International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 18s, 2025
https://theaspd.com/index.php

Improving the Quality of Fixed Broadband Service at PT X Tangerang, we use the DMAIC Method and the 4DX Framework

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Abstract
Digital transformation plays a pivotal role in enhancing performance and efficiency in the service sector, especially within the telecommunications industry. Despite technological advancements, service providers such as PT X Tangerang continue to face recurring service disruptions, which negatively impact customer satisfaction and financial outcomes. This study aims to improve the service quality of Fixed Broadband in the Tangerang area by implementing an integrated improvement initiative that combines the Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) methodology with the 4 Disciplines of Execution (4DX). A mixed-method case study was conducted, utilizing both quantitative and qualitative approaches through service disruption records, technician Key Performance Indicators (KPIs), and financial data from January 2024 to February 2025. Tools such as Pareto charts, Ishikawa diagrams, Cost of Poor Quality (COPQ) analysis, and paired t-tests were applied, alongside qualitative evaluations of Standard Operating Procedures (SOPs) and field reports. Root cause analysis identified key issues in ONT–CPE and ODP–ONT connections, stemming from equipment failure, human error, and inconsistent SOP adherence. Improvements including technician retraining, SOP standardization, and the introduction of a performance dashboard led to a drop in service disruption rates from over 5% to below 2.5%, technician KPIs exceeding 90%, and financial performance shifting from a loss of Rp 558 million to a peak profit of Rp 279 million. These improvements were statistically significant ($p < 0.05$). The study concludes that integrating DMAIC with 4DX effectively enhances service reliability and operational performance, offering a replicable framework for digital infrastructure optimization in the telecommunications sector.
Keywords: *4DX, DMAIC, Fixed Broadband, PT X, service quality, digital transformation, disruption, KPI, COPQ, and Six Sigma.*

INTRODUCTION

Companies all around the world, especially in Indonesia, are required to undergo digital transformation promptly due to rapid technological advancements and market expectations are rising. Digital transformation in the service sector improves operational efficiency, service quality, and the customer experience through the use of digital tools, automation, and data analysis (Anggoro et al., 2024).

But service interruptions are still a big problem, especially for internet service providers like Fixed Broadband. Frequent internet outages disrupt daily activities, reduce customer satisfaction, and negatively affect profitability by raising complaints, churn rate, and harm to the company's brand (Diki et al., 2020). According to Saputra et al., (2023) emphasize the importance of management in assessing whether application systems are capable of delivering secure and uninterrupted services. Furthermore, as highlighted by Candiwan and Wibisono (2021), understanding the key dimensions of website quality is crucial in identifying the factors that contribute to a positive user experience, which in turn increases the likelihood of users returning to the platform. Telkom's internal performance dashboard (2024) shows that service performance in the Tangerang region is always worse than in other metropolitan areas. Tangerang's disruption reduction only reached 50.5% between 2021 and 2023, which was lower than

Bekasi's (62.4%) and Bogor's (56.5%). The rate of repeat disruptions in Tangerang went down by only 36.4%, which is much less than in Bekasi (81.4%) and Bogor (74.0%).

Even though the IOAN business of PT X Tangerang made a net profit of IDR 2.8 billion in 2023, it is still far short of its goal of IDR 13.02 billion. This shows that there is a big chance to make more money by controlling disruptions in a planned and proactive way. Telkom Group has a data-driven efficiency strategy, but its internal dashboards are mostly used reactively and are not yet part of predictive operational planning. From a strategic management point of view, service disruptions can be seen as failures in operational strategy that raise the Cost of Poor Quality (COPQ) and lower customer loyalty (Wibowo, 2018). To fix these problems, you need a structured, data-driven quality control system that can find the core causes, keep an eye on performance in real time, and put in place remedies that work and can be measured. Accroding to (Pratomo et al., 2016) One of the widely recognized benchmarks for ensuring excellence in performance is the implementation of international quality standards.

