Critical Success Factors for Lean Healthcare Implementation and Sustainable: A pilot study in Local Healthcare in Malaysia

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Abstract

The assessment of lean deployment in the health sector should be determined to evaluate the success and sustainability of the practice. The measurement shall be identified through the alignment of the Critical Success Factor (CSF) to the lean objective. This paper developed the preliminary framework for measuring lean healthcare sustainability through the CSF measure. 56 item measures were identified that linked to 11 basic CSF in assessing lean sustainability. In sequence, this paper established the importance of CSF measures through a quantitative method. The 30 participants whose has knowledge and experience in lean practice were identified in the local hospital in the southern region. The survey questionnaire was distributed to participants with 100 percent response rate. The data was analyzed by performing reliability and validity test to appraise the quality. The findings of this

study are concluded by recommending all item measures as important for this measurement framework. The top CSF which are leadership and management, employee involvement, lean healthcare practice, efficient infrastructure and education and training perspective has been considered as the main vital CSF for lean implementation that drive other CSFs for continuous and sustainable practice in the healthcare organization.

Keywords
Critical success factor; Sustainability; Lean healthcare; Healthcare management

1. Introduction
Lean in healthcare continues to develop as a strategic approach that expands organizational efficiency and effectiveness. Lean was introduced in 2007 which was designed to increase the quality of service with minimal cost operation (D'Andreamatteo et al., 2015). In general, lean was adopted in the healthcare system to maximize value and eliminate waste that affected customer interest and company sustainability.

Despite the advantage of lean adoption, the concept aimed to improve the operation process was not obtained due to restrictions. D'Andreamatteo et al. (2015) argue that lean should be viewed as a holistic transformation in the organization by overcoming barriers and challenges that may slow down lean adoption. Applying lean has been considered as a strategic mission, however the key driver has to be determined to gain potential success in lean implementation.

Critical Success Factor (CSF) is considered vital to understanding the success and sustainability of lean implementation in the organization. CSF is a key driver in the lean process, poor identification led to poor implementation and failure deployment. According to Vaishnavi & Suresh (2020), CSF should be identified as it is useful for management to understand the potential of lean implementation and success. CSF study had carried out to identify, investigate and analyse CSF in lean success in the healthcare organization for the sustainable mean (Gonzalez-Aleu et al., 2018; Habidin et al., 2012; Stelson et al., 2017; Vaishnavi & Suresh, 2020; Waters, 2016). Correct identifications and clear definitions of every factor by an organization are vital to gaining a bigger view and insight about CSF.

Lean healthcare offer advantages to hospital performance in term of financial and social benefit as well as environmental impact (Tasdemir & Gazo, 2018). Thus, a measurement initiative has to be deployed for a reason of organizational performance status. According to Elg et al. (2013), performance evaluation indicates the stability and efficiency organization in current as well as in future conditions. The assessment method is crucial to measure the maturity of lean and help in sustaining the implementation in the organization.

Furthermore, the used of CSF as performance measured was identified by researchers (Swarnakar et al., 2021; Vaishnavi & Suresh, 2020; Waters, 2016) to determine the lean deployment status. Sustainable performance of an organization can be achieved through the success of lean implementation.

In order to address the shortcomings, this research is developing a new performance measurement model to assess the sustainability of lean healthcare at the hospital through CSF perspectives. The application of the framework enables organization management to align key factors and lean objectives for achieving sustainable practice and excellent operation.

2. A framework of lean healthcare performance measurement for hospital organization
Based on the previous studies of performance measurement in lean healthcare, this paper proposed a sustainability performance measure of lean healthcare in hospitals which consists of 11 perspectives. Table 1 presents a summary of CSF perspectives used by the authors.

Table 1. Summary of Critical Success Factor Perspectives for Lean Healthcare Implementation used by Authors.

Author	Critical Success Factor Perspectives										
	Leadership and management	Organizational culture	Employee involvement	Lean healthcare practice	Quality measurement	Financial capability	Customer focus and perspective	Employee satisfaction	Education and training	Efficient infrastructure	Environmental concern
Swarnakar et al. 2021	x	x	x		x	x	x	x	x		x
V.Vaishnavi, M.Suresh 2020	x	x	x	x	x	x	x		x		
Henrique et al. 2020	x	x	x		x				x		
Aleu et al. 2018	x	x	x	x					x	x	
Zhu et al. 2018	x	x	x	x							x
AlJaberi et al. 2017		x	x	x			x	x			
Stelson et al. 2017	x	x	x			x			x		
Waters 2016	x	x	x	x	x		x		x	x	
Abuhejleh et al. 2016	x	x	x	x	x	x		x			
Habidin et al. 2012	x	x	x				x				
Soti et al. 2010	x	x	x	x		x		x	x	x	

