process capability report for Error reduction

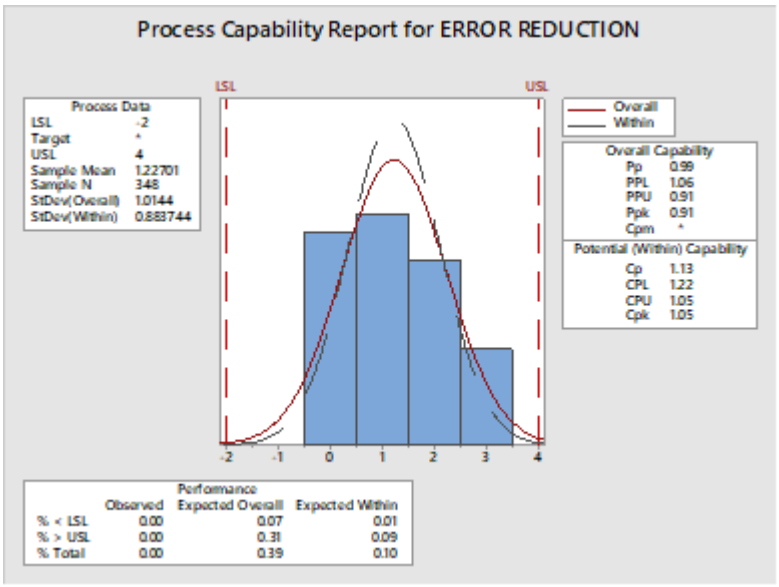

Fig-12: Process capability report for Error reduction

3 OUTLOOK & CONCLUSIONS

The thrust on Six Sigma Quality has helped in creating and sustaining customer focus in educational organizations and industrial training institutes for oil and gas service industry projects, leading to improved customer satisfaction as indicated in the feedback from the customer. At the same time, active participation of the team members from all levels in the Six Sigma project has evolved a culture of effective and creative team work. The goal was to achieve Six Sigma level not only in deliverable quality and on-time delivery. Currently Six Sigma is forecasted at 5.85, but also in the other client specified metrics of on-time delivery and estimate compliance. To achieve this goal, educational organization industrial training institutes have been planning to increase Six Sigma Projects. Further to monitor the quality of deliverables, Key Performance Indicators are fixed for Engineering Services. Engineering error quality is one of the indicator for the performance for engineering services. Self-Check review was improved and internal review was improved and finally client comments were reduced by more than 50%. The initial criteria for a successful Six Sigma project was met with the following: i. Process capability was improved by one sigma, ii. Reduced errors by more than 50% and specifically, client errors were reduced from 29% to 11% in terms of errors. iii. Return on investment was achieved by 20% overall by considering the bonus for the schedule achievement.

4 RECOMMENDATIONS, LIMITATIONS AND FUTURE RESEARCH

Leaders should focus on improving the process in educational organizations and industrial training institute to enhance educational organizational performance, Quality, work-life balance, and safety for all stakeholders.

This will help achieve the quality of an educational organization as well as to meet target budget for capital expenditure (CAPEX) and operational expenditure (OPEX) of agile leaders, while promoting a harmonious work environment. The government and MSMEs should prioritize offering six sigma training to each leaders in an educational organization to promote high levels of system and process, intellectual connection, and a healthy company culture. Future research can investigate leaders' focus on the six sigma implementation among stakeholders in the global diversified service sector.

