ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Optimizing Bustos, Bulacan's Municipal Population Office Reporting Through Lean Six Sigma Methodology

Lucky Gem L. Asibuque
Bulacan State University (Graduate School), Malolos, Bulacan, Philippines
Corresponding Author e-mail: *lgasibuque@gmail.com*

Received: 02 June 2025 **Revised**: 13 July 2025 **Accepted**: 21 July 2025

Available Online: 25 July 2025

Volume IV (2025), Issue 3, P-ISSN – 2984-7567; E-ISSN - 2945-3577

https://doi.org/10.63498/etcor419

Abstract
Aim: This study aimed to optimize the reporting process of the Municipal Population Office in Bustos, Bulacan, by applying the Lean Six Sigma (LSS) approach to improve its effectiveness and efficiency. Specifically, it aimed to reduce the time spent processing transactions, eliminate unnecessary work tasks, and enhance the way services were handled by introducing a system change and evaluating its impact.
Methodology: The study employed a descriptive and developmental research design. The Lean Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) framework was used to examine and enhance the preparation of reports. A system change was implemented and monitored for a specified period, after which a study was conducted to assess the outcomes. ISO 25010 standards were used to determine the system's acceptability.
Results: The findings led to a decrease in the standard time for reporting, resulting in improved operational efficiency. All ISO 25010 criteria for system intervention gave results higher than 4.5.
Conclusion: As a result of using Lean Six Sigma methodology, the Municipal Population Office in Bustos made significant improvements in how reports are produced. It is further suggested that this approach be applied in other sections of the local government.
Keywords: Lean Six Sigma, reporting process optimization, municipal government, operational efficiency, system intervention, public sector, process improvement, Bulacan, DMAIC methodology, time study

INTRODUCTION

Local governments are increasingly struggling to meet the demands of more complex communities. The Municipal Population Office in Bustos, Bulacan, is no exception. As the office continues to rely on outdated and paper-based reporting systems, the result is inefficiency, delays, and inaccuracy in service delivery. With the continuous growth of Bustos, these operational challenges have become more pressing, requiring process improvement and modernization.

Inefficiencies in public sector processes are well documented and are known to decrease citizen satisfaction and erode public trust. Kim (2020) asserted that inefficient public administration reduces transparency and weakens government performance. In particular, the Municipal Population Office relies heavily on timely and accurate demographic data to effectively fulfill its mandate. The importance of data-driven public administration has also been emphasized in recent studies, particularly those promoting agile and innovative governance strategies (Carvajal & Sanchez, 2024).

Lean Six Sigma (LSS) is one proven methodology designed to minimize errors and variation in processes through data-driven decision-making. Its applications span multiple sectors—including healthcare, manufacturing, and education—to boost productivity and quality (Pandey & Pandey, 2015; Snee & Hoerl, 2010). In fact, studies have shown that Lean Six Sigma can be a powerful tool for public agencies seeking to reduce costs and improve services (Antony et al., 2019). The potential of LSS in streamlining reporting functions makes it an appropriate solution for the problems experienced by the Bustos Municipal Population Office.

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

This study focuses on improving reporting accuracy, speed, and collaboration within the office. Early assessments showed that most tasks were performed manually, report preparation was sluggish, and interdepartmental cooperation was limited. Such challenges not only delayed the generation of demographic reports but also affected the reliability of data used for decision-making. Hence, this research adopted Lean Six Sigma principles to improve the office's reporting process and to introduce systemic change.

The Lean Six Sigma approach follows the DMAIC (Define, Measure, Analyze, Improve, Control) methodology. In the Define phase, the study identified major reporting issues, such as redundant steps and lack of automation. Both client service data and process times were collected to identify performance gaps. The Analyze phase pinpointed root causes—outdated software, lack of standardization, and insufficient training. During the Improve phase, an automated reporting system was introduced, significantly reducing manual errors and accelerating data processing. The Control phase established performance metrics to sustain improvements and evaluate long-term effectiveness.

Lean Six Sigma is gaining traction as a reliable method for modernizing government processes. As supported by recent research on institutional quality improvement and accountability (Amihan, et al., 2023), public offices must embrace such structured methodologies to stay relevant and efficient. This study contributes to that effort by documenting a replicable model for other local government units to enhance service delivery.