The assessment of lean sustainability has been increased but a good impact on all parties involved will be obtained if the assessment covered a comprehensive dimension. True sustainability of lean should include profit, people and the planet which reflect the economy, social and environmental pillars (Tasdemir & Gazo, 2018). However, most studies focus to associate lean sustainability with the economic aspect (Henao et al., 2019) while a few research aimed to embed environmental awareness in lean practice (Zhu et al., 2018). Thus, a whole assessment of the sustainable aspect is vital to be evaluated to present an actual result that fulfils all parties' requirements.

The idea of sustainability is basically linked to the Tripple Bottom Line (TBL) principle that promotes efficiency and effectiveness of service or product to people and the environment. According to Tasdemir & Gazo (2018), lean sustainability emphasized on the enhancement of financial performance by waste elimination, improving people's satisfaction and reducing of impact on the environment factor. Therefore, the organization which adopted comprehensive sustainability should stay competitive in their area.

In addition, Ramori et al. (2019) conclude that the success of waste reduction, operation cost minimization and increment of patient satisfaction through lean application lead to sustaining competitive advantage in the market. The assessment of lean healthcare in holistic dimensions is crucial to meet the financial and non-financial aspect to enhance organizational performance and meet its objectives.

Thus, a comprehensive assessment model to evaluate lean healthcare sustainability is developed with emphasized CSF and linked to sustainable principles as presented in Figure 1.

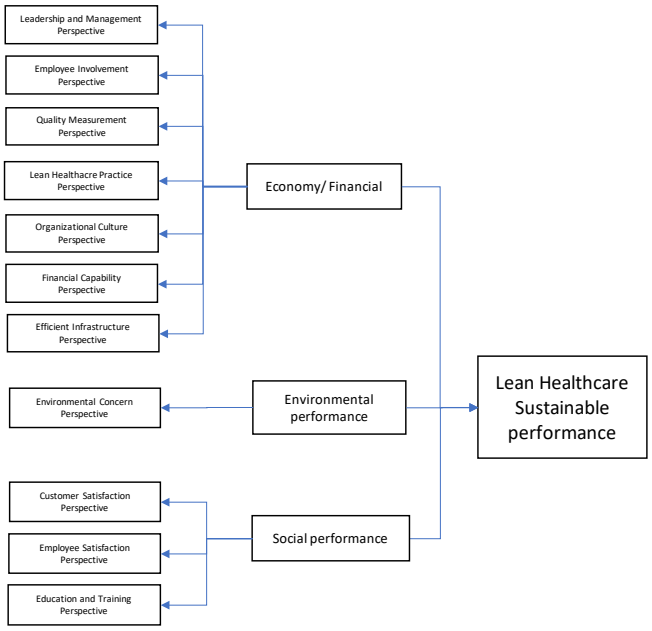

Figure 1. Conceptual framework of Lean Healthcare Sustainable Performance for hospital organization.

To make a clear and holistic assessment of lean sustainability. 56 item measures are identified which have been categorized into 11 perspectives based on aim and focus as demonstrated in table 2. The items of measurement were adopted and modified based on relevant literatures (AlJaberi et al., 2017; Anuar et al., 2018; D'Andreamatteo et al., 2015; Gonzalez-Aleu et al., 2018; Hallam & Contreras, 2018; Helleno et al., 2017; Hung et al., 2019; Poksinska & Swartling, 2018; Stelson et al., 2017; Swarnakar et al., 2021; Vaishnavi & Suresh, 2020; Zhu et al., 2018). The proposed framework measured lean in healthcare organizations in a multidimensional aspect for sustainability performance. Based on Tasdemir & Gazo (2018), little study about lean and holistic sustainability because of the limitation proposed framework for research. The previous study did not focus much on social sustainability due to lack benchmarking capability while environmental sustainability gained incremental interest due to concern of climate change consequences.

Finally, the initial framework of lean healthcare sustainability performance measurement for hospital organization is proposed which consist of the financial, environmental, and social pillar. The assessment of performance is presented to understand the performance of lean practice in hospitals as well as the sustainable approach. The measurement is covered operational efficiency that affects financial sustainability, customer and employee satisfaction which give a significant impact on social sustainability and, waste reduction with efficient resource utilization that contributes to environmentally sustainable. (Table 2)

Table 2. The proposed item measure Lean Healthcare Sustainability performance

Critical Success Factor Perspective	Item Measure
Leadership and Management	Effective top management action to support lean program. Clear goal and direction of lean implementation. Involvement of top management in lean program. Supplier relationship and management. Top management commitment and responsibility towards success of lean healthcare. Alignment of lean objective and healthcare direction.
Organizational Culture	Effective communication practice among staffs and top management. Efficient delivery of information throughout the organization. Rewarding and recognition system for target achievement. Wide deployment of lean application. Service quality accreditation.

