Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AP06.20250060
Published: August 5, 2025

A 5S Implementation Case Study for Organizing a Storage Space

Hlawuleka Joe Menele
Department of Mechanical and Industrial Engineering Technology
University of Johannesburg
Johannesburg, South Africa
222012686@student.uj.ac.za

Kapil Gupta
Department of Mechanical and Industrial Engineering Technology
University of Johannesburg
Johannesburg, South Africa
kgupta@uj.ac.za

Samuel Loyiso Gqibani
Department of Mechanical and Industrial Engineering Technology
University of Johannesburg
Johannesburg, South Africa
samuelg@uj.ac.za

Abstract

This study successfully integrated the 5S methodology and the PDCA cycle to significantly enhance productivity within the university department's storage room. By utilizing key performance indicators (KPIs) and conducting a thorough cause and effect analysis, the study achieves substantial improvements. Specifically, the time required to locate essential items like apparel, cleaning products, and tissues decreased by 25%, 19.12%, and 44.4%, respectively. The finding shows that disorganization and excess inventory as the primary causes of inefficiency. These issues led to wasted time spent searching for items in a cluttered environment, were ultimately impacting overall productivity. This study offers a practical, long-term solution to address storage room inefficiencies by demonstrating the effective application of 5S, PDCA, and cause and effect analysis.

Keywords
Efficiency, 5S, PDCA, Storage space

1. Introduction
In competitive business environment, optimizing operational efficiency has become a top priority for organizations aiming to maintain a competitive edge. An often underestimated yet crucial aspect of achieving overall efficiency lies in effective storage-room management. Efficiently managing storage rooms not only ensures seamless operations but also significantly impacts productivity, cost-effectiveness, and workplace safety (Sirkku Muotka et al, 2023). Among the methodologies, gaining increasing recognition across industries for achieving these goals is the 5S system. Originating from Japanese manufacturing philosophies, the 5S system comprises five core principles: Sort, Set in Order, Shine, Standardize, and Sustain. Each principle plays a unique role in transforming storage rooms from

disorderly spaces into well-organized and productive environments (Khumalo, 2019). Sort involves systematically eliminating unnecessary items from the storage area, ensuring that only essential items are retained. This initial step not only declutters the space but also simplifies inventory management and reduces the time spent searching for items (Peterson & Smith , 2019). Set in Order focuses on arranging items in a logical and ergonomic manner. By assigning specific locations for each item based on frequency of use and operational flow, this principle minimizes wasted time and effort in accessing necessary materials. Implementing visual cues such as color-coded labels and clear signage further enhances efficiency and reduces the likelihood of errors (Mahlaha, 2020). Shine emphasizes the importance of cleanliness and maintenance. A clean and well-maintained storage room not only enhances workplace aesthetics but also improves operational efficiency by reducing the risk of equipment malfunction and ensuring the longevity of stored materials (Rizkya, 2019). Standardize aims to establish and enforce standardized processes and procedures. By creating clear guidelines for storage-room management, organizations ensure consistency in practices across shifts and personnel changes, thereby minimizing confusion and maximizing efficiency. Sustain, the final principle, involves integrating 5S practices into the organizational culture. Continuous improvement through regular audits, employee training, and management support ensures that the gains achieved through initial implementation are sustained over the long term.

