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Boosting Workplace Safety and Health with 5S: A Case Study at the IMU Construction Site

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ABSTRACT

The construction industry is one of the most dangerous economic sectors, which has a major role in workplace fatalities and accidents. Strategies for continuous improvement that can methodically improve occupational safety and health (OSH) are necessary to address this issue. Implementing the 5S program, a Japanese methodology rooted based on the Kaizen philosophy, is one of the ways to encourage workers in an organization to practice discipline, cleanliness in the workplace. This research was conducted to assess how well the 5S program contributed to improving OSH aspects at the International Medical University (IMU) Hospital construction site in Kuala Lumpur. The issue stems from the absence of organized and regular safety procedures at building sites, which raises the possibility of mishaps and lowers output. This study explores how such problems can be mitigated by employing a methodical approach, such as 5S. A qualitative research design using a survey methodology was employed. Field interviews and self-observation were used to collect primary data, and literature reviews were used to collect secondary data. The study covered the pre- and post-implementation phases of the 5S program and was carried out over three years (2018–2021). The findings reveal that all five of the 5S elements, Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke (sustain), had significantly improved OSH practices. These upgrades resulted in improved worker discipline, cleaner work environments, reduced material hazards, safer storage procedures, and safety compliance. In the future, the study recommends making the 5S practices a standard procedure in the Malaysian construction sector. In order to maintain the advancements made possible by this system, it also emphasizes the necessity of ongoing training, top management commitment, and regular audits.

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1. Introduction

The construction sector plays a vital role in the national and economic development of the country, which involves complex and large-scale projects that usually require many laborers and heavy machinery. According to Mazliah (2012), this industry includes a broad range of tasks requiring the use of large machinery and equipment, such as building high-rises, commercial complexes, housing projects, infrastructure development, and other civil engineering projects. However, safety management is a crucial concern because the construction

industry is also known for its highly hazardous working environment.

In order to address these concern, many private construction companies in Malaysia and around the world have started incorporating Kaizen, a Japanese concept of continuous improvement, into their operational procedures in response to the growing demand for increased productivity and safety. The 5S program, which emphasizes workplace organization and standardization to enhance productivity and occupational safety and health (OSH), is one popular Kaizen tool (Gapp et al., 2008; Gupta and Jain, 2015). Originally developed in Japan as a productivity tool for manufacturing industries, the 5S system, which is Seiri (Sort), Seiton (Set in Order), Seiso (Shine), Seiketsu (Standardize), and Shitsuke (Sustain), has since been successfully applied to a variety of industries, including construction (Hirano, 1995; Visco, 2017).

The 5S program was implemented at the midpoint of the project lifecycle at the IMU Hospital construction site in Kuala Lumpur. This timing made it possible to compare the working conditions prior to and following implementation, providing important information about the program's effects. The site's implementation of 5S was meant to foster a strong safety culture among employees in addition to streamlining processes and cutting waste. This is in line with research by Akbar (2017), who highlighted how 5S improves quality awareness and creates a structured workplace that is crucial for high-risk industries like construction.

Furthermore, visual management tools and audits were used to track the systematic implementation of 5S at IMU Hospital, in line with Suwondo's (2012) and Rahman et al. (2010) recommendations that the program's success is reliant upon leadership commitment, consistent training, and employee participation. These procedures were put in place to make the workplace cleaner, safer, and more productive; in the end, this resulted in lower accident rates, happier workers, and better adherence to the 1994 Occupational Safety and Health Act (OSHA) regulations. Moreover, the previous research has shown that 5S enhances productivity and safety (Fitri & Putra, 2024; Nurdiatmoko & Sulistyowati, 2020), yet long-term implementation of 5S in the context of complex construction projects are less documented. This report adds to the body of knowledge 3 years after its implementation of 5S program at IMU Hospital construction site on what effect did 5S have on workplace behavior, hazard control, cleanliness and OSH compliance.

The 5S program focuses on boosting work productivity while also increasing awareness of quality factors (Quality Awareness) (Akbar, 2017). Table 1 presents the 5S practices applied at the IMU Hospital construction site following the Kaizen 5S methodology

Table 1 5S Practices at the IMU Hospital Construction Site

Japanese Term	Malay Term	5S Practice Description
• Seiri	• Sisih	• This refers to the separation or disposal of materials that are no longer usable or are damaged.
• Seiton	• Susun	• This involves systematically organizing tools and equipment so they can be easily accessed, used, and returned according to their classification.
• Seiso	• Sapu	• This is the process of cleaning the workplace and equipment to make sure a safe and healthy working environment.
• Seiketsu	• Seragam	• This refers to maintaining a safe workplace layout, creating a conducive working environment, and ensuring all tools and materials are stored according to labeled designations.
• Shitsuke	• Sentiasa Amal	• This represents the commitment of every worker to consistently practice the 5S principles at the workplace.

