

Integrating 5S Practices into Haccp Food Safety Management Evidence From a Malaysian Food Manufacturing

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ABSTRACT

Hazard Analysis and Critical Control Point (HACCP) systems depend on disciplined prerequisite programmes and consistent execution at the workplace. This study examines how the 5S practices of Sort, Set in Order, Shine, Standardise, and Sustain can support HACCP-based food safety management in the context of Malaysian probiotic beverage manufacturing. The article reanalyses and updates a single-case study originally completed in 2020, with empirical data collected in 2019. Ten employees from executive and laboratory-supervisory functions completed a structured questionnaire, while two executives participated in semi-structured interviews. Questionnaire evidence, interviews and documentary interpretation were triangulated. The case showed strong routine implementation of HACCP controls, while 5S implementation was uneven. Shine was the most established practice, reflecting the sanitation demands of food production, whereas Sustain was the weakest because it depended on employee commitment, self-discipline, leadership and continuous reinforcement. The case-based mapping linked Sort with HACCP Principles 1 and 4; Set in Order with Principles 2 and 3; Shine with Principle 4; Standardise with Principles 5 and 6; and Sustain with Principles 6 and 7. The dominant implementation barriers were employee-related, particularly communication, awareness, commitment and resistance to change, followed by organisational and resource constraints. The findings suggest that 5S should be treated not as housekeeping but as an operational layer that makes prerequisite programmes, visual control, documentation and verification easier to execute consistently. The study offers a practical 5S-HACCP integration sequence for food manufacturers while acknowledging the limitations of a small, single-site case study.

Keywords: 5S; HACCP; food safety management; lean manufacturing; prerequisite programmes; Malaysia

1. INTRODUCTION

The process of food manufacture involves two opposing requirements. On one hand, production processes must operate efficiently. On the other hand, food safety controls must operate dependably every day. The HACCP (Hazard Analysis and Critical Control Point) system can be understood as a preventive approach to food safety. It is the assessment of hazards and establishment of control systems that focus on prevention, not inspection. The current Codex recommendations place various types of hygiene (including HACCP) within a broad picture, not just a certification exercise. According to the General Principle of Food Hygiene, the use of prerequisite programmes and Good Hygiene Practices (GHPs) is essential for the establishment of a Good Hygiene Practices (GHPs) on which an effective HACCP system can be built (FAO & WHO, 2023). This certification creates a significant operating differentiation. A certification will demonstrate that a system has been designed, audited or verified, but does not guarantee food safety at all times. This instead depends on how people prepare, clean, standardise, document, and sustain work on a day-to-day basis.

Malaysia continues to formalise its operational focus. Malaysia's Ministry of Health maintains national arrangements for the HACCP and Good Manufacturing Practice (GMP) Certification Scheme. In May 2026, the Ministry of Health Malaysia updated the HACCP and GMP scheme (Ministry of Health Malaysia, 2026). The implementation of food safety requires not only formal compliance with implementation procedures but also control of activity quality, assurance activities, personnel capability, and the organisational context within which the food safety management system is implemented (Halim et al., 2024; Hua Yen et al., 2021). Such is the finding of Malaysian researchers. For manufacturers, the management problem is not whether HACCP exists but how the criteria are converted into repeatable workplace behaviour.

5S is one possible operational mechanism. The efficient workplace structure developed from lean production, called '5S', refers to Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardise (Seiketsu), and Sustain (Shitsuke). The implementation of these practices is primarily associated with visibility, neatness, orderly material flow, cleanliness, standard work, and behavioural discipline in manufacturing. Or, generally, one finds these practices implemented for manufacturing. Organisations are focusing on eliminating non-value-adding activity, which is a present-day lean research issue. Manufacturing waste still affects direct costing and performance

penalties, according to Ozguner (2026) in CINEFORUM. According to Mehra's 2024 study, food engineering developments should be taken in the context of safety, quality, resilience and implementability. In contrast, in food manufacturing, efficient 5S is not enough. Well-organised spaces, clearly marked equipment and materials, clean and tidy surfaces, visible standards and disciplined routines can help implement more...