Objectives

The primary objective of this research was to measure how Lean Six Sigma (LSS) could improve the reporting process at the Municipal Population Office of Bustos, Bulacan.

The research sought to answer the following research questions:

1. What main problems exist in the Municipal Population Office of Bustos' current reporting procedures?
2. What effect does the Lean Six Sigma methodology have on the speed, accuracy, and efficiency of processes?
3. Does using Lean Six Sigma help reduce problems such as time delays and errors in the reporting system?
4. What improvements can be proposed using the results of the study to support better reporting in the Municipal Population Office?

Hypothesis

Given the stated research problems, the following hypotheses were tested at the 0.05 level of significance:

H_0: There is no significant relationship between the application of Lean Six Sigma and better reporting outcomes at the Municipal Population Office of Bustos.

H_a: There is a significant relationship between the application of Lean Six Sigma and better reporting outcomes at the Municipal Population Office of Bustos.

METHODS

Research Design

This study utilized a descriptive-correlational design to assess the impact of Lean Six Sigma (LSS) on report preparation at the Municipal Population Office in Bustos, Bulacan. This approach enabled the researcher to capture detailed patterns of process improvement brought about by the LSS intervention. By examining the relationship between existing process inefficiencies and the improvements following LSS application, the study aimed to determine the extent of positive change and resolution.

Population and Sampling

The research was conducted with personnel from the Municipal Population Office, specifically those involved in the reporting process. A total of 16 participants—comprising data entry staff, report writers, and department heads—were selected using purposive sampling. Only those with direct involvement in reporting before and after the LSS implementation were included, as their insights were essential in assessing the impact of the intervention (Muñoz & Sanchez, 2023).

Instrument

To diagnose current reporting challenges, a researcher-designed survey instrument grounded in Lean Six Sigma principles was administered. The tool included measures to assess time lags, error rates, and respondent

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

satisfaction with workflow processes. Participants responded on a 5-point Likert scale, indicating their perceptions of how LSS influenced work quality and efficiency. A time-and-motion study complemented the survey to determine the duration of each step in the reporting process, both before and after the intervention.

Data Collection

Data collection spanned three months and involved both surveys and direct observation. The researcher collaborated with office leadership to distribute the questionnaires and observe the staff during report preparation tasks. This dual approach ensured data triangulation, adding reliability to the analysis. Observation allowed for an accurate comparison of pre- and post-intervention performance, ensuring a comprehensive assessment of the intervention's effects.

Treatment of Data

Descriptive statistics—such as mean scores and frequency counts—were computed to describe the respondents' experiences and highlight process inefficiencies. The reporting time, error rate, and staff satisfaction levels were recorded before and after the LSS intervention to determine measurable improvements. Furthermore, Pearson's correlation coefficient (r) was used to assess the strength and direction of the relationship between the LSS implementation and reporting efficiency. Data were visually presented through graphs, tables, and charts for clarity. This visual presentation made it easier to communicate findings with stakeholders, resonating with evidence-based strategies to modernize public offices (Carvajal et al., 2024).

Ethical Considerations

Ethical standards were strictly followed. Participants gave informed consent, and confidentiality was maintained throughout the research process. All responses were anonymized to protect participant privacy.

RESULTS and DISCUSSION

This section incorporates Lean Six Sigma to guide reporting in the Municipal Population Office by using data gathered during the intervention period.

Main Problems in the Reporting Process Before Lean Six Sigma Intervention

The table below presents the main problems identified by the Municipal Population Office of Bustos prior to the implementation of Lean Six Sigma.