1.1 Research Objectives

1. To examine the implementation of the 5S program at the IMU Hospital construction site.
2. To study the comparison of OSH conditions before and after 5S implementation.
3. To study how each 5S element influences workplace safety and reduces hazards.
4. To study worker perceptions and behavioural changes resulting from 5S implementation.

1.2 Significance of the study

Even though there has been an increasing number of studies on the 5S method, most of the 5S studies in the construction industry seem to have focused on the short-term implementation of the 5S methodology, productivity outcomes, or manufacturing-based

environments. Very little attention has been given to the long-term occupational safety and health (OSH) impacts, behavioural change, and safety culture development, especially in complicated construction projects like hospital developments. Hence, this research aims to investigate the implementation and effectiveness of the Kaizen-based 5S system in enhancing OSH practices at a hospital construction site in Malaysia over a period of three years.

This research is important because it emphasizes the OSH outcomes rather than just productivity and thus provides empirical evidence on the effect of structured workplace organisation on hazard control, worker behaviour, and safety culture in a highly hazardous construction environment. In contrast to the previous studies, this one uses a qualitative case study approach which is supported by triangulated data from site observations, interviews, and safety documentation, thus offering a comprehensive understanding of the physical and behavioural safety enhancements. By filling the gap of the absence of long-term, site-based studies in the construction industry, this study not only expands the existing knowledge in construction safety literature but also shows that 5S can be a proactive and sustainable safety management tool rather than just a housekeeping practice.

2. Literature Review

2.1 Overview of 5S and OSH

The 5S methodology is widely acknowledged as a basis for accident prevention, organizational efficiency, and workplace safety. According to Nurdiatmoko & Sulistyowati (2020), the implementation of 5S significantly increased productivity and OSH through improved organization and hazard control. Similarly, according to Rhaffor & Jamian (2020), the 5S is a cost-effective OSH improvement strategy for Malaysian SMEs. An early 5S production environment study focused on manufacturing where productivity, quality control, and housekeeping were enhanced (Rahman et al., 2010; Gupta & Jain, 2015). The studied practices involved sorted, orderly, clean, standardised, and sustained ones which resulted in waste reduction and improved operational efficiency. However, occupational safety and health (OSH) were only recognised as a consequence and were not the main focus of work.

Researchers have extended their investigation of 5S in the last few years, and the issue of how 5S implementation influences OSH performance has been probed (Suwondo, 2012; Nurdiatmoko & Sulistyowati, 2020). The staffs in the studied sites were safer as their work environments were free from hazards resulting from disorganisation and improper equipment handling. Since 5S methodologies require an overhaul of the enterprise, initial studies on these projects may not be able to realise the long-term behavioural changes and safety culture that 5S can bring about.

Usage of 5S in the construction industry is not noticeable and is much less than in manufacturing. The results of a few construction-based research have pointed to how site productivity, cleanliness, and visual management were emphasised rather than comprehensive OSH outcomes (Fitri & Putra, 2024). Besides, the majority of construction research purely concentrates on general building projects and does not sufficiently account for highly specialised or risky environments such as hospital construction, where hygiene, material control, and uninterrupted access routes are essential for safety. So, it is questionable to a great extent whether the findings from existing studies can be applied to complex construction settings.

Thus, a major weakness that some of the recent research has identified is the paucity of follow-up qualitative research in which the impact of worker behaviour, discipline, and safety culture in relation to 5S practices could be tracked over time. On the one hand, some research has pointed to the significance of the fifth factor of 5S, that is, Shitsuke (sustain), on the other hand, very little evidence of continuing behavioural change after the first 5S implementation phases has been presented. Also, most work tends to depend on one instrument only, e.g., questionnaires or audits without combining interviews, observations, and documentary evidence which makes their conclusions less valid.

2.2 5S in Construction Project

After the manufacturing sector dominates 5S implementation, the construction sector is likely to begin adopting 5S in the construction site to address housekeeping, clutter, and unsafe behaviours. During 2021, a mixed-method study applying 6S (5S + Safety) in construction workplaces found significant improvements in safety climate and reduced accidents. According to Fitri & Putra (2024), the application of 5S at construction sites reduces waste and improves safety communication.

2.3 5S, Safety Culture, and Worker Behaviour

Recent work emphasizes that 5S improves not only physical organization but also behavioural discipline (Shitsuke). According to Fitri & Putra (2024), consistent 5S practices improved attitudes toward OSH compliance, decreased risky behavior, and increased discipline.

2.4 Research Gaps

Despite the established advantages, several gaps remain, such as 1) Limited studies that examine long-term 5S implementation. 2) A very limited study covers hospital construction sites, where safety requirements differ from typical building projects. 3) Many studies only cover productivity, while fewer analyse OSH outcomes, worker perceptions, or behavioural change. 4) The construction site in Malaysia still lacks site-based case studies with qualitative triangulation.

This research fills these gaps by providing a detailed, three-year analysis of 5S implementation in a live hospital construction site, using triangulated qualitative data (interviews, observation, documents).

