

LEAN PRACTICES AND BENEFITS: STUDY OF SRI LANKAN SMALL AND MEDIUM ENTERPRISES

**R. Y. H. De Alwis Seneviratne, K. Dissanayake, S. P. Premaratna,
Nayani Melegoda, S. Ranwala, A. Fernando**

University of Colombo
rajishtha@dbe.cmb.ac.lk

Abstract

Implementation of lean practices creates multiple benefits as depicted in literature. However, the experiences of implementing lean practices in manufacturing Small and Medium Enterprises (SMEs), in Sri Lanka, remain unexplored. Thus, the purpose of this study is to examine the extent to which manufacturing SMEs use lean practices and their accrued benefits. The study adopts survey method and uses a structured questionnaire looking into three areas; lean practices implemented, driving forces of lean implementation and the benefits experienced. Data is collected from 342 manufacturing SMEs located in the Western Province of Sri Lanka, selected adopting random sampling representing seven major sub-sects including clothing and textiles, food and beverages, electronics and computers, metals, petroleum, wood, leather, paper and construction. The study finds that Just-In-Time, 3P and Kanban/Kaizen/Pull systems are the commonly used lean practices. The implementation of lean practices in manufacturing SMEs are mainly driven by improved quality, customer demand for shorter lead time and competitive advantage in price and service experienced through the implementation. The main benefits experienced by the SMEs are customer satisfaction, improved corporate image, reduced waste and higher efficiency and productivity. In addition to these, reduced inventory levels, higher flexibility, reduced transportation lead time, reduced capacity surplus are revealed to be achieved more with lean practices. The findings of this study are beneficial for planning further investigations into the lean adaptation in the SME sector. This also has implications for SME owners as they

can be encouraged to implement lean practices and policy-making when promoting lean practices among SMEs.

Keywords: Benefits; Lean implementation; Lean practices; SMEs; Sri Lanka; Sustainability

1. Introduction

The current buzz word in Economics and business circles is sustainable development of economies and how businesses can contribute towards this cause. Lean practices are focused on creating more effective business by eliminating wasteful practices and improving efficiency. Lean practices also are an approach to develop and continuously improve production processes (Majava & Ojanpera, 2017) and also address consumers expectation of better values when they purchase products (Bhamu & Sangwan, 2014). Thus, SMEs implementing lean practices can contribute to achieving sustainable development of a country highlighting its importance to firms, economies, societies, and the environment (Premaratna et al. 2021).

SMEs in Sri Lanka account for a large portion of businesses (98.5 per cent of total industrial establishments are SMEs as per the Department of Census Survey and Statistics (2015)). Thus it is important that SMEs implement such practices. Given a major challenge faced by SMEs is how to compete with large firms who achieve cost efficiency by adopting lean practices. Lean practices enable a firm to be responsive to customer expectations and at the same time reduce costs and wastage throughout the supply chain (Bhamu & Sangwan, 2014).

Many studies have (e.g., Kumar et al., 2006; Chen et al., 2010; Knol et al., 2018) been conducted in other parts of the globe on how lean practices are utilized by business, what determines the use of such practices and the perceived benefits of such practices and whether lean practices enhances such benefits. Such knowledge directs business practitioners and supporting agencies towards a broad understanding of the prevailing conditions and prospective needs of SMEs for their continuous improvement. However, Yadav et el. (2019) note that SMEs are often not studied when adoption of lean practices are concerned with most focus going to large enterprises or Western Europe (Alkhoraif et al., 2019). Further

Knol et al., (2018) also argue the universality of findings of research done on lean practices in SMEs which stresses the importance of doing more research to find how in different contexts lean practices are being implemented and reap benefits where even Belhadi et al. (2018) recommend more research to be done on lean practices in SMEs. In the Sri Lankan context, there is dearth of research on the nature of the lean practices adopted by SMEs and the benefits experienced by those practices with limited research done limited to a particular sector (e.g. research on apparel exporters (Wickramasinghe & Wickramasinghe, 2017). This vacuum in the knowledge has blocked practitioners' involvement in lean-based improvements in the SME sector. Thus, this study aims to examine the lean practices adopted by SMEs and the benefits of adopting lean practices in Sri Lanka.

