

Lean Manufacturing and Operational Performance: An in-depth Case Study of an Apparel Manufacturing Company in Sri Lanka

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Abstract

Objective – The present study aims to explore how a firm implements lean management practices by utilizing firm-specific resources and their influence on the operational performance of an apparel manufacturing company.

Design/methodology – The paper uses a single case, in-depth study approach based on a Sri Lankan apparel manufacturing company. Data is collected using interviews, observations, and documentary evidence.

Results – The research study found that lean manufacturing considerably impacts on enhancing the firm's operational performance through improved quality, reduced cost, improved safety, increased speed, and improved morale. The case data suggested around twenty-five lean practices suitable to be implemented by a selected apparel manufacturing company and gain a competitive advantage in the contemporary market. Through the analysis, it was found that the contribution of organizational resources and technology resources of a firm are essential to sustain the gained competitive advantage through lean manufacturing, confirmed by the assessment of the criteria of value, rare, inimitability and non-substitutability.

Research limitations/implications – As the research is directed towards the apparel manufacturing industry in Sri Lanka, the applicability of the findings may cause adversity for other manufacturing industries. As an extension to the lean manufacturing compositions, the findings of the study will have pragmatic implications to operational managers and executives involved in developing and implementing lean strategies, particularly in terms of applicable lean practices and key strategic resources to sustain the competitive edge through lean implementation.

Novelty/Originality – This study contributes to the literature on strategic management by documenting the impact of lean manufacturing on operational performance in the Sri Lankan context through the Resource-Based-View approach, such interrelated theoretical insights are vital to gain a sustained competitive advantage.

Keywords: Apparel Industry, Lean Manufacturing, Operational Performance, Resource-Based View Theory

1. Introduction

The manufacturing industry has undergone monumental changes in production throughout the past decades. The intense global competition and sophisticated advanced manufacturing technologies have challenged the long-standing patterns of production, forcing firms to optimize manufacturing processes that enable them to derive significant gains in quality, productivity, cost, and delivery time (Belekoukias et al., 2014; Bhamu & Sangwan, 2014; Karim & Arif-Uz-Zaman, 2013). The pursuit of this optimization has intensified the demand for high-quality product development, manufacturing flexibility, waste elimination, better operational control, efficient manpower utilization, and global reach to gain a competitive advantage (Karim & Arif-Uz-

Zaman, 2013). Essentially, to sustain a competitive position in the long run, organizations are required to be agile in the contemporary market implementing progressive conversion procedures that strive to offer innovative products and services. Hence, organizations extensively tend to embrace new mechanisms and principles, expecting to be profitable within the turbulent marketplace (Sahoo, 2019).

Lean manufacturing is one of the initiatives adopted by many major businesses to streamline the production process and achieve resource optimization (Karim & Arif-Uz-Zaman, 2013). It represents Toyota's way of speeding the production system via the zero waste concept (Perera, 2016). The core thrust of lean manufacturing is to produce finished products at the pace of customer demand through the elimination of waste and non-value-adding activities (Bhamu & Sangwan, 2014). Achieving manufacturing leanness is a continuous process improvement technique, implemented as a holistic organizational strategy (Fullerton et al., 2014). Moreover, it is regarded as a manufacturing philosophy that if precisely adopted can undoubtedly lead to global manufacturing excellence (Karim & Arif-Uz-Zaman, 2013).

Lean manufacturing is a multidimensional approach that encompasses a wide variety of management practices including Just-In-Time (JIT), Total productive maintenance (TPM), Cellular manufacturing, Supplier management, etc. that work synergistically to create a modernized high-quality system (Shah & Ward, 2003). Over time, these practices under lean strategy's umbrella have continued to surpass and become industry or organization-specific (Gamage et al., 2012). Lean implementation started in the automobile industry and soon its application was adopted by other manufacturing industries including textile, construction, food, electronics, furniture, etc. (Bhamu & Sangwan, 2014).

The improvements perceived by different industrial sectors have led to a spurt in lean research worldwide (Bhamu & Sangwan, 2014). A broad portfolio of academic research has been dedicated to investigating the impact of lean methods and practices on various measures of operational performance (Fullerton et al., 2014; Hernandez-Matias et al., 2019; Malonza, 2014; Rahman et al., 2010; Sahoo, 2019; Shah & Ward, 2003; Yadav et al., 2020). Accordingly, with the growth of lean execution within organizations, scholars in different countries have investigated emerging issues to deliver solutions concerning resource contribution, implementation models, critical success factors, etc. However, conceptual research continues to stress the importance of empirically examining the effect of multiple dimensions of lean production programs simultaneously.

Amongst the diverse research approaches in the literature, the present study draws on the ordinary combination of lean manufacturing and operational performance to a new approach through the theoretical lens of a Resource-Based View (RBV). Specifically, this study contributes to enriching the literature on the integrated concepts of lean manufacturing and RBV concerning the apparel manufacturing industry by investigating on following three questions.