3. Methodology

3.1 Location and Duration of Observation

This study was conducted at the International Medical University (IMU) Hospital construction site. It is located at Persiaran Jalil 1, Bandar Bukit Jalil, 57000 Kuala Lumpur. An excellent case study for assessing occupational safety interventions is the construction of a healthcare facility such as IMU Hospital, which necessitated rigorous adherence to safety protocols. From the first stages of excavation to the project's completion and handover, the researcher, who was actively involved as a worker, contributed invaluable insider knowledge.

The three-year observation period, which ran from December 2018 to December 2021, covered both the pre- and post-implementation stages of the Kaizen-based 5S program. A thorough examination of workplace modifications, the development of safety culture, and the long-term effects of 5S practices was made possible by this extended involvement (Gapp et al., 2008; Hirano, 1995).

3.2 Method and Data Collection

By using both primary and secondary data collection methods, the study was able to provide a comprehensive and verified understanding of the topic.

3.2.1 Primary Information Gathering

Self-observation and field interviews were the two primary techniques employed. The interviews were conducted in the field. Supervisors, safety officers, and main contractor employees were among the site staff who participated in informal and semi-structured interviews. These interviews provided qualitative data on attitudes, difficulties, and workplace behaviors while focusing on determining perceived changes in OSH conditions prior to and following the adoption of 5S (Gupta & Jain, 2015).

The researcher used participant observation, a validated method for gathering firsthand data in qualitative research, while working on-site full-time (DeWalt & DeWalt, 2011). Journals and logbooks were used to document daily observations, which tracked environmental changes, incidents, and adherence to 5S practices. This approach was essential for capturing the subtleties of behavior, tool use, and space organization that are context-specific and nonverbal

3.2.2 Gathering Secondary Data

Using academic publications, legal documents, and technical standards pertaining to the 5S methodology, Kaizen philosophy, and OSH performance in construction, secondary data was obtained through an extensive literature review. The literature found weaknesses in Malaysia's present safety management system implementation and offered standards for best practices.

The 5S elements and their adaptation across industrial contexts were validated in large part by notable studies like those conducted by Suwondo (2012) and Rahman et al. (2010). Additionally, CIDB Malaysia's safety guidelines and compliance frameworks based on the Occupational Safety and Health Act (OSHA) 1994 were essential resources for assessing implementation standards at the location.

3.3 Triangulation

The Triangulation was performed by comparing findings from participant observation, which are the actual site conditions. Direct observations were carried out at the IMU Hospital construction site by the researcher for three years to record real-time safety practices, worker behavior, housekeeping conditions, and OSH compliance. These observations provided objective evidence of actual safety performance and compliance levels.

Interviews were conducted to analyse perceptions and attitudes of participants toward occupational safety and health (OSH), technology adoption, and continuous safety training. This qualitative data helped explain the reasons behind observed behaviors and practices.

Another data collection using the document review, such as site safety audit records, non-compliance reports, and site inspection logs. These records give information regarding recurrent problems, remedial measures, and management responses.

Consistency across these sources strengthened the validity and reliability of results, such as the improvements noted in seiri and seiton were confirmed by the interview session.

3.4 Moral Aspects to Take into Account

The goal of the study was explained to each participant, and verbal consent was acquired before data collection, even though formal ethical clearance was not necessary. No proprietary or commercially sensitive information was revealed, and anonymity and confidentiality were maintained.

4. Research Result

The study's conclusions came from a comparison of the working conditions at the IMU Hospital construction site before and after the 5S program was put into place. Every step of the 5S method was examined and assessed in light of risk reduction techniques, workplace organization, and safety performance. The first subject of this section is Seiri (sort) is the first 5S pillar.

4.1 Seiri (Sort)

The term "Seiri," which means "sort," describes the methodical removal of superfluous equipment, supplies, and objects from the workplace. Seiri is particularly important in the context of a construction site since cluttered spaces and broken equipment make accidents more likely and decrease operational effectiveness (Gapp et al., 2008). Only useful, pertinent, and secure materials are maintained in active work zones thanks to this procedure, which also makes sure that redundant or broken items are disposed of, fixed, or stored properly.

By encouraging a neat and orderly workspace that can reduce

workplace accidents and boost productivity, Seiri plays a fundamental role in the 5S system, as stated by Suprayitno & Sumarno (2019). This strategy is in line with Malaysia's Occupational Safety and Health Act (OSHA) 1994, which requires employers to keep a workplace free from predictable risks.

The main contractor used checklists, scheduled inspections, and site audits to continuously apply the Seiri method at the IMU Hospital construction site. The following significant results were observed:

1. Taking Out Damaged Tools
Tools with mechanical flaws, broken insulation, or exposed wiring were immediately taken out of service. By doing this, the chance of electric shocks, burns, and cuts was greatly decreased. Such proactive tool sorting reduces injuries and enhances maintenance cycles, claim Gupta & Jain (2015).