The benefits of implementing the 5S system extend beyond mere organization. Enhanced productivity, reduced waste, improved safety, and increased employee morale are among the many advantages reported by organizations that have adopted this methodology. For instance, companies in manufacturing, healthcare, retail, and logistics have all experienced significant improvements in operational efficiency and cost savings after implementing 5S in their storage-room environments (Gupta, 2022). However, successful implementation of 5S requires commitment and engagement at all levels of the organization. Leadership support is crucial in setting the tone and providing resources for implementation, while frontline employees play a pivotal role in driving day-to-day adherence to 5S principles (Tahasin et al, 2021). Moreover, fostering a culture of continuous improvement ensures that the storage-room productivity gains achieved through 5S are sustained and built upon over time. Initially developed to streamline manufacturing processes, the principles of 5S are highly adaptable and have been widely applied to various industries, including warehousing and storage operations. By improving organization and cleanliness, 5S helps reduce waste, minimize errors, and enhance overall productivity (Peterson & Smith , 2019). Lima et al (2023) highlighted that PDCA cycle was found to be a complementary with 5S by fostering continuous improvement and ensuring sustainability of the organizational changes. As it yielded a positive result of the Lean application and offered numerous customer benefits for and business which have become globally acknowledged. Across different industries cause and effect analysis was found to be instrumental in identifying key inefficiencies and measuring the impact of 5S implementation. Tahasin et al (2021) noted that photographs were used to capture the before-and-after conditions, highlighting improvements such as easier equipment location, enhanced safety, and better space utilization in the storeroom. Smith et al (2022) used fishbone analysis to streamline processes, reducing search time. Martin (2020) found PDCA and Kanban improved storage productivity, reducing retrieval time. Patel and Reddy (2021) used Kanban with 5S, achieving 25% delay reduction. Jones and White (2018) applied DMAIC, boosting space utilization by 30%. 5S reduced preparation time by 30%, decreasing waste and accidents, creating a safer, organized workspace (Gupta, 2022).

In conclusion, the implementation of the 5S system represents a proactive approach to enhancing storage-room productivity and operational efficiency. By systematically organizing, maintaining cleanliness, and standardizing processes, organizations can transform their storage rooms into strategic assets that contribute to overall business success. As industries continue to evolve, embracing methodologies like 5S not only meets current operational challenges but also prepares organizations for future growth and competitiveness in a dynamic global market.

2. Problem Statement and Objectives

This work attempts to solve a problem that was being faced by the staff and users of a storage room located in the premises of an engineering department of an international university. The storage room was completely unorganized with improper arrangements of items that were being used periodically in other parts of the department and used to get removed if and when required. Failure in maintaining neatness, cleanliness, and orderliness, was affecting

productivity adversely. The present work implemented a hybrid 5S-PDCA methodology with the following key objectives:

- To assess the current state of storeroom and identify key areas for improvement through the application of 5S principles.
- To implement a structured 5S framework in conjunction with the PDCA cycle to systematically organize, clean, and standardize storeroom operations.
- To evaluate the effectiveness of the 5S and PDCA integration by measuring improvements in productivity, safety, inventory management, and overall operational efficiency. Lastly, providing actionable recommendations for sustaining and continually improving storeroom management processes.

3. Methodology

In this study, a mixed method was utilised. This method utilizes both qualitative observations to understand current practices and challenges, and quantitative analysis to measure productivity. The process flow approached in a storeroom combined 5S principles and Plan-Do-Check-Act (PDCA) cycle using 10 basics steps as presented in Figure 1.