Growing evidence demonstrates the benefit of synergies in lean and food safety. Cabrera et al., in their 2020 case study, indicate that quality can be improved while reducing returnable products in the process through the utilisation of 5S, Lean tools, Statistical process control and HACCP. As stated by Domínguez et al. (2021), when the promotion of safety is treated as a condition or fundamental goal of the development, the logic of lean 6S and HACCP is strongly compatible. Sykilili et al. (2026) reviewed 65 peer-reviewed studies and noted that lean tools, such as 5S and visual management, were repeatedly applied by food manufacturers alongside HACCP to enhance process standardisation, documentation, and operational control. The writings, however, leave us a pragmatic question. Which aspect of HACCP is addressed through the 5S? When a food manufacturer already has a mature certification system, at what point does implementation fall through the cracks?

Through an anonymised Malaysian probiotic beverage manufacturing case, this article answers that question. The empirical data were collected in 2019. The paper in question does not argue that the case reflects the organisation's performance. In contrast, it reanalyses the event as evidence of the functional linkage between 5S and HACCP; it updates the reading using the literature available up to September 2026, and derives implications that remain applicable to food safety. The aim of the 5S Concept is intentionally management-centred: the routines that we use to make HACCP controls more visible, simpler to perform, and easier to sustain.

The study will answer three research questions. In RQ1, we will examine the implementation of 5S practices in the case organisation and identify which practices appear most robust or weakest. RQ2 aims to understand how each of the 5S practices can help address a specific HACCP principle and prerequisite programme activity. RQ3 examines what organisational barriers limit the use of 5S as a supporting mechanism for HACCP. By responding to these questions, 5S-HACCP integration can be accounted for more specifically than by treating lean and food safety as two parallel management systems.

2. LITERATURE REVIEW AND ANALYTICAL FRAMEWORK

2.1 HACCP, prerequisite programmes and food safety management

Preventive control plays the leading role in HACCP. Food businesses should not simply inspect the end product. The system requires them to be aware of potential hazards associated with raw materials, their processes, and the production environment; determine where control is most critical; and determine monitoring, corrective action, verification, and documentation procedures. According to Codex, GHPs and other prerequisite programmes are now clearly positioned as the operating base on which HACCP functions (FAO & WHO, 2023). This architecture is very important in that many ordinary circumstances that determine food safety – facility design, cleaning and sanitation, pest control, personnel practices, storage, supplier control, calibration and training – are, by and large, addressed through prerequisite programmes rather than critical control points.

The literature on food safety distinguishes clearly between system design and how systems work. It is a complex task to translate HACCP principles into operational control (Rosak-Szyrocka & Abbase, 2020). Maiberger and Sunmola (2022) have identified various technical, organisational and human problems that greatly affect safety management systems. In a Malaysian beverage setting, Hua Yen et al. examined whether monitoring the context, core control activities, and assurance activities provides a more informative picture of food safety performance than certification status alone. The data from the case studies support a key hypothesis of this project. A HACCP plan must be supported by everyday workplace activities that make safe behaviour visible, repeatable and auditable.

It is particularly useful in the production of milk and fermented products. The final report on the production of dairy and fermented beverages identifies the degree of microbiological sensitivity associated with the controls applicable to their thermal processing, sanitation, storage, ingredient control, and documentation. The review of HACCP in Yogurt Production (Aslani et al., 2024). Effective hazard control in dairy schemes depends on coordinating preventive measures across various stages of processing. The significant operational considerations in the original report were pasteurisation, microbiological checks, supplier controls, traceability and record-keeping, and recognition of physical, chemical and biological hazards (Md Ramli, 2020). Although the product and organisation have been anonymised in this paper, the analytical case provides useful context for understanding the interaction between lean workplace practices and food safety controls.

2.2 5S as an operational discipline in food manufacturing

Although it is common practise to introduce 5S as a workplace organisation technique, the management logic is of much wider scope than housekeeping alone. Sorting entails removing items not needed for your work and clarifying what does belong. The Set in Order intends to locate, identify, retrieve and return the items everybody

needs. Shine blends cleaning and examination, which further helps detect abnormalities. The first three practices include documented procedures, visual controls, and common approaches to working. The improvements achieved must be sustained by discipline, training, audit, feedback and reinforcement. When these practices are implemented together, deviations become clearer and standard work becomes more manageable.