2. Getting Rid of Dangerous or Deteriorated Items
To stop possible radiation leaks that could endanger staff members and future hospital residents, hazardous materials such as lead sheets in radiology areas and barium compounds used in wall shielding were identified and disposed of if damaged. Because damaged lead shielding poses a risk of radiation transmission, it should never be reused without verification, according to IAEA (2005) safety standards.

3. Establishment of Well-Ordered Storage Spaces
More room was created for the appropriate storage of brand-new, secure, and usable items by getting rid of extra materials. This supported Lean principles of minimizing "muda," or waste, by improving inventory control and cutting down on time spent looking for functional materials (Hirano, 1995).

Labeling procedures, disposal bins, and monthly audit checklists were implemented to support this system and guarantee ongoing enforcement. In order to promote a bottom-up safety culture, employees received training on how to recognize and classify materials according to their usability. Table 2, shows that the implementation Seiri resulted in the systematic removal of damaged materials and improved housekeeping.

Table 2 Comparison of Conditions Before and After Implementation of the Seiri Method at IMU Hospital Site

No	Condition Before	Condition After	Description
1	Damaged wires were taped and reused	Damaged wires were discarded	Monthly inspection checklist introduced
2	Steel off-cuts scattered around	Off-cuts placed in special collection bins	Penalties for non-compliance enforced by main contractor
3	Unusable materials left in storage	Damaged items removed regularly	Inventory updated with reusable items only
4	Construction debris on every floor	Designated areas created for non-reusable waste	Waste disposal via chutes improved cleanliness
5	Power tools are scattered and mixed	Faulty tools segregated, good tools tagged (green)	Visual tags helped workers avoid using unsafe tools
6	Leaks in diesel/petrol skid tanks	Skid tanks are inspected and maintained monthly	Checklist for fuel storage implemented

These findings support the overarching objective of accident prevention by showing that Seiri helped to produce quantifiable gains in the site's occupational safety performance. Sorting, as demonstrated in earlier case studies (Rahman et al., 2010), is an immediate, cost-effective intervention that, when incorporated into routine operations, can lower risks and improve compliance.

As shown in table 2, The improvement in the Seiri phase of 5S were more than surface changes. In fact, they indicated fewer hidden safety hazards at the site. Removing systematically damaged tools, excess materials and hazardous waste from the site increased the chance of unsafe acts due to equipment failure or clutter greatly decreased. This revised procedure shows hazard elimination at the source which is the most basic principle in occupational safety management. The element Seiri also introduced clear rules, regular inspections and labelled storage systematics. Workers informed that having organized storage easily to used right tools and avoid of using broken tools. A safety officer stated '*Before this seiri implemented the tools are store everywhere. Now organized tools with labelled are segregated properly*.' This shows a behavioural shift toward safer practices.

4.2 Seiton (Set in Order)

The second pillar of the 5S methodology, known as "Set in Order," or seiton, stresses the methodical arrangement of tools, supplies, and equipment to guarantee prompt access, proper use, and a tidy return after use. This idea is particularly important on building sites because chaos can result in delays, inefficiencies, and mishaps (Gapp et al., 2008). Arranging items according to their function, safety category, and frequency of use improves task performance and lowers operational hazards (Peterson and Smith, 2001; Yasuhiro, 1995).

By rearranging physical areas, enforcing labeling regulations, and separating hazardous from non-hazardous materials, the Seiton method was applied at the IMU Hospital construction site. The following were the primary goals of the Seiton implementation:

1. Enhanced Utilization of Tools
Tools are grouped according to their purpose and frequency of use. As an illustration of the significance of task-equipment alignment, floor cutting was delegated to diamond cutters, which are safer and more efficient than standard grinders (Hirano, 1995).

2. Inspection and Labeling
Tools were examined before being stored, and those that were in good working order were labeled, while those that weren't were separated out. This procedure is in line with Lean Safety principles, which encourage visual controls and lessen human error (Gupta & Jain, 2015).

3. Arrangement for Safe Storage
In order to ensure that hazardous materials, such as diesel fuel, were kept away from sources of ignition in distinct, labeled rooms, materials were arranged according to their flammability, weight, and hazard class (Rahman et al., 2010).

4. Accessibility of Documents
The Seiton process even included administrative files. Site offices implemented labeling and categorization systems, which improved the efficiency of document retrieval and decreased the possibility of misunderstandings or safety protocol violations. Table 3 shows the comparison of conditions before and after implementation of the seiton method at IMU Hospital site.

