

## Article

# Uncovering Readiness Factors Influencing the Lean Six Sigma Pre-Implementation Phase in the Food Industry

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**Abstract:** The aim of this study is to identify the readiness factors of Lean Six Sigma (LSS) for the food manufacturing industry. A multi-method qualitative approach was used. Semi-structured interviews were conducted with twelve quality practitioners and three case food companies to identify and explore the LSS readiness factors in the food manufacturing industry. Twenty-eight factors were identified and classified into six LSS readiness factors (RF) in the food manufacturing industry context, namely, management support and leadership, organisational culture readiness, process management, project management, employee involvement, and external relations. This study could benefit managers in the food business as a diagnostic tool to evaluate their readiness to implement LSS prior to investing in the programme. The proposed framework identifies LSS readiness dimensions and their attributes to enable food businesses to conduct readiness level self-assessments, thereby contributing to the successful implementation of LSS in the food manufacturing industry. The determined readiness factors will potentially enable an organisational transformation to be better understood, making the implementation of LSS practices in food businesses more successful and sustainable.

**Keywords:** lean six sigma; readiness; continuous improvement; change management; Lewin's change theory; food industry



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## 1. Introduction

Variations in food industry processes negatively impact quality and can be hazardous, critical or even fatal. A considerable number of obsolete inventories have been identified in the food industry [1]. The recent increase in the demands for quality, faster delivery and lower prices is due to high customer expectations, stringent government regulations and fierce market competition [2,3].

Since the year 2000, a hybrid improvement programme combining Lean and Six Sigma has been widely deployed to successfully improve operational efficiency and productivity, as well as to cut costs [4–6]. Six Sigma uses a data-driven strategy to identify and eradicate the root causes of problems that contribute to process variances [7]. However, the increase in academic research on LSS does not represent the relevance of the application of LSS, notably in the food business [8].

However, the implementation of LSS seems to be lacking or infrequent in the food manufacturing industry [8]. The major issues in this industry include substantial variations in food production processes, long setting-up and clean-up times, sales slowdowns, rising operational costs, and a significant number of changeovers [8–10]. These issues may have contributed to the LSS implementation issue. Furthermore, the food industry is

a conservative industry [11,12], which might explain the slow rate at which LSS has been adopted [8].

Most LSS literature focuses only on the elements of the LSS implementation phase, such as its critical success factors, benefits and advantages, challenges, performance indicators, and the LSS implementation framework, but the pre-implementation stage remains understudied [8,13]. Before any changes are introduced based on Lewin's change model, it is pertinent to explore the unfreeze (pre-implementation) stage by unfreezing the current state of mind to motivate change [14].

Most transformation initiatives fail owing to a lack of preparation and strategic planning [15]. A business must assess the readiness and ability of its workforce to acclimate before implementing change to the organisational aspects of the company. By adapting organisational change theories and promoting the importance of preparedness before LSS is implemented, perceived barriers such as the food industry's resistance to change can be reduced [8,16]. However, the promotion of readiness is an understudy phase of LSS and has only been addressed by a few publications in the field of Continuous Improvement (CI) implementation [5,13]. In [17], it is stated that the outcome and pace of change, as well as the outcome of Lean, vary across industries. To better understand the pre-implementation phase of LSS, it is appropriate to focus on a specific sector, such as the food industry [5,13].

The aim of this study is to identify the readiness factors of LSS for the food manufacturing industry. The main objective of this study is to develop the dimension of LSS readiness for the food manufacturing industry. This study explores the factors that contribute to LSS preparedness in Malaysia's food manufacturing industry, which extended change management theory in the literature. Preparation variables for LSS implementation were identified and analysed. The findings contribute to LSS implementation research and practice by focusing on essential factors, especially in the pre-implementation stage. Practically, the study identifies the LSS readiness dimension for the food manufacturing industry, which is useful for practical application of the LSS self-assessment readiness scale for practitioners in the food manufacturing industry. The LSS readiness dimension can be a foundation tool for a company in considering LSS through the determined critical readiness factors at the pre-implementation stages. This paper follows previous research by developing the LSS readiness dimension for the food manufacturing industry and validating the readiness factors identified in subsequent case studies. Knowledge regarding the contextual readiness factors that influence the adoption of LSS in the food manufacturing industry will contribute to the existing field of research and bridge the relevant gap in the current literature. This contributes to the development of the following research questions:

- (1) What are the LSS readiness factors in Malaysia's food manufacturing industry?
- (2) What are the critical LSS readiness factors in Malaysia's food manufacturing industry?

## 2. Literature Review

### 2.1. LSS in The Food Industry

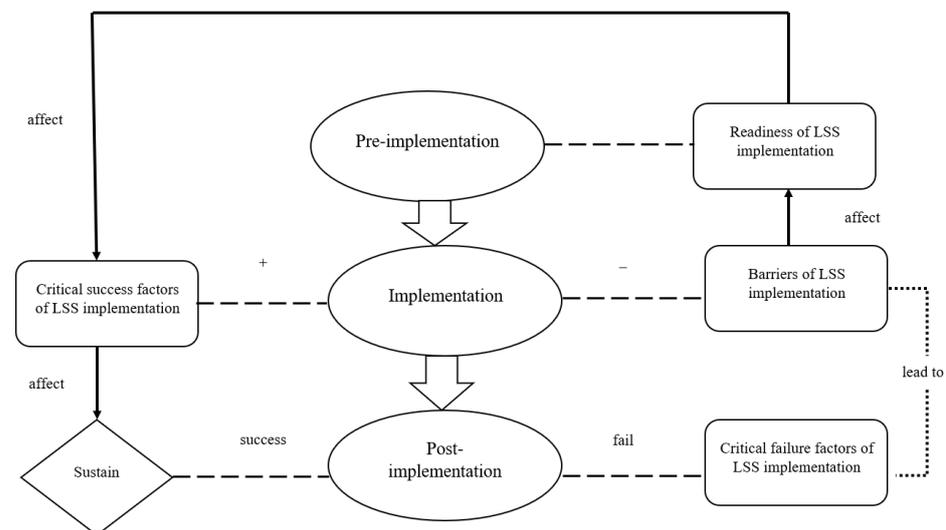
Lean emphasises eliminating non-value-added components along a process and seven types of wastes: unnecessary motion, over-processing, overproduction, waiting time, rework process, excess inventory and defects [18,19]. However, there are two emerging types of wastes recently mentioned by [19], which are environmental wastes and low deployment of people's creativity. Six Sigma focuses on identifying and eliminating defects, mistakes, or failures in business processes or systems [20]. Six Sigma is a data-oriented approach; thus, it consists of many analytical and statistical tools and techniques.