DMAIC (Define, Measure, Analyze, Improve, Control) from Six Sigma is one of the most popular methods for this reason. It helps with organized process improvements (Rizki, 2017). Muchtiar & Noviyarsi, (2010), (Pratiwi et al., 2021) and Bustommy et al., (2021) have all proved that this strategy works to lower customer complaints and maintenance costs in Telkom units. This study is mostly on PT X Tangerang, which is a very important operational unit that provides Fixed Broadband services in a densely populated city. Telkom Indonesia wants to deliver dependable and affordable internet to as many people as possible. Improving service quality in this unit fits with that goal because it has a lot of users and a complicated service architecture. The goal of the research is to create a model of service improvement that can be used again and again and that can be used as a guide for similar projects throughout the firm. The major goal of this study is to use the DMAIC Six Sigma method in a systematic way to make Fixed Broadband's services in the Tangerang area better by using data to guide the process. This study's goals are to use technical and historical operational data to look at existing patterns of service disruptions, find the core causes using structured quality analysis techniques, and make targeted changes at each level of the DMAIC cycle. The study also wants to find out how well these changes work to lower the Cost of Poor Quality (COPQ) and raise the net profit of the IOAN unit at PT X Witel Tangerang.

OBJECTIVES

This study aims to enhance the service quality of Fixed Broadband in the Tangerang region through a structured and systematic application of the Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) methodology, integrated with data-driven operational insights and performance analytics. The primary goal is to address recurring service quality issues by leveraging statistical tools and quality management frameworks. Specifically, the objectives of this study are to: (1) comprehensively analyze patterns and trends of service disruptions using historical data and key technical performance indicators; (2) identify and validate the root causes of these disruptions through structured quality tools such as Cost of Poor Quality (COPQ) analysis, Pareto charts, and fishbone (Ishikawa) diagrams;

(3) design and implement targeted improvement initiatives at critical points in the service delivery process to eliminate or mitigate these root causes; and (4) evaluate the effectiveness of these interventions in terms of reducing the frequency and duration of service disruptions, minimizing the COPQ, enhancing customer satisfaction, and ultimately increasing the operational efficiency and net profitability of the IOAN (Fixed Broadband Operation Assurance Network) unit at PT X Tangerang. This integrated approach is expected to contribute not only to service reliability but also to long-term strategic value creation.

METHODS

The DMAIC (Define–Measure–Analyze–Improve–Control) paradigm is used to frame this research's mixed-methods case study approach. We got quantitative data from internal dashboards, service tickets,

KPIs, and monthly financial reports from January 2024 to February 2025. Document reviews, SOP analysis, and technician field records were used to get additional qualitative data.

We used Pareto Charts to find the most common causes of problems, Fishbone Diagrams (Ishikawa) to find the root reasons, and COPQ Calculation to figure out how much money we lost because of bad service. The statistical study used paired t-tests to see how important the changes were before and after the implementation period. We used Minitab 22 and Excel to do the analysis. Triangulation between quantitative indicators and qualitative insights made sure that the results were interpreted correctly.

RESULTS

1. Baseline Performance (January to June 2024)

Initial observations at PT X Tangerang revealed that the average monthly service disruption rate consistently exceeded the company's maximum threshold of 2.5%, reaching a peak of 5.5% in April 2024. Technician Key Performance Indicators (KPIs) also failed to meet expectations, averaging only 78.75%, below the organizational standard of 86.5%. Financially, the IOAN business unit recorded substantial monthly losses, with net profit declining to IDR 510 million in June 2024. These metrics indicate systemic quality and execution issues within service operations.