The structure of this paper is as follows. It first presents a brief literature review on lean practices, followed by the methodology. Then it presents the analysis and concludes with limitations and suggestions for future research and implications for policy making.

2. Literature Review

The lean concept originated from Japanese manufacturing methods adopted in Toyota (Hu et al., 2015). Lean practices at Toyota can be traced back to its founders Sakichi Toyoda's automatic loom. The automatic automated work that used to be performed manually, and built the capability to make judgments into the machine itself. This eliminated defective products and waste, rapidly improving both productivity and work efficiency. Lean practices now have spread across the world (Toyota, n.d.).

Thus, Hu et al. (2015) argue that the lean idea involves operation concepts such as zero inventory, just in time, and small lot sizes, quality procedures such as Total Quality Management and total productive maintenance, and empowering employees.

Further, lean practices could also support the achievement of sustainable development. Sustainable Development Goals (SDGs) cover 17 diverse goals

which include health, environmental preservation, and economic prosperity, and these goals are expected to be achieved in 2030. It has been observed that lean practices can contribute to achievement of these goals (Premaratna et al., 2021)

2.1 Lean practices adopted in SMEs

Literature has identified different types of lean practices used by SMEs. These include Value Stream Mapping (VSM)¹(Belhadi et al., 2018; Kumar et al., 2006; Chen et al., 2010), Total Productive Maintenance (TPM)² (Gunasekaran & Lyu, 1997), Gunasekaran, 1998; Kumar et al., 2006; Valente et al., 2019) 5S³ (Belhadi et al., 2018; Gunasekaran & Lyu, 1997; Gunasekaran, 1998; Kumar et al., 2006; Rose et al., 2013) Kanban⁴. (Belhadi et al., 2018; Gunasekaran, 1998) Kaizen (continuous improvement) (Rose et al., 2013) Six Sigma (a set of techniques and tools for process improvement) (Kumar et al., 2006; Kumar et al., 2009; Thomas et al. 2009; Nabhani & Shokri, 2009) just to name a few. Negrao et al. (2017) in their review of literature note that out of 38 articles reviewed the most common was Kaizen followed by Just-In-Time delivery, pull systems, cellular manufacturing, TPM, supplier development to name the top five. Other practices also include 5S, visual management, customer involvement, continuous flow, Single Minute Exchange of Die (SMED). In a study done in three European countries in the food manufacturing industry, it was noted that the implementation of lean practices was at initial stages (Dora et al. 2013) and SMEs have lower implementation of lean practices compared to larger enterprises (Shah & Ward, 2003). Whether it is the same for a South Asian country is to be studied.

1. Analyzing the current state and designing a future state for the series of events that take a product or service from the beginning of the specific process until it reaches the customer.
2. Method of physical asset management focused on maintaining and improving manufacturing machinery
3. Sort, Set in Order, Shine, Standardize, Sustain. These steps involve going through everything in a space, deciding what's necessary and what isn't, putting things in order, cleaning, and setting up procedures for performing these tasks on a regular basis
4. A scheduling system for lean manufacturing and just-in-time manufacturing

2.2 Critical success factors for lean implementation

Several Critical Success Factors for lean adoption have been identified in literature. Employee involvement and participation is a commonly identified factor in studies such as Chin and Rafuse (1993), Kumar et al. (2009) and Panizzolo et al. (2012). The support from top management support and commitment have been identified by Chin and Rafuse (1993), Achanga et al. (2006), and Kumar et al. (2009), Panizzolo et al. (2012). In addition, training and education have been stressed in studies by Achanga et al. (2006), Kumar et al. (2009), and Dora et al. (2013). Organisational change (change in culture, strategy, vision and performance evaluation system) has been also stressed (Achanga et al., 2006; Kumar et al., 2006; Panizzolo et al., 2012; Dora et al., 2013). Financial capability (Achanga et al., 2006) and supply chain integration (Kumar et al., 2009) too have been identified as Critical Success Factors in adopting lean practices. It has also been argued that success of lean implementation is subjected to how resources are allocated and how the firms improve their competitive position in the supply chain (Hong & Jeong, 2006).