Table 3 Comparison of Conditions Before and After Implementation of the Seiton Method at IMU Hospital Site

No	Condition Before	Condition After	Description
1	The pallet of bricks is stacked in up to 3 layers	Stacking is limited to 2 layers to reduce the risk of danger to workers	Only forklifts are allowed in the brick storage area
2	Flammable materials are stored next to petrol and diesel tanks	Petrol and diesel storage are arranged in a special room, labeled, and kept away from flammable materials	Monthly inspections are conducted using a checklist
3	Construction materials are scattered in the storage area	Construction materials are organized by function and labeled with expiration dates	Systematic arrangement reduces the risk of accidents when retrieving materials
4	Construction materials are mixed on every building level	Construction materials are organized by category in designated areas	Flammable materials are not allowed to be stored in work areas
5	Hand power tools are scattered in the storage room	Tools are organized and labeled according to function and category	Inspections are conducted before arrangements are allowed
6	Files in the office are difficult to refer to because there are no labels	Files are labeled and organized by category on the shelf	A special room is provided to facilitate document retrieval

As shown in Table 3, the Seiton method greatly improved site organization, safety, and accessibility, as demonstrated above. In line with Lean Construction best practices, it is successful implementation requires worker participation, top management commitment, and the availability of labeling and inspection systems (Alarcon, 1997; Womack & Jones, 1996). These improvements occurred because the element seiton teaches clear rules regarding the safe storage of materials and documents. "*Previously, we always experienced near-miss accidents. Now, a better arrangement for materials storage reduces the risk of accidents when retrieving materials*" (worker 2).

The Seiton execution brought about the improvement in the workers' task efficiency and simultaneously the level of safety in handling materials was also raised along with the correct storage. Tools and materials being organized and clearly labelled helped to lessen confusion, avoid laborious and unsafe retrieval of items and reduce the risk of struck-by or collapse-related incidents.

4.3 Seiso (Clean/Shine)

Seiso, which translates to "Shine," places a strong emphasis on routinely and methodically cleaning the workspace and tools in order to preserve a clean, safe, and aesthetically pleasing environment. In addition to improving physical safety, a clean

workplace also raises employee satisfaction and productivity (Harrington, 2000). Seiso was used at the IMU Hospital construction site to avoid physical, biological, and ergonomic risks, particularly in small or moist areas.

The Seiso method's main goals were:

1. A hygienic and secure workplace

Routines for daily and weekly cleaning helped keep waste and debris from piling up, making the workspace more orderly and safe from hazards (Visco, 2017).

2. Control of Animals and Pests
Construction sites are vulnerable to pests and venomous animals, such as spiders and snakes, particularly in tropical regions. Seiso procedures made sure that storage areas were regularly sanitized to avoid infestation or nesting.

3. Unobstructed Emergency RoutesCleared Emergency Paths
Every assembly point, stairway, and emergency exit was routinely cleaned and inspected for impediments. This is in line with DOSH Malaysia's Fire and Safety Guidelines, which require clear escape routes in case of an emergency.

4. Keeping Infectious Diseases at Bay
Frequent sanitation in restrooms and worker quarters helped minimize mosquito and rodent breeding grounds, which are known to spread diseases like leptospirosis and dengue (WHO, 2020).

5. Reducing Environmental Risks
The most frequent kind of workplace injuries are slips, trips, and falls, which can be caused by poorly managed waste. Accordingly, cleaning procedures had a direct effect on lowering accident rates (Suarez-Barraza et al., 2015).

Table 4 shows the conditions at IMU Hospital before and after seiso implementation.

Table 4 Conditions at IMU Hospital Before and After Seiso Implementation

No	Condition Before	Condition After	Description
1	Office area filled with domestic waste	A mandatory cleaning routine is established by the main contractor every Wednesday	All workers are involved in cleaning the office environment
2	Construction materials present along emergency routes	All emergency routes and assembly areas are free from obstructions	Penalties are imposed on non-compliant contractors
3	Staff desks are disorganized and documents are scattered	Staff are required to maintain desk cleanliness, with important documents arranged on shelves and a file room provided	Audits are conducted by HQ to ensure workspaces are neat and organized
4	No complaint channel for safety improvement in the office	All staff are encouraged to report areas needing cleaning	Workers are hired for daily cleaning in office areas, especially restrooms
5	No cleanliness monitoring system at the construction site	One staff member is assigned as a warden for each floor of the construction area	Wardens are responsible for maintaining cleanliness on their assigned floors
6	No contractor representative for daily cleaning	Each contractor assigns a worker representative to carry out cleaning at the construction site	Cleaning by contractor representatives is monitored by the floor warden

Table 4 shown improvement toward cleanliness and reduced obstruction in emergency routes. Particularly in a high-risk, multi-stakeholder construction setting, the Seiso method was essential in fostering workplace discipline, health, and safety. Cleaning is a fundamental safety and quality assurance function in industrial and construction settings, as stressed by Hirano (1995) and Suwondo (2012). It is not just a visual or aesthetic objective. "*The Seiso element teaches of a hygenic and secure workplace which indirectly help reduce pest issues at IMU site*," (Safety Supervisor).