This logic is compatible with food manufacturing because cleanliness, zoning, labelling, equipment condition and procedural discipline are not merely productivity concerns; they can influence contamination risk and the reliability of food safety controls. Cabrera et al. (2020) used 5S within an integrated food-industry improvement model to address contamination and deterioration risks in work areas. Domínguez et al. (2021) further developed the relationship by positioning HACCP safety requirements alongside lean 6S, arguing that food production requires that lean improvements be subordinated to product safety. Veseli et al. (2024) similarly report that 5S and related lean practices can support equipment availability, quality, workplace safety and waste reduction, while noting that management commitment, training and employee involvement are critical to implementation.

The human dimension is particularly important. Food safety and lean systems can be technically well designed yet undermined by low readiness for change, unclear roles, inadequate training, or limited managerial reinforcement. In Malaysian food manufacturing, Azalanzazlay et al. (2022) identify leadership, employee involvement, knowledge and organisational readiness as critical in the pre-implementation phase of Lean Six Sigma. These readiness conditions closely resemble the behavioural requirements of Sustain in 5S. The implication is that the fifth S is not simply the final step in a sequence. It is the mechanism that determines whether the other four practices remain part of routine behaviour after initial implementation.

2.3 Why 5S can complement HACCP

The conceptual overlap between 5S and HACCP is strongest at the interface between prerequisite programmes and formal HACCP controls. Sort and Set in Order influence what materials are present, where they are located, how they are identified and whether inappropriate items can enter controlled areas. Shine reinforces cleaning, sanitation and inspection. Standardise supports standard operating procedures, visual instructions, corrective action routines, and records. Sustain provides the training, audit, feedback and behavioural consistency needed for verification and documentation to remain reliable. None of these activities replaces hazard analysis or the technical determination of critical control points. Instead, they create operating conditions that make HACCP easier to execute correctly.

The literature now exhibits much greater visibility of this complementary relationship than was apparent when the original thesis was completed. According to a 2026 study by Syikilili et al, the hybrid Lean Six Sigma-HACCP model can improve compliance with standardisation and regulations through documentation. In the same vein, the limited technical expertise and inconsistent documentation are recurrent issues. Dima et al. (2024) demonstrate that constraints on HACCP implementation are interconnected, extending beyond knowledge of food safety to include managerial and organisational conditions. Similarly, Okpala and Korzeniowska (2021) stress that commitment to continual improvement, management commitment, Davies and integration of good hygiene and quality-management practices are essential. According to these analyses, 5S must not be viewed as a management programme competing with a food safety management system, but as an enabling layer.

Thus, for this research, the analytical framework treats 5S as a sequence of operational capabilities. The first three S practices influence the appearance and physical nature of the environment; Standardise converts a good practice into a common routine; Sustain freezes that routine through people and governance. HACCP outlines the logic and control requirements for food safety, while the prerequisite programs facilitate the implementation of 5S practices. The empirical analysis examines whether this sequence is observed in the case and where it breaks down.

3. METHODOLOGY

3.1 Research design and case context

Based on evidence from a descriptive questionnaire, the present study employs a qualitative-dominant single-case design. The second author's MBA thesis (2020) was the source of the empirical material (Md Ramli, 2020). The research questions focused on the use of 5S in practice within an organisation and employees' understanding of its relationship to HACCP. Therefore, a case-study approach was selected. According to Yin (2009), a case study is the appropriate choice when the phenomenon and organisational context are closely related, and the evidence is drawn from multiple sources.

Jointly owned by a Japanese company and a Malaysian company, the case organisation is a manufacturer of a probiotic beverage in Malaysia. Prior to the data gathering process, 5S had already been implemented. To protect privacy, the company's name and location, the product brand, and other identifiers will not be disclosed. Anonymity is consistent with the confidentiality commitments reported in the sourcing thesis and allows the article to focus on operational mechanisms rather than the manufacturer's identity.

3.2 Participants and data collection

Employees with firsthand experience implementing HACCP and 5S were purposively sampled. The questionnaire was completed by 10 employees from executive and laboratory supervisory functions. Two of the executives involved in the 5S programme also took part in semi-structured interviews. According to the thesis, the interviews were conducted face-to-face between 8 October and 16 November 2019, lasted about 20-35 minutes, and used a common set of open-ended questions about participants' experiences applying 5S in the organisation (Md Ramli, 2020).