The integration of Lean and Six Sigma has successfully improved operational efficiency, raised productivity and lowered costs in companies compared to other continuous improvement practices that have been used extensively in the past few years [5,21]. LSS hybrid methodology is reported as the most recent continuous improvement approaching this generation, which aims to upgrade quality, speed, customer satisfaction and costs to maximise bottom-line results [22]. The food industry has not been excluded from implementing LSS initiatives, as they promise wide-ranging wealth benefits and the capability

to address problems horizontally through the Lean approach and vertically through the use of Six Sigma [8,23]. LSS implementation helps food companies from being penalised for underweight packaging and reduces the overfilling of food products such as tomato paste [24], gingerbread and confectionery [9]. Recently, LSS has been linked to the concept of a circular economy as it involves waste reduction [23] by improving carbon footprint and packaging waste management in the food industry.

## 2.2. Creating Readiness For LSS in the Food Industry

In [25], the term ‘readiness to change’ was pioneered, establishing that the term is semantically opposite to ‘resistance to change’. Employees are more motivated to change when the organisation is ready to change [14]. Kurt Lewin’s change management theory is used as the underlying framework of the current study, as it is considered the foundational theory of change in human systems [26]. The three stages of change introduced by Lewin were unfreezing conventional behaviour, changing it to a new level of practice, and refreezing the practice at the new level. A similar understanding of the unfreeze phase is evident in several theories of change management, such as Lippitt’s theory (1958), the “Lewinian” Model of Attitude Change of Schein and Bennis, the Planned Change Model of Kolb and Frohman and Kotter’s Eight Steps of Change, as shown in Figure 1.



**Figure 1.** Mapping the readiness stage in LSS implementation.

The goal of unfreezing is to establish a seamless transition to change as a quasi-stationary equilibrium state that involves both managerial and psychological components [27]. LSS readiness is associated with a practice that promotes organisational transformation by abolishing LSS inhibitors, provides knowledge and helps to improve the abilities required to successfully establish change [28].

Leadership is important, and there are five types of leadership theories based on the behavioural perspective, contingency perspective, competency perspective, transformational perspective and the implicit leadership perspective [29,30]. It is believed that during the phase of unfreezing, the transformational perspective is considered, as the leader acts as a change agent in creating, communicating and modelling the vision of a team and organisation towards LSS [30].

Assessing readiness is extremely important when implementing LSS, to the extent that some experts have even declared it a prerequisite for LSS implementation [5,31]. Several studies consider that the importance of readiness goes beyond the implementation phase, since this also promotes the sustainability of an LSS programme [32]. The development of this theoretical research framework positions the readiness of LSS pre-implementation in

the food manufacturing industry as an important aspect, which is commonly neglected before the implementation stages.

### 2.3. LSS Readiness Factors in the Food Industry

A lack of preparation might result in resistance to change at multiple levels within an organisation, causing the deployment of LSS to fail [11,32,33]. The body of knowledge that addresses LSS readiness in the food industry is very limited. In [34], it is asserted that, of all the various stages of LSS implementation in the food industry, it is crucial to critically study the pre-implementation issues including leadership, team implementation and the experience of team members. In [11], Statistical Process Control (SPC; a technique in LSS) readiness factors are identified for the food industry, which incorporate a sense of urgency, measurement system readiness, senior management support, organisational culture and employee involvement.

A systematic literature review was conducted for this research activity. However, there is a dearth of evidence and a lack of in-depth research on LSS application in the food industry [34]. The majority of the research has focused on case studies (SLR,  $n = 49$ ) centred on the use and application of Lean and Six Sigma [34]. Furthermore, although studies addressing the pre-implementation stage of change management in Lean, Six Sigma and LSS exist, their number is small. This indicates that the research topic is still in an infancy stage, and there is no customised study addressing the food industry context [8,34]. The literature was critically reviewed in the current study through thematic analysis and comparison of previous readiness studies in the quality improvement research area, as listed in Table 1.

**Table 1.** The most prominent studies pertaining to LSS readiness.

References	Theme/Purpose	Category of Readiness Frameworks/Factors	Industry
[33]	To reveal the LSS readiness factors which are required for the successful introduction and development for the higher education sector.	<ul style="list-style-type: none"> <li>RF1: Leadership and vision</li> <li>RF2: Management commitment and resources</li> <li>RF3: Linking LSS to university's strategy</li> <li>RF4: Customer focus</li> <li>RF5: Selecting right people</li> </ul>	Service (Higher education industry)
[35]	Development of hypothesis model for German manufacturing SMEs to investigate the readiness of people in SME manufacturing to embark on LSS projects	<ul style="list-style-type: none"> <li>Hypothesis 1: Core personal competence and readiness for LSS</li> <li>Hypothesis 2: Strategic and operational vision and readiness for LSS</li> <li>Hypothesis 3: Organisational culture and readiness for LSS</li> </ul>	Manufacturing (Food, automotive and aerospace industry)
[36]	Development of instrument for LSS organisational readiness for Kenya Institute of Management	<ul style="list-style-type: none"> <li>Dimension 1: Challenge</li> <li>Dimension 2: Freedom</li> <li>Dimension 3: Idea time</li> <li>Dimension 4: Dynamism</li> <li>Dimension 5: Support</li> <li>Dimension 6: Openness</li> <li>Dimension 7: Playfulness</li> <li>Dimension 8: Conflicts</li> <li>Dimension 9: Debates</li> <li>Dimension 10: Risk takings</li> </ul>	Service (Non-profit organisation)
[37]	Structural path model on organisational readiness for change due to new quality implementations (LSS)	<ul style="list-style-type: none"> <li>RF1: Top management support</li> <li>RF2: Employee relations</li> <li>RF3: Customer relationship management</li> <li>RF4: Process management</li> </ul>	Manufacturing (Apparel and textile industry)

Table 1. Cont.