Table 1: Main Problems in the Reporting Process Before Lean Six Sigma Intervention

Problem	Frequency	Impact	Mean Score
1. *Performing too many tasks manually*	*High*	*Longer processes and higher chances of errors*	*4.23*
2. *Problems with prompt approval and feedback*	*Medium*	*Report finalization is taking more time.*	*3.78*
3. *There are no standard methods for reporting incidents.*	*High*	*Problems with the reliability of the data and reports*	*4.15*
4. *Issues in communication between departments*	*Medium*	*Difficulties in moving data quickly*	*3.55*
5. *No program for the automation of reports*	*High*	*Increasing tasks for employees and the chance of making mistakes*	*4.30*

Table 1 indicates that significant problems arise during the reporting process within the Municipal Population Office of Bustos. The majority of respondents (M = 4.23) identified manual data entry as the most significant issue, as it led to more mistakes and longer delays. Not having automation (M=4.30) exacerbated this difficulty, as manually entering the data led to delays and could cause errors in the reports.

The process was slowed down by delays in getting approval (M=3.78) and in receiving regular updates (M=3.55). Such delays made it take longer to receive signatures and feedback, which, conferring to Pandey and

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Pandey (2015), are common issues for organizations with ineffective workflows. As paperwork was not processed according to set rules (meaning many people gave it a score of 4 or less), this made the information in reports unreliable and caused changes in how data was entered.

According to Pandey and Pandey (2015), manual work introduces inefficiencies because it is slow, often results in errors, and relies on human intervention. Many public sector organizations continue to use outdated methods, and as these organizations lack automation, manual processes result in delays and errors (Antony et al., 2019). As procedures vary from one project to another, it is more challenging to notice improvements in how things are done and how well they are done (Bevan et al., 2016). With Lean Six Sigma, tasks are handled by machines, waste is eliminated, and all steps are made the same to promote consistent results.

Effect of Lean Six Sigma on Speed, Accuracy, and Efficiency

Table 2 shows how the Municipal Population Office of Bustos has improved significantly in speed, accuracy, and efficiency by embracing Lean Six Sigma. Streamlining processes, adding automation, and standardizing procedures were among the key contributions of Lean Six Sigma. L

Table 2: Effect of Lean Six Sigma on Speed, Accuracy, and Efficiency

Improvement Area	Pre-Intervention	Post-Intervention	Mean Score
1. *Processing time*	*1,920 minutes*	*310 minutes*	*4.50*
2. *Error rate in data entry*	*High*	*Low*	*4.45*
3. *Staff satisfaction with the new system*	*Low*	*High*	*4.30*
4. *Time to generate and submit reports*	*8 hours*	*2 hours*	*4.60*

Lean Six Sigma's implementation improved the rate, precision, and overall performance of reporting tasks, as shown in Table 2. The processing time is now 310 minutes, a 75% decrease compared to the prior 1,920 minutes it took. It is evident that by addressing waste and automating work, Lean Six Sigma made the report generation process much faster.

With this specific improvement, the error rate has decreased by more than 4.45%, and tasks previously handled by people have been automated through Lean Six Sigma. According to the assessment, staff satisfaction was 4.30, reflecting an improvement in morale. Replacing manual work with the new system enabled staff to focus on tasks that mattered more. This aligns with the findings of Pandey and Pandey (2015), who note that Lean Six Sigma enhances efficiency, quality, and job satisfaction among employees.

The results in Table 2 show more speed and accuracy, which agree with Pandey and Pandey (2015), observation that applying Lean Six Sigma leads to better control of processes. According to Bevan et al. (2016) and Snee and Hoerl (2010), standardizing and automating processes are important for better operations, and they were major contributors to the success of Lean Six Sigma here.

Reduction of Time Delays and Errors Post-Intervention

The following table illustrates how Lean Six Sigma has reduced both the time required to report and the frequency of errors in the process.

Table 3: Reduction of Time Delays and Errors Post-Intervention

Problem	Pre-Intervention	Post-Intervention	Mean Score
1. *Excessive waiting time for signatures and feedback*	90 minutes	0 minutes	4.70
2. *Time taken for data entry*	300 minutes	30 minutes	4.55

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

3. *Manual errors in report generation*	High	Low	4.50
4. *Delays due to inter-departmental communication*	60 minutes	15 minutes	4.40

Table 3 reveals that time delays and errors have been significantly reduced once Lean Six Sigma was implemented. The M=4.70 demonstrates that waiting for signatures and feedback was the main issue that the intervention fixed. The report was concluded more quickly since there were no additional waiting periods before finalization.