The questionnaire contained four sections. Section A collected seven demographic items. Section B contained seven items on HACCP implementation. Section C contained 15 items on 5S implementation. Section D contained 19 items relating to barriers to 5S implementation in support of HACCP. The original instrument drew on prior 5S and HACCP literature and was used primarily to describe implementation patterns rather than to estimate population parameters. Because the respondent pool was small and purposively selected, the present article does not use inferential statistics.

Table 1. Empirical design of the case study

Component	Description
Case	One Malaysian probiotic beverage manufacturing site with established HACCP and 5S practices.
Questionnaire participants	10 employees from executive and laboratory-supervisory functions with experience of the relevant systems.
Interviews	Two executive participants involved in the 5S programme; face-to-face, approximately 20-35 minutes.
Questionnaire structure	Demographics (7 items), HACCP implementation (7 items), 5S implementation (15 items), and 5S implementation barriers (19 items).
Analysis	Descriptive interpretation of questionnaire results, thematic interpretation of interviews, and triangulation across evidence sources.
Empirical period	October-November 2019; thesis completed in 2020; literature and regulatory interpretation updated to September 2026.

3.3 Data analysis and triangulation

The analysis proceeded in three stages. First, questionnaire findings were reviewed to identify the relative pattern of HACCP and 5S implementation reported in the thesis. Second, interview and narrative evidence were examined for recurring barriers, including communication, awareness, commitment, management support, training and resource constraints. Third, the five 5S practices were mapped against HACCP principles and prerequisite-programme functions using the case interpretation developed in the thesis. Evidence from the questionnaire, interviews, and case documentation was triangulated so that the findings did not rest on a single source.

The present article deliberately preserves the level of precision supported by the source material. The thesis includes a graphical summary of affirmative and negative 5S responses by dimension, but it does not clearly specify the denominator used to aggregate those dimension-level frequencies. Accordingly, this article reports the relative implementation pattern, for example, Shine as the strongest and Sustain as the weakest, but does not convert the plotted frequencies into percentages. This avoids creating numerical precision that the archived thesis does not support.

3.4 Ethical and confidentiality considerations

The source thesis states that organisational access was obtained through the manufacturer's senior public relations and administrative personnel, and its acknowledgements record permission to conduct a factory tour. It also states that research participation was voluntary and that information provided by participants was confidential and used for academic purposes (Md Ramli, 2020). The thesis does not report an institutional ethics-approval identifier. The present article, therefore, uses only aggregated, non-identifying findings and anonymises the company. No proprietary process parameters or participant identities are reported.

4. RESULTS

4.1 HACCP was embedded in routine production control

The case evidence described HACCP as strongly implemented in routine operations. Respondents and the thesis narrative identified control of biological, chemical and physical hazards, with particular attention to the microbiological characteristics of a cultured beverage. Critical control was linked to production stages such as raw material receipt and pasteurisation. Critical limits were supported by process specifications and microbiological checks, while monitoring depended on trained personnel, calibrated equipment and recorded observations.

The instance also demonstrated that HACCP was not merely a checkpoint along the production line. Supplier control was implemented to safeguard the quality and effectiveness of the raw material. Trace-and-recall procedures to be used for complaints or deviations. For the purposes of internal and external audits, records of monitoring, deviations, and actions were kept. There were a periodic review and external validation. These habits suggest that the firm had progressed beyond the first phase of HACCP implementation and was maintaining a system.

Moreover, the originating thesis was explicit that the result reflects employee experience and is not an independent audit of the company as such. The distinction remains intact here. The selected employees' perceived implementation was strong, according to the evidence, but not according to a new certification judgment by the current authors.

4.2 5S implementation was uneven: Shine was strongest, and Sustain was weakest

Not all 5S practices were implemented at the same level. The practice of shine was highly established. The abovementioned finding is sound, given that food and probiotic beverage production relies on cleaning, sanitation, and visibly controlled work areas to ensure acceptable product safety. Participants described cleaning as an operational necessity rather than a lean activity. So, in this sense, the food safety requirements appeared to directly reinforce the third S.