Table 1. Fixed Broadband KPI and Interruption Baseline (Jan-Jun 2024)

Month	Disruption Rate (%)	Target (%)	Technician KPI (%)	Target KPI (%)	Net Profit (IDR)
Jan 2024	5.4	2.5	77.0	86.5	510,000,000
Feb 2024	5.1	2.5	78.2	86.5	532,000,000
Mar 2024	5.3	2.5	78.8	86.5	574,000,000
Apr 2024	5.5	2.5	79.5	86.5	592,000,000
May 2024	5.0	2.5	80.1	86.5	546,000,000
Jun 2024	5.2	2.5	78.9	86.5	511,000,000
Average	5.25	–	78.75	–	544,166,667

(Source: PT X Tangerang Internal Dashboard)

2. Sigma Quality Performance

To measure process capability, the Sigma level was calculated based on the volume of service disruptions. The average monthly DPMO (Defects Per Million Opportunities) was 210,833, corresponding to a Sigma level of approximately

Table 2. Calculation of DPMO and Sigma Level Fixed Broadband Tangerang

Month	Total Customers	Total Disruptions	DPMO	Sigma Level
Jan 2024	100,000	5,400	216,000	2.29
Feb 2024	100,000	5,100	204,000	2.34
Mar 2024	100,000	5,300	212,000	2.31
Apr 2024	100,000	5,500	220,000	2.27
May 2024	100,000	5,000	200,000	2.36
Jun 2024	100,000	5,200	208,000	2.32

Average	–	–	210,833	2.34

(Source: Calculated from Fixed Broadband Disruption Data)

3. Root Cause Analysis

Using Ishikawa diagrams (fishbone), the dominant sources of service disruption were categorized into human, machine, method, and environment. Major contributors included uncalibrated diagnostic tools, SOP inconsistencies, faulty fiber cables, and technician error.

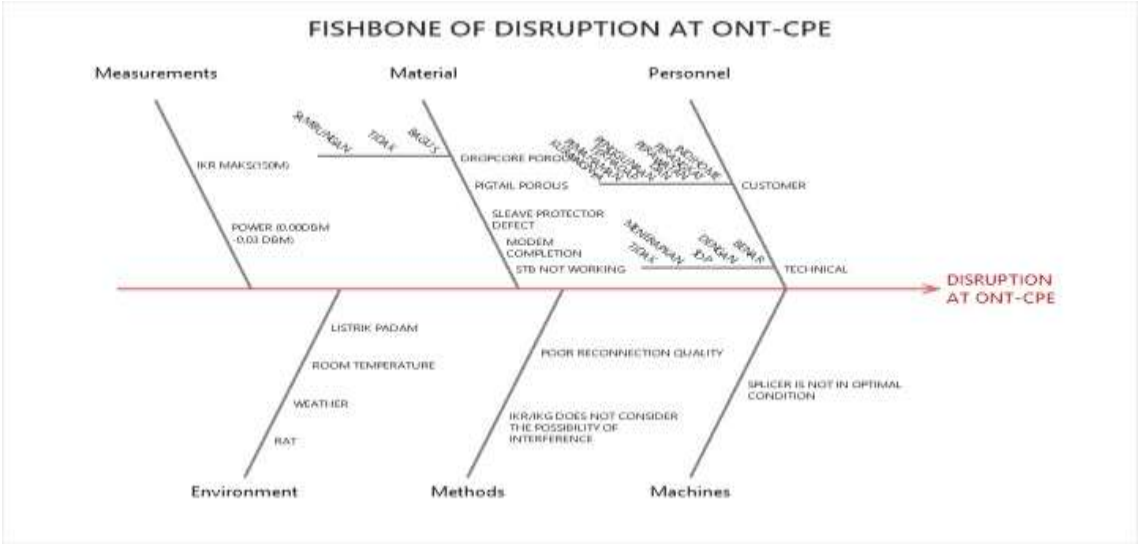

Figure 1. Root Cause Analysis (Analyze Phase)
Source: Author's Analysis based on Ishikawa Diagram Analyze Stage DMAIC