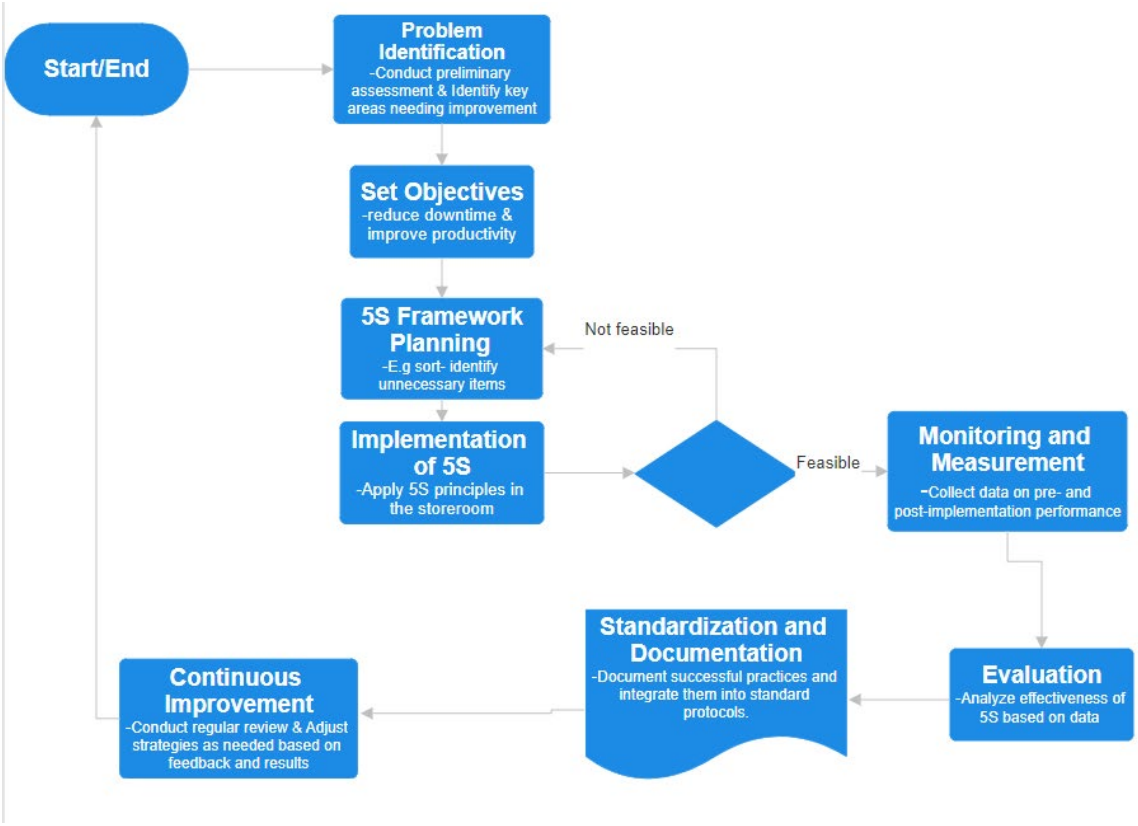


Figure 1. Continuous improvement process flow of 5S combined PDCA cycle

Phase-1: Plan

Step 1: Problem Identification: An intensive preliminary assessment was conducted to identify areas in need of improvement. The team entered the storage room to visualize the current inventory setup. Upon inspection, it quickly became evident that the storage room was disorganized with excess inventory laying there as shown in Fig. 2.

Step 2: Set Objectives: Upon discovering the current problem, realistic objectives needed to be set and that include reducing downtime by 10% and improving overall productivity by 20%.

Step 3: **5S Framework Planning**: This step involves planning the application of the 5S principles (Sort, Set in order, Shine, Standardize, Sustain) with a focus on areas like identifying unnecessary items and organizing the workspace.

- Sort: Identify and eliminate unnecessary items from workstations.
- Set in Order: Organize necessary items for easy access and efficient workflow.
- Shine: Clean the repository to maintain a tidy environment.
- Standardize: Establish standards for organizing and maintaining the workspace.
- Sustain: Develop a culture of continuous adherence to the 5S standards (Figure 2).

Figure 2. Conduct of preliminary assessment and identification of problem

Phase-2: Do

Step 4: Implementation of 5S: The 5S principles were applied practically, such as organizing the storeroom or workspace. This involves physical actions based on the 5S methodology in the following ways.

- Sort and remove unnecessary items from the repository.
- Arrange necessary items methodically for easy access.
- Clean and perform routine maintenance.
- Create and display standard operating procedures (SOPs).

The pictures after 5S implementation are shown in Figure 3.

Figure 3. After 5S was implemented

Phase-3: Check

Step 5: Monitoring and Measurement: Data was collected to track performance before and after implementing 5S. This helps in understanding the impact of the changes made.

Step 6: Feasibility check: checking of the work done (5S framework) If it is feasible or not. For example, if 5S framework is feasible, the process may continue to Evaluation and if not feasible process may revert to earlier stages for re-evaluation and adjustment.

Step 7: Evaluation: An analysis was conducted to assess the effectiveness of the 5S implementation based on collected data.

Phase-4: Act
Step 8: Standardization and Documentation: Once successful practices are identified, they are standardized and documented to become part of regular processes and protocols and shown in Figure 4.