1. What is the nature of lean practices mostly used by the case apparel manufacturing company?
2. What type of resources are needed for the effective implementation of lean manufacturing?
3. How does lean manufacturing influence the operational performance of the apparel manufacturing company?

This article deploys a qualitative in-depth case study approach to one large apparel manufacturing company in Sri Lanka, and the paper differs from prior research in two aspects. First, this study contributes to the lean literature by investigating the sources of sustainable competitive advantage concerning lean manufacturing through

operational performance metrics. Second, the current study contributes to strategic management by emphasizing the practical usefulness of the RBV's core tenets. This drives the Resource-Based-View theory in the local context to a new purview, highlighting the contribution of strategic resources for the effective implementation of lean manufacturing.

2. Literature Review, Theoretical Framework, and Hypothesis Development

Resource-Based-View theory (RBV) is an important paradigm in Strategic Management to explain how an organization can achieve sustainable competitive advantage by using firm-specific resources and capabilities (Punnakitikashem et al., 2009). RBV takes an introspective stance on persistent performance differences that exist between firms (Mbarki & Agrell, 2017). It begins at the point of competition between the product market position and resource position of a company (Wernerfelt, 1984). The firm's sustainable competitive advantage utterly depends on the continuous recombination of important resources rather than acquisitions through strategic factor markets (Sony, 2019). The two underlying assumptions that are essential to RBV are: (1) firms within an industry may be heterogeneous for strategic resources they control; and (2) resources should be imperfectly mobile across firms (Barney, 1991).

The essence of RBV theory defines strategic resources as a unique bundle of tangible and intangible resources, which could be a strength or weakness of a firm functioning. These resources vary considerably between firms even though they operate in the same industry. Tangible resources are assets that can be seen and quantified, having physical substance; while intangible resources are hard to recognize and deeply rooted in the company's history which has accumulated over time (Silva et al., 2019). Similarly, theory notifies that organizations should possess dynamic capabilities to renew or recreate their strategic capabilities to meet the needs of a changing environment (Teece et al., 1997). According to Barney (1996), these resources and capabilities are dubbed sources of competitive advantage.

However, RBV perceives the fact that all resources of an organization are not equally important to achieve a sustained competitive advantage. To have the potential, a firm resource must embody four attributes, often abbreviated as VRIO (Barney, 1996). In brief, (1) it must be valuable, in the sense that the company to exploit an opportunity or neutralize the impact of a threat; (2) it must be rare among a firm's current and potential competition; (3) it must be imperfectly imitable; (4) it must be non-substitutable in which the company should extract the maximum of the potential of the resources. Central to assertions put forth by Barney (1991), resources are considered valuable when they enable a firm to conceive of or implement strategies that improve its efficiency and effectiveness. In particular, they should be unique. Moreover, firms that do not possess such valuable and rare resources should not be in a position to obtain or imitate. Firm resources can be imperfectly imitable for one or a combination of three reasons: (a) the ability of a firm to obtain a resource is dependent upon unique historical conditions, (b) the link between the resource possessed by a firm and a firm's sustained competitive advantage is casually ambiguous, or (c) the resources generating a firm's advantage is socially complex (Dierickx & Cool, 1989). Lastly, there must be no strategically equivalent valuable resources that are themselves either not rare or imitable and should not be substitutable.

The RBV appears deceptively practical for managers to focus on resources and capabilities that are valuable, rare, inimitable, non-substitutable, and appropriate; then leverage with sustainable competitive advantage (Arend & Lévesque, 2010). Thus, RBV could be employed to develop a theoretical construct in explaining how the lean implementation in an organization can create its strategic resources to sustain the competitive edge (Punnakitikashem et al., 2009). In other words, the competitive

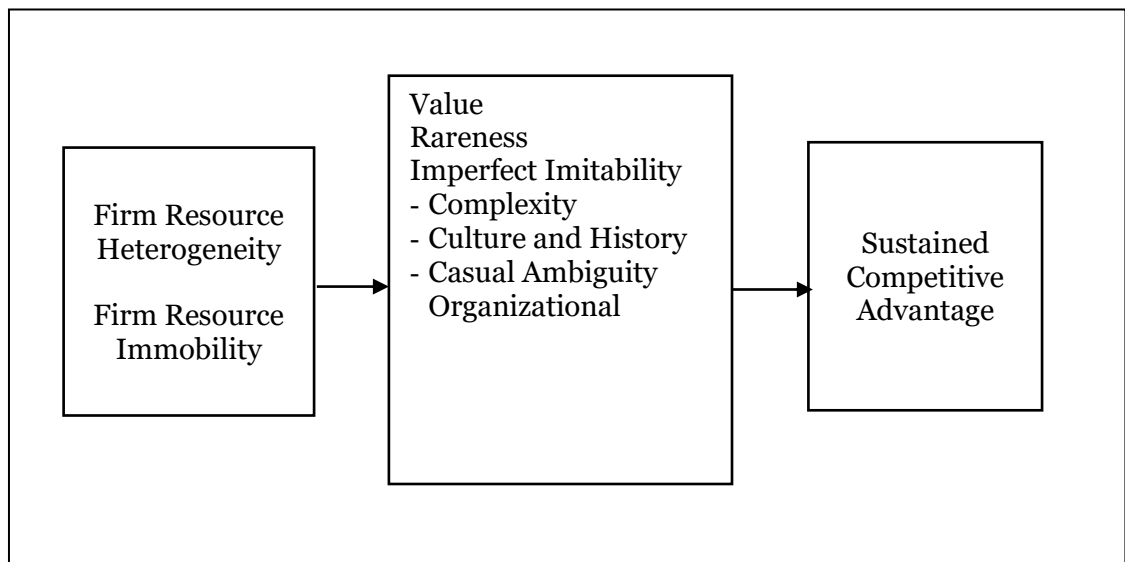
Apparel
Industry, Lean
Manufacturing,
Operational
Performance,
Resource-
Based View
Theory