	Effective organizational structure which supports lean program.
Employee Involvement	Employee commitment in lean implementation. Dedicated implementation team. Competent team member. Time allocation to implement lean. Clear roles and responsibilities of team members. Team authority in decision making.
Lean Healthcare Practice	Problem-solving method; to solve issue in workplace. Continuous improvement event; kaizen, 5S, continuous system. Right lean healthcare practice in workplace. An appropriate lean tool used; VSM, Kanban tool.
Quality Measurement	Accurate measurement system. Established performance metrics; quality, journey lead time, length of stay, turn over time, readmission, productivity. Checklist and monitoring system. Establish project tracking.
Financial Capability	Availability of fund. Financial and resources allocation. Financial capability. Time and cost benefits.
Efficient Infrastructure	Statistical analysis tool. Reliable and available data. Effective use of technology (e.g IT).
Customer Satisfaction	Understanding customer requirement and need. Customer complaint rate. Patient-oriented process and service. Cooperate social responsibility. User-friendly facility provided. Reputation and brand image. Patient care and service.
Employee Satisfaction	Employee performance review toward career development. Work safety at floor. Employee empowerment. Staff satisfaction in lean program implementation.
Education and Training	Enhancement of skills. Awareness of lean advantages. Education program for lean knowledge. External trainer support in lean program.
Environmental Concern	Waste inventory management system that aligned with lean practice. Waste reduction monitoring. Optimization of resources (medicine, water, energy, etc) used in organizational. Promotion of environmental education. Reduction of environmental impact through friendly process (paperless, no plastic usage). Promotion of resources saving initiative to achieve lean objective. Development of new energy saving initiative.

3. Research method and findings

The pilot study was implemented using a specific method of survey. It is vital and useful to facilitate empirical analysis and judgement of quality (Forza, 2002). The activity was begun with a face validity test after questionnaire development. This research involves developing questionnaires as an instrument through extensive literature reviews. 10 subject matter experts were appointed from the industrial and academic sectors to validate the instrument.

Six industrial practitioners from healthcare were identified who have knowledge and experience in lean healthcare implementation. Wide experience in lean implementation and role in the lean project were the main criteria for selection. While four academician experts were selected according to their research background in the lean

management system. Consultation activity regarding lean systems in the industry was an advantage in the appointment. The preliminary questionnaire was sent through email. 10 experts examined the quality of the instrument in terms of content, wording, sequence, respondent interest, time consumption, flow as well as continuity.

The preliminary questionnaire was modified according to comments and feedback received from experts. To enhance the validation result, Item-level Content Validity Index (I-CVI) assessment was carried out to measure expert judgement on the instrument. I-CVI assessment is a content validity test used to quantify expert judgement. Based on Polit & Beck (2006), content validity is a matter of judgement on instrument quality by an expert which gives some indicator of evaluation.

A validated questionnaire was sent to 30 respondents which involved doctors, nurses and allied staff who have participated in the lean project in the hospital according to record in quality unit. The respondents are from various departments in the hospital. The return rate by the respondent is 100%. The questionnaire comprised of three main sections which related to i) respondent general information, ii) organization background and lean healthcare practice status, and iii) critical measurement for the success of lean in the health sector. A five-point Likert-scale was used to indicate responses to the survey.

A reliability test using Cronbach's Alpha measure was conducted to assess the consistency of measurement on the study survey. The objective of the test is to examine the measurement properties and viability of the research instrument (Forza, 2002). The result of the reliability test presents the measurement scale consistency for the use in the next phase of research.

4. Result and Discussions

The pilot study was implemented at public hospital in southern region which are listed as Lean Agile Hospital by the National Institutes of Health under the Ministry of Health Malaysia. Data collection was conducted between May 2022 until June 2022. Reliability and validity tests were conducted to examine the quality of the survey instrument.

4.1 General information analysis

The first section of the survey present respondents' positions in the organization and experience in quality management. Most respondents (57%) in this pilot survey were doctors and officers who have been involved in the lean project. Nurse and allied staff formed 43% of respondents. More than 70% of respondent have experience of at least 2 years in quality management like lean.