This means the automation did not take as long as manual entry, which is why the time was decreased to 4.55. Automation helped reduce mistakes made by staff (M = 4.50), ensuring that the processed data was more accurate and reliable. The decreased delays in communication (M = 4.40) suggest that improved communication between teams helped speed up both approvals and responses.

This aligns with the views of Pandey and Pandey (2015), who suggest that Lean Six Sigma helps reduce waiting times and streamlines communication. Snee and Hoerl (2010) explain that automation and improved processes can significantly reduce errors and increase speed, as observed in this study. According to Bevan et al. (2016), Lean Six Sigma facilitates smooth communication and minimizes delays.

Table 4: Lean Six Sigma's Impact on Reporting Process Efficiency

Factor	Pre-Intervention	Post-Intervention	Pearson's Correlation (r)	Significance (p-value)
Processing Time (minutes)	1,920 minutes	310 minutes	-0.92	0.001
Error Rate in Data Entry	Frequent	Minimal	-0.85	0.002
Staff Satisfaction with the New System	Low	High	0.88	0.003
Time to Generate and Submit Reports	8 hours	2 hours	-0.94	0.000
Inter-departmental Communication	Delayed	Improved	0.77	0.004

The successful implementation of Lean Six Sigma (LSS) at the Municipal Population Office of Bustos, Bulacan, has yielded significant advantages in operational efficiency, accuracy, and communication. The time required to generate reports was reduced by 75 percent, decreasing from 1920 minutes to 310 minutes (12.6 hours), thereby demonstrating LSS's effectiveness in waste elimination and the automation of routine tasks. This reduction aligns with the principles of Lean Six Sigma, which emphasize process simplification and efficiency optimization, as articulated by Sharief and El-Sebaie (2014) and Hoyer et al. (2013) in their scholarly analyses of waste reduction and operational efficiency. Furthermore, an improvement in data entry accuracy was achieved, supporting the application of automation to enhance precision, corroborating the assertions of Snee and Hoerl (2010) that automation reduces human error.

According to Pandey and Pandey (2015), minimizing manual labor and achieving comparable gains can lead to enhanced job satisfaction and increased productivity. Kim (2020) further added that such improvements may also promote higher levels of employee engagement. Staff satisfaction was significantly improved, with a correlation coefficient of r = 0.88, indicating a positive influence of Lean Six Sigma (LSS) on employee morale. This enhancement is attributed to the reduction of manual activities, which allows staff to concentrate on higher-priority tasks. Additionally, report preparation and filing, previously requiring eight hours, are now completed within two hours, demonstrating a reduction in operational time, which demonstrated a negative correlation of r = -0.94.

Adherence to process speed was emphasized in the works of Bevan et al. (2016), who advocated streamlining processes to expedite operations, and Antony et al. (2019), who noted that shorter process durations positively influence overall organizational performance. Lastly, interdepartmental communication was markedly improved, as evidenced by a positive correlation of r = 0.77, indicating that standardization of processes and enhanced data sharing facilitate better communication between departments.

This increase in teamwork aligns with the findings of Antony et al. (2019), who reported that LSS can significantly enhance cross-departmental coordination within public sector organizations. Collectively, these findings

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

confirm that Lean Six Sigma serves as an effective instrument for enhancing public sector operations by promoting efficiency, accuracy, effective communication, and staff satisfaction.

Conclusions

In conclusion, the implementation of Lean Six Sigma in the Municipal Population Office of Bustos significantly improved the efficiency, accuracy, and speed of the reporting process. The research indicated that automation reduced the time needed for processing by 75% (1,920 minutes were reduced to 310 minutes) and decreased the number of mistakes in data entry by 57% (the number of errors dropped from 6.32 to 4.45). Besides, there were no longer any waits for approvals (M = 4.70), and manually inputting data took only 30 minutes instead of 300 minutes (M = 4.55), showing the difference Lean Six Sigma made in clearing up bottlenecks and improving the workflow. These changes enabled staff to work more effectively and stay engaged (M = 4.30). The evidence suggests that Lean Six Sigma is effective in enhancing the efficiency of public sector operations. If people are kept well-trained, processes are automated, and departments collaborate, services will continue to improve and become more efficient.