advantage of the firms implementing lean manufacturing depends upon the resources and capabilities of the organization (Sony, 2019). RBV sees organizations with superior systems and structures being profitable due to lower cost, higher quality, and superior products and is also concerned with efficiency and elimination of waste (Preutisrunyanont et al., 2010). Lean manufacturing helps the firms to make the resources and capabilities free from waste or non-value adding activities and reduce the variation (Buer et al., 2021; Gibbons et al., 2012; Lewis, 2000; Onofrei et al., 2019; Silva et al., 2019; Sony, 2019). The level of competitive advantage achieved is measured through the operational performance metrics or the competitive priorities (Silva et al., 2019).

Following this view, literature compounds the contribution of strategic resources toward the implementation of lean manufacturing in a foreign context. Firm resources following the VRIO attributes to sustain competitive advantage have been explored by many operations management scholars in the past decades. Silva et al., (2019) highlighted three tangible resources: operational workforce, skilled managers, and heavy machinery, and two intangible resources: culture and training as most crucial for a successful implementation of lean practices. As Preutisrunyanont et al., (2010) asserted, there has been an increase in productivity after the implementation of lean manufacturing due to its capital investment intangible resources and intangible organizational resources and capabilities. According to Onofrei et al., (2019), the Operating Intellectual Capital (OIC) in terms of Human Capital (HUC), Structural Capital (STC), and Social Capital (SOC) contribute to enhancing lean investments' performance. Later justifying the above empirical insights, (Sony, 2019) explained the Lean Six Sigma (LSS) implementation framework using the Resource-Based Theory approach.

Given these precedents on the relationship between RBV and lean manufacturing internationally, the local literature is scarce on experimental research on the aforementioned subject matter. Hence, this study is a pioneering effort to provide insights into the RBV's theoretical relationship between strategic resources and lean manufacturing to uplift the level of operational performance of an organization.

Figure 1.
The VRIO Model of
Competitive Ad-
vantage



Source: Barney (1991)

3. Research Method

Based on the research questions and theoretical considerations, this study is formed on qualitative data, applying a single case study strategy in the apparel manufacturing industry in Sri Lanka. The apparel industry is one of the most significant

contributors to the Sri Lankan economy, known to be the country's primary foreign exchange earner and the largest single employment provider in the industrial sector (D. Wickramasinghe & Wickramasinghe, 2012). Also, it is the strongest manufacturing subsector that has vastly embraced lean manufacturing and derived significant benefits in the Sri Lankan context. Thus, the success stories of key apparel exporters of the nation blend with a lean culture that inspires developing companies to sustain their competitive edge within the industry. Alpha (Pvt) Ltd is a leading apparel manufacturing company and a spearhead of the lean implementation process in Sri Lanka. The visible benefits of Alpha from lean practices provide real-time pieces of evidence of the implications for this comprehensive analysis.

Alpha (Pvt) Ltd is considered the largest division of Alpha Group which provides the world's leading brands of intimate wear with innovative designs to deliver solutions. It is known as the largest garment manufacturer in the South Asian region. The legacy of Alpha Group continues for over 30 years in the apparel and textile manufacturing industry of Sri Lanka. Alpha (Pvt) Ltd is considered the highest revenue earner under Alpha Group and it is the preferred partner for major global apparel brands for over three decades. Its product portfolio consists of intimate wear, shapewear, performance wear, sleepwear, lifestyle wear, and wearable electronics & smart clothing. Furthermore, it conducts its manufacturing operations both locally and internationally.

A total of 15 in-depth and semi-structured interviews were conducted with diverse representatives from various hierarchical levels within the research organization. These interviewees were selected based on the importance of their roles to lean manufacturing, specifically prioritizing the local plants. The interview duration varied from 40mins to 90mins. Semi-structured interviews were conducted by a set of pre-defined questions, developed covering the main aspects of resource-based perspective and established research questions. Following the initial insights, subsequent interview questions were altered. Direct observations in local plants were also carried out along with field notes to re-confirm the interviewee's comments. To add triangulation validity to the case study, the collected data were supplemented by different archival records of the case company.