Suppliers and buyers play a key role and the trust and commitment will help to successfully implement lean practices (Golicic & Mentzer, 2006). If the customers and suppliers are not willing to change and be influenced, then the lean implementation may not be as successful (Golicic & Medland, 2007) and that SMEs need to be in control of the practices. Skill level of employees, expertise available in the firm, and the culture of the firm determine successful implementation of lean practices (Dora et al., 2013). Along these lines Negrao et al. (2017) argue that changes in the treatment and behavior of people who are involved in the business is essential before, during and after implementation of lean practices. Knol et al. (2018) find that the factors for successful implementation vary based on the progression. They observed that in the initial stages of implementation lean practices could be improved by a 'bottom up manner' where factors such as learning focus, training and support become important. When however lean practices are more advanced top management support, supplier link, and a shared vision of improvement become important.

2.3 Benefits of lean practices in SMEs

The benefits of implementing lean practices include improvement in operational performance in terms of productivity and quality (Dora et al. 2013), however country-of origin could create a difference (Dora et al., 2013). In a study of Dutch SMEs lean practices were found to contribute towards improving operational performance (Knol et al., 2018). In a case study of a North African SME by Belhadi et al. (2018) even noted that lean implementation impacts green performance. In a study of Portuguese SMEs by Valente et al. (2019) they concluded that lean practices improve market, financial and operational performance of SMEs.

-A review of literature by Ugochukwu et al, (2012) identifies the main benefits of implementing lean practices. These include low inventories, customer satisfaction, efficiency, quality, reduced cost and improved delivery, flexibility (flexibility in volume, product mix and delivery). In the review, they note that these benefits are linked to practices such as value chain analysis, waste elimination, system organisation, end-customer focus, problem solving and strong and effective relationships. Improved delivery can be realized by implementing practices such as TPM, and VSM. Supplier involvement is needed to achieve high quality specially in the early design stage and proper screening of suppliers is also needed. Flexibility can be achieved by using lean practices such as use of small lot sizes, supplier involvement, pull production and effective communication and information sharing. It is also argued that the benefits from lean practices arise in the long term (Alkhoraif et al., 2019; Negrao et al., 2017).

Babalola et al. (2019) identify three main clusters of benefits of lean practices as economic (cost, quality and time), social (relationship and satisfaction), and environment in relation to construction projects. Under economic benefits reduction in time and cost, improvement of quality, better inventory control and risk minimisation were some of the benefits identified. Under social employee satisfaction, employee health and safety, better cooperation among stakeholders were some of the benefits. Under environmental benefits, reduction of waste and attaining green construction were identified.

It is also noted that in some cases there were reports of a negative impact of lean practices on performance. This is when environment is not conducive for implementation of lean practices, where the culture negatively influences the effect lean practices have on the performance of the business (Negrao et al., 2017)

2.4 Lean practices in SMEs in Sri Lanka

When it comes to the Sri Lankan context there was a study done on BOI registered firms which export most of their output (90%) and had a workforce from 300 to 5000. The waste minimisation, defect minimisation, cross-functional teams, continuous improvement, JIT, and pull, information and employee involvement as a bundle of lean production practices. These practices when simultaneously implemented positively affect production outcomes (Wickramasinghe & Wickramasinghe, 2017). Even Hu et al. (2015) in their review of literature that there is inadequate research done on lean practices in SMEs. Based on the above studies it could be seen that hardly any research has been done on lean practices in SMEs in Sri Lanka. There is a lack of studies done on what are the lean practices in Sri Lanka and how they benefit SMEs in Sri Lanka.