Recommendations.

The results of this study indicate that the Municipal Population Office of Bustos should further automate both data entry and report creation, which would result in reduced manual tasks and more accurate results. Implementing a real-time reporting system fosters open communication among departments, minimizes delays, and facilitates informed decision-making. Additionally, using standard methods for reporting will ensure uniformity and elevate the quality of reports. Also, regular training of all employees in Lean Six Sigma will support continuous advancement and mastery of the new procedures. If the process is frequently audited, it helps maintain its success and identify further opportunities for growth. Bringing the improvements of Lean Six Sigma from the Population Office to other departments within the municipality could lead to enhanced teamwork across departments and more consistent processes throughout the organization. As a result of these initiatives, reporting will be more effective, and the services provided by the Municipal Population Office will be efficient and timely.

REFERENCES

Amihan, S. R., Sanchez, R. D., & Carvajal, A. L. P. (2023). Sustained quality assurance: Future-proofing the teachers for an ASEAN higher education common space. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR),* 2(4), 276-286. https://etcor.org/storage/iJOINED/Vol.%20II(4),%20276-286.pdf

Antony, J., Cudney, E., Rodgers, B. (2019). *Lean Six Sigma in policing services: case examples, lessons learnt and directions for future research.* Total Quality Management & Business Excellence 30(5-6):613-625. DOI:10.1080/14783363.2017.1327319

Bevan, N., Carter, J., Earthy, J., Geis, T., & Harker, S. (2016). *New ISO standards for usability, usability reports, and usability measures. In Human-Computer Interaction. Theory, Design, Development and Practice:* 18th International Conference, HCI International 2016, Toronto, ON, Canada, July 17-22, 2016. Proceedings, Part I 18 (pp. 268–278). Springer International Publishing, https://link.springer.com/chapter/10.1007/978-3-319-39510-4_25

Carvajal, A. L. P., & Sanchez, R. D. (2024). Probing the Leadership Qualities of Local Chief Executives (LCEs) in Creating Competitive Creative Communities: Basis for Leadership Framework and Development Plan. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR),* 3(1), 380-400. https://etcor.org/storage/iJOINED/Vol.%20III(1),%20380-400.pdf

Carvajal, A. L. P., Sanchez, R. D., Pangilinan, A. M., & Sario, J. (2024). Helping Should Be Measured: Examining the Impacts of Underhelping and Overhelping in Corporate Social Responsibility (CSR) Initiatives. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR),* 3(4), 476-495. https://etcor.org/storage/iJOINED/Vol.%20III(4),%20476-495.pdf

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Hoyer E. (2013). *A Lean Six Sigma Quality Improvement Project to Increase Discharge Paperwork Completeness for Admission to a Comprehensive Integrated Inpatient Rehabilitation Program*, vol. 28 (4). DOI: 10.1177/1062860612470486

Kim, K. (2020*). Implementation of lean six sigma in municipal government operations to improve efficiency and quality: A Case Study. Journal of the Korea Industrial Information Systems Research,* 25(4), 49–63, Journal of the Korea Industrial Information Systems Research Vol 25 No.4, Aug. 2020:49-63 http://dx.doi.org/10.9723/jksiis.2020.25.4.049 ISSN: 1229- 3741

Muńoz, M. C., & Sanchez, R. D. (2023). Exploring Fernandino Teens TV as a supplementary learning delivery modality: Opportunities and challenges from the lens of select learners. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(1), 358-374.

Pandey, P., Pandey, M., (2015). *Research Methodology: Tools and Techniques*, Kogaion Publishing Center, https://www.euacademic.org/BookUpload/9.pdf

Snee, R., & Hoerl, R. (2010). *What's Next After Lean Six Sigma?*, Semantic Scholar, https://pdfs.semanticscholar.org/fb76/0d11ce6cbe61283cb712dbf3246aecb08ba7.pdf

Sharief, M. A., & El-Sebaie, M. G. (2014). *Study of tools, techniques and factors used in lean six sigma*. Int. J. Sci. Eng. Res, 5(12), 1652-1658.