The Implementing Sort and Set in Order showed a moderate pattern. "Case reported removal of unnecessary items from the working area, assigned areas, identification/labelling, zoning, and orderly positioning of necessary items" They helped separate materials and activities. This made it easier to identify abnormal things, which helps with food safety and efficiency.

Standardise was less developed than Shine. The case included standard work instructions, visual controls, 5S charts, and audit-related practices. However, it was dependent on how well the worker understood and followed the standard. Sustain was the weakest practice. Interview results indicated that employees sometimes performed 5S tasks when it was convenient, rather than as part of the routine. The organisation's ability to sustain 5S was heavily dependent on motivation and self-discipline. Discovering the gap between a clean workplace and a self-sustaining culture of improvement is among the key study findings.

Table 2. The relative pattern of 5S implementation is reported in the case

5S practice	Relative pattern	Case interpretation
Sort (Seiri)	Moderate	Unnecessary items were removed, and designated/quarantine areas were used, supporting clearer control of materials and hazards.
Set in Order (Seiton)	Moderate	Labelling, zoning and defined locations supported the retrieval, identification and segregation of necessary items.
Shine (Seiso)	Strongest	Cleaning and sanitation were reinforced by the food-production environment and were closely connected to routine hygiene control.
Standardise (Seiketsu)	Lower than Shine	Standard instructions, visual controls and audit practices existed, but their effectiveness depended on consistent understanding and execution.
Sustain (Shitsuke)	Weakest	Employee commitment, self-discipline, leadership, training and continuous reinforcement were insufficiently embedded as routine behaviour.

4.3 Mapping the five S practices to HACCP principles

The case's primary analytical contribution is the clear mapping of the five 5S practices and seven HACCP principles to one another. The mapping should not be understood as a substitution. HACCP principles are technical

food safety requirements. The practices of 5S, on the other hand, provide the operational conditions that enable the principles to be executed. This is particularly true for prerequisite programmes and visual management.

Sort was connected to HACCP principles 1, 3 and 4. Removing unnecessary materials, separating out suspicious items, establishing quarantine zones, and making unwanted items visible can help with hazard analysis, control of critical limits, and process monitoring. The concepts of Principles 2 and 3 were connected by order set as defined locations, labels and zoning made critical points and controlled materials easier to identify and manage. Shine was most closely linked to Principle 4: cleaning schedules, contamination checks, and sanitation routines result in monitoring opportunities and expose abnormal conditions.

Standardise has the broadest link to the subsequent HACCP control cycle. The study was associated with Principles 5, 6 and 7, as corrective actions, verification and record-keeping depend on common procedures, standard work instructions, audit protocols, visual controls and consistently maintained documentation. Sustain has been associated with Principles 6 and 7. Verifications and documentations of the system remain reliable only if employees are aware of their responsibilities, audits occur as scheduled, feedback is communicated, and corrective learning is retained over time.

Table 3. Case-based integration of 5S practices with HACCP

5S practice	Operational mechanism	Supporting the prerequisite programme functions	HACCP principles supported
Sort	Remove unnecessary or uncontrolled items; identify and segregate questionable materials.	Internal design, zoning, and cross-contamination prevention.	1 Hazard analysis; 3 Critical limits; 4 Monitoring.
Set in Order	Define locations, labels and access for necessary materials and equipment.	Purchased-material management; waste management; zoning; cleaning and sanitation.	2 Critical control points; 3 Critical limits.
Shine	Clean while inspecting; make contamination and equipment abnormalities visible.	Facility condition, waste management, cleaning, and sanitation.	4 Monitoring procedures.
Standardise	Convert good practice into standard work, visual controls, audit routines and documented procedures.	Dedicated tools and zoning; manual intervention procedures; standard operating procedures.	5 Corrective action; 6 Verification; 7 Record keeping and documentation.
Sustain	Reinforce roles, training, audits, feedback and continual improvement until practices become routine.	Validation and verification; competency; recurring audit and communication.	6 Verification; 7 Record keeping and documentation.

