MEST Journal
DOI 10.12709/mest.11.11.01.06

FRAMEWORK FOR SUCCESSFUL PROBLEM-SOLVING IN LEAN: A FOCUS GROUP RESEARCH IN MALAYSIAN AUTOMOTIVE

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JEL Category: **D23, D24, L23**

Abstract

From household issues to complex organizational cases, problem-solving is a common but critical matter in our life. Organizations have tried to harness maximum benefit from lean, but evidence of implementing problem-solving principles is rare. This study intends to emphasize on importance and expose the highly influencing success factors to establish continuous problem-solving and learning in any organization with the example of an automotive industry case in Malaysia. A list of elements of problem-solving principles of lean and another for success factors to implement lean has been compiled through a comprehensive review of contemporary literature. Then a focus group of sixteen professional experts selected meticulously from a reputed Malaysian Automotive industry thoroughly discussed the subject matter in group meetings to get their judgments based on experience and shared knowledge. The approach of grading success factors at the element level of principles of lean is an added methodology to the existing knowledge, and the results of highly influencing success factors for the implementation of elements of principles of problem-solving in lean is a new and helpful insight for organizational leaders and researchers. The author assumes this research may take lean implementation to the next level of success. Modern organizations must build lean problem-solving culture by motivating and empowering management employees who have process-level understanding and are accountable with different metrics. The key to success also depends highly on operators' inclusiveness and managing their reactions to change. Both management and process workers must drive lean as a team.

Keywords: *Lean; problem-solving principle; success factor; focus group; analysis of influence; Malaysian automotive*

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1 INTRODUCTION

For Toyota Production System (TPS), or what is now called 'lean' (Parsley, 2018), now is the time for it to remain a thing for only true believers (Hohmann, 2017a). A few organizations become able to implement lean successfully (Drew et al., 2016), but most of them did not reach the goals

(Anand & Kodali, 2011). In the book 'Lean Implementation: Why Lean Fails and How to Prevent failures', Asefeso (2014) conducted a large survey in 2012 that resulted in only 2% of the companies have achieved their anticipated results from lean. Many researchers found that lean fails in more than 50% of cases (Anand & Kodali, 2011), and the range of failure is between 50% and 95%, and among those who succeed, only 30% sustain (Asefeso, 2014).

Lean has mostly emphasized on waste (activities adding no value) elimination and time (lead time, processing time, development time etc.) reduction (Islam et al., 2018a, 2018b) to build fast and flexible manufacturing system to meet modern competition and customer demand (Islam, 2021). Again, Coetzee et al. (2016) have shown concern that so far, strategies for lean implementation have focused alarmingly minimum on principles of problem-solving, although continuous improvement (CI) is at the core of objectives to implement lean principles that are not achievable if problem-solving is excluded. Some companies, in practice, take limited initiative and work on some split and irregular kaizen workshops to fix broken processes or some easy and quick waste elimination (Hohmann, 2017b), and think they are already lean. People are reluctant to change by nature. Neuropsychology favors this by demonstrating that due to well-worn neural pathways, people find it comfortable to do things the same way repeatedly (Asefeso, 2014). Hence research on finding ways to implement new principles of lean at different levels in an organization, from upper management to frontline employees (Choo et al., 2015) is inevitable.

Liker (2005) has introduced a 4P model of lean: Philosophy, Process, People and partners, and Problem-solving. There he proposed fourteen principles. Principles number 12, 13, and 14 were grouped into the category of problem-solving which covers the tenets of continuous improvement and learning (Liker, 2005; Jeffrey & Meier, 2006). Principle number 12 is articulated to spot improvement opportunities and recognize problems in the organization. And together with principle number 13, it is essential to engage people in the total process of problem-solving. But in existing research, although principle 14 has gotten some attention to encourage CI to be a learning organization, there is not enough concern for direct observation (principle 12) or making decisions slowly with the total agreement (Principle 13) (Coetzee et al., 2016).

Recently, the method and implementation of problem-solving of lean have received attention. Parsley (2018) studied the impact factors to engage employees in problem-solving to implement lean. In an article titled "Comparison of problem-solving tools in lean organizations", luga and Rosca (2017) analyzed and compared the problem-solving methods. Another study titled 'Organizational structure, employee problem-solving, and lean implementation' presents an investigation of how lean employee grows their problem-solving skills through the journey through lean implementation (Worley & Doolen, 2015).

Malaysia started a lean program under Malaysian-Japan Automotive Cooperation (MAJAICO) in November 2006 (SME Corp., 2010). Until 2011, 87 companies had participated, and 220 improvement projects were completed, under Japanese industrial experts with vast experience in the automotive industry (Chay, 2014). Then Malaysian Automotive Institute (MAI) took another program under Automotive Technical Expert Assistances (ATEA) for Lean Production System (LPS) implementation and 20 companies saved a total amount of RM18.36 million. Now, to benchmark with global automotive industries like JAPAN, a program named the Automotive Supplier Excellence Program (ASEP) program has been taken. This program also includes LPS as a tool for improving the manufacturing process. This sustainable manufacturing with lean production program (SMLP), was driven towards transforming 120 companies and raising their competence and skill levels to a world-class standard by 2020 (Malaysia Automotive Institute, n.d.).