3. Methodology

This study follows a sample survey with 342 SMEs in the Western Province in Sri Lanka was conducted under the World Bank project namely, 'green adoption of SMEs in Sri Lanka. Face to face interviews were carried out from May to September, 2019 with SME owners and managers. The sample was based on a random selection from the manufacturing SME list prepared by the research team based on the information collected from the Chamber of Commerce, Ministry of SME Development, Department of Census and Statistics in Sri Lanka as there is no single list readily available about SMEs in Sri Lanka. The lean practices covered in this study were 5S, Kanban Kaizen/Pull system, 3P (production process preparation), Total Productive Maintenance (TPM), Just-in-Time, Six Sigma, and Value Stream Mapping (VSM). Thus, the SMEs were asked whether they had such a practice or not. Data was also collected as to what drove SMEs to implement lean practices. These include pressure that could come from customers, competitive

advantage, supply chain and government regulations as identified in literature. The respondents were asked whether customers demand for shorter lead times, pressure to efficiently consume resources, supply chain capacity reduction, competitive advantage in price and service, government regulations, customer demand for production flexibility, improved inventory turns, and improved quality of products drove the SMEs to implement lean practices or not.

Benefits such as increased customer satisfaction/ loyalty, improved corporate image, reduced waste throughout the supply chain, higher efficiency and productivity, reduced production lead time, reduced inventory levels, higher flexibility, reduced environmental incidents, reduced overall costs, reduced capacity surplus, increased energy and water savings, reduced transportation lead time were also asked based on a five point Likert scale.

The benefits would be then compared between SMEs who had implemented a lean practice and not implemented a lean practice using independent t sample test and Levene’s test for equality of variances (Derrick et al., 2017)

4. Findings

4.1 Sample characteristics

The sample of 342 SMEs in the manufacturing sector were from different sectors and the details are shown in Table 1.

Table 1: Sectors of the SMEs in the Sample

Sector	Number of SMEs (%)
Clothing and Textiles	50(14.6%)
Food and Beverage	48(14%)
Metals	52(15.2%)
Petroleum, Chemicals and Plastics	30(8.8%)
Electronics and Computers	30(8.8%)
Wood, leather, and paper	70(20.5%)
Construction	36(10.5%)
Others	26(7.6%)

Based on the above most of the sample represented wood, leather and paper (20.5 percent) followed by metals (15.2 per cent) and then clothing and textiles (14.6 percent). The average turnover of the firms during the past three years was Rs. 88 million while expenses are Rs. 57 million.

4.2 Lean practices

The respondents were asked what lean practices they adopted. The commonly implemented lean practices included Just-in-Time (61.7 per cent), 3P (42.1 per cent) and Kanban/Kaizen/Pull systems (33.6 per cent). Further details are shown in Table 2

Table 2: Lean Practices Implemented in SMEs

Practice	Yes	No
5S	69 (20.2%)	273 (79.8%)
Kanban Kaizen/Pull	115 (33.6%)	227 (66.4%)
3P Production Process Preparation	144 (42.1%)	198(57.9%)
Total Productive Maintenance	31 (9.1%)	311(90.9%)
Just-in-Time	211(61.7%)	130 (38.3%)
Six Sigma	7 2%	335 (98%)
Value Stream Mapping	32 (9.4%)	310 (90.6%)

In terms of the duration that the SMEs used lean practices,18 out of 87 respondents stated that they have used lean practices for 10 years while 16 have used lean practices for 5 years. Twenty-eight respondents have been using lean practices for 12 months or less. The mean number of months is 52 which translates to 4 years and four months. Thus it appears that in Sri Lanka lean practices are in its early stages.

When looking at the factors that drive SMEs to lean practices, 8 factors were identified details of which are shown in Table 3.

Table 3: Factors that drive the SMEs to become Lean

Driving towards lean	Yes	No
Customers demand for shorter lead times	187 (54.7%)	155 (45.3%)
Pressure to efficiently consume resources for supply chain capacity reduction	123 (36%)	219 (64%)
Competitive advantage in price and service	180 (52.6%)	162 (47.4%)
Government regulations	63 (18.4%)	279 (81.6%)
Customers demand for production flexibility	175 (51.2%)	167 (48.8%)
Improved inventory turns	45 (13.2%)	297 (86.8%)
Improved quality of products	292 (85.4%)	50 (14.6%)

Based on the above it is observed that the 3 main commonly stated factors that drove the SMEs to be lean are improved quality (85.4 per cent), customer demand for shorter lead time (54.7 per cent) and competitive advantage in price and service (52.6 per cent).