References	Theme/Purpose	Category of Readiness Frameworks/Factors	Industry
[4]	Development of LSS Readiness (LESIRE) evaluation model by using fuzzy approach	<ul style="list-style-type: none"> <li>• Enabler 1: Organisational culture</li> <li>• Enabler 2: Management commitment and leadership</li> <li>• Enabler 3: LSS impact</li> <li>• Enabler 4: Linking LSS to business</li> </ul>	Manufacturing (Automotive and heavy machine industry)
[13]	Development of LSS readiness factors model in healthcare organizations	<ul style="list-style-type: none"> <li>• RF1: Management commitment and leadership</li> <li>• RF2: Effective communication</li> <li>• RF3: Customer-oriented</li> <li>• RF4: Supplier management</li> <li>• RF5: LSS tools and techniques</li> <li>• RF6: Teamwork and execution technique</li> <li>• RF7: Training and learning</li> <li>• RF8: Effective use of technology</li> <li>• RF9: Organisational strategy</li> <li>• RF10: Goal management culture</li> <li>• RF11: Organisational infrastructure</li> <li>• RF12: Continuous performance measurement</li> <li>• RF13: Employee commitment and trust</li> <li>• RF14: Recognition and reward system</li> <li>• RF15: Project selection and service design</li> <li>• RF16: Time and cost management</li> </ul>	Service (Healthcare industry)
[5]	Development of LSS Readiness assessment model for the clothing industries using fuzzy logic	<ul style="list-style-type: none"> <li>• Enabler 1: Management responsibility level</li> <li>• Enabler 2: Client level</li> <li>• Enabler 3: Organisational level</li> <li>• Enabler 4: Employee level</li> </ul>	Manufacturing (Apparel industry)

Table 1 shows that only seven studies have addressed the pre-implementation phase of LSS and that there is no study on the conceptual dimension for LSS readiness that is specific to the food manufacturing industry. It is believed that different industries have different settings that present different kind of problems [4]. Therefore, the importance of developing the conceptual dimension lies in giving an insight for future academics to study the readiness of LSS implementation in the food manufacturing industry specifically. The study of readiness should not be neglected, as it is one of the success factors of LSS implementation [33,37].

### 3. Research Methodology

For this study, semi-structured interviews were conducted with 12 food industry practitioners at first, to explore the LSS readiness factors of the food manufacturing industry. The subsequent case studies with three food companies were conducted to validate the factors identified from the interviews.

#### 3.1. Semi-Structured Interview

A qualitative approach was implemented due to the exploratory nature of the research, which was to undertake a survey of the food industry's readiness for LSS implementation without limiting the respondents' expressions of their views, opinions and insights [38]. A semi-structured qualitative interview was conducted since LSS readiness in the food manufacturing industry has been underexplored. A qualitative approach was taken in this readiness study instead of a quantitative approach, which was deemed deficient for determining new knowledge in a specific setting [4].

Purposive sampling was used to recruit respondents from diverse food industry backgrounds, such as food professionals with industry knowledge and prior engagement in CI initiatives. To improve convergent and discriminant validity, a pre-study to better understand the practitioners' contexts was also conducted [39].

This empirical study is based on semi-structured interviews with twelve food industry practitioners in Malaysia who had knowledge of Lean, Six Sigma, or LSS (Table 2). An interview protocol was developed to reduce bias and guide the interview sessions, while a pilot study was conducted with three respondents, as outlined by [40]. The flexibility and adaptability of the interviews were maintained through an inductive approach according to each interviewee's judgement. The interview protocol (Appendix A) was used with notes and annotations as the interview progressed. The interviews were conducted in English and lasted between 60 and 120 min, depending on data saturation [41]. The data was saturated at the tenth respondent; however, the researcher proceeded to interview the final two participants to validate the data [41]. The research ethic for this research were considered and formal ethical approval was attained (Ethical protocol reference: JKEUPM-2019-220).

**Table 2.** Profiles of the food industry practitioners.

Respondent Code	Type of Company (Commodities)	Years of Experience in Food Industry	Position
RA	Oil and Fats	9 years	Operational Excellence Manager/LSS Black Belt
RB	Dairy Products	14 years	Production Manager/Six Sigma Green Belt and Lean Black Belt
RC	Dairy Products	7 years	Process Engineer/LSS Green Belt
RD	Oil and Fats	9 years	Assistant Manager Quality
RE	Beverages	7 years	Production Engineer
RF	Bakeries	2 years	Quality Assurance Executive
RG	Oil and Fats	1 year	Continuous Improvement Manager/LSS Black Belt
RH	Dairy Products	15 years	Operation Manager/LSS Black Belt
RI	Beverages	2 years	Quality Assurance Executive/Certified Quality Engineer
RJ	Confectionery	13 years	Value Stream Manager
RK	Oil and Fats	9 years	Supply Chain Manager
RL	Meat and Poultry	10 years	Quality Assurance Manager/Six Sigma Green Belt

The data was verbatim transcribed with field notes and analysed using QSR NVivo 12 software by inductive thematic analysis and deductive pattern elucidation [42]. The four-step data analysis process was as follows [42]:

- (1) After reading the data multiple times for familiarisation, the data was descriptively coded.
- (2) The content of the coded data was thematically analysed to generate new notions as the basis of the development of a readiness to change theory.
- (3) The data were tabulated by comparing the themes and patterns that were identified and matched from the respondents' answers.
- (4) The evaluation considered conceptual and theoretical grounds. The condensed and reduced data were analysed and interpreted to rationally govern earlier inferences and gain a better understanding of the data.

The four principles outlined by [43] were utilised in this study to validate the results, (see Figure 2):

The analysis of the readiness data used to develop the LSS readiness framework outlined a cluster of nodes under six identified themes of readiness factors. Figure 3 shows the development of the LSS readiness framework for the food manufacturing industry.

### 3.2. Case Study

The readiness factors identified in the previous research stage were then validated through case studies of three food companies (one medium-sized and two large). The LSS readiness of the companies was assessed through semi-structured interviews with the employees of the companies with the questionnaires seen in Appendix A following the research protocol. Table 3 presents the profile of the case studies of each company. Analysis of data was performed and the data are tabulated in Table 4, which shows the results of LSS readiness in each company.