Thematic analysis is commenced to verify and draw conclusions from the empirical findings. The interviews were transcribed in full length and then the transcripts were closely examined to highlight key themes. Coding was then carried out and sectioned transcripts, field notes, and archival documents into manageable categories to further analyze and answer the research questions of the study.

4. Results and Discussions

Lean manufacturing, Resource contribution, and Operational Performance

The next section discusses the appropriate lean practices, resource contribution for lean implementation, and its overall impact on a firm's operational performance, in the apparel and textile manufacturing industry.

Lean initiation at Alpha (Pvt) Ltd

Since its inception, Alpha group has begun to grow its business in the apparel and textile manufacturing industry in Sri Lanka. Gradually, with the expansion of its business, Alpha group partnered with global brands to pioneer the art of lingerie manufacturing in the South Asian region. After years of rapid and profitable growth, Alpha witnessed a plateaued operational performance and realized that it needed to do even better to stay ahead of increasing local and international competition.

In the early 2000s, the company began to absorb lean manufacturing principles into the manufacturing process from the proven Toyota Production Systems (TPS). With the exposure gained from Toyota and Nike manufacturing systems, Alpha group developed a unique lean matrix, customized to the requirements, and inaugurated a specialized lean team to drive its initiatives. With over a decade in existence, the lean

team gradually progressed from its core focus on the production floor to encompass the entire value stream of operations and transformed into a Lean Enterprise. Highlighting the importance of lean implementation, the assistant manager - of the lean team stated:

"The early adoption of lean manufacturing helped us to survive in 2008, during the global economic downturn when other firms in the industry struggled in their operations".

In this journey of excellence, lean has been implemented in different divisions within the Alpha group including Alpha (Pvt) Ltd, and its local and overseas plants. Hence, as a summary of responses lean has turned Alpha to be a responsible business that could succeed in the highly volatile and dynamic business environment.

Lean practices adopted by Alpha (Pvt) Ltd

The implementation of lean attributes is a progressive journey at Alpha towards its pursuit of excellence. Given the intention to eliminate non-value adding activities, many lean practices have been appraised at multiple phases, guided by a lean assessment tool guide. This lean matrix provides guidelines to create process stability within the company and achieve the ultimate result by enlightening the manufacturing and front-end workforce of Alpha group.

Table 1.
Implementation
Phase

Phase	Implementation
Phase 1	Policy Deployment
Phase 2	Operational Stability
Phase 3	Quality Enhancement
Phase 4	Continuous Improvement
Phase 5	Just-In-Time

Policy Deployment or *Hoshin Kanri* is the principle lean technique utilized at the initial phase of Alpha's lean process (Preutisrunyanont et al., 2010). It maneuvers the organization into a solitary route through policies, strategies, and key performance indicators (KPIs), ensuring that the strategic goals of the organization drive progress and action at all levels. As the senior executive of the lean team admitted, *hoshin* is a collaborative effort from top to bottom, constructed by both the senior management and lean team including group, division, and plant levels. Hence, based on the policies of Alpha (Pvt) Ltd each plant develops strategies and projects to achieve the desired objective of the division, and appoints a project champion responsible for the respective project. Once the *hoshin* is completed, analogies are drawn and displayed in obeya rooms [1], located at each corporate and manufacturing unit of company Alpha for the ease of superiors to focus on the broader view. Subsequently, leader standard work-sheets (LSW) are used by the Alpha's leadership to fairly allocate time for a combination of operational work, mind time to think on strategies, coaching, and mentoring time for bottom-level members. Besides, the active engagement of the leadership team is highly appreciated to take prompt action on present concerns. According to the lean terminology, this move is known as '*Gemba*', meaning "the real place" (Belekoukias et al., 2014).

Corresponding with the lean assessment tool guide, the second phase of lean implementation embodies a set of lean attributes to ensure operational stability within its manufacturing units. Accordingly, the 5S principle lays the foundation for this proposition. Despite the complexity of the manufacturing domain, the orderly workplaces observed in the field visits validate how Alpha believes in the 5S technique. In addition, total productive maintenance (TPM) is a common attribute implemented in plants to focus on proactive and preventive techniques for improving equipment relia-

bility. Under TPM, mainly autonomous maintenance and planned maintenance are enacted (Silva et al., 2012). Given the fact, assistant manager - two continued:

"We give more priority to New product introduction (NPI) and Failure mode effect (FME) by a specialized marketing team to ensure robust production in Alpha. NPI certifies that marketing teams of different customer silos combined with innovation teams develop new products into Alpha's product portfolio, while FME assures to give a smooth product to the production floor".

In the third phase, predominant weightage has been given to enhance quality through close supervision of the defined KPIs. The implemented process maps plot the material and information flow of the plant, leading its workforce to expedite activities at each stage of production. Senior executive three of the lean team demonstrated:

"In addition, we have adopted quality gates, quality supportive matrix, standard worksheets, and andon systems for quality inspections in manufacturing units. Especially, standard worksheets are used in every repetitive operation to display the sequence of its roles".