Bon and Karim (2011) raised the issue that transparency in Malaysian industries is not evident enough in the case of lean implementation. Additionally, they pointed out that case study of lean in the Malaysian industry is limited. Within the automotive industry in Malaysia, studies have been done on lean implementation considering 12 success factors (SFs) (Rose et al., 2014); and 12 perceived barriers (Roslin et al., 2014). Another study has been made based on a survey of empirical data but excluded some significant factors "such as cultural differences, project management competence, and employee participation" (Fadly & Mohd, 2013). Marodin and Saurin (2013) studied and declared that 86% of all

lean pieces of literature published from 1996 to 2012 were based on research in only developed western countries.

Putri et al. (2016) found in their both case study companies in Malaysia that have taken lean initiatives, that the Kaizen initiatives, one of the principles within lean (Coetzee, 2016) represent a continuous improvement aspect (Bhuiyan & Baghel, 2005), have not been effectively implemented. The teamwork approach to solving problems was not founded enough on team members. Also, they were reluctant to build skills for continuous improvement at the individual level. Also, the team was not entitled to practice power to make decisions to solve problems. In case of any problem found by team members, they had to report first to middle management, and then middle management could report to top management. Top management was not interested in both, observing issues and providing training directly on the production floor. Only middle management participated in direct observations, while top management only waited for their report (Putri et al., 2016). But to solve problems in lean management, leaders have no excuse, must see and thoroughly understand the situation for themselves (Liker, 2005), and face relentless unpredictability because of non-stop interruption and fast changes (Myszkowski et al., 2015).

All these studies (Rose et al., 2014; Roslin et al., 2014; Fadly & Mohd, 2013) have been carried out based on the overall impact on lean implementation though the top factors based on overall influence may miss some, for the overall score, not dominant factors although they have a high impact on a specific element of a single lean principle. Maybe Malaysian automotive companies which are trying to be lean still do not know the highly influencing SFs to implement the problem-solving principle (PSP) of lean and/or are not giving enough importance to implementing PSPs of lean to adopt continuous learning and improvement culture.

But the Automotive industry is at the heart bridge of the development of a nation (Sultana & Ibrahim, 2014; Rashid et al., 2015) and is currently one of the world's largest economic contributors with 98.9 million motor vehicles produced globally in 2017 ("World production," 2018). The industry is also a vital financial driver of the Malaysian economy (Sultana & Ibrahim, 2014; Mamat et al., 2015) and is projected to add to the nation's development so much that the country can turn out to be an advanced country by 2020 (Sultana & Ibrahim, 2014).

2 LITERATURE REVIEW

There is little consensus on the definition of problem-solving (Hall, 2017). Mayer and Wittrock (2006) have defined problem-solving as "cognitive processing directed at achieving a goal." Atuahene-Gima and Wei (2011) define problem-solving as "a process of seeking, defining, evaluating, and implementing solutions". The process of any problem-solving naturally begins when someone appeals to any "goal-directed sequence of cognitive operations" (Anderson, 1985). In the first stage, simply knowing about effective tools provide some hypothetical insight into the processes. Then these tools may be combined to develop training programs supported by experimental research (Vernon et al., 2016). In case of a process problem like bottlenecks or defects, after receiving the information about the current practice and objective, analysts develop some solutions and identify the preferred one, and then develop the future process. Finally, the assessment of the new process is done concerning the original objective (Figl & Recker, 2016). But the implementation of problem-solving in most organizations is practiced with just a form where all the boxes are to fill in. As such, problem solvers direct their thinking towards solving the problem without focusing on methodology. Upon completing the activity, they document the results on pre-made templates. So, a new tactic for solving problems has no impact on users' thinking because the thinking of other employees has remained the same. To change an individual; the norms, values, and beliefs of his or her organization need to be addressed (Marksberry et al., 2011).

The principles of lean are a set of beliefs about what works. Lean connects the organizational rules of the manufacturing system and organizational culture (Liker & Hosesus, 2008). It always begins with the buyer considering value-added processes for them and then identifying the waste in any process. It takes time and experience to get waste out of the process - a learning process in continuous improvement. Only process

possessors and supervisors who work closely with the process can improve it daily. *Kaizen* (change for the better) drives organizational learning continually (Principle 12), and this learning is contained by making decisions slowly but with everyone's consent at a time after looking into every detail of all possibilities, but the implementation of solutions is performed rapidly (Principle 13). The decision-making process also considers the mindset of managers to attend directly to the floor to recognize the situation comprehensively (Principle 14) (Alpenberg & Scarbrough, 2009).