5 REFERENCES

1. Anbari, F. T. (2002). Six sigma method and its applications in project management. Paper presented at Project Management Institute Annual Seminars & Symposium, San Antonio, TX. Newtown Square, PA: Project Management Institute.
2. Anbari, F. T. & Kwak, Y. H. (2004). Success factors in managing six sigma projects. Paper presented at PMI Research Conference: Innovations, London, England. Newtown Square, PA: Project Management Institute.
3. Dusharme D, (2004). Quality conversation with Mikel Harry: The foremost expert on Six Sigma talks about its past, present and future. Quality Digest, February2004.
4. D.H. Stamatis, (2002). *Six Sigma and Beyond: Foundations of Excellent Performance,* CRC Press.
5. Forrest W. Breyfogle, (2017). Implementing Six Sigma: Smarter Solutions Using Statistical Methods : OJT Six Sigma Application, GEPS Playbook, GE Power Systems.
6. Hammer, M.. (2003). Process Management and the Future of Six Sigma. Engineering Management Review, IEEE. 30. 56- 56. 10.1109/EMR.2002.1167284.
7. Harry, M. and Schroeder, R. (2000) Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations. Doubleday, New York.
8. Hassan, S., Kaur, P., Muchiri, M. *et al.* Unethical Leadership: Review, Synthesis and Directions for Future Research. *J Bus Ethics* 183, 511–550 (2023). https://doi.org/10.1007/s10551-022-05081-6.
9. Hyun Jeong Kim, Won-Moo Hur, Tae-Won Moon, Jea-Kyoon Jun (2017), Is all support equal? The moderating effects of supervisor, coworker, and organizational support on the link between emotional labor and job performance,BRQ Business Research Quarterly,Volume 20, Issue 2,Pages 124-136,ISSN 2340-9436,https://doi.org/10.1016/j.brq.2016.11.002.
10. James R. Evans, (2014). An Introduction to Six Sigma and Process Improvement, Cengage Learning, 9781133604587.
11. Javad Mehrabi,(2012). Application of Six-Sigma in Educational Quality Management, Procedia - Social and Behavioral Sciences, Volume 47, Pages 1358-1362, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2012.06.826.
12. Kremcheeva, D.A & Kremcheev, E A, (2022). Implementation of the six sigma method in the educational process, Journal of Physics: Conference Series, IOP Publishing, 1384 (1), 1742-6596, DOI:10.1088/1742-6596/1384/1/012022, https://dx.doi.org/10.1088/1742-6596/1384/1/012022
13. Latifa Rahman, (2022). Six Sigma and Educational Quality Management, *International Journal of Trend in Scientific Research and Development (IJTSRD),*Volume 6 Issue 3, https://www.ijtsrd.com e-ISSN: 2456 – 6470
14. Michael George, et al. (2004). The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to Nearly 100 Tools for Improving Quality and Speed, McGraw-Hill, ISBN: 9780071505734.
15. Michael L. George, (2023). Lean Six SIGMA for Service, McGraw-Hill, 9781265918927, DOI: 10.1036/0071436359
16. Paulk M, et al.(1995). The Capability Maturity Model: Guidelines for Improving the Software Process. Addison Wesley, Reading, MA.
17. Robert G. Cooper, (2001). *Winning at New Products: Accelerating the Process from Ideato Launch,* Cambridge, MA: Perseus Books.
18. S. L. Ho, "Six Sigma and Educational Excellence," *2006 IEEE International Conference on Management of Innovation and Technology*, Singapore, 2006, pp. 743-747, doi: 10.1109/ICMIT.2006.262319.
19. Stephen G. Anthony & Jiju Antony, (2020). Lean Six Sigma in Higher Education Institutions, Emerald publishing, 978-1-80382-602-8, DOI: 10.1108/9781803826011
20. Wilson, Adrianne (2021) "Emotionally Agile Leadership Amid COVID-19," School Leadership Review: Vol. 15 : Iss. 2 , Article 1. Available at: https://scholarworks.sfasu.edu/slr/vol15/iss2/1
21. Ying-Chen Lo, Chongfeng Lu, Ya-Ping Chang, Shu-Fen Wu, (2024). Examining the influence of organizational commitment on service quality through the lens of job involvement as a mediator and emotional labor and organizational climate as moderators, Heliyon, Volume 10, Issue 2, e24130, ISSN 2405-8440,https://doi.org/10.1016/j.heliyon.2024.e24130.