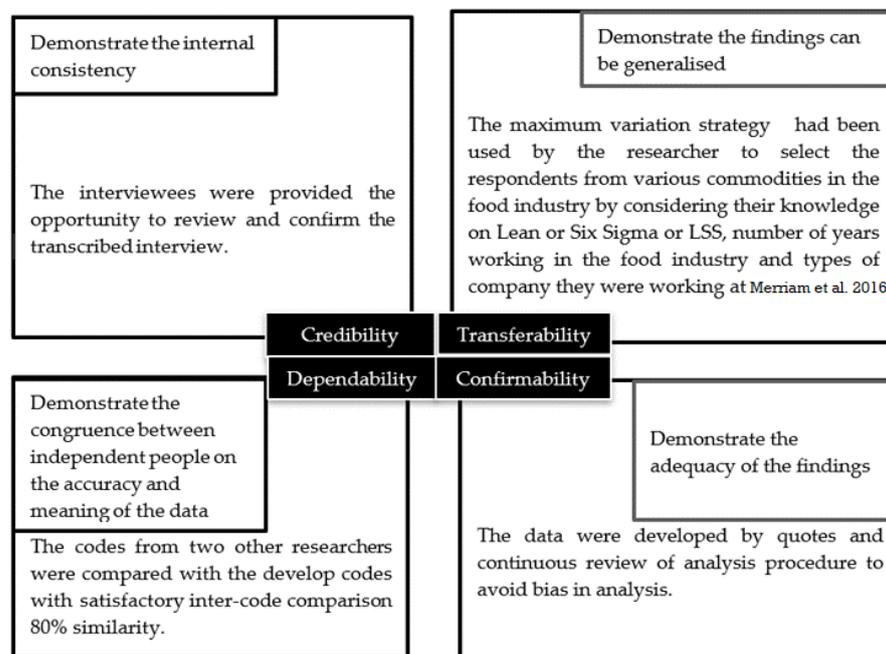


Figure 2. The four principles that ensure the trustworthiness of the results [44].

Table 3. Profile of Case Study Company.

Company	Type of Products Produced	Year Established	Annual Profit	Food Safety Certifications	Process Involved
A	Packed vegetables and fruits	2013	17.2 million	ISO 22000 GMP HACCP	Receiving raw materials, cleaning, sorting and grading, weighing, packaging, labelling, cartoning, storing, loading and delivery
B	Condiments	1975	14 million	ISO 22000 GMP HACCP	Receiving raw materials, weighing, mixing, cooking, filtering, filling, capping and sealing, labelling, cartoning, storing, loading and delivery.
C	Instant coffee	2001	5.6 million	GMP	Receiving raw materials, dispensing, sieving, blending, filling, bottling, packing, storing and delivery.

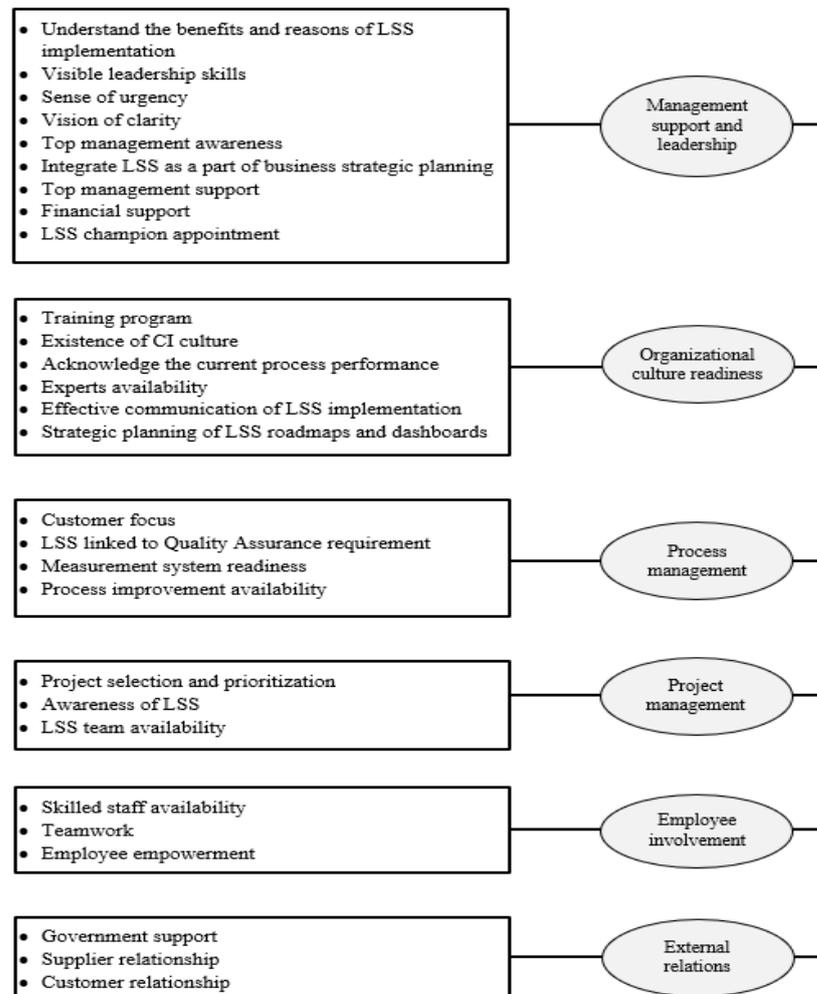
#### 4. Results and Discussions

Failures of organisational change were recorded because managers were unaware of the importance of implementing change and thus perceived that they were unprepared to implement any changes. Managing challenges is a crucial part of organisational change preparation to implement LSS [4]. Through the interviews conducted in this study, valuable information was accumulated from LSS practitioners in the food industry regarding LSS readiness factors. The interview generated 28 nodes of readiness factors. The results emphasise that the factors discovered during the unfreezing phase determine what should be done by the food industry to enhance and interactively expand its scope as it evolves. The findings of the interviews provide insights into and reflections on the LSS experience in the food industry from the perspectives of industry practitioners and experts.

##### 4.1. LSS Readiness Criteria in the Food Industry

Successful change management by adopting a systematic programme such as LSS is a major discussion topic among organisations. It involves identifying the critical factors

that affect the success of change [45]. In [8], it is stated that the introduction of LSS in the food industry demands high capital costs and long-term investments to ensure a strategic position in a company's unfreezing phase to prevent under-expenditure on CI operations. The following section reports how, based on the interviews, factors were identified and classified into six readiness factors for devising a comprehensive change strategy for LSS (Figure 3).