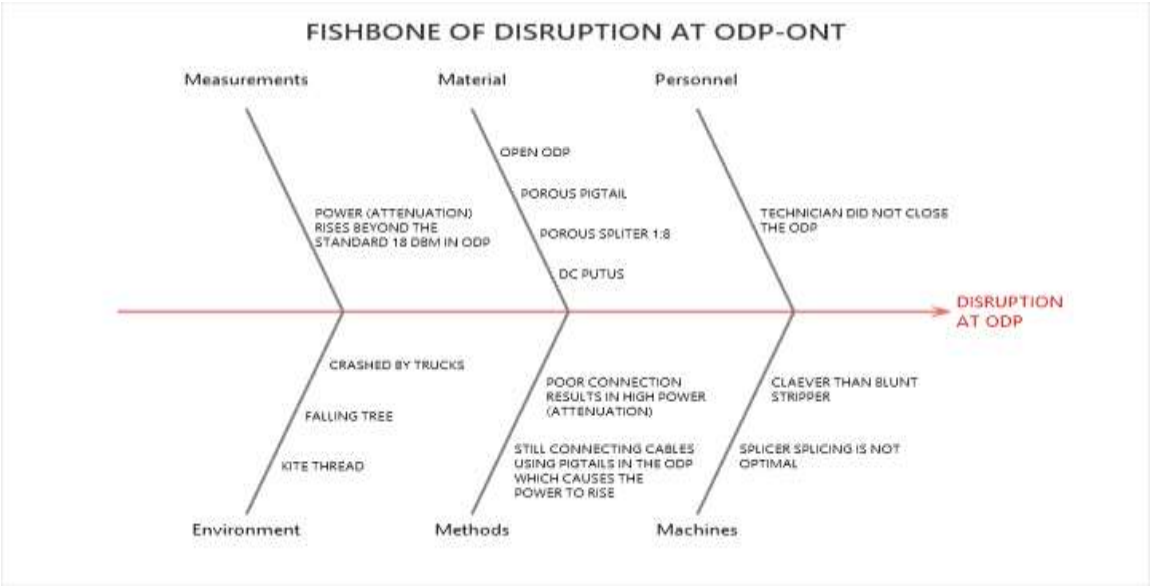

Figure 2. Root Cause Analysis Disruption at ONT
Source: Author's Analysis based on Ishikawa Diagram Analyze Stage DMAIC

4. Improvement Actions and Execution Discipline

Based on the root cause analysis conducted in the previous phase, several targeted improvement actions were implemented in August 2024 to reduce service disruptions, enhance technician performance, and address financial inefficiencies. These actions were divided into two key areas: technical improvements and execution discipline enhancements through the 4 Disciplines of Execution (4DX) framework.

Technical Improvement Actions

The technical interventions were aimed at resolving the systemic issues identified in the Analyze phase:

- **Technician retraining:** All field technicians received updated training sessions focusing on Standard Operating Procedures (SOPs), proper diagnostic tool usage, and common troubleshooting scenarios. The training emphasized consistency, safety, and root cause-based problem resolution.
- **Recalibration and replacement of diagnostic tools:** Devices such as optical power meters (OPM), splicing machines, and ONT testing tools were calibrated to ensure accuracy.
- **SOP revision and enforcement:** Updated SOPs were distributed and implemented uniformly across field teams to minimize human error and process inconsistencies.

Figure 3. Technician retraining session at PT X Tangerang

(Source: Internal documentation)

Execution Discipline with 4DX Framework

To ensure sustained execution of these technical improvements, the 4 Disciplines of Execution (4DX) framework was deployed across technician and supervisor teams. This involved: (Nurul Izzatul Rahma et al., 2023; Wu et al., 2019)

- **Wildly Important Goals (WIGs):** Each unit defined a clear, measurable goal such as "Reduce disruption rate to below 2.5% by November 2024."
- **Lead and Lag Measures:** Teams tracked proactive actions (e.g., number of SOP-compliant repairs) as lead measures and monitored outcomes like KPI scores as lag measures.
- **Visible Scoreboards:** Each technician team maintained a simple, real-time scoreboard displaying their weekly performance metrics.

- **Weekly Accountability Meetings:** Weekly "WIG Sessions" were held every Monday to review scoreboard data, address performance gaps, and assign field-level corrective tasks.

This execution system embedded discipline, transparency, and peer accountability into daily operations.