The next survey determines the level of lean adoption and sustainability approach in hospital. 90% of respondents stated that organizations have begun to implement lean healthcare. However, the adoption of the lean approach differs based on the department. The longest adoption is more than five years at a particular department such as emergency, oncology, orthopaedic and anaesthesiology. All respondents agreed that a sustainable of lean healthcare approach is important to enhance an organization's performance. Furthermore, 93% of respondents believe implementing and sustaining lean could obtain cost savings, improve operation efficiency, enhance quality service and reduce waiting time. These data indicate that most respondents have a similar agreement to consider the lean healthcare approach as a critical strategy to enhance operational performance.

The last section, respondents were asked about the factors of lean success at the hospital. The respondents indicate the critical factors which contribute to the success and sustainable lean healthcare. 99% of respondents considered it is necessary to identify the right lean factor which able to drive success in implementation and sustain continuous advantage. Thus, the management of the healthcare sector needs to identify the critical factor that contributes to lean success.

4.2 Reliability and validity

The internal consistency method is an analysis which increasingly used to measure the consistency and stability of measuring instrument. This method used 0.6 Cronbach's Alpha value as a lower threshold for acceptance (Taber, 2018). Since, the value of each factor is above 0.6, all factors are accepted and reliable to be used as a measurement. The result shows that items belonging to the factor present homogeneity and inter-correlation. The summary of reliability is given in Table 3.

Table 3. Reliability test

Critical Success Factor	Number of items	Cronbach's Alpha value
Leadership and Management	7	0.961
Organization Culture Change	6	0.983
Employee Involvement	6	0.983
Lean Healthcare Practice	4	0.915
Measurement	4	0.948
Financial Capability	4	0.930
Efficient Infrastructure	3	0.929
Environmental Concern	7	0.973
Customer Satisfaction	7	0.944
Employee Satisfaction	4	0.963
Education and Training	4	0.961

To measure the accuracy of the survey instrument, validity test was conducted. The first analysis was face validity through an expert judgement process. The quality of the research instrument was appraised to ensure that scale of item measured the right research construct. Based on comments and feedback received from experts, the instrument was improved and modified accordingly. The content validity was implemented to quantify expert judgement through I-CVI analysis. The analysis computing degree of agreement between an expert on an item measure. The threshold value is 0.78 considered adequate for validation purposes when there are three to ten judges (Almanasreh et al., 2019). All the I-CVI value for each expert was 0.9 and above, thus it shows that the experts agreed item measured accurately what it is supposed to be measured. Table 4 presents the I-CVI result for each expert.

Table 4. I-CVI for each expert.

	Expert										
Item	1	2	3	4	5	6	7	8	9	10	I-CVI
1	/	/	/	/	/	/	/	/	/	/	**1.0**
2	/	/	/	/	/	/	x	/	/	/	**0.9**
3	/	/	/	/	/	/	x	/	/	/	**0.9**
4	/	/	/	/	/	/	/	/	/	/	**1.0**
5	/	x	/	/	/	/	/	/	/	/	**0.9**
6	x	x	/	/	/	/	/	/	/	/	**0.8**
7	/	/	/	/	/	/	/	/	/	/	**1.0**
8	x	/	/	/	/	/	/	/	/	/	**0.9**
9	/	x	/	/	/	/	/	/	/	/	**0.9**
10	/	/	/	/	/	/	/	/	/	/	**1.0**
11	/	/	/	/	/	/	/	/	/	/	**1.0**

Based on the result of the reliability and validity analysis, the questionnaire was improved and validated. The reliability value is more than 0.6 presenting the stability of the research instrument. Furthermore, validity analysis demonstrates results exceed the low limit that led to the correct assessment of research. Therefore, the instrument developed for this study could be considered to have content validity and reliability. Thus, can be used for the next phase of research.

4.3 Interpretation of Mean Importance level of Critical Success Factor

Figure 2 shows the Mean Importance level of CSF in lean healthcare implementation as well sustainability approach. This analysis aims to determine the most importance of CSF based on respondent knowledge using a Likert scale ranging from 1 = not important at all to 5 = very important. From the figure, five CSF perspectives have scored more than 4.50. The highest score is Leadership and Management, followed by Employee Involvement, Lean Healthcare Practice, Efficient Infrastructure and Education and Training. The top factor needs to identify and implement first than other factors because it is considered a driving factor that facilitates the process (Vaishnavi & Suresh, 2020). On the other hand, four perspectives obtain a score between 4.40 to 4.50; Customer

Satisfaction, Financial Capability, Environmental Concern and Organization Change Culture. These factors would be likely implemented in the next phase to create a continuous process.