**Figure 3.** Readiness factors of LSS Implementation in the food manufacturing industry.

#### 4.1.1. Management Support and Leadership

Management support and leadership were the most cited readiness factors at the unfreezing point, with most respondents highlighting that both factors influence the success of LSS. This is in accordance with [33], who mention that unwavering support and budget allocation from the senior management are vital to the introduction of a CI initiative. The top management has the authority to provide resources to initiate the change process by integrating an LSS strategic plan into the company's central strategy. This would bring about quality improvement and business excellence during the unfreezing phase. To effectively manage the adoption of new technology or, in this case, a new management style, [46] suggest that the support of the senior management functions acts as a local change agent.

The actions taken and the policies set by senior management personnel could support and accelerate the introduction of LSS in the food business, in terms of financial support or the integration of LSS into the organisation's business strategy [47]. This is intended to avoid adherence to a "quick fix" initiative and to prepare for a long-term commitment

to CI. The respondents emphasised the importance of a company's financial capability to invest in training, reward and recognition, software and machines, as well as external consultants to advise on the adoption of LSS [48]. The respondents stated that organisations should hire experts to conduct internal training for employees to understand the concept of LSS implementation and the software. Senior management teams might integrate LSS as a company-wide strategy by introducing LSS at the highest level of the corporation and implementing it fully within an organisation. This process aims to reduce process variability, waste, and costs, as well as to ensure product safety [8,9].

As the food industry is a strictly regulated sector, food safety is given primary importance [49]. Moreover, information about operational performance and essential LSS projects must be shared [11]. The respondents stressed the need for the top management to establish clear LSS objectives and directions by structuring LSS as a feature of cost-saving projects while meeting the existing consumer demands [4].

The respondents also stated that the top management should act as an agent and create a real sense of urgency by seizing opportunities, avoiding hazards, and shedding low priorities in order to operate smoothly, which would then widen the perception and parameters of food quality in the food sector [8,50,51]. The food industry prioritises product safety due to its primary concerns: food poisoning and microbiological outbreaks [52]. However, [11] clarify that the industry is cautious about innovative technology and easily satisfied with their current performance, which are factors that need to be considered to increase the sense of urgency.

The know-why justification for introducing LSS in the food industry would impact the decisions of senior management teams regarding the LSS adoption process [46,53]. The respondents agreed that support from the top management was perceived through a common understanding of why and how the introduction of an LSS mechanism could impact a company. The most frequently mentioned readiness factor was the awareness among the top management of LSS implementation. It is important to ensure that senior managers acknowledge the need for LSS implementation and fully understand the reasons for introducing LSS, as stated in various interview sessions.

The interview results suggest that the senior management should identify the communication vehicles that promote LSS implementation as a part of a strategic initiative to steer a company towards business excellence. The management should convince their employees that LSS projects with proper LSS tools and techniques could resolve existing food process problems and process variations, as well as reducing waste [9]. The top management should communicate legitimate reasons for implementing LSS, for instance to facilitate the reduction of food process variations [53]. Respondent RG mentioned that communication was important in ensuring that everybody understood the reason for LSS implementation and would align with the target of business performance, so that everybody in the company would be aware that this is not just a fad.

Transformational leaders with the ability to coach and guide training sessions will include real case study activities, as well as their knowledge and expertise of LSS tools and techniques, to help employees to find and resolve problems that occur in the food processing lines. Respondent RK mentioned that leadership capabilities ensured the buy-in of shop-floor-level employees and reduced the resistance to change that was often involved in attempts to implement LSS. Therefore, a good leadership style will make it easier for an organisation to embark on organisational change initiatives involving LSS [4,54].

The respondents stressed the importance of appointing an LSS champion to lead the project. This type of appointment helps the top management to establish LSS project structures for the company, which can lead to proper strategic planning and help to develop internal experts in the organisation through a training programme that may involve coaching and mentoring activities [4].

The top management should convince employees that LSS projects could resolve existing food process problems with the appointment of an LSS leader. The change agent can be internal or external. However, internal change agents have generally been found

to impact the sustainability of the LSS programme as they provide continuous support, guidance and approval for LSS projects [55].

#### 4.1.2. Organisational Culture Readiness

The results demonstrate that organisational culture (OC) readiness is one of the key elements in ascertaining a food industry player's preparedness for implementing LSS. In the 'readiness to change' theory, OC includes continuous training programmes, the willingness to change, the availability of equipment and software, a CI culture, an acknowledgement of the performance of the current process, the availability of in-house experts, an effective communication medium, strategic planning of an LSS roadmap and dashboards, as well as rewards and recognition [4].

Respondents RC and RH suggested the need to acknowledge the nature of the current process performance to verify the urgency of implementing a superior and more effective quality improvement technique. This knowledge justifies the recognition of the need for proper planning of the company's strategic quality objectives through LSS implementation. This would involve the use of the appropriate tools and techniques to solve identified problems, eliminate food waste and reduce food process variations [9,23]. It has been observed that it is important to acknowledge an organisation's current performance in order to adopt LSS at the readiness phase, as the food industry is found to be slow-moving in terms of change efforts [56]. Thus, determining the existing process performance of an organization by assessing its existing food business conditions would facilitate LSS adoption.

The respondents stressed that a food company's top management must formulate a strategy to change their employees' attitudes to embrace new quality improvement strategies, especially LSS, by using an approach deemed acceptable to the company's culture. The respondents also emphasised that a food company's senior management must devise a plan to shift the employees' mindset towards accepting new quality improvement initiatives, such as LSS, by utilising an approach that is deemed appropriate to the company's culture. Employees should be practically trained in a CI-oriented approach while executing their tasks. The people within an organisation should also be driven to accept responsibility for the quality of their work and to remain motivated. This can be best accomplished through sustained communication and education training, whereby people within the organisation must come to know, and be aware of, the need for LSS change.