Lean supports organizations to standardize problem-solving methods in a simple but sustainable way (Mohamed, 2016). Flinchbaugh and Carlino (2006) list five practices for 'personal lean' in the Hitchhiker's Guide to Lean – the fifth practice is mentioned to "see more with your own eyes". The fifth practice mentioned: see more with your own eyes. Examples of application of this significant element of problem-solving principle are missing in the extant lean literature, but they are abundantly discussed in The Toyota Way. The presentation of principle number 12 is much different in the lean literature and "The Toyota Way" written by Jeff Liker because the eastern culture and the western way of thinking are not the same. While Liker stresses the "deep understanding" and the Japanese view; lean is all about adapting the TPS principle to the western culture. To summarize in this direction, both TPS and Lean have essentially the same objective to fulfill through principle number 12 (Kochnev, 2007).

According to Iuga and Rosca (2017), the whole TPS philosophy is mainly standing on problem-solving and decision-making, but decision-making has not got that much attention in lean. TPS principle 13 talks about analyzing decisions considering all alternatives and obtaining ideas from all involved. This way, at a time, it creates total agreement on solutions between all engaged, and all the tasks are shared on a single piece of A3 paper. The evidence of these steps of the decision-making process is not revealed much in extant lean literature. Only The Hitchhiker's Guide to Lean (Flinchbaugh & Carlino, 2006) has talked a bit about this TPS principle 13 and formulated the lean principle: 'Establish agreement on WHAT and HOW'. This lean principle mainly talks about collaborative standardization to achieve the "what". Cappelli and Rogovsky (1998) investigated workers' involvement in decision-making and the legal and psychological propositions but not the agreement and thought of all options. The absence of guidance in good decision-making and consensus-building for problem-solving is noticed in the Lean literature (Kochnev, 2007).

The author compiled elements of PSPs of lean from the contemporary literature and presented them along with the respective sources in Table 1.

Table 1: Elements of PSPs of Lean

Sl. #	Elements of PSPs	Source(s)
1	Use Reliable Data	Spear (2004), Liker (2005), Jeffrey & Meier (2006), Vermaak (2008)
2	Structure Problem-Solving Procedure	Staats et al. (2011), Jeffrey & Meier (2006), Marksberry et al. (2011)
3	Root Causes & Alternative Solutions	Liker (2005), Jeffrey & Meier (2006), Vermaak (2008), Mann (2010)
4	Implement Quickly	Liker (2005), Jeffrey & Meier (2006), Vermaak (2008), Marksberry et al. (2011)
5	Make Problems Visible	Bowen & Spear (1999), Liker (2005), Jeffrey & Meier (2006)
6	Approach Problems Categorically	Spear (2004), Jeffrey & Meier (2006)
7	Reflect Mistakes & Standardize Processes	Liker (2005), Vermaak (2008), Marksberry et al. (2011)
8	Encourage Continuous Improvement	Spear (2004), Liker (2005), Jeffrey & Meier (2006), Vermaak (2008)
9	Best Practices & Strengthening	Liker (2005), Jeffrey & Meier (2006)
10	Knowledge Protection	Liker (2005), Jeffrey & Meier (2006), Vermaak (2008)

Lean represents a holistic approach to change. Even the base of lean requires a momentous organizational transformation, and this amendment is a radical process and not an effortless task (Smeds, 1994). While a few organizations are successful, many organizations get trapped in the primary lean execution efforts (Smalley, 2006). Even with grave investments, lots of organizations have failed to attain the projected benefits (Donovan, 2005). Lean practices have also been attempted in some developing countries, but the level of consideration in lean thinking is not the same (Mohamad et al., 2013). Many researchers have worked on enablers, barriers, and SFs of lean. The author compiled and presented a list of SFs of lean (Islam, 2020) along with their sources shown in Table 2.