During the observations, plant accountant-two described how the positioning of the *Andon* system indicates any process interruption of the plant. As witnessed, *andon* is an alarm system, incorporating signal lights to notify the management and maintenance on quality or process interferences. Quick changeover (QCO) is another lean technique used to minimize the changeover time/standard hour loss when changing across diverse product portfolios. The improvement of quality through the reduction of waste can be interpreted as means of exposing problems that enforce organizations to confront and eliminate their prime cause (Belekoukias et al., 2014). Thus, problem-solving tools mainly PDCA (Plan, Do, Check, Act), 5-Why, 8-Step, and Fishbone are used by departments to identify root causes of problems, highlight points to improve processes, know future states, identify any gaps, and set new directions or standards (Panwar et al., 2018). As emphasized by the lean team, the implemented mistake-proofing mechanism, termed 'poka-yoke' detects and prevents such errors identified through problem-solving tools, and complies with the philosophy of zero defects. In contrast, plant accountant-one stated how expensive it is to find all defects through inspection and correct defects at each stage of the production.

Substantiating the above insights, assistant manager - two featured continuous improvement alternatively known as the Kaizen mindset, as a fundamental lean tool that preserves the uniqueness of the organization amongst rivalries. Hence, dedicated teams from all departments including raw material, production, quality, engineering, maintenance, cutting, and finished goods engage voluntarily to make suggestions that involve process enhancements and savings to the organization. Kaizen improvements assure standard operating procedures are designed for every operation and are documented and kept for future reference. Continuing the discussion, assistant manager - two explained how the workforce is encouraged to develop the said kaizens through a rewarding mechanism. In brief, it recompenses teams for the best kaizen in plants, twice a month.

Noting that lean manufacturing revolved around Alpha becoming more agile and responsive in the apparel industry, Just-In-Time (JIT) has provided a competitive boost for the company to meet the demands of global competition. JIT involves a pull production system that absorbs emerging trends in the apparel market together with the motive of waste elimination. Admitting the fact, senior executive-three of the lean team stated:

"JIT relies on many other tools such as continuous flow, value stream mapping, Jidoka, Yamazumi, Takt time, and Kanban. Especially through this continuous flow concept, we ensure our manufacturing to constantly flow through production with minimal interruptions".

Amidst this, value stream mapping is implemented to visually map this continuous flow including material, people, and production, and indicates opportunities for any improvement. Moreover, *kanban* is used to regulate the flow of goods both within the plant and with suppliers and customers. *E-kanbans* and manual *kanbans* are used to devise the supplier-customer connectivity. Similarly, *yamazumi* is adopted to balance the workload of employees within the given takt time. This mechanism ensures that the workload of the plant is properly balanced between employees, and finished goods are delivered to customers in shorter delivery lead times. In sum, it was found that the company Alpha adopted around twenty-five lean practices, predominantly on the production floor. At the same time, informants reflected the need to take spontaneous actions to implement correct lean attributes at the right time without being merely confined to the lean assessment tool guide. However, the competitive advantage of the firms implementing lean manufacturing depends upon the contribution of their resources and capabilities (Sony, 2019).

Resource contribution towards lean implementation of Alpha (Pvt) Ltd

The apparatus of lean manufacturing pursued by Alpha (Pvt) Ltd is a holistic organizational strategy driven through a peculiar lean assessment tool and led by a specialized lean team. As revealed in the interviews with plant accountants, the lean implementation process of Alpha entails the contribution of its strategic resources since inception. Examining the fact, all responses gathered in interviews are condensed into ten key resources and arranged under four main categories; Organizational resources, Human resources, Technical resources, and financial resources, based on past literature as shown in the following table 2 (Kiatcharoenpol et al., 2015).

Table 2.
Strategic
Resources
Used in Lean
Implementation

Resource Category	Key Resources of Alpha
Organizational Resource: This resource differentiates the organization from rivalries and helps to execute its strategy. In other words, it is a set of management practices that could be used to establish the strategic direction of companies. The strong leadership, clear vision, long-term objectives, and the lean believing culture of Alpha play a vital role in supporting the lean implementation	Strong Leadership and Commitment Clear Vision and Target Deployment Continuous Improvement Culture
Human Resource: It is simply the workforce of an organization. In a wider view, the organization can hire, maintain, and develop qualified personnel to achieve its objectives. Here, human resources sum up the engagement of employees for lean implementation, the knowledge enhancement sessions for the workforce, and the contribution of lean expertise to Alpha.	Empowerment External Consultants Training and Development
Technology Resource: The organization can maintain and control existing manufacturing operations by acquiring new process technologies to identify the appropriate sources of technology.	Production Technology Support Lean Manufacturing Knowledge
Financial Resource: This covers all financial funds of an organization. Moreover, it is the management budget allocation for lean implementation.	Financial Support Reward and Recognition

Following the logic of Resource-Based View theory (RBV), the resources identified above are analyzed to verify their potential to provide a sustainable competitive advantage. The underlying notion of RBV stipulates that organizations are a collection of resources that are; Valuable, Rare, Inimitable, and Organizational (Barney's VRIO Model). This section allows for the extraction of the resources directly from the analysis and provides the basis for the evaluation of the intensity of the resource-practical relationship.