The SMEs were asked what the benefits they experienced with lean practices. The main benefits with the highest mean values were customer satisfaction (3.57), improved image (3.47), reduced waste (3.4), and higher efficiency and productivity (3.36). These results also imply that the experienced benefits of lean practices are more of outward-focused rather than inward. The results are shown in Table 4 below.

Table 4: Benefits of Lean Practices

Benefit	Mean	Standard Deviation
Increased customer satisfaction and loyalty	3.57	0.563
Improved corporate image	3.47	0.63
Reduced waste throughout the supply chain	3.4	0.632
Higher efficiency and productivity	3.36	0.651
Reduced production lead time	3.32	0.69

Reduced inventory levels	3.29	0.719
Higher flexibility	3.28	0.556
Reduced environmental incidents	3.25	0.676
Reduced overall costs	3.21	0.729
Reduced capacity surplus	3.13	0.631
Increased energy and water savings	3.11	0.588
Reduced transportation lead time	3.09	0.644
Other	2.06	0.305

The SMEs were asked what were the key factors for successful implementation of lean practices. The results of it are shown in Table 5 below.

Table 5: Key Factors for Successful Implementation of Lean Practices

Key Factors to successful implementation of lean manufacturing	Mean	StdDev
Product quality and design	3.69	0.614
Reliable and efficient equipment and infrastructure	3.59	0.543
Standardization of work processes	3.5	0.675
Effectiveness	3.44	0.66
Steady material flow	3.44	0.559
Customers	3.33	0.639
Safety	3.33	0.551
Management and culture	3.31	0.576
Flexibility (system/production process)	3.25	0.58
Low inventory levels	3.24	0.711
Suppliers	3.23	0.577
Lean tools and techniques	3.14	0.566
Employees	3.06	0.61
Government basic requirement only	1.98	0.939

Based on the analysis shown on Table 5 above, the three key factors for successful implementation of lean practices are product quality and design (3.69), reliable and efficient equipment and infrastructure (3.59) and standardization of work processes (3.5).

Given the lean practice that was used most was Just-In-Time, the benefits of lean practices were compared between firms that had implemented Just-In-Time with those who had not. The results are shown below.

Table 6: Means of Benefits

Benefit of Lean Practice	Lean practices adopted- Just-in-Time Production	Mean	Std. Deviation
Higher efficiency and productivity	Yes	3.34	.667
	No	3.38	.627
Reduced inventory levels	Yes	3.35	.676
	No	3.18	.775
Reduced environmental incidents	Yes	3.23	.687
	No	3.28	.659
Reduced waste throughout the supply chain	Yes	3.39	.649
	No	3.41	.606
Increased customer satisfaction/ loyalty	Yes	3.61	.561
	No	3.50	.560
Increased energy and water savings	Yes	3.12	.617
	No	3.10	.541
Higher flexibility	Yes	3.33	.597
	No	3.21	.477
Reduced overall costs	Yes	3.13	.744
	No	3.35	.690
Reduced production lead time	Yes	3.28	.719
	No	3.38	.640
Reduced transportation lead time	Yes	3.15	.627
	No	2.99	.665
Reduced capacity surplus	Yes	3.21	.658
	No	2.99	.564
Improved corporate image	Yes	3.52	.664
	No	3.39	.564

Based on the above in almost all the benefits there was a higher mean value with Just-In-Time system in place. The means were then compared using Levene’s test and the t test. The results are shown on table 7 below.