Table 2: List of Success Factors of Lean

Sl. #	Success Factors	Sources
1	Vision and business plan	Rosario (2000), Hamid (2011), Asefeso (2014)
2	Manageable goals	Manville et al. (2012), Asefeso (2014), Salonitis & Tsinopoulos (2016)
3	Organizational structure	Faron (2012), Siemerink (2014)
4	Human resource empowerment	Jurado et al. (2013), Doustar et al., (2014)
5	A compelling need to change	Asefeso (2014), Salonitis & Tsinopoulos (2016), Alefari et al. (2017)
6	Leadership from top management	Hofmann (2015), Baviskar (2015), Salonitis & Tsinopoulos (2016), Lande et al. (2016), Zhou (2016)
7	Financial capabilities	Achanga et al. (2006), Salonitis & Tsinopoulos (2016)
8	Organizational culture	Salonitis & Tsinopoulos (2016), Zhou (2016), Lande et al. (2016), Alefari et al. (2017)
9	Total commitment to theories & tools	Roslin et al. (2014), Asefeso (2014), Salonitis & Tsinopoulos (2016), Alefari et al. (2017)
10	Resistance to change	Asefeso (2014), Zhou (2016)
11	Resources allocation	Marodin & Aurin (2015), Salonitis & Tsinopoulos (2016), Singh & Singh (2016), Alefari et al. (2017)
12	Timing for change	Asefeso (2014), Salonitis & Tsinopoulos (2016)
13	Project management	Manville et al. (2012), Lande et al. (2016)
14	Engagement of Process Owners	Manville et al. (2012), Asefeso (2014), Roslin et al. (2014)
15	Knowledge and Mindset	Furukawa (2016), Zhou (2016), Lande et al., 2016), Salonitis & Tsinopoulos (2016)
16	Skills and expertise	Dora et al. (2013), Zhou (2016)
17	Utilize Technology	Slack & Lewis (2017), Nightingale (2000)
18	Attitudes and behaviors	Asefeso (2014), Hoffman (2015), Singh & Singh (2016), Kumar et al. (2017)
19	Understand the process	Asefeso (2014), Womack (2017)
20	Create internal consultant	Vermaak (2008), Womack (2017)
21	Effective communication	Lande et al. (2016), Salonitis & Tsinopoulos (2016), Alefari et al. (2017), Islam (2019)
22	Teamwork	Asefeso (2014), Roslin et al. (2014), Furukawa (2016), Salonitis & Tsinopoulos (2016), Alefari et al. (2017)
23	Right kind of training	Singh & Singh (2016), Salonitis & Tsinopoulos (2016), Lande et al. (2016)

Sl. #	Success Factors	Sources
24	Downtime management	Jeffrey & Meier (2006), Asefeso (2014)
25	Metrics and accountability	Womack & Jones (2003), Aberdeen Group (2006)
26	Keep track of progress	Holland et al. (1999), Sumner (1999), Rosario (2000)
27	Extend beyond production & to suppliers	Jeffrey & Meier (2006), Asefeso (2014), Lande et al. (2016)
28	Manage reactions	Bollbach (2012), Asefeso (2014),
29	Motivation	Jeffrey & Meier (2006), Haleem et al. (2012), Asefeso (2014)
30	Supplier's performance	Singh & Singh (2016), Salonitis & Tsinopoulos (2016)
31	Business strategy	Manville et al. (2012), Lande et al. (2016)
32	Detailed Implementation Plan	Narang (2008), Norani et al. (2011)
33	Apply the full set of lean principles and tools	James (2006), Herron & Braiden (2007)
34	Quality awareness and management	Salonitis & Tsinopoulos (2016), Lande et al. (2016)
35	Inventory control	Lande et al. (2016), Salonitis & Tsinopoulos (2016)
36	Organizational infrastructure	Coronado & Antony (2002), Manville et al. (2012)

3. METHODOLOGY

To find SFs for the elements of PSPs of lean first, the three principles of the Toyota 4P PSPs model are compiled from the literature and divided into distinct groups per contemporary literature. In parallel, we consolidated SFs of lean and other relevant management. We used, in the next step, the opinion of industry experts to evaluate the SFs for each element of the PSP. Some ethical guidelines we strongly maintained from the start to the end of this research ensured uprightness and eminence in the research design and review. The purpose, methods, and potential risks we communicated to all concerned. The discretion of information and the secrecy of respondents are stringently maintained. Participants are requested to join willingly; the research is carried out independently without any conflict of interest.

We selected the automotive industry for this study because of the capability and capacity of operation, manufacturing and management system, diversity of expertise, implementation status of lean, age of the company, number of employees, etc. The company has the capability of a wide range of services like automobile Assembly/Production, Any Motor-part production, Industrial Consultation, etc.

It operates using world-class production facilities with an efficient management system. It provides complete solutions for individual systems like vehicle module assembly and production from extra-low volume to high volume. The company is enough old and big and more likely can adopt lean principles (Tam & Chin, n.d.) and has been abiding by strict global standards in operation and quality.

Focus groups frequently used across a broad variety of research disciplines, including operation management and social sciences (Guest et al., 2017) are the participants of this research. To ensure in-depth group discussions participants are selected based on low age difference, social closeness, and personal relations (Richardson & Rabiee, 2001). Participants are tolerant and excellent problem solvers. Selected respondents have had at least a bachelor's degree and more than 5 years of professional experience, an excellent understanding of lean concepts (Lila, 2012), and work closely with operators (Bollbach, 2012) on the shop floor.