The respondents stated that it is critical for the top management to take a correct approach that involves, for instance, transformational leadership, a reward and recognition system, and education and training to ensure employees embrace LSS implementation. Existing CI practices can help to boost the willingness to change; as employees become familiar with the LSS concept, they will subsequently enhance their adaptability to change. Furthermore, respondent RI stated the need for updating employees on the departments' current CI project performance and CI practices. Hence, supportive internal communication nurtures information sharing and directs the vision of the senior management towards a CI programme that avoids conflicts and provides a better understanding of the execution of LSS [31].

The respondents stressed the importance of restructuring organisations. For instance, the respondents emphasised that a food company's top management should prepare proper LSS roadmaps and dashboards by setting realistic targets for LSS implementation. This could be achieved by linking LSS to a food business strategy that focuses on major problems in the food industry, including high production costs, excessive food inventories, increases in food process variations, and food waste [8,9,23].

The results also show that a reward and recognition programme is inseparable from the initiation of LSS projects and is a part of LSS investment mentioned by respondents RH and RK. In [31], it is argued that incentives, recognition and rewards should be given when achieving an LSS goal during the implementation phase to boost employee motivation. However, this should be part of the resources allocated to a CI planning activity at the

readiness stage. The top management should consider allocating a budget for rewards and recognition at the readiness point, as this can help to enhance employee motivation to practise LSS activities during the implementation phase [8,47].

#### 4.1.3. Process Management

Process management refers to creating customer values and enhancing the focus of the process based on customer needs [48]. The food industry supply issues involve meeting different customer demands while conforming to quality assurance requirements [3]. Food industry initiatives concentrate on food quality and safety to develop customers' trust [11,57,58]. Thus, LSS benchmarks and guidelines should be based on customer requirements, while considering the inherent characteristics of the food sector.

Respondent RE highlighted the requirement of customer focus at the pre-implementation phase due to the sensitivity of customers towards product cost. This does not appear to be controversial, as the food industry is usually defined by divergent product structures, whereby product differences may be associated with customer-specific product specifications, either in packaging (form, size, printing or labelling) or product recipes [8,22]. This broadens the sense of food quality by focusing on food process line productivity and reduces quality perception bias by focusing only on food safety operations [8,50]. Other considerations in this area include measurement system availability and process optimisation. Measurement system analyses should be performed based on the critical-to-quality parameters that impact customer requirements parameters. In [53], it is clarified that the food industry often underestimates measurement system issues even though measurement system readiness has been identified as essential at the implementation stage. Respondents RC, RH and RK stated that proper guidelines need to be created within a manual to inform an organisation's LSS initiation. This would involve, for instance, requirements for proper preventive maintenance activity schedules and equipment or machine re-calibration, which would avoid disputes during the implementation phase. The food industry faces long set-up times due to product variations that require cleaning activities and adhering to QA criteria [9]. Respondents recommended updating the types of machinery and software by increasing their efficiency, thus accommodating continuous effort (e.g., long waiting times when machines break down). Besides that, equipment and software resources are required to facilitate document and information sharing during LSS projects [4].

Process improvement is vital in an LSS change programme because it helps to categorise typical problems in food processing lines. Respondent RC stated that the availability of process improvement practices helped to identify problems and root causes at different Sigma levels, allowing for the generation of improvement solutions. For example, annual food industry activities are conducted to ensure food safety regulations are fulfilled by renewing their certificates, and LSS should be the solution that allows companies to obtain the relevant certification [59].

#### 4.1.4. Project Management

Appropriate project management skills in the unfreezing phase represent one of the contributing factors to a successful CI initiative [48]. Although LSS deployment helps, a company should be able to choose a project based on profitability. LSS project selection and prioritisation are based on existing and future customer demands by considering the profits gained, since the food industry is customer-centric [13,48]. Respondent RE said that the food industry faced increasing taxes on raw materials. Instead of changing the food taste quality, the top management should anticipate cost-saving activities by reducing their use of raw materials or increasing the price of the finished products. The senior management should consider LSS to be a game-changer and an economical solution.

Food production planning and controls often consist of Make-to-Stock and Make-to-Order strategies [1]. The demand response strategy mentioned by [8] is applicable in cases where food raw materials are highly perishable and seasonal. This requires Make-to-Stock product manufacturing, which affects the Just-In-Time (JIT) adoption practices [1,8,60].

In [8], it is stated that the type of production influences the adoption of LSS practices. In [8] and [61], it is further discussed how specific products require specific equipment in terms of availability and reliability, which in turn require fast changeover practices, which are less applicable to LSS implementation.

The organisational impact criteria involve learning benefits and concerns to create LSS awareness among employees at the initial phase. In [48], it is explained that project management consists of evaluating the level of awareness according to Six Sigma, as well as making an organisation ready and amenable in terms of implementation. Food industry practitioners are generally warned about the need to schedule the implementation of the LSS programme by establishing quality-related activities within the organisation. The activities help the employees become comfortable and familiar with adapting LSS in their daily tasks [48]. Respondents RH and RK mentioned that the creation of a special week of a CI awareness programme in their company CI activities enhanced employee motivation.

One respondent said that LSS adoption should be led by champions, with a dedicated team to support them and execute the task. Respondent RJ suggested that, at the very least, employees from food safety or quality departments should be represented, as an LSS strategy should be linked to business strategies, while the major concerns in the industry are food safety and quality issues at the pre-implementation stage. They are the workforce responsible for CI projects and there, a dedicated team is needed to support the LSS champion and execute the task [34]. A company should encourage its employees to solve problems by appointing them to certain positions of responsibility, which will build respect and trust between managers and employees.

#### 4.1.5. Employee Involvement

The involvement of skilled employees at the unfreezing phase of a quality improvement project is a crucial sign of LSS readiness. Employees should be part of the LSS transformation at the initial phase as improvements in employee routines represent the foundation of LSS strategic decisions. The respondents strongly recommended developing internal talent within a CI organisation. Respondents RB and RD stated that the employees of an organisation should be equipped with LSS knowledge, and RE indicated that LSS education should be provided at early tertiary education. Employees should also be sufficiently knowledgeable to use the LSS improvement tools and techniques to solve problems [5,9]. In addition, the food technology curriculum at universities should be revised to include LSS as a core subject. At the industry level, organisations should equip their employees with LSS training through knowledge transfer activities with the involvement of a change agent.

Respondents RA and RB stated that companies should consider the need to develop internal talent in CI. Having the right people and suitable projects were also said to be critical for the LSS programme. LSS training involves multiple levels of belt training, the highest being a black belt. Results show that identifying the right candidate to train helps to add extrinsic value to the company.