Figure 4. Standardization and Documentation

Step 9: Continuous Improvement: This is an ongoing process where regular reviews are conducted, and strategies are adjusted based on feedback and results to ensure continuous improvement.

- For example, it may include holding regular review meetings to discuss performance and identify areas for further improvement.

Step 10: Process End.

The qualitative and quantitative data collected for evaluation before and after the implementation of 5S and 5S with PDCA can provide valuable insights into the effectiveness of these methodologies.
Qualitative Data: Non-numerical data was gathered through observations.
Quantitative Data: Numerical data was collected through various methods, including time studies, waste audits, and inventory audits.
This data can be analyzed and visualized using graphs, charts, to identify trends, patterns, and areas for improvement.

4. Results and Discussion

Table 1 shows the time study results, conducted in the storage room to quantify the effect of disorganization on productivity workflow. Both 5S and 5S with PDCA have led to significant improvements in task times. The 5S with PDCA approach has consistently outperformed 5S alone in terms of time reduction. Figure 5 illustrates the impact of the 5S methodology on productivity and efficiency in the storeroom by measuring the time it takes to locate various items ("Apparels," "Cleaning Products and Tissues") before and after 5S implementation, and after applying 5S with PDCA (Plan-Do-Check-Act) for continuous improvement (Figure 5).

Table 1. Time study results

Items	5S before (time in Sec)	5S after (time in Sec)	5S+PDCA (continuous improvement) (time in Sec)
Apparels	120	90	30
Cleaning products	136	110	55
Tissues	45	25	15

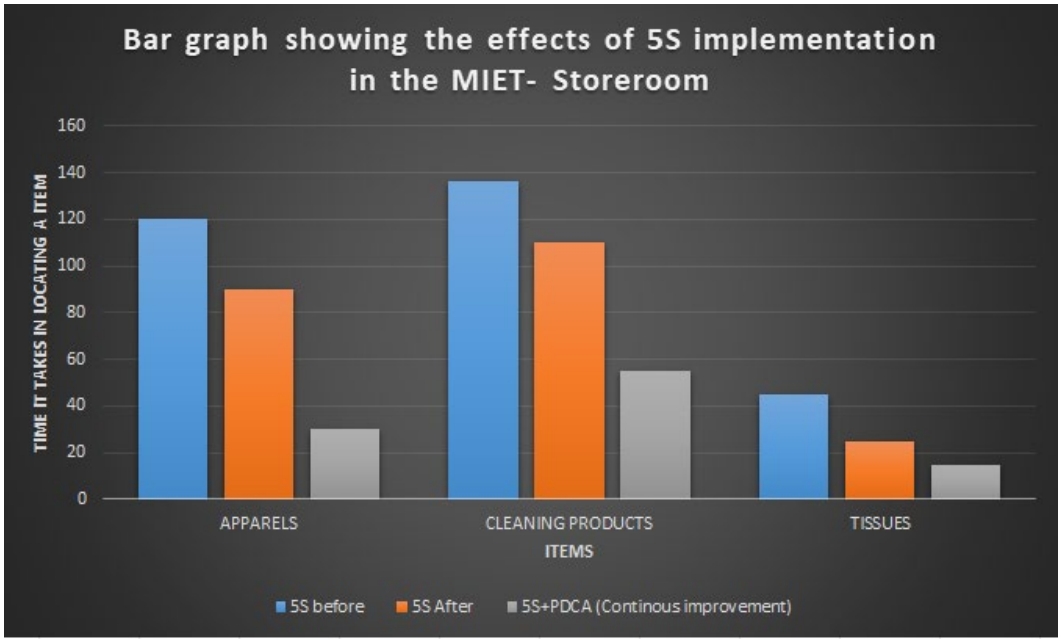


Figure 5. Effects of 5S implementation

Before 5S Implementation: At the current problem**.**

- The initial time to locate items was significantly high across all categories, with "Cleaning Products" taking the longest at 136s, followed by "Apparels" around 120s, and "Tissues" (about 45s).
- This indicates inefficiency in storage organization, where employees spend a considerable amount of time searching for items, leading to lower productivity levels.