The more participants, the less group decision error! (Skulmoski et al., 2007) A group of eight to twelve (Stewart & Shamdasani, 2014) or even four individuals with a high degree of knowledge (Romney et al., 1986) is enough for a focus group. In this study, for reasons of control and consistency, there is an attempt to limit the size of the focus groups to four groups with four members in each group, i.e., a total of sixteen participants. And the head of the lean department was selected as the moderator. He led the process improvement teams for a decade and has 18 years of experience in operational excellence. He is a certified Six Sigma Black Belt as well. He took up a relatively passive role and allowed the discussion to be led primarily by the group respondents and facilitated the expression of potentially sensitive or emotive issues.

Most employees were found very busy at any working hour in the organization. The meeting schedule we agreed on in advance by the company human resources manager. Meetings we tape-recorded to enable verbatim analysis, but we did not use the records as it was difficult to understand who said what on the tape recorder. Video recording is also disregarded to avoid any adverse reaction. As a solution, in this research, at the meetings and when it was likely to be significant for the subsequent analysis, we wrote notes about who said what. First, to get an idea of the participant's knowledge and experience of lean, we asked general questions as presented in Table 3. From the answers, we verified instantly whether such a company understood lean and was practicing it or not.

Table 3: General questions for industry experts

Please mention your department/section.
How many years of practical experience have you had with lean? (<2 years or 2 – 5 years or >5 years)
What was your role with lean?
How successful is your organization with lean? (Laggard or Average or Failed)

Face validity (FV) refers to the extent to which measurement instrument items look usable to evaluate linguistically and logically. Common FV methods are Expert assessments of items, Post hoc theory, Cohen's Kappa Index (CKI), etc. For content validity (CV), the measurement instrument items need to be related and representative of the goal construct. Common CV methods are literature review, expert panels or judges, content validity ratio (CVR), etc. This research has used the judgmental approach to set up content validity through literature reviews followed by the evaluation by a focus group of experts. Along with experts, the researcher took part in the discussion to facilitate validations (Taherdoost, 2016).

To ensure the validity of data, in this study, elements of PSPs of lean and SFs to implement them are compiled by literature review and will be assessed by the industry experts' scoring based on '0' for 'no influence', '1' for 'low influence', '2' for 'influence', '3' for 'high influence' and '4' for 'extreme influence'. First, the average of all sixteen experts' scores will be calculated as the average for each factor separately, for each element, and then for all elements, together. If the average score of a factor for all elements is below '3' (high influence) and no score for any element is close to '4' (extreme influence); the factor will be considered not highly relevant and will keep outside of the study. The followed method is more robust; because in the traditional CVR method, items are assessed using only a "three points scale (not useful, useful but not essential, and essential) where the number of "experts" agreed on an item as essential is considered" (Lawshe, 1975).

This study uses the most used internal consistency measure of the Cronbach Alpha coefficient (Taherdoost, 2016) with the Likert scale. Because Cronbach Alpha coefficient is used as the most appropriate measure of reliability when Likert scales are used (Whitley, 2002; Robinson, 2010). The minimum internal consistency coefficient will be considered 0.70 because there are no set rules for internal consistencies, but most investigators agree on 0.70 as a minimum (Whitley, 2002; Robinson, 2010; Taherdoost, 2016). All calculations we will make using Microsoft Excel instead of any costly statistics software package (Mondal & Mondal, 2017).

This study has one very experienced moderator, and most participants are lean six sigma black

belts. They have similarities in terms of their background in society, education, employment, industry, etc. Well-structured instruments with fixed questions and response ranges are asked to literally all groups and in the same order. Study one can classify between simple and moderately complex. The participants were asked about their opinions and experience with the research topic. Also, as the range of SFs is wide, the subject topic is management with a frequent issue. The experienced participants expressed their views while arguing general issues (Guest et al., 2017), and the results from this study were highly expected to be generalizable.

4. RESULTS

General questions to selected participants provided information as in Table 4.

Table 4: General information of participants

Occupation category	Experience with lean	Experienced lean as	Perceived lean success
Production/Operations	2 – 5 years	Manager	Laggard
Production/Operations	2 – 5 years	Non-management	Laggard
Quality	>5 years	Manager	Average
Quality	2 – 5 years	Non-management	Laggard
Process Engineering	<2 years	Manager	Laggard
Process Engineering	2 – 5 years	Manager	Laggard
Marketing/sales	2 – 5 years	Manager	Average
Marketing/sales	>5 years	Manager	Failed
Engineering/Technical/ Maintenance	>5 years	Non-management	Average
Engineering/Technical/ Maintenance	2 – 5 years	Non-management	Laggard
Human Resources/Training	2 – 5 years	Manager	Average
HSE	2 – 5 years	Manager	Average
IE	<2 years	Non-management	Failed
Finance/Administration	2 – 5 years	Non-management	Failed
Logistics/Distribution/ Procurement	2 – 5 years	Non-management	Failed
IT	<2 years	Manager	Laggard

In focus group discussions, to identify which SFs are influencing at what level, separately for the ten elements of PSPs of lean, they scored based on '0' for 'no influence', '1' for 'low influence', '2' for 'influence', '3' for 'highly influence' and '4' for 'extremely influence'. Using a 4-point scale data validity was ensured, and for reliability, the Cronbach Alpha coefficient was calculated and found as 0.99926. Hence the data is highly reliable. Table 1 shows the average scores of SFs for elements of PSPs of lean given by sixteen experts where the score more than or equal to 3 is shown in bold in Table 5.