The selection of black belt candidates is based on their capability to lead, guide and coach as it aims to produce internal trainers in food organisations [5]. However, LSS training for shop floor employees should not be neglected. They are the executors of the food processing lines who handle quality practices on a daily basis. It is stated in [62] that employees should understand the key processes involved in food production, while [4] note that an important factor that contributes to preparedness for LSS implementation is the employees' understanding of the LSS methodology.

Respondents RG, RF, RK and RI stated that employees with high levels of LSS awareness benefited during the initiation process, which may necessitate reducing resistance to change. Employee motivation is impacted by their understanding of a CI programme and the clear communication of the direction in which the company is moving with the adoption of LSS. Several respondents suggested that a CI awareness programme could be embedded within other quality assurance and food safety programmes to introduce CI initiatives such as LSS in a company.

#### 4.1.6. External Relation

The results also highlight the importance of the government's position and customer relationships at the LSS unfreezing point. Any external activities, such as relationships with suppliers, customers, the government and competitors, may influence the initiation process of LSS adoption. External relations refer to all the actions used to evaluate an organisation's environment [63]. One respondent mentioned the role of government support, such as conducting education programmes to deliver awareness of LSS to food companies through knowledge-sharing sessions and industrial visits. No study has yet highlighted government support in the readiness stage; however, government support had been mentioned as a critical factor in Lean adoption in red-meat industries, whereby the government acts as a policymaker and strategizes the appropriate implementation approach [64].

The food industry is a customer-driven manufacturing sector, where a positive customer relationship influences the planning of the strategy of an LSS initiative at the readiness phase. Respondent RE stated that customers were price-sensitive, which strictly impacted their purchasing power activities. Thus, food industry players should consider customer complaints and their existing and future demands as part of their business strategies. Food businesses face various customer requests, including for product recipes, packaging, or the validation of product safety [8]. In this regard, [65] say that organisations should establish collaboration and openness with their external actors.

The quality of natural food materials often depends on the growing conditions such as rainfall and temperature, as well as the processing and transportation methods employed by suppliers [66]. The impact of raw material variation is that food processes must be altered to allow for the variation in the end product [23]. The role of the food industry suppliers at the beginning of the food production process is to supply good quality raw materials just-in-time (JIT) to avoid challenges during LSS implementation [8,60].

#### 4.2. Validation Case Studies

The results shown in Table 4 reveal each company's current status based on the identified readiness attributes. Company A met only 11 out of 28 LSS readiness factors, hence failing to achieve all the readiness factors in the management support and leadership dimensions, which are the most important dimensions of the LSS readiness factors. Thus, the results show that Company A is not ready for LSS initiatives. Company A is struggling to sustain their Lean practices, which were initiated a year before. The factory manager led all the CI activities; however, the company depended on external consultants to deploy LSS.

Company B achieved 27 out of 28 LSS readiness factors, which indicates that they are fully ready for LSS practices. They were introduced to LSS by their internal expert and at the time of writing, they were undergoing training before proceeding to LSS implementation. The management contended that they were ready for this implementation. CI activities were guided and led by an internal food safety team, and employees in the organisation were aware of the LSS initiatives.

Company C only achieved one readiness factor, indicating that they are not ready for LSS implementation. They were highly concerned about food safety and regulations. However, instead of improving their process through LSS methodology, the company reluctantly invested in CI practices. Their customers mainly focused on obtaining food safety certification as they were contract manufacturing companies that depended greatly on their own customers' needs.

The results demonstrate that food companies in Malaysia are still biased in favour of quality efforts as they lean towards food safety certification, as evidenced by the practices of Companies A and C. However, Company B managed to link LSS practices with the strict QA requirements, guided by their internal HACCP team. The food industry prioritises food safety and hazard avoidance; however, LSS deployment reduces the bias towards quality efforts with the help of the quality team as the change agent.

The participants declared that the identified readiness factors—management support and leadership, organisational culture readiness, process management, project manage-

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ment, employee involvement and external relations—provide a close reflection of their company's readiness to apply LSS. The participants stressed that LSS readiness was strongly influenced by managerial support and leadership; however, other readiness factors should not be neglected.

**Table 4.** Empirical findings for LSS readiness in the food industry.

Dimensions	Company A	Company B	Company C
Management Support and Leadership	<ul style="list-style-type: none"> <li>• Top management understands the benefits of and reasons for LSS implementation; however, they expect fast results, which contradicts the nature of LSS in a company.</li> <li>• Visible leadership skills in conducting LSS. The factory manager hired external consultants to lead the LSS practices.</li> <li>• Sense of urgency in practising LSS in the company, which aims to improve their quality practices by reducing waste during sorting processes.</li> <li>• No clarity of LSS vision in the company.</li> <li>• Top management teams are aware on how LSS would benefit their company.</li> <li>• The company tries to integrate LSS as part of their strategic business planning but has failed due to a lack of commitment and their expectation of fast results.</li> <li>• Top management supports LSS projects; however, they are unwilling to invest further in LSS as they lean more towards their current practice, ISO22000.</li> <li>• No appointment of LSS champion in the company as they depend on their external consultant</li> </ul>	<ul style="list-style-type: none"> <li>• Top management understands the benefits of and reason for LSS implementation as a process that aims to improve their food production flows.</li> <li>• Visible leadership skills in conducting LSS implementation by having internal experts (HACCP team) lead the LSS practices.</li> <li>• Sense of urgency in practising LSS in the company, which aims to improve their quality practices by reducing waste during food production processes.</li> <li>• Clarity of LSS vision in the company, which seeks to reduce their production costs.</li> <li>• Top management teams are aware on how LSS would benefit their company.</li> <li>• The company integrates LSS as a part of their strategic business planning.</li> <li>• Top management supports LSS projects by providing sufficient resources and a capability leader to support the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Top management does not understand the benefits of and reason for LSS implementation.</li> <li>• No visible leadership skills in conducting LSS implementation.</li> <li>• There is no sense of urgency in practising LSS in the company. This company only focuses on practising food safety standards; GMP.</li> <li>• No clarity of LSS vision in the company.</li> <li>• Top management are unaware of LSS as a feature of CI.</li> <li>• The company is unfamiliar with CI practices as they focus only on GMP practices.</li> <li>• There is no support from the top management for LSS projects and other CI practices as they majorly lean towards GMP practices.</li> <li>• No appointment of LSS champion in the company as they are uninterested in practising LSS as part of their CI programmes.</li> </ul>
Organisational culture readiness	<ul style="list-style-type: none"> <li>• Provide LSS awareness training for their employees.</li> <li>• Existence of CI culture in the company, which aims to reduce sorting waste.</li> <li>• Acknowledge their current process performance creates high levels of waste from the sorting process.</li> <li>• Highly dependent on external experts to conduct LSS practices.</li> <li>• Ineffective communication of LSS implementation at the lower level, thus primarily among foreign workers.</li> <li>• No long-term strategic planning of LSS roadmaps and dashboards.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide LSS awareness training and scheduled training for their employees.</li> <li>• Existence CI culture in the company helps in the readiness for LSS implementation.</li> <li>• Acknowledge their current process creates waste during food production processes.</li> <li>• Internal experts from the HACCP team lead the LSS projects.</li> <li>• Effective communication of LSS implementation; the whole organisation is aware of LSS benefits.</li> <li>• Proper long-term strategic planning of LSS roadmaps and dashboards by the HACCP team.</li> </ul>	<ul style="list-style-type: none"> <li>• No training in LSS as the company is only willing to invest in GMP training.</li> <li>• No existence of CI culture in the company.</li> <li>• Satisfied with their recent process performance.</li> <li>• Unavailability of LSS expert.</li> <li>• Ineffective communication on LSS practices in the company.</li> <li>• No strategic planning for CI as they focus only on food safety initiatives and GMP.</li> </ul>