After 5S Implementation: Solving the current problem.

- Post-implementation of the 5S methodology, there is a noticeable reduction in time across all item categories:
  - **Apparels:** Time was reduced from around 120 to 90s, indicating a 25% improvement in efficiency.
  - **Cleaning Products:** Time drops from approximately 136s to 110s, showing a 19.12% increase in productivity.
  - **Tissues:** The time taken decreases from around 45s to 25s, marking a 44.4% enhancement in efficiency.
- The significant reduction in time demonstrates that 5S—Sort, Set in Order, Shine, Standardize, and Sustain—effectively streamlines the organization of the storeroom, reducing wasted time and effort.

The calculation methodology is given below:

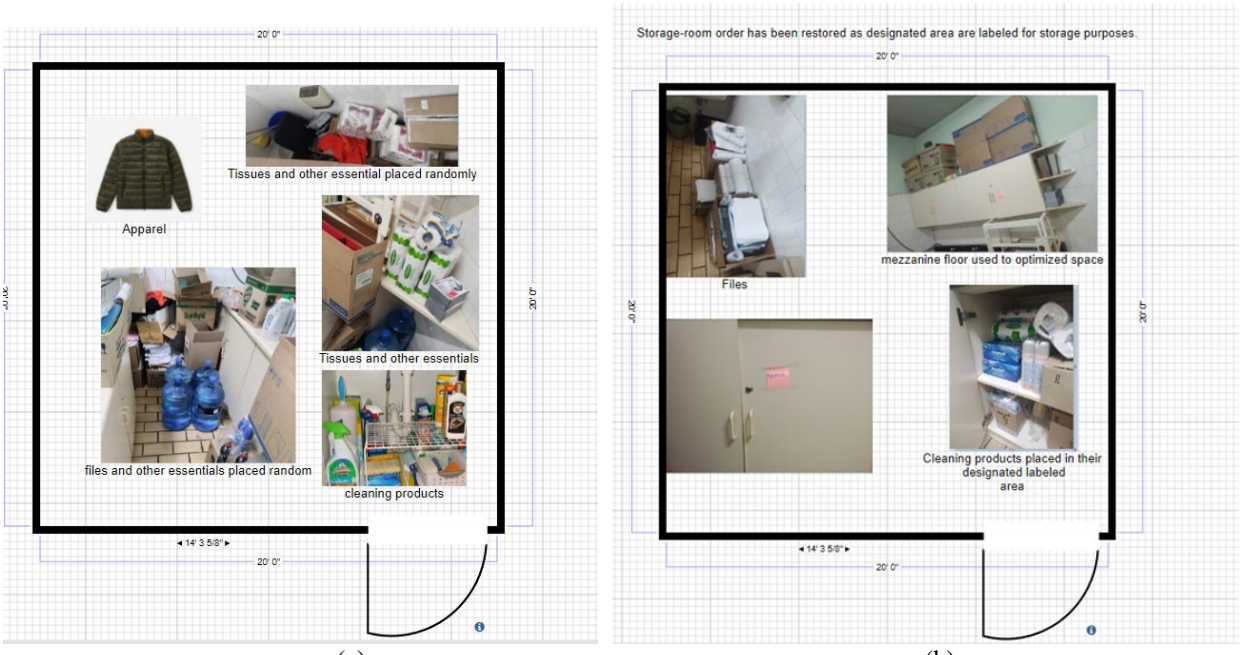
$$Efficiency = \frac{\text{Old value} - \text{New value}}{\text{Old value}} * 100$$

Efficiency of Apparels: Before 5S implementations: $E=:\frac{120-90}{120} * 100 = 25\%$

5S plus PDCA (Continuous Improvement):

- After applying the PDCA cycle along with 5S, further time reductions are observed:
  - **Apparels:** Time to locate drops to approximately 30s, an additional 75% improvement compared to post-5S.
  - **Cleaning Products:** Time was further reduced to around 55s, showing a 59.56% improvement over the post-5S state.
  - **Tissues:** Time taken to locate items decreases to around 15s, marking another 66.67% increase in efficiency.
- The integration of PDCA (Plan, Do, Check, Act) facilitates continuous monitoring, feedback, and iterative improvements beyond the initial 5S setup. This leads to sustained and enhanced productivity, as reflected by the dramatic reduction in time spent locating items.