Table E: Element-wise success factor(s)' score analysis

Sl.	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Average	Rank (R)	Con-sider
F1	0.7	2.8	**3.8**	**3.4**	2.8	**3.8**	1.7	**3.8**	**3.4**	**3.8**	2.988		Y
F2	0.7	1.7	2.3	2.8	0.6	2.8	1.7	**3.8**	1.7	**3.4**	2.138		
F3	2.5	**3.8**	1.7	2.8	0.6	1.3	2.3	2.8	2.8	**3.8**	2.425		
F4	**3.2**	**3.8**	**3.8**	2.8	**3.8**	1.7	**3.8**	**3.8**	2.8	**3.8**	**3.325**	R3	
F5	0.7	**3.4**	2.8	**3.8**	2.8	**3.8**	**3.8**	**3.4**	**3.8**	0.6	2.881		
F6	1.8	**3.8**	1.3	2.8	2.8	2.8	2.8	**3.8**	**3.8**	**3.8**	2.925		Y

Sl.	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Average	Rank (R)	Con-sider
F7	0.7	2.8	0.6	2.8	0.6	2.3	0.6	0.6	2.8	**3.8**	1.756		
F8	**3.9**	2.8	2.8	2.8	**3.8**	2.8	**3.8**	**3.8**	**3.4**	**3.8**	**3.350**	R2	
F9	1.8	2.8	**3.8**	**3.8**	2.3	1.7	1.7	**3.8**	2.8	0.6	2.500		
F10	1.8	2.8	**3.8**	**3.8**	**3.8**	1.7	**3.8**	**3.8**	**3.8**	0.6	2.969		Y
F11	1.8	**3.8**	2.3	**3.8**	0.6	**3.8**	2.3	**3.4**	**3.8**	**3.8**	2.944		Y
F12	0.7	0.6	2.8	**3.8**	1.7	1.7	1.7	2.8	**3.4**	1.7	2.075		
F13	0.7	2.3	0.6	**3.8**	0.6	1.7	1.7	1.7	1.7	1.7	1.650		
F14	**3.1**	**3.8**	**3.8**	**3.8**	**3.8**	2.8	1.7	**3.8**	2.8	2.3	**3.069**	R6	
F15	1.8	2.8	2.8	**3.8**	2.3	2.8	**3.8**	**3.8**	1.7	2.8	2.819		
F16	1.8	**3.8**	**3.8**	2.8	1.3	1.7	1.7	2.8	1.7	1.7	2.288		
F17	1.8	2.3	1.7	1.7	1.3	0.6	0.6	0.6	2.3	0.6	1.350		
F18	1.8	1.5	2.2	1.3	1.6	1.4	0.9	1.7	1.3	2.2	1.575		
F19	**3.9**	**3.8**	**3.8**	**3.8**	2.3	**3.8**	2.8	2.8	**3.4**	0.6	**3.094**	R5	
F20	0.4	2.0	2.0	**3.9**	0.3	2.3	1.4	2.0	2.0	0.3	1.663		
F21	**3.9**	**3.8**	**3.8**	2.8	**3.4**	2.3	1.7	**3.8**	2.3	1.7	2.944		Y
F22	2.8	**3.8**	**3.4**	**3.8**	1.7	1.7	**3.4**	**3.8**	**3.4**	2.8	**3.050**	R7	
F23	1.8	2.8	**3.8**	**3.8**	1.7	2.8	2.8	2.8	2.8	1.3	2.606		
F24	0.7	2.8	0.6	**3.8**	0.6	2.3	2.8	2.8	2.8	0.6	1.969		
F25	2.8	**3.8**	**3.8**	**3.4**	2.8	**3.8**	1.7	**3.8**	2.8	**3.4**	**3.200**	R4	
F26	2.8	2.8	1.7	2.8	1.7	2.8	2.3	**3.8**	**3.8**	2.8	2.713		
F27	**3.3**	2.8	2.8	2.8	2.3	2.8	2.8	2.8	**3.8**	2.8	2.819		
F28	1.8	**3.8**	**3.8**	**3.8**	2.8	2.8	2.8	**3.8**	2.3	2.8	**3.031**	R8	
F29	2.8	**3.8**	**3.8**	**3.8**	**3.8**	1.7	**3.4**	**3.8**	**3.8**	**3.8**	**3.456**	R1	
F30	0.7	1.7	1.7	2.8	0.6	1.3	1.7	2.9	2.3	0.6	1.625		
F31	0.7	1.7	2.3	1.7	0.6	**3.4**	1.3	2.8	2.8	**3.8**	2.094		
F32	0.7	2.8	2.8	2.8	0.6	2.8	**3.8**	2.8	2.8	2.8	2.438		
F33	0.7	**3.4**	**3.8**	**3.8**	2.8	1.7	2.8	**3.8**	**3.8**	0.6	2.713		
F34	1.8	2.8	**3.8**	**3.8**	**3.8**	**3.4**	2.8	2.8	**3.8**	0.6	2.925		Y
F35	0.7	1.7	**3.4**	2.8	2.8	0.6	2.8	**3.8**	2.8	0.6	2.181		
F36	1.8	1.7	1.7	2.8	0.6	1.7	1.7	1.7	1.7	0.6	1.588		