The organizational resources reflected in Table 2 furnish the basement for a lean embedded culture, endowed with agility to posture during movement. In particular, the leadership team headed by the Chairman of Alpha group pioneered in initiating lean manufacturing, based on the knowledge gained from foreign manufacturing processes. As prescribed by an assistant manager - three, since then the leadership team has immensely contributed to the success of lean, and their strong leadership skills, visionary thinking, and commitment towards lean implementation have directly persuaded the subordinates to engage in the proceedings. The lean believing culture, rooted in Alpha's history and trajectory deemed to be the core strength of the company, despite its difficulty in detecting in the interviews (Silva et al., 2019). Moreover, by reiterating the value of organizational resources, plant accountant-one highlighted the challenge faced by the entrants to establish such a culture in firms aiming to compete within the industry. Hence, the contribution of organizational resources towards lean implementation is hard and even impossible to surrogate it is non-substitutable. Consistent with Barney (1996), it is evident that the organizational resources possessed by company Alpha, drive lean manufacturing to achieve a sustainable competitive advantage in the present market.

From the company's perspective, human resource is a major success factor in the implementation of lean manufacturing. Throughout the journey, Alpha's lean team has empowered teams at all work levels to believe in continuous improvement to build a sustainable manufacturing process (Preutisrunyanont et al., 2010). Given that, assistant manager - two of the lean team demonstrated:

"All our employees are pushed towards lean implementation through continuous training and development, irrespective of the position they hold".

She also highlighted job family-based training and belt training conducted by the central lean team for manufacturing and front-end executives, team leaders, and group leaders annually. Such training sessions provide the basic knowledge of lean manufacturing and gradually on the applicability of advanced lean practices. Substantiating the insights, assistant manager-one added:

"We also invite external lean consultants occasionally to guide employees about lean manufacturing".

Hence, it is evident that human resource directly contributes to developing a lean-believing culture within the company Alpha. Despite the value of human involvement, conflicting arguments were presented in the interviews regarding other attributes of the VRIO model. Plant Accountants one & two claimed:

"Large-scale apparel organizations can conduct training consulting lean experts externally irrespective of the cost, but small-medium organizations may fail due to their financial constraints. However, they also can motivate their workforce towards lean implementation which means human resources including skills and capabilities could be imitable and substitutable".

Under the technology resource, the contribution of production technology support and lean manufacturing knowledge were equally valued in the interviews. Further emphasizing the gravity of production technology support, the assistant manager - of the lean team stated:

“We have our technical experts to maintain and control existing operational processes in manufacturing units. Especially, our divisional lean team in collaboration with the automation team engage in this procedure to develop process automation continuously”.

In addition, the knowledge of lean manufacturing is viewed as essential in the interviews to implement lean practices within company Alpha. As factory floor manager-one explained, lean training help to enhance the lean knowledge of the workforce and to accomplish given production targets at a minimum cost. Even though the training is considered imitable, the technology resource is unique and non-substitutable for the rest of the competitors in the industry. Hence, corresponding with the attributes of Barney's VRIO model, technology resources can be identified as a source of sustainable competitive priority toward lean manufacturing.

As (Sahoo, 2019) asserted, finances facilitate in a manner compatible with the budget guidelines to effectively implement lean manufacturing mechanisms in an organization. Referring to Table 2, financial resources consisting of financial support and rewards were confirmed as a major supporting factor in the interviews which induce the implementation of lean in company Alpha. Given that, plant accountant-two described how funds are been allocated for lean initiatives annually. The budgeting process officially starts in October and all plant lean teams prepare discrete budgets for lean practices and training forecasted for the following year. After the budget meetings, finalized budgets are approved through the finance department before execution. Similarly, the divisional and group lean teams prepare budgets for training and consultations respectively. Furthermore, the rewarding system motivates the workforce and promotes a culture for continuous improvement. This is specifically performed at the plant level in weekly, quarterly, and monthly reviews for project achievements and kaizen improvements. However, the financial resource is given the least priority among other resource types in terms of sustainability and is considered a resource that can be possessed by competitors in the apparel industry. Hence, the VRIO analysis of finance resources contradicts the belief that financial support is the key success factor in efficiently promoting lean in the Sri Lankan apparel industry (Kiatcharoenpol et al., 2015).

In many instances, interviewees reiterated the importance of organizational resources and technology resources to create a sustained competitive advantage through lean manufacturing. However, the summary of responses implicitly expressed how the cumulative contribution of organizational, human, technology, and financial resources and capabilities discussed above-supported company Alpha to succeed in the implementation of lean manufacturing.

Impact of lean manufacturing on the operational performance of Alpha (Pvt) Ltd

Persuaded by the impact of lean manufacturing, the interviews conducted with plant accountants and the lean team reflected how the company benefited from lean implementation. Assistant manager - one stated:

“Even before lean implementation we experienced profits in operations, but it was based on the traditional thinking of profit generation (Price – Cost = Profit)”.