The change from reacting to dirt and mess to cleaning as a way of preventing accidents etc. is indicated by the upgrades made in the Seiso stage. Consequently, regular cleaning of the site prevented slip, trip, and fall accidents as well as obstructions in emergency routes while, at the same time, it also reduced the outbreak of pest-related diseases. Given the fact that there are some pretty strict regulations on sanitation and infection control in hospitals, the fact that this site was a hospital construction site adds even more significance to these changes.

4.4 Seiketsu (Standardize)

Seiketsu is the process of setting up a secure and comfortable work environment where tools and materials are kept in the proper locations with the proper labels. Through standardization, Seiketsu seeks to create high-quality environmental standards for the workplace, guaranteeing that it is consistently hygienic and orderly (Rahman et al., 2010). Suwondo (2012) states that the Seiketsu method seeks to uphold the three primary 5S principles Seiri, Seiton, and Seiso to guarantee.

Ongoing application of the 5S methodology. The following are the goals of standardization:
1. To maintain safety on the construction site by organizing the space according to the type and purpose of the tools and materials.
2. To give employees a comfortable workplace, which can increase productivity.

3. To guarantee that tools and materials are examined and marked as safe for use.
4. To facilitate the removal of building supplies from storage without causing damage or relocating extraneous items.
5. To improve construction site safety while implementing a methodical and efficient work system.

Table 5 shows the comparison of the conditions before and after the Seiketsu method was implemented

Table 5 compares the Conditions Before and after the Seiketsu Method Was Implemented

No	Condition Before	Condition After	Description
1	Disorganized storage of work tools	Standardized tool storage in the storeroom	The quantity of tools can be recorded, and missing or damaged tools can be identified
2	No labels for construction materials in the storage area	Labels are placed in each storage area to prevent mixing	Labeling is done to identify damaged or hazardous tools and materials
3	No system for storing materials and tools	A color-coding system is used to convey information to workers	Rules and instructions are more easily understood by all workers
4	Workers require guidance to understand instructions	Workers better understand instructions through standardized color codes	The rules and instructions are better understood by all workers
5	No standardized documented instructions	Standardization is done by documenting the first three stages of 5S (Seiri, Seiton, Seiso)	Standardization ensures a more efficient way of working

As shown in Table 5, the Seiketsu implementation resulted in secure and comfortable work environment at IMU site. "*The workers easier to understand the instruction given by employer when standard system code are used at the site*," (Site Engineer).

The element of Seiketsu is crucial to establishing the highest work standards at the IMU Hospital construction site, as demonstrated by the comparison table above. All employees must, however, fulfill their duties and obligations, particularly the principal contractor, who must give the employees written instructions that are uniform and unambiguous. A uniform set of visual aids such as colour codes, safety signs, labels combined with a paper trail of safety policies all helped to reduce misunderstandings and clarify that the safety rules are the same for workers regardless of their educational backgrounds and levels of experience. That, in turn, helped to avoid unsafe exceptions and reinforced conformity to the safety rules of the site.

Only after the first three 5S stages Seiri, Seiton, and Seiso have been effectively applied to the work system at the IMU Hospital construction site can the Seiketsu (standardize) method be put into practice. To make sure that all of the employees' efforts are not in vain, it is essential to consistently maintain cleanliness in the workplace

All workers are required to adhere to written guidelines in order to improve the quality of their work and, indirectly, the safety and health aspects of the construction site through the established standard procedures. Standard Operating Procedures (SOPs) at work, obtaining a Permit to Work (PTW) prior to beginning any task, and creating an emergency Process Flow chart are a few examples of such guidelines.

4.5 Shitsuke (Sustain)

Shitsuke is the discipline principle that motivates employees to consistently apply the 5S method at work. This approach is thought to be the most challenging for all employees to use consistently (Gupta and Jain, 2015; Suwondo (2012). Nonetheless, it can greatly enhance employee discipline, particularly with regard to following the safety rules set forth at work. Additionally, this positive workplace culture can improve the organization's output and quality of work. The following are the goals of applying the Shitsuke method at the construction site of IMU Hospital:

1. In accordance with the Occupational Safety and Health Act of 1994, to enhance workplace safety and foster a more productive work culture.
2. To teach employees how to keep the workplace tidy so that everyone can work in a peaceful and healthy setting.
3. To instill a culture and habit of safe and healthy work practices among employees, guaranteeing the production of high-quality work.
4. To set an example for other businesses in terms of boosting productivity while consistently strengthening safety protocols.
5. To continuously give employees more insight into creating a safe and healthy work environment.
6. To carry out the employer's obligation to guarantee that health and safety procedures are followed while employees are at work.

Table 6 shows the comparison of the conditions before and after the Shitsuke method was implemented.