As per Figure 6a-b, the new storage-room layout had optimized space, facilitating organization and accessibility. Clear zones for inventory had reduced clutter, enabling effective 5S implementation. This transformation had minimized excess items on the floor, enhancing efficiency and workplace safety.



(a) (b)

Figure 6. Layout (a) before 5S was implemented, (b) after 5S was implemented

Zones: Clearly defined areas for item categories enhance organization, reduce search times, and streamline workflows in the storage room.
Labels and Color-Coded Shelving: Visual cues improve item identification, maintain organization, and minimize errors, facilitating quicker access to needed supplies.
Pathways: Unobstructed pathways ensure smooth movement, promote safety, and enable quick retrieval of items, enhancing overall operational efficiency.
Mezzanines: Utilizing vertical space increases storage capacity, keeps frequently used items accessible, and reduces floor clutter, optimizing storage room functionality.

5. Conclusion

This study enhanced storage-room productivity in the engineering department through the 5S-PDCA methodology, a lean management tool focused on creating organized, efficient workspaces. Implementing 5S resulted in substantial time savings for locating items, addressing issues of disorganization and excess inventory, which previously led to wasted time and reduced productivity. The key improvements included a better-organized layout that reduced clutter and minimized time spent on non-essential tasks. The significant decrease in time to locate various items after 5S implementation was further reduced by complementing 5S by PDCA due to continuous improvement strategy placed. The findings of this study offered a sustainable solution for storage inefficiencies. Ongoing audits and time studies are recommended to maintain 5S practices and monitor efficiency gains over time, demonstrating that commitment to these principles can lead to lasting productivity improvements across similar organizational settings.

References

Anderson, P. Visual management using Kanban and 5S: Enhancing productivity in storage environments. Journal of Industrial Management, 28(3), 45-58, 2019.

Fernandez, R., Patel, G., & Singh, D. Combining 5S with Cause and Effect for root cause analysis in industrial settings. International Journal of Lean Manufacturing, 12(4), 70-83, 2017.

Gupta, K. A review on implementation of 5S for workplace management. Journal of Applied Research on Industrial Engineering, 9(3), 323-330, 2022.

Gupta, R. PDCA cycle and 5S for operational efficiency: A case study in storage facilities. Operations Management Review, 15(2), 30-42, 2020.

Gupta, S., & Chandna, P. A case study concerning the 5S lean technique in a scientific equipment manufacturing company. Grey Systems: Theory and Application, 10(3), 339-357. https://doi.org/10.1108/GS01-2020-0004, 2020.

Helmold, M. Lean Management and Kaizen Fundamentals: From Cases and Examples in Operations and Supply Chain Management. 1st ed. Cham: Springer International Publishing, 2020.

Jones, M., & White, H. The role of 5S and DAMIC in continuous improvement for storage-room productivity. Journal of Quality Engineering, 34(1), 15-28, 2018.

Khumalo, V., & Gupta, K. A case study on effectiveness of 4S implementation in a machine shop. In Proceedings of the International Conference on Industrial Engineering and Operations Management (pp. 798-807), 2019.

Khumalo, V., & Gupta, K. Implementation of Shitsuke for sustaining with 5S culture in a mechanical workshop. In Proceedings of the International Conference on Industrial Engineering and Operations Management (pp. 808-819). IEOM Society International, Pilsen, Czech Republic, 2019.

Kuchekar, P. N., Pant, R., & Polampally, R. P. Implementation of 5S in manufacturing industry: A case study. International Journal of Innovative Science and Research Technology, 4(5), 1254-1260, 2019.

Lee, H., & Tanaka, M. Cause and effect analysis with 5S: A study in industrial warehouses. Warehouse Management Journal, 21(5), 95-110, 2019.