Therefore, after the adoption of lean manufacturing, company Alpha was able to accomplish the goal of cost reduction through waste elimination and generate a sustainable profit to compete within the apparel industry. The previously mentioned lean assessment tool guide has been used to continuously measure the impact of the lean on the operational performance of the company. According to the explorations of the lean assessment tool guide, the manufacturing units of Alpha (Pvt) Ltd measure its operational performance through key performance indicators, categorized as Safety,

Quality, Delivery time, Cost, and Moral (SQDCM). Reiterating the fact, factory floor manager-two declared:

"SQDCM are visually displayed in manufacturing units along with KPIs and measures. Based on these, team leaders and group leaders conduct meetings to measure and monitor progress against planned performance".

Furthermore, as senior executive-three of the lean team stated, SQDCM measurements are used daily, weekly, and monthly to assess the performance of the operations within manufacturing units. Measurements such as Plan to Performance, efficiency, and rejection are assessed daily, 6S audit scores every week and Cost per hour (CPH), Standard hours per person, and sales are calculated monthly.

Apparel Industry, Lean Manufacturing, Operational Performance, Resource-Based View Theory

KPI	Indicators
Safety	No. of Accidents, No. of Near Misses, Incident Rate, Ergonomic Rating
Quality	First Time Through (FTT), Rejection Rate, AQL Pass Rate, Internal Quality Rate, External Quality Rate, Quality Reports
Delivery Time	On-time Delivery (OTD), Order Fulfillment (OFF), PED Hit Rate [3], Plan to Performance (P to P), Inventory Turns, Cut to Ship
Cost	Productivity, Scrap, Customer Returns, Change over Time (COT), Additional RM, Transportation, Dock to Dock (DTD) [4], Cost Per Hour (CPH)
Moral	Labor Turnover (LTO), Absenteeism, Suggestion Rate, 6S

Table 3.
Performance Measurements

Pertinent to the SQDCM measurements, Alpha (Pvt) Ltd has aimed to improve safety, reduce cost, increase speed, improve quality, and increase customer and employee satisfaction through appropriate lean practices. Noting that quality enhancement is an important phase of lean implementation, assistant manager-three of the lean team demonstrated, "The quality of apparel enhanced up to a certain extent after lean implementation and thereby customer claims reduced approximately by 70% which is a good rate. Measures like FTT, internal and external quality rates, quality inspection rates have also improved in Alpha after 2007". Further speaking with senior executive-two of the lean team revealed lean practices like PDCA, *Poka Yoke*, automation, and *yamazumi* have facilitated performance enhancements in manufacturing units. In addition, the lean conducive environment has helped employees to find problems firsthand and rectify them within a short period. During the observations, factory floor manager-two emphasized:

"We expect 100% adherence to yamazumi or line balancing within plants, and non-adherence means workload has not properly been divided in between the workforce".

Hence, these spotted favorable quality measures indicate reduced cost, increased capacity utilization, and improved customer satisfaction within company Alpha. Additionally, the company has also experienced a reduction in the cost of failure through lean mechanisms. This was further validated through archival documents as it reported a reduction in write-offs, air freights, and overtime payments, which in turn increased shareholder value. Factory floor manager-two further claimed:

"Through planned and autonomous maintenance concepts we were able to reduce the overall machine downtime".

Therefore, it is evident that TPM implementation has positively resulted to reduce costs in plants and improve overall productivity. Similarly, JIT has impacted significantly to reduce inventory within plants, where inventory had only been kept when it is needed for production. Moreover, lean practices such as continuous flow, QCO, and

TQM have contributed to eliminating non-value-adding waste from manufacturing processes and thereby increasing the profits of the organization.

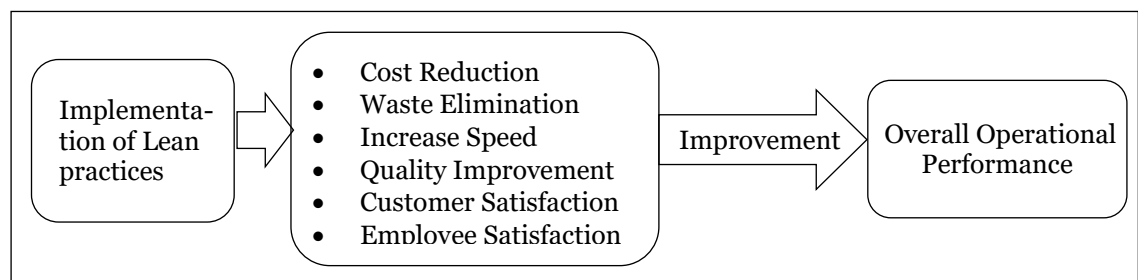
Given the priority of satisfying customers, lean has been implemented to shorten the delivery lead times. As expected, gradually company Alpha has experienced a reduction in delivery cost and time. Speaking about how the lean implementation process can improve the overall On-Time-Delivery (OTD) to customers through increased efficiency in production, assistant manager - three continued:

“Improvement in OTD in both raw material and finished goods have reduced wastes like transportation cost and waiting losses in delivery”.