4.4 Employee-related barriers were the most prominent

The paper categorised barriers into sub-categories: employee, organisational, resource, top management, and training. According to its narrative interpretation, employee-related barriers were seen as playing the most prominent role. The next most significant barrier is organisational barriers, followed by resource constraints. Aspects like poor communication, limited awareness, low commitment, and resistance to change had an employee dimension. According to executive interviewees, communication is particularly important in 5S because instructions, observations and feedback move between management and operational employees without ambiguity.

Cultural differences, limited policy support, and weak coordination added to the barriers. Financial constraints, competing quality-system demands and limited expertise were resource barriers. Involvement of top management cut across these categories because decisions on time, budget, priorities, and follow-up required management approval. According to the stakeholder views presented, training was also depicted as a cross-cutting enabling condition. Without repeated training, one cannot expect employees to standardise 5S correctly and sustain it as a self-disciplined routine.

This pattern is still significant because it is not accidental. Sustaining was acknowledged by the participants as the least practised of the 5S practices. To put it another way, implementing technical improvements can be straightforward. Cultural institutionalisation, on the other hand, is challenging. It is possible for a factory to be

tidy and orderly during an audit cycle without having developed the routines to sustain 5S control in the absence of supervision.

Table 4. Main barriers and their implications for 5S-HACCP integration

Barrier area	Evidence from the case	Implication for HACCP support
Employees	Poor communication, limited awareness, low commitment and resistance to change.	Weakens routine execution, deviation reporting, and the behavioural consistency needed for verification.
Organisation	Cultural differences, limited policy support and coordination gaps.	Creates inconsistent expectations across units and reduces the ability to maintain common standards.
Resources	Financial constraints, competing system demands and limited expertise.	Restricts time, technical support, audit activity and improvement work.
Top management	Time, budget and implementation priorities require management approval and reinforcement.	Determines whether 5S is treated as a continuing management system or a short-term housekeeping campaign.
Training	Insufficient reinforcement limits understanding and standardisation.	Reduces competence in documented procedures and undermines Sustain, verification and record quality.

5. DISCUSSION

5.1 5S functions as an operational layer beneath HACCP

This case supports a pragmatic understanding of 5S as an operational underpinning of HACCP rather than an enhancement initiative. The Codex categorises the hygiene conditions that must be in place before the start of the production and the additional controls required at critical control points (FAO & WHO, 2023). The case illustrates how 5S can help make these preconditions more manageable. The method of Sort and Set in Order assists in shaping the physical environment; Shine maintains cleanliness and observation; Standardise involves creating repeatable, consistent methods; and Sustain is the process of keeping the routines alive and active. In this configuration, the 5S does not determine food safety hazards or critical limits. When workplace conditions remain visible and stable, the likelihood that they will control the hazards increases.

This interpretation is aligned with contemporary integrated evidence. According to Cabrera et al. (2020), the use of 5S and HACCP could ensure contamination risk and quality loss. On the other hand, Domínguez et al. (2021) argued for food production connecting lean discipline with safety requirements. According to Sykilili et al. (2026), Lean Six Sigma-HACCP documentation, standardisation and process control objectives are achieved through the repeated effectuation of 5S and visual management. The current situation assures us that there is nothing wrong; it just wants us to enjoy the accident.

There are only two points for the strongest connections. The first aspect: the relationship between the physical workplace and early hazard control. The principles of sorting, setting in order, and shining affect how materials are segregated, cleaned, and zoned, as well as the detectability of abnormal conditions. There exists some distinction between standard work and the later HACCP principles. The determination of corrective action, verification, and documentation should not rely on memory. When HACCP shifts from initial setup to long-term operation, Standardise and Sustain take on particular importance.

5.2 The gap between Shine and Sustain is a food-safety management issue

The difference shown between strong Shine and weak Sustain merits special focus. The immediate needs of food production reinforced SHINE: a dirty work area or a poorly maintained sanitation routine is visible and directly contradicts what one is trying to achieve from a hygiene standpoint. The term "sustains" lacks physicality or substance. It asks employees to continue following standards when supervision is limited, workloads compete, a programme's novelty has faded, or no audit is imminent. The 5th S is thus a fundamental behaviour and manager. This interpretation is consistent with evidence on lean readiness and food safety management effectiveness. Azalanazlly et al. (2022) found that the various factors which affect Lean Six Sigma implementation in Malaysian food manufacturing are leadership, employee involvement, knowledge and preparedness. According to Maiberger and Sunmola (2022), human and organisational factors are equally important for effective food safety management systems. The case implies the convergence of these factors in Sustain. When Sustain is weak,

the organisation is likely to lose discipline in documentation, standard work, audit follow-up, and learning from improvement despite appearing visibly clean.