Table 7: Independent Samples Test

Benefit	Levene's Test (sig)	T Stat (sig)	Mean Difference
Higher efficiency and productivity	0.234 (0.629)	-0.597 (0.551)	-.043
Reduced inventory levels	2.832 (0.093)	2.082 (0.038)	.166
Reduced environmental incidents	0.494 (0.482)	-0.655 (0.513)	-.049
Reduced waste throughout the supply chain	1.307 (0.254)	-0.203 (0.839)	-.014
Increased customer satisfaction/ loyalty	0.993 (0.320)	1.781 (0.076)	.111
Increased energy and water savings	4.468 (0.035)	0.281 (0.779)	.018
		0.290 (0.772)	.018
Higher flexibility	25.057 (0.000)	2.007 (0.046)	.124
		2.115 (0.035)	.124
Reduced overall costs	0.015 (0.903)	-2.644 (0.009)	-.213
Reduced production lead time	1.650 (0.200)	-1.365 (0.173)	-.105

Reduced transportation lead time	5.405 (0.021)	2.162 (0.031)	.155
		2.132 (0.034)	.155
Reduced capacity surplus	25.843 (0.000)	3.110 (0.002)	.216
		3.225 (0.001)	.216
Improved corporate image	5.316 (0.022)	1.775 (0.077)	.124
		1.845 (0.066)	.124

It appears that firms which implemented Just-In-Time practice experienced significantly higher benefits (95% confidence) in reduced inventory levels, higher flexibility, reduced transportation lead time, and reduced capacity surplus. These findings are indeed supported by many studies (e.g., Dora et al., 2013; Knol et al., 2018) which argue that lean practices improve performance of SMEs. The above can be explained by the study of Singh et al. (2010) who noted that the implementation of Just-In-Time reduced the lead time, the processing time, reduced the work in progress inventory and also reduced the requirement for man power where the productivity per operator also rose. Ugochukwu et al. (2012) also argued that implementation of lean practices such as Just-In-Time and pull production, cost of holding inventory is reduced as inventory accumulation is minimised. Further, lead time is also reduced as unnecessary processes are avoided. Benefits are further achieved by waste elimination, avoiding over production, unwanted transportation, stock piling and processing activities. As the focus is on the customer, the entire value chain is driven towards reducing waste and adding value and hence customers are also satisfied. However, it is also found that overall cost is higher with Just-In-Time. This could be due to the lack of a conducive environment and given that benefits are more in the long term, it might

take time for this to be realized (Alkoraif et al., 2019; Negro et al., 2017). Thus the benefits could be experienced more in the long term.

5. Conclusion

This study was conducted based on survey of 342 SMEs in the Western Province of Sri Lanka to identify what are the lean practices implemented in SMEs and the benefits from such practices. The lean practices examined in this study are all with foreign origin. They have been introduced to Sri Lankan enterprises, educated and inculcated into the existing practices. Thus, we understand that non-indigenous practices, which are learnt from diverse external contexts can be internalized into the local SME sector. Irrespective of the origin, good practices can be convinced and informed to the communities involved in SMEs, however, proper education and training would be the prime mover. It was observed that the commonly adopted lean practice was Just In Time. The three main commonly stated factors that drove the SMEs to be lean are, improved quality, customer demand for shorter lead time and competitive advantage in price and service. The main benefits with the highest mean values were customer satisfaction, improved image, reduced waste, and higher efficiency and productivity.

Implementing practices such as Just In Time gave greater benefits compared to not implementing in benefits such as reduced inventory higher flexibility reduced transportation lead time reduced capacity surplus based on the analysis it can be concluded that lean practices amongst SMEs in Sri Lanka need to be further improved. Many SMEs have implemented lean practices recently with most of them having had practices for a short term. It is a long-term process and gradual improvement of organisational processes and thus SME owners need to be encouraged to have a long-term view (Alkoraif et al., 2019). As evidenced in the findings of this study, lean practices in SMEs seemed to be encouraged by pull factors which are emanating from the external environment. However, the theoretical logic behind the primary use of lean practices is an internal drive towards achieving efficiencies which could lead to gaining competitive advantage in the long-run. Therefore, educating SME owners on the internally achievable benefits of implementing lean practices seem to be the need in this

context. In addition to this, the regulatory involvement in promoting lean practices would be another need as implied in the study.

Limitations of this study include the fact that relationships were not identified and a model was not developed, as the intention of this study was to identify what the practices were and what SMEs experienced as benefits. This could be further expanded in subsequent research to develop a model for SMEs usage of lean practices. Further studies could be done on cases of SMEs that had implemented lean practices to identify why and how they implemented lean practices and get an in-depth understanding of the challenges they faced and how they were overcome.

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