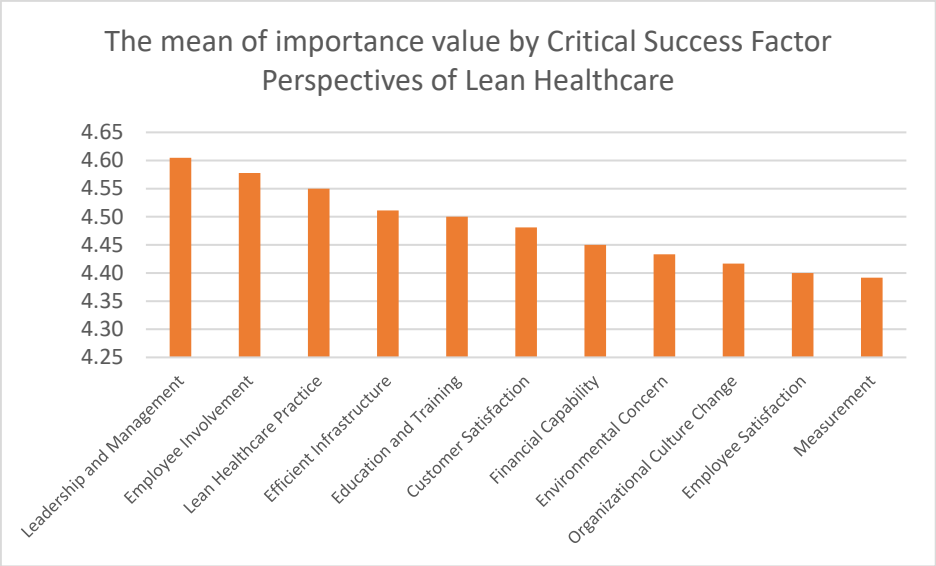

Figure 2. The mean importance level of Critical Success Factor Perspective

In contrast, Employee Satisfaction and Measurement perspectives were considered the least important with a score of 4.40 and 4.39 respectively. However, this value can still be important as the score is high and close to the top rank. The importance and priority of CSF are vital to gain a significant impact on lean implementation as well as sustainability. Clear identification of vital CSF increases the adoption level of lean in health organizations that advocate continuous practice (Stelson et al., 2017).

Thus, the local hospital needs to know the priority of CSF to facilitate the implementation of lean healthcare for success. Management commitment and employee participation are important perspectives which considered as a driving factors. Both factors contribute a significant effect to lean deployment (Stelson et al., 2017). Moreover, the successful adoption of lean healthcare can promote sustainable practice in organization level.

4.4 Importance level of Item Measures

From the results of the importance level of CSF perspective. The most important level of every item measure has been determined. Table 5 presents the highest importance level of item measures for CSF.

Table 5. The importance level of item measures for the Critical Success Factor

Item Measure	Mean Score
Effective top management action to support lean program	4.67
Clear goal and direction of lean implementation	4.67
Identification of project scope, selection, and objective of the project	4.67
Team authority in decision making	4.63
Top management commitment and responsibility towards success of lean healthcare	4.60
Dedicated implementation team	4.60
Competent team member	4.60
Problem-solving method; to solve issue in workplace	4.60
Reliable and available data	4.60
Awareness of lean advantages	4.57
Involvement of top management in lean program	4.57
Alignment of lean objective and healthcare direction	4.57

The Table 5 above shows that item measures under CSF perspectives obtained the highest mean score by the respondent. The results present that these items are considered the most critical measures in the framework of lean healthcare sustainability performance. Most of the items belong to the top CSF perspective, leadership and management, employee involvement, lean healthcare practice, efficient infrastructure and education and training.

5. Conclusion

Lean healthcare practice has become important for the improvement of quality and efficiency of service delivery. Previous studies have identified critical factor for lean implementation. However, there is evidence that indicates a lack of linkage between CSF to sustainable lean performance in a holistic dimension. Due to this phenomenon, thus a comprehensive and priority factor of lean is urged for enhancement of lean adoption and sustainability.

The study objective was to validate a survey instrument for the development of a preliminary framework of sustainable lean healthcare performance. A pilot study results present that all measures for the assessment of lean healthcare are important. Thus, all proposed 56 measures that have been categorized into 11 perspectives are suitable to be used for performance measurement of sustainable lean healthcare.

In the next step of research, a full survey is recommended to validate the preliminary framework of sustainable lean healthcare performance that covers a different angle of dimensions (economy, environment, social aspect).

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Biography

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