F29 (Motivation), F8 (Organizational culture), F4 (Human resource empowerment), F25 (Metrics and accountability), F19 (Understand the process), F14 (Engagement process owners), F22 (Teamwork), and F28 (Manage reactions) are highly influencing success factors in descending order. Also, F1 (Vision and business plan), F6 (Leadership from top management), F10 (Resistance to change), F11 (Resources allocation), F21 (Effective communication), and F34 (Quality awareness and management) should be considered as significantly influencing to the overall implementation of PSPs in lean. F17, F18, F30, and F36 have appeared as less influencing success factors. Based on these results, a conceptual framework has been drawn and given in Figure 1.

5. DISCUSSION

Motivated employees will always perform better in a culture favorable for continuous improvement and learning. Additionally, if the people who understand the process are empowered to take decisions, results will come faster and better. So, we need to empower shop floor workers with the maximum number of tasks and responsibilities to

create the need to think actively and proactively. A performance measurement system should be used to monitor the evolution of performances and assess whether the decisions taken by them are compliant with the plan. When employees like to work in a team, it becomes easy to manage their reactions to changes. Working in small groups as teams with long-term focus is always highly advantageous.

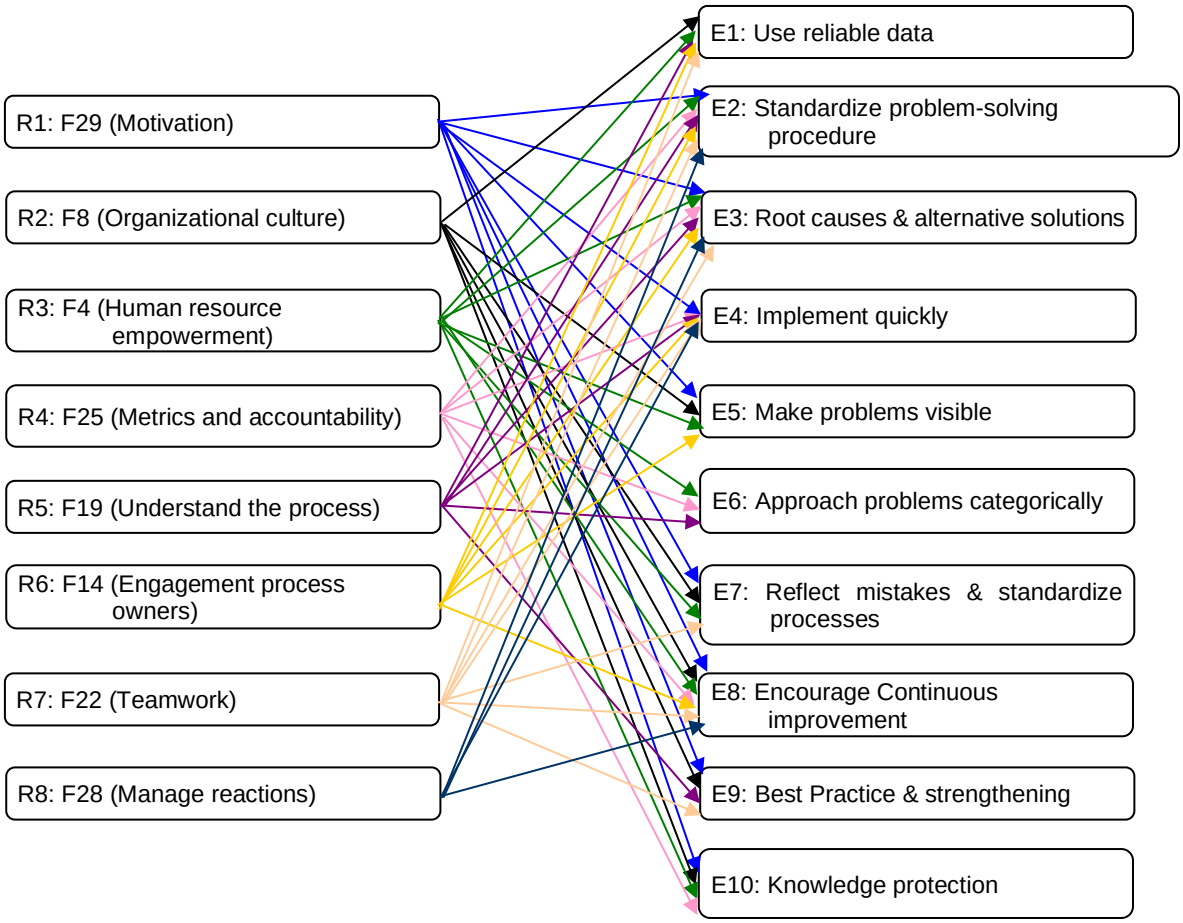

Figure 1: Conceptual framework for highly influencing SFs and Elements of PSPs

Continuous improvement must be inspired by top management who instill it in other members of the organization and create the paramount conditions for the diffusion of principles and minimize the resistance to change. Management needs to be efficient at relaying the vision of change to all employees and aligning their goals. Everyone in the organization should be alert to quality issues and manage them properly. In some cases, resources are required to implement the solutions. But all the initiatives should be effectively communicated (Touhidul & Sorooshian, 2019). Problems and ideas need to be shared timely and openly. Communication is an imperative way for lean transformation, which creates a strong motivational force in employees to share the best thoughts, results, and practices of lean programs across the whole organization.

This research intends to create a new approach to enhance the success rate of lean implementation. In place of considering the overall impact of SFs on the implementation of lean as available in contemporary literature, going into deeper details of principles and even their elements, this study will render more reliability and confidence to implement lean more successfully. Segregating SFs as per elements of principles of a management system and compiling them as per criticality found at the element level, is an added methodology to the existing knowledge. Some factors may not be in the higher rank in overall implementation but for a specific element of a specific principle, they can be highly influential. Hence, they should be considered while implementing the corresponding elements. Using the same approach and methodology we can find and subsequently address all the highly