Lima, R. M., Souza, I., Pereira, E., Belém, A. C., Pinto, C. M., Lazzaris, J., & Fonseca, P. Characterising project management of lean initiatives in industrial companies—Crossing perspectives based on case studies. Engineering Management in Production and Services, 15(1), 57-72, 2023.

Mahlaha, K., Sukdeo, N., & Mofokeng, V. A Lean 7S methodology framework to improve efficiency and organizational performance: A review study in an SME organization. In Proceedings of the International Conference on Industrial Engineering and Operations Management (pp. 962-968), 2020.

Martin, S. PDCA and Kanban synergy in warehouse management: Boosting productivity. Operations Research Journal, 14(6), 60-72, 2020.

Mohamed, I., & Singh, L. Root cause analysis and 5S for lean storage management: A case study. Journal of Operations Excellence, 11(4), 80-95, 2018.

Patel, K., & Reddy, S. Enhancing productivity using Kanban and 5S in storage-room settings. International Journal of Production Management, 29(7), 40-55, 2021.

Peterson, J., & Smith, R. The 5S Pocket Guide. 1st ed. New York: CRC Press, 2019.

Pita, M. Implementation of 5S principles in mechanical engineering laboratories of University of South Africa, Science Campus. In SAIIE31 Proceedings (pp. 252-257), 2020.

Rizkya, I., Syahputri, K., Sari, R. M., & Siregar, I. 5S implementation in a welding workshop: A lean tool in waste minimization. IOP Conference Series: Materials Science and Engineering, 505(1), 012018. https://doi.org/10.1088/1757-899X/505/1/012018/meta, 2019.

Santos, R., & Kumar, A. DAMIC and 5S: A comprehensive approach to productivity enhancement in storage environments. Quality Management Review, 18(2), 65-78, 2021.
Siahaan, F. S., Purba, J., Buwono, A., Ratih, R., & Refendi, H. The Monozukuri concept as the right 5S implementation tool in Jakarta vocational high schools. Journal of Physics: Conference Series, 1469(1), 012129. https://doi.org/10.1088/1742-6596/1469/1/012129/meta, 2020.
Sirkku, M., Amir, T., & Juha, V. A design thinking approach: Applying 5S methodology effectively in an industrial work environment. 33rd CIRP Design Conference, 119, 363-370, 2023.
Smith, L. PDCA and 5S in storage-room productivity: A continuous improvement approach. Industrial Efficiency Journal, 9(1), 20-35, 2020.
Tahasin, T. A., Gupta, H. S., & Tuli, N. T. Analyzing the impact of 5S implementation in the manufacturing department: A case study. International Journal of Research in Industrial Engineering, 10(4), 286-294, 2021.
Vienažindienė, M., & Čiarnienė, R. Lean implementation in management systems: A case study approach. Polish Journal of Management Studies, 28(3), 423-437, 2023.

Biographies

Hlawuleka Joe Menele is a final-year student pursuing a BEng Tech in Industrial Engineering at the University of Johannesburg within the Faculty of Engineering and the Built Environment (FEBE). As an aspiring engineer, he is eager to make a positive impact on his community. Additionally, as a professional long-distance runner, athletic experiences give him a unique perspective on discipline and perseverance, qualities he brings to his academic and professional pursuits. He looks forward to contributing value through his skills and dedication.

Kapil Gupta is working as Professor at University of Johannesburg, South Africa. He obtained PhD in Mechanical engineering. He has over ten years of professional experience. He has authored more than hundred research and review articles. He has also authored and edited twenty international books. His area of specialization is advanced manufacturing and modern industrial engineering. He has carried out research projects in lean manufacturing, six sigma, sustainable manufacturing, modern machining, and materials engineering. He is holding positions on the editorial boards of international journals. He has supervised nine doctorate and eighteen masters students and hosted five postdoc fellows.

Samuel Loyiso Gqibani is working as Senior Lecturer and Head of School of Mechanical and Industrial Engineering. He obtained PhD in Mechanical Engineering. He has vast experience of academic and administration. His interests are engineering education, thermal engineering, industrial engineering and management. He has published articles in international journals and conference proceedings.