The finding also explains why 5S should not be assessed with just photographs and housekeeping scores. A clean and visually organised production area may provide a false sense of security if procedures are not standardised, records are incomplete, or employees don't understand the importance of controls. In the HACCP context, we will assess the reliability of the control system using 5S. The hazards are easily recognised; materials are identified; monitoring is on schedule; corrective actions are followed, and there is proof to verify that.

5.3 Communication, training and management support are system controls, not peripheral factors

The role of communication, training, and management support is unsurprising in improvement programmes; the case study illustrates how these factors have food-safety consequences. When communication is poor, it is unclear what is in the area, which process applies, who owns the deviation, or whether corrective action has been completed. In a HACCP environment, control-system failures exist and not just employee-relations problems. The hurdles to adopting HACCP are interrelated across the organisational and managerial dimensions (Dima et al., 2024).

Training plays a role with equal specificity. While a first-time instruction may have adequately explained the meanings of the five S terms, for Sustain, repeated indoctrination tied to what is actually done may be needed. Staff need to understand the purpose of a label, storage location, cleaning schedule, audit record or visual control, and what food-safety risk it relates to. HACCP competency, therefore, should be aligned with training and not treated as a separate housekeeping module. The link between training and competence, as a component of the hygiene prerequisite for food safety, is also consistent with the current Codex (FAO & WHO, 2023).

How much time and attention does management provide to these practices? According to the case interviews, the management made 5S decisions on time and budget approval. A typical way that 5S is unsuccessful is easy to see. Management endorses 5S but does not provide sufficient time for audits, training, corrective action, and employee participation. The outcome is limited to cosmetics. When 5S is treated as a food safety governance issue, audit findings and sustainment gaps become operational risks that require management review.

5.4 Relevance to Malaysian food manufacturing in 2026

Although the issue was raised in 2019, it remains very relevant. The food sector remains operational and meets the requirements of formal hygiene, HACCP, and GMP, while the Ministry of Health issued an updated guideline on HACCP/GMP certification in 2026 (Ministry of Health Malaysia, 2026). The research shows that food safety regulations in Malaysia are linked to broader production and food security outcomes. Halim et al. (2024) illustrate. Consequently, organisations now face managerial difficulties related to the quality of submissions rather than merely the recognition of certification criteria.

This situation is especially advantageous for established manufacturers. An organisation with a well-developed HACCP system can operate without a stand-alone quality programme. Using 5S to link hygiene, lean management, and employee behaviour may be more beneficial for them. The food industry study done in recent years appears to endorse integrated rather than duplicated management systems (Sykilili et al., 2026). It fits the multidisciplinary scope of CINEFORUM, as it brings together operations management, organisational behaviour, and food safety in a single empirical case.

6. MANAGERIAL IMPLICATIONS

Employing a 5s 6-step implementation sequence, the findings support manufacturers' efforts to strengthen HACCP. The existing HACCP and prerequisite programme system, rather than an off-the-shelf 5S initiative, should serve as the starting point. Managers ought to identify recurring weaknesses in management control. For example, cluttered material areas, inconsistent labelling, cleaning deviations, missing records, or recurring audit findings. An example of control improvement is the selective use of 5S.

Subsequent stages must transition from the physical workplace only to behavioural sustainment. The objective of Sort and Set in Order is to create controlled materials, zoning, and visible ownership. Cleaning and inspection should be combined so that sources of contamination leaks, damage and abnormal equipment conditions are reported and not just cleaned. Successful practices should be converted into approved work instructions, visual standards, and audit criteria. You should manage Sustain through training, scheduled audits, feedback, recognition, corrective-action follow-up, and management review. The ultimate test of success is not whether the area appears tidy on inspection day, but whether the goodwill arrays are enhancing the evidence for HACCP and remain stable.