Table 3. Example of 4DX execution scoreboard used by field team

WILDLY IMPORTANT GOALS (WIGs)	CURRENT CONDITION X	DESIRED RESULT	DEADLINE (BY WHEN)	PRIORITY
MAINTAIN NPS GET SUPPORT	100	100	Every Month	1
LOWERING THE Q NUMBER OF HVC	2,11	0,44	30-Dec-24	2
CUG RAISING THE VALIDATION NUMBER 2	74,83	90%	30-Dec-24	3
HVC INCREASE PREVENTIVE WORK	130	169	30-Dec-24	4
MAINTAINING THE HVC SUGAR	100	100	30-Dec-24	7
NUMBER RAISING THE SCC NUMBER INET PPG	69	85	30-Dec-24	8
REDUCE THE AMOUNT OF MATERIAL	730	511	30-Dec-24	9
USED RAISING THE SCC NUMBER INET CUG	68	85	30-Dec-24	10
SPEEDING UP PROMAN ODP WORK	Deadline : 27	Date: 20	Every Month	11
SPEED UP THE WORK IXSAODC OF	Deadline : 27	Date: 20	Every Month	12
ETHICAL ASSURANCE TEST	Deadline : 27	Date: 20	Every Month	13
DECREASE THE AMOUNT OF PHYSICAL SQM FROM	383	287	30-Dec-24	14

(Source: Field Implementation Monitoring, 2024)

Performance After Improvement (September 2024–February 2025)

After applying the improvements, average disruption rates fell consistently below 2.5%, technician KPIs exceeded 90%, and net profit turned positive, reaching IDR 279 million in January 2025. The DPMO and Sigma level post- intervention are still under monitoring but showed substantial improvement.

Table 3. Before and After Comparison of Key Performance Indicators

Indicator	Target Before (Jan–Jun)	After (Sep–Feb)
Disruption Rate (%)	≤ 2.5% > 5%	< 2.5%
Technician KPI (%)	≥ 86.5% < 80%	> 90%
Monthly Net Profit (IDR)	Positive –558 million	+279 million
Sigma Level	≥ 3.0 2.34	> 2.7 (est.)

(Source: Author's Calculations, 2025)

Statistical Validation

To validate the effectiveness of the interventions, a paired t-test was conducted comparing the six-month periods before and after implementation.

Table 4. Paired t-Test Results for Pre- and Post-Intervention Metrics

Indicator	t-value	df	p-value
Disruption Rate	-5.41	5	< 0.01
Technician KPI	4.85	5	0.005
Net Profit	3.92	5	0.011

(Source: Minitab 22 Analysis, 2025)

The results indicate statistically significant improvements in all three performance indicators ($p < 0.05$).

DISCUSSION

The results show that the DMAIC method works to uncover and fix problems with service quality in digital infrastructure operations. The early high rate of disruptions and poor performance by technicians were mostly due to systemic problems, such as poor training, uneven implementation of SOPs, and tools that weren't properly calibrated. The changes made a big difference in both the reliability of the service and the company's bottom line. This supports the Six Sigma idea that making processes more consistent makes them better and more profitable (Gaspersz, 2005). From a strategic management point of view, this instance shows how important it is to make sure that field operations are in line with the company's long-term goals. The 4DX dashboard improved field-level execution by making daily performance more visible, disciplined, and accountable. This was in line with strategic goals like keeping costs low and keeping customers. This study is more valuable than previous ones (for example, Setiawan, 2019) because it combines DMAIC with execution discipline (4DX), which is a hybrid model that isn't often used in public telecommunications services. It also fills a hole in tracking profitability in public sector operations that Wibowo (2018) pointed out before by connecting technical KPIs to financial results. The combination of Six Sigma and execution discipline shows that digital service transformation can be done in a scalable and data-driven way. This paradigm can be used in other Telkom areas or comparable digital service ecosystems.