Table 6 Compares the Conditions Before and After the Shitsuke Method was Implemented

No	Condition Before	Condition After	Description
1	Personal hygiene and workplace cleanliness were not emphasized	Workers consistently practice personal hygiene and maintain a clean workplace	Workers adhere to instructions given by the employer
2	Disorganized work system	A more systematic work system	Workers comply with the Standard Operating Procedures (SOPs) set by the employer
3	Tools in the storage room were disorganized and poorly maintained	Tools are organized, and usable and damaged tools are recorded to avoid loss	A supervisor is appointed to manage and update tool records in the storage room
4	Construction workers frequently violated established safety regulations	Through 5S training and audits, all workers have a better understanding of the established safety regulations	A demerit system is implemented by HQ for workers who fail to adhere to 5S regulations
5	Lack of reminders for workers to consistently practice safe work culture	Notice boards are installed on each floor as reminders for workers to practice safe and healthy work habits	Notice boards are updated regularly with information, reminders, instructions, and training provided by the employer

Table 6 illustrates the changes towards implementation of element Shitsuke at IMU site. This element introduced improvement from time to time and sustain the 5S program all the time. A site engineer stated, '*All the employees became more disciplined after Shitsuke training. For example, they started cleaning their work station before going back without being reminded*'.

The Shitsuke method is crucial for creating a culture of safe and healthy work at all times, as the comparison table above illustrates. Each employee needs to be taught this good practice so that the love of cleanliness in particular and the sense of community become the norm while working.

5. Discussion and Conclusion

The study indicates that the Kaizen-based 5S system can serve as a potent occupational safety and health (OSH) tool in a challenging construction environment, especially a hospital project that requires stringent cleanliness, orderliness, and risk control standards. This section discusses the results in light of existing literature and points out the implications for construction safety management.

Structured workplace management can significantly enhance Occupational Safety and Health (OSH) performance in the construction industry. Shitsuke (Sustain), the last component of the 5S system, is essential for fostering a positive safety culture among employees and establishing long-term discipline. Shitsuke makes sure that cleanliness and safety become routine habits

rather than sporadic ones, as the comparison analysis demonstrates. This supports the opinions of Gupta & Jain (2015), who contend that maintaining 5S is the most difficult yet essential step for a long-term change in workplace culture.

The study results largely agree with those of previous study which found that 5S implementation was positively related to safety performances, housekeeping, and worker discipline (Rahman et al., 2010; Gupta & Jain, 2015; Fitri & Putra, 2024). Just like manufacturing-focused and short-term construction case studies, the IMU Hospital project demonstrated that hazard reduction through Seiri and Seiton was very effective, especially in the segregation of damaged tools, neat storage, and visual labeling. However, this work goes beyond the earlier ones by providing evidence that such changes can be maintained for a longer time (three years) in a live construction environment, thus solving a major issue raised by earlier studies.

The findings show common grounds as well as differences due to the contextual factors when compared with other construction-

oriented research. On the one hand, most of the studies were centered on the impact of 5S on productivity and general housekeeping (Nurdiatmoko & Sulistyowati, 2020). Besides that, this study is more focused on the direct OSH outcomes, including the reduction of near-miss risks, enhancement of emergency access, and better handling of hazardous and flammable materials. In the context of hospital construction, the role of Seiso and Seiketsu has been elevated as the concepts of hygiene, infection control, and free-flow of traffic become much more significant than in regular projects. Therefore, it can be argued that the 5S components will have a different level of influence depending on the type of project and the risk mix.

The changes in workers' behaviour, particularly observed in relation to the Shitsuke element corroborate the findings of studies that 5S discipline and safety culture are the hardest yet most rewarding outcomes of 5S implementation activities (Suwondo, 2012; Gupta & Jain, 2015). In the IMU project, the behaviours upkeep has been the nature which is different from those studies where the gains in 5S have been atrophied as a result of lack of follow-up mechanisms. This difference is attributable to ongoing training, demonstration of management commitment, the presence of safety inspections, and disciplinary measures such as the demerit system. All these factors are

proposed as mechanisms by which management and leadership can convert the 5S initiative into a lasting safety behaviour.

The use of triangulated qualitative data further lends support to these findings. The agreement among the observation records, interview feedback, and safety audit documents suggests that the improvements gained were not just on the surface or for a short time. Any small differences that were found, mainly in subcontractor compliance, are typical problems in project-based construction and do not signify the shortcomings of the 5S framework itself. The accountability aspect of previous studies is consistent with this matter, as they have pointed out the necessity of good coordination and communication in a multi-contractor setting.

From both management and safety viewpoints, the results imply that if only considered as a simple housekeeping or productivity tool, 5S is being greatly underutilized. Changes brought about by the systematic removal of clutter, streamlined material flow, and standardized procedures, all go towards proactive hazard control, thus supporting accident causation theories which focus on unsafe condition and behaviour prevention before the occurrence of accidents. Therefore, it is quite clear that by using 5S as one of the OSH tools, the compliance with the Occupational Safety and Health Act 1994 and CIDB Green Card Requirements can be achieved in an effective and relatively low-cost manner.