Table 5. Proposed management sequence for integrating 5S with HACCP

Stage	Management action	Expected HACCP contribution
1. Diagnose	Use HACCP, GMP/GHP and audit evidence to identify recurring workplace-control weaknesses.	Directs 5S effort towards food-safety-relevant problems rather than generic housekeeping.
2. Sort and segregate	Remove unnecessary items; define quarantine and controlled-material rules.	Supports hazard recognition, zoning and prevention of cross-contamination.
3. Set in Order	Establish fixed locations, labels, visual identification and access rules.	Improves material control, CCP visibility and response speed.
4. Shine and inspect	Combine cleaning schedules with checks for contamination, damage and abnormal conditions.	Strengthens routine monitoring and prerequisite hygiene control.
5. Standardise	Create standard work, visual procedures, audit criteria and documentation rules.	Supports corrective action, verification and record keeping.
6. Sustain and review	Reinforce training, audit cadence, feedback, recognition and management follow-up.	Maintains verification discipline and continuous evidence that controls remain effective.

7. LIMITATIONS AND FUTURE RESEARCH

There are many limitations to the study. It is important to note firstly that it is based on a single manufacturing site and a small purposive sample. The 10 questionnaire participants and two executive interviewees were chosen based on their experience with the systems, not for statistical representation of the Malaysian food industry. In the second instance, the empirical data were obtained in 2019, and the article updates the regulatory and scholarly interpretations through 2026, meaning they do not necessarily reflect the organisation's current practices. In addition, the evidence is mostly perceptual and descriptive. The 5S interventions were not associated with microbiological outcomes, audit non-conformities, product recalls, downtime, waste costs, or other long-term performance indicators.

There is also a limitation regarding the archived representation of 5S questionnaire results. The 5S thesis has reported 15 5S implementation items, while the dimension-level chart displays the cumulative frequencies of affirmative and negative responses across the various dimensions. However, it does not provide a clear denominator for each respective dimension. To avoid percentage estimates, this article relies on the relative pattern explicitly interpreted in the thesis. Future research should report item wording, scale structure, denominators and scoring rules in full so that the 5S profile can be reproduced.

In the future, the proposed mapping should be tested across various food subsectors using larger sample sizes. To create a more effective design, the employee surveys would be combined with the audit scores, and clinical or environmental. Multi-site research may also explore whether Standardise and Sustain predict the sustained performance of HACCP after initial implementation. In Malaysia, future work could directly assess the degree of alignment between 5S-supported prerequisite programmes and the 2026 national HACCP/GMP certification guidelines. These studies may move the evidence from a useful explanatory case to a validated management model.

8. CONCLUSION

Research shows that the 5S methodology is valuable in food manufacturing because it translates food safety requirements into visible, repeatable routines in the workplace. The Malaysian probiotic beverage case revealed HACCP's strong institutionalisation. However, the various 5S strengths were not too high. While sanitation requirements made Shine naturally stronger, Sustain remained difficult because it relied on commitment, communication, leadership, training, and employees' organisational follow-through.

The mechanism of integration was clarified through the case-based mapping. Sort helps with hazard analysis, critical limits, and monitoring; Set in Order helps identify critical points and limits; Shine helps with monitoring; Standardise helps with corrective action, verification, and documentation; and Sustain helps verify and maintain records over time. HACCP technical requirements are not replaced by these relationships. According to the authors, 5S can enhance the essential and behavioural prerequisites for HACCP.

The message to managers is clear: 5S should not be implemented as a cleaning initiative separate from food safety. The strongest contribution is made when workplace organisation, visual control, standard work, audit and training is explicitly linked to HACCP risk and records. The main challenge is not initiating 5S but maintaining it. When Sustain is incorporated into management review and employee practice, 5S could potentially serve as a practical link to maintaining lean operations and food safety management.

ETHICS AND CONFIDENTIALITY STATEMENT

A thesis is to be prepared on a voluntary basis. Information is to be treated confidentially and used only for academic purposes. This article hides the agency's identity and shares only aggregated, anonymised findings. There is no ethics approval identifier from an institution. The corresponding author should check for any extra pertinent local institutional or organisational specifications relevant to journal publication before submission.

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