CONCLUSIONS

This study highlights the effectiveness of the DMAIC method in addressing service quality issues in digital infrastructure operations. Initial disruptions and technician inefficiencies stemmed from systemic problems, such as inadequate training and inconsistent SOPs. The resulting changes significantly improved service reliability and financial performance, aligning with the Six Sigma philosophy of process consistency (Gaspersz, 2005). Strategically, the integration of the 4DX dashboard enhanced visibility and accountability in daily operations, supporting key goals like cost reduction and customer retention. This research contributes by combining DMAIC with the 4DX framework, filling a gap in linking technical KPIs to financial outcomes in public telecommunications.Ultimately, the combination of Six Sigma and execution discipline demonstrates that scalable, data-driven digital service transformation is achievable, applicable not only to Telkom but also to other digital service ecosystems.

REFERENCES

1. Ismail, Anggoro, S., Nurhayati, S., Ismail, A., & Yakub. (2024). transformasi Digital.
2. Alhassan, M., Adam, A., & Yusof, S. (2019). The impact of quality improvement initiatives on customer satisfaction in the telecommunications industry. International Journal of Quality & Reliability Management.
3. Baker, R. (2016). The power of execution: How 4DX can drive results. Harvard Business Review.
4. Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. MIS Quarterly, 37(2), 471-482.
5. Bustommy, A. Y., Saroso, D. S., & Hasibuan, S. (2021). Improving the quality of Fixed Broadband services using six sigma DMAIC method: Case in industrial area.
6. Candiwan & Wibisono, C. (2021). Analysis of the Influence of Website Quality to Customer's Loyalty on E-Commerce. International Journal of Electronic Commerce Studies, 12(1), 2021. doi: 10.7903/ijecs.1892
7. Covey, S. R., Merrill, R. R., & Merrill, R. (2012). The 4 Disciplines of Execution: Achieving Your Wildly Important Goals. Free Press.
8. Diki, Darna, N., & Suhendy, R. M. (2020). Pengaruh Kualitas Layanan Dan Kualitas Produk Terhadap Kepuasan Pelanggan (Suatu Studi Pada Pt Telkom Kandatel Banjar). Business Management And Enterpremeirship Journal, 2(September), 152–168.
9. Kumar, V., Singh, R. K., & Kumar, R. (2019). Application of Six Sigma in telecom service industry: A case study. Journal of Quality in Maintenance Engineering.
10. Muchtiar, Y., & Noviyarsi. (2010). Implementasi Six Sigma Untuk Peningkatan Kualitas Jasa Layanan Telkom Speedy(Studi Kasus Pt. Telkom Padang). Prosiding Seminar Nasional Resatek-2010, 1–44. Https://Dokumen.Tips/Documents/Implementasi-Six-Sigma-Untuk-Peningkatan-Kualitas-Jasa-Layanan-Telkom-Speedy-Studi-Kasus-Pt-Telkom-Padang.Html
11. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64(1), 12-40.
12. Pratiwi, I., Suryani, F., & Adrian, M. reza. (2021). Penerapan Six Sigma untuk Peningkatan Kualitas Jasa Layanan Fixed Broadband. 7(April), 71–83.
13. Pratomo, Dudi, Yudowati, Siska, P. (2016). Analysis Effectivity of Quality Control System of ISO 9001:2008 in Institute of Road Engineering Agency for Research and Development Ministry of Public Works and Housing Republic of Indonesia. American Scientific Publishers, 22(12), 4279-4284. https://doi.org/10.1166/asl.2016.8128
14. Rizki, F. (2017). 8 Teknik Six Sigma, Solusi Inovatif Peningkatan Kualitas.
15. Saputra, K., S., Isnaini, M., Agrefine, T., S., Mariam, S., & Candiwan. Analysis of Information Technology Governance on Process Management Services and Management of Information Technology Security Using COBIT 2019 (Case Study: PT XYZ). 2022 IEEE 8th International Conference on Computing, Engineering and Design (ICCED). 10.1109/ICCED56140.2022.10009924
16. Snee, R. D. (2010). Six Sigma: The evolution of a revolutionary quality improvement methodology. Quality Progress, 43(10), 22-30.
17. Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2002). Services Marketing: Integrating Customer Focus Across the Firm. McGraw-Hill.