The research outcomes provide direct answers to the research objectives, demonstrating how the 5S program was deployed, what the changes in occupational safety and health (OSH) conditions were due to 5S implementation, and how each 5S element played a part in hazard and behavioural changes. Theoretically, these results align with the accident causation and safety culture theories, especially Heinrich's Domino Theory. Basically, by Seiri and Seiton removing unsafe conditions and Seiketsu and Shitsuke focusing on standardisation and behavioural reinforcement, workplace accidents can be effectively prevented by breaking the sequence that leads to them. Hence, this is yet another proof that in high-risk construction environments, it is very important to have organisational and behavioural controls that are proactive.

In conclusion, the use of the 5S system at the IMU Hospital serves as proof of its applicability in the enhancement of OSH performance in the Malaysian construction sector. It goes without saying that the results generally agree with similar studies, however, this study has made additional contributions by illustrating long-term sustainability, visible behavioural change, and hospital project-specific advantages. The key findings highlight the vital role of continued top management support, the involvement of workers, and regular systematic auditing in the transition of 5S from a simple procedural demand to a fully functional safety culture.

5.1 Limitations of the Study

Several limitations of this study should be considered even though positive outcomes have been observed. First, this study was only one construction site, and the findings might not be applicable to other project types or organisational contexts. Construction projects differ greatly in scale, complexity, and management, and hence, the effectiveness of 5S may vary. Second, the research mainly depended on qualitative data from observations, interviews, and document reviews, and only a few interviewees. Even though the validity was increased by triangulation, qualitative research inherently contains some level of subjectivity. To further develop the evidence, future investigations could consider the inclusion of multiple sites, larger samples, and quantitative indicators like the number of accidents, near-misses recorded, or safety performance indices.

5.2 Contribution to Academic Knowledge

Referring only to the study's managerial implications is not enough since this research also, in various ways, contributes to academic knowledge. Firstly, it gives an extension to the present literature on 5S by presenting a three-year longitudinal qualitative case study in construction whereas the majority of the previous studies are either short-term or manufacturing-based implementations. Secondly, it contributes to the OSH literature by illustrating via qualitative triangulation that 5S practices not only influence safety culture but also the behaviour of workers over time. Thirdly, this work introduces empirical evidence on hospital construction projects which is an unexplored niche in construction safety research despite its inherent higher safety and hygiene requirements. In doing so, by integrating lean management principles with safety culture and accident prevention theories, this paper significantly contributes to the theoretical understanding of the relationship between operational improvement tools and construction safety.

5.3 Obstacles and Restrictions

The construction industry, which is marked by project-based timelines, diverse subcontractor teams, and high-risk 3D (Dirty, Dangerous, Difficult) work environments, presents unique challenges to the application of Kaizen 5S, despite its effectiveness.

1. Exorbitant Operating Expenses
Small and medium-sized contractors may find it difficult to cover the initial setup costs, which include buying storage systems, labeling tools, performing audits, and designating specific safety roles (Suarez-Barraza et al., 2015). This covers the price of training materials, visual control tools, and 5S signage.

2. Constant Management Dedication
Top management must be consistently involved in order to monitor, encourage, and enhance compliance in order to sustain 5S; this involvement may diminish throughout long-term or fast-track projects (Gapp et al., 2008).

3. Engagement of Stakeholders
Every project participant, including employers, contractors, and site workers, must embrace and internalize the 5S principles in order for full integration to occur. The efficacy of the program is reduced by fragmented participation.

4. Workforce Requirements and Scalability
More personnel are needed for larger projects to oversee, audit, and enforce 5S. This can put a strain on resources and make scheduling more difficult, especially when overseeing a multinational workforce that speaks multiple languages.

5. Cultural Barriers and Training
To properly comprehend and implement 5S practices, workers—especially foreign workers who are illiterate or unfamiliar with Japanese-origin concepts—need regular, customized training. This calls for multilingual resources and visual learning aids (Visco, 2017).

6. The Way Ahead
The Kaizen 5S system ought to be established as a common management tool in Malaysia's construction industry due to its demonstrated advantages. In addition to providing organizational and safety benefits, it supports safe and effective working conditions, which is in line with the Sustainable Development Goals of the UN (SDG 8: Decent Work and Economic Growth). The following tactics are suggested to get past implementation obstacles:

1. Tax breaks or training grants under CIDB Malaysia are examples of government incentives for small contractors implementing safety management systems.

2. Incorporation into site-level regulations, like requiring 5S adherence in contractor agreements and project kickoff meetings.

3. Usage of digital tools for monitoring and auditing, such as visual inspections and 5S checklist mobile apps.

4. Site supervisors can earn certification as 5S practitioners through continuous professional development (CPD).

5. Modules for cross-language training to close communication gaps, particularly for foreign employees.

Ultimately, Malaysia can drastically lower workplace accidents, boost productivity, and establish new standards for construction management excellence by integrating 5S into the safety culture of construction projects.

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Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper

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