In addition, archival documents reported an improvement in Cut to Ship ratio and a decrease in Cut to Order ratio as well. Similarly, the results were cross confirmed in the interviews with the plant accountants. Thus, lean practices such as QCO, FME, and JIT have significantly affected increased flexibility in production, reduce process interruptions and thereby reduce the lead time in manufacturing.

Apart from the manufacturing processes, internal processes have also improved since lean initiation in company Alpha. As per plant accountant-four, implementation of lean in service departments such as finance and HR in Alpha has improved the lead time in the finance payment process and recruitment process respectively. Moreover, the lead time in the commercial documentation process has improved, connecting logistic teams effectively with plant finished goods departments. Therefore, lean practices such as 5S, *Jidoka* (autonomation), continuous flow, and problem-solving techniques which have been implemented in service departments, significantly impacted improved efficiency within the front-end workforce.

Figure 2.
Lean
Implementation
and Operational
Performance



In sum, the implementation of lean manufacturing has significantly enhanced the overall operational performance of the organization via cost reduction, waste elimination, quality improvement, and customer and employee satisfaction as aimed at the beginning. Therefore, the empirical findings of this research about the impact of lean manufacturing on the operational performance of apparel manufacturing companies are in line with past literature under both local and foreign contexts (Belekoukias et al., 2014; Gunarathne & Kumarasiri, 2017; Silva et al., 2019; G. L. D. Wickramasinghe & Wickramasinghe, 2017).

5. Conclusion

The paper has examined three aspects of lean manufacturing: the applicable lean practices, the resource contribution for effective implementation of lean practices, and the impact of lean implementation on the operational performance of an apparel manufacturing company in Sri Lanka. When analyzing the results obtained from empirical evidence, the first conclusion that emerges is that the initial goal of identifying lean practices is mostly used by apparel companies. Lean practices are aligned with the competitive priorities of the operations strategy (Silva et al., 2019). Around twenty-five, such lean practices implemented by company Alpha were identified following a progressive lean implementation process. However, the empirical evidence suggested

that inappropriate selection of lean practices can result in adding waste to the manufacturing process leading to many inefficiencies (Belekoukias et al., 2014; Karim & Arif-Uz-Zaman, 2013). Thus, it is essential to follow a systematic methodology, exclusively to address significant organizational difficulties of a company in particular (Anvari et al., 2010; Fullerton et al., 2014; Karim & Arif-Uz-Zaman, 2013).

Following the assertions of Barney (1996), the sustained competitive advantage implementing lean practices could be reached by the effective use of firm-specific resources and capabilities, such resource contributions are evident in company Alpha. Further being consistent with Kiatcharoenpol et al., (2015) who identified firm resources as critical success factors, a total of ten key resources were recognized and aggregated into organizational, human, technology, and financial resources of the Alpha's manufacturing domain. The analysis of these resources pertinent to the VRIO model of Resource-Based View theory concluded that two resources; organizational and technology amongst the four types of resources are significant for the effective implementation of lean manufacturing. Organizational resources; strong leadership & commitment, clear vision & target deployment, continuous improvement and technical resources; production technology support, lean manufacturing knowledge were compatible with all four attributes of value, rarity, inimitability, and non-substitutability (Onofrei et al., 2019; Silva et al., 2019; Sony, 2019). According to *RBV* theory insights, firm resources that have the potential to generate a sustained competitive advantage for the company may assure the survival of the organization within the industry in long term. Thus, the contribution of organizational resources and technology resources could be considered sources of sustainable competitive advantage explicit for the implementation of lean manufacturing (Barney, 1991).

As with the findings of Gamage et al., (2012) and Gunarathne & Kumarasiri (2017), the implementation of lean manufacturing significantly impacts the overall operational performance of company Alpha. The empirical findings of this study lastly concluded that lean manufacturing has positively impacted the performance in terms of improved safety, reduced cost, improved quality, increased speed, and improved morale, which is a universally accepted conviction except for some contradictory arguments raised by Chen & Tan (2013) and Huson & Nanda (1995).

Thus, the most compelling implication of this research is that it narrows the knowledge gap of operational managers and executives involved in developing and implementing lean strategies to make proper decisions and thereby eliminate unnecessary costs of investment. This inevitably reduces the stress of defects and rework for the team players. Furthermore, the findings of this paper lead managers to specifically focus on key strategic resources of a company to sustain the competitive edge through lean implementation. Also, this research provides deep insights into the existing body of local literature through the impact of lean manufacturing on operational performance from the perspective of a Resource-Based View, giving more prospects for future research. Additionally, further investigations can extend to develop a comprehensive lean implementation framework for the apparel industry and other manufacturing industries in Sri Lanka. As the research is directed towards the selection of in-depth inquiry of specific settings infused with culture, values, and ideology, it might cause to diminish the researcher's analytical objectivity and research independence.

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