influencing SFs for all elements of all principles to implement and sustain any advanced management system like lean.

However, some issues remain open for future research. First, some factors have scored on average for all elements lower than 3, but for some elements, they scored more than 3, and avoiding them might be wrong. Including all such factors to solve this issue in further research can be done by applying Multi-Criteria Decision Making (MCDM) methods like Decision Making Trial and Evaluation Laboratory (DEMATEL). In this study, the researcher has been able to contact local experts in a Malaysian automotive company only. Hence, if international lean experts from different industries are included the results might be more interesting, and thus the research could be free from cultural influences – in that case, the outcomes of the research will be more broadly applicable. Since process owners are at the center of problem-solving and are deeply engaged, a future researcher in this field can also investigate their opinions.

6. CONCLUSION

When there is a need to build a culture of problem-solving as per lean principles, top management needs to align employees to the business vision and plan and lead the transformation journey across the whole organization. The human resource department is empowered to take decisions, create quality awareness, and manage continuous improvement and learning. Tremendous resistance to change the behavior pattern of employees and the old work process is expected. The motivation of all employees, including process workers, helps to manage this resistance. Sometimes a little confusion about a new method creates chaos. So, every activity and result must be communicated effectively (Islam, 2019) and everyone must work as a team. Finally, linking performance metrics to responsibility will ensure the accountability of all employees and the successful implementation of lean problem-solving principles in a company.

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Received for publication: 08.09.2022
Revision received: 22.09.2022
Accepted for publication: 03.01.2023

How to cite this article?

Style – **APA** *Sixth Edition:*

Islam, A. S. (2023, 01 15). Framework for successful problem-solving in lean: A focus group research in Malaysian automotive. (Z. Cekerevac, Ed.) *MEST Journal, 11*(1), 59-74. doi:10.12709/mest.11.11.01.06

Style – **Chicago** *Sixteenth Edition:*

Islam, A. S. M. Touhidul. " Framework for successful problem-solving in lean: A focus group research in Malaysian automotive." Edited by Zoran Cekerevac. *MEST Journal* (MESTE) 11, no. 1 (01 2023): 59-74.

Style – **GOST** *Name Sort:*

Islam A. S. M. Touhidul. Framework for successful problem-solving in lean: A focus group research in Malaysian automotive [Journal] // MEST Journal / ed. Cekerevac Zoran. - Belgrade – Toronto : MESTE, 01 15, 2023. - 1 : Vol. 11. - pp. 59-74.

Style – **Harvard** *Anglia:*

Islam, A. S. M. T., 2023. Framework for successful problem-solving in lean: A focus group research in Malaysian automotive. *MEST Journal,* 15 01, 11(1), pp. 59-74.

Style – **ISO 690** *Numerical Reference:*

Framework for successful problem-solving in lean: A focus group research in Malaysian automotive. **Islam, A. S. M. Touhidul.** [ed.] Zoran Cekerevac. 1, Belgrade – Toronto : MESTE, 01 15, 2023, MEST Journal, Vol. 11, pp. 59-74.