Table 4. Cont.

Dimensions	Company A	Company B	Company C
Process management	<ul style="list-style-type: none"> <li>Customer needs focus on food safety certification as this company supplies retailers who demand such certificates.</li> <li>The company cannot link LSS to the QA requirements as they focus on the sorting process, which is difficult when highly perishable products are involved, specifically at the grading stage.</li> <li>Lack of availability of measurement system readiness and process improvement.</li> </ul>	<ul style="list-style-type: none"> <li>Improve the food process line (filling step) to accommodate the customer concerns and needs; no exemption from the strict QA practices led by the HACCP team.</li> <li>Evidence of measurement system and process improvement as the company has automated food processing lines, which involves making data available to be analysed statistically.</li> </ul>	<ul style="list-style-type: none"> <li>Customer needs focus on food safety certification as this company is engaged in contract manufacturing, whereby their own customers demand food safety certificates.</li> <li>The company perceives that LSS is not linked to QA practices.</li> <li>Lack of availability of measurement system readiness and process improvement.</li> </ul>
Project management	<ul style="list-style-type: none"> <li>Unavailability of CI team leads to improper project selection and prioritisation.</li> <li>Awareness of LSS practices.</li> </ul>	<ul style="list-style-type: none"> <li>Availability of CI personnel from the HACCP team to lead the LSS projects.</li> <li>Everyone in the organisation is aware of the LSS practices to be implemented.</li> <li>The LSS projects were being selected and prioritised by focusing on reducing waste from automated processing lines.</li> </ul>	<ul style="list-style-type: none"> <li>Unavailability of CI team leads to improper project selection and prioritisation.</li> <li>No awareness of CI practices in the organisation.</li> </ul>
Employee involvement	<ul style="list-style-type: none"> <li>Existence of teamwork.</li> <li>Lack of employee empowerment.</li> <li>Unavailability of staff with LSS skills.</li> </ul>	<ul style="list-style-type: none"> <li>Existence of teamwork.</li> <li>Employee empowerment.</li> <li>Availability of staff with LSS skills from the HACCP team to guide LSS projects.</li> </ul>	<ul style="list-style-type: none"> <li>Existence of teamwork.</li> <li>Lack of employee empowerment.</li> <li>Unavailability of staff with LSS skills.</li> </ul>
External relations	<ul style="list-style-type: none"> <li>Support from the government by providing LSS training.</li> <li>No support from the supplier.</li> <li>Focus on improving customer relationships by being primarily concerned with food safety certification.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain a good supplier relationship in ensuring JIT practices.</li> <li>Aims to improve customer relationships through LSS practices.</li> </ul>	<ul style="list-style-type: none"> <li>No support from the supplier.</li> <li>Focus on improving customer relationships by being primarily concerned with food safety certification.</li> </ul>

## 5. Conclusions and Future Research Agenda

This study focuses on the critical phase of LSS unfreezing by providing an in-depth description and analysis of areas that are still underexplored in the literature. The determined readiness factors that should be considered by food industry practitioners in the adoption of LSS include management support and leadership, organisational culture readiness, process management, project management, employee involvement, and external relations. The results also indicate that the most critical LSS readiness factors are senior management and leadership.

It is recommended that the grounded theory be tested quantitatively and with a larger sample size, as this would facilitate the design of better-defined constructs, given that this study only involved a qualitative approach with a small number of participants and therefore faces generalisability issues. Hence, future researchers should undertake an explanatory survey to assess the relationship between factors to determine the weightage of factors leading to LSS readiness. This would allow the readiness factors to be prioritised and the identified factors to be generalised through a larger sample size. The contribution of this research is twofold. First, it contributes to the extensions of organisational change readiness theory in LSS implementation through the final determination of LSS readiness constructs. It can help researchers better understand major aspects of the unfreezing phase and conduct their future research in a more comprehensive and oriented way. Second, the study concludes with the identification of LSS readiness factors that can be fundamental sources of information in the development of an LSS self-assessment readiness scale for the food industry, which practitioners can employ to improve the success and effectiveness of LSS adoption. The practitioners will be able to use it as a diagnostic tool in evaluating their LSS readiness at the pre-implementation stages, specifically for food industry settings.

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## Appendix A

Semi-Structured Interview Questionnaires:

1. What are factors that you think that may impact the readiness of LSS application in food manufacturing industry?
2. How may those readiness factors mentioned impact LSS application in food manufacturing industry?

Case-Study Questionnaires:

1. Based on these readiness factors, which do you think affect the LSS readiness of your company?
2. How may those readiness factors mentioned impact LSS application in your company?
3. What do you think of the level of readiness of your company for LSS application?

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