

# Essential Factors for the Advancement of the Yarn Manufacturing Sector in Sri Lanka: Implications of the Socio-Economic Environment

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**Abstract** - The textile and apparel sector are well-represented in the industrial sector of the Sri Lankan economy. It has become Sri Lanka's largest export industry since 1986. Enhancing quality and decreasing expenses are the main priorities for the Sri Lankan apparel sector, highlighting the necessity for deliberate growth. More significant export revenue and considerable import expenditure on raw materials like yarn, fabric, etc., for apparel manufacturing, is a common phenomenon in the Sri Lankan apparel sector leading to less economic value generation. Thus, this paper studies the key factors affecting the advancement of the yarn manufacturing sector in Sri Lanka and the implications of the turbulent socio-economic environment. To address the identified research problem, this study proposes a conceptual framework through a systematic literature review, which identifies the essential factors for the advancement of the yarn manufacturing sector in Sri Lanka under the current socio-economic environment. The Partial Least Square Structural Equation Modelling (PLS-SEM) method was used to capture the interactive relationships among the key factors and the advancement of the yarn manufacturing sector in Sri Lanka. Data was gathered using questionnaires from employees in the yarn manufacturing industry, textile industry, and textile engineering students in Sri Lanka. The results show that the quality of raw materials, machines and technology and better investors have a positive relationship with the advancement of the yarn manufacturing sector in Sri Lanka.

**Keywords:** Apparel Industry, PLS-SEM and Yarn Manufacturing.

## I. INTRODUCTION

The history of the yarn manufacturing industry goes back many centuries. There is a famous folk tale that when Aryans settled in the Island in 200 BC, aboriginal people had the technology to spin cotton yarns. Also, the Sri Lankan Textile and Apparel industry way back to the early 1950s, and today it has spread internationally. Accordingly, Sri Lankan textiles are highly valued in the international market. As a result, the Sri Lankan economy highly depends on the textile and apparel industry, and the apparel industry is the third largest industry in Sri Lanka (Abeynanda, 2017). The textile and apparel industry is the most robust manufacturing sub-sector in Sri Lanka regarding its contribution to industrial production, foreign exchange earnings, and employment creation.

Textile products are exported here, and most relevant raw materials, such as yarn, fabric, etc., are imported for apparel manufacturing. Much of Sri Lanka's exports come from the industrial sector, dominated by the textile and apparel industries, further establishing the sector's vitality to the country's economy. On the contrary, a significant amount of import expenditure is also allocated to importing textiles and textile articles, indicating less value addition within the country (Central Bank of Sri Lanka, 2021).

Given the highly competitive global market for these products, Sri Lanka must seek new ways to enhance efficiency in its textile and apparel industry. However, integration of the textile and apparel sector is low. The foreign currency goes out of the country as a major percentage of the textile and apparel industry inputs are imported. This

impacts the country's economy, and today industrial goods account for 77.6 percent of Sri Lankan exports, of which textile accounts for 43.5 percent. In contrast, 59.6 percent of Sri Lankan imports are intermediate goods, of which textile and garment imports comprise 14.9 percent (Central Bank of Sri Lanka, 2021).

The present Sri Lankan economic crisis is unique in the island's history. It has been characterized by high inflation and severe energy and fuel shortages. High levels of foreign debt, declining currency depreciation, foreign currency reserves, and a series of lockdowns have slowed economic growth. In addition to the impact of the COVID-19 pandemic, the crisis in Sri Lanka was caused by poorly managed government finances and sick-timed tax reductions. As a result, India, China, and Bangladesh have stepped up to aid Sri Lanka in the face of the crisis. To adequately address the economic crisis, Sri Lanka may apply for financial assistance from the International Monetary Fund (IMF). The reason behind the economic crisis is poor economic policy decisions, including halving the value-added tax and removing certain other taxes and introducing a fertilizer ban which significantly reduced the production of the country's two main export products, rice, and tea. Apart from that, the identified other reasons are the COVID-19 pandemic, diminishing Forex, and global fear/ uncertainties like the Russia-Ukraine war, leading to a sharp rise in oil prices.

This economic crisis's impact on the Sri Lankan textile and apparel industry has significantly impacted apparel exports. After the country's foreign exchange reserves dwindled to alarming levels in the first quarter of this year, the foreign exchange crunch prevented manufacturers and exporters from importing raw materials. In April 2022, Sri Lanka's apparel exports earned \$408.142, down more than five percent compared to \$430,282 million in exports in the previous month. Garment exports earned \$456.846 million for Sri Lanka in November 2021. In December 2021, this figure grew to \$483.478 million. However, there was a downward trend in the export value of the Sri Lankan textile and apparel industry starting from January 2022. It dropped to \$478.023 million and declined to \$456.111 million in February of the same year. This decline was reportedly due to some textile importers failing to pay their international suppliers.

As a solution, the raw materials imported to the country for the textile and apparel sector can be produced within the country itself. As an example, among the raw materials used in the textile sector, yarn is one of the key ingredients that is imported to the country in large quantities. While the country already has some involvement in manufacturing yarn, considering the demand for the textile sector, there is much room to advance the yarn industry in Sri Lanka. The development of the yarn industry may result in many benefits to the country. Some of such benefits can be (but are not limited to) – first, retention of foreign currency (millions of dollars), currently spent to import yarn; second, potential export from the country, as not many countries have the necessary geographical conditions to grow and manufacture yarn inhouse; third, the indirect positive implication to the socio-economic growth of the country as the yarn manufacture sector may generate job / entrepreneurial opportunities. Concerning the impact, the yarn manufacturing sector may have on the textile industry as well as the economies at large, there is ample scholarly work evince in the literature. The proceeding section outlines some of the key insights that are worth outlining. Importantly, this study clarifies the implication of four essential factors and the moderation implications of the socio-economic context to the yarn manufacturing sector.

## II. LITERATURE REVIEW

### A. The Yarn Manufacturing Industry

The systematic literature review identified nine studies on the yarn manufacturing sector in developing countries and the yarn manufacturing sector in developed countries because analyzing only the Yarn manufacturing sector in developing countries alone was insufficient. The findings of the studies are given in the following Table 1 with their objectives.

**Table 1. Summary of previous research related to the yarn manufacturing industry**

Objective	Findings
Examine the different factors that can affect yarn demand and, thus, yarn production and price (Dodd & Oxenham, 2002).	Labor does not always strongly influence yarn cost; it depends more on every component put together, such as raw materials, capital, power, waste, etc. Labor is cheaper overseas than in the U.S., and machinery is more affordable in the U.S. than in these overseas countries.
Investigate the dyeing behaviour of fabrics made from the ring, rotor, and Murata vortex spinning (MVS) yarns (Anam et al., 2019).	Due to the difference in fibre orientation and distribution of each yarn, its dyeing behaviour varied. The polyester + cotton dyed fabrics made of MVS yarns exhibited higher colour strength than the fabrics of ring and rotor yarns.
Review the current state of technological development in yarn production and compare the pros and drawbacks of each system (Oxenham, 2002).	The ring and rotor will remain dominant spinning technologies for at least the next decade.
Find the factors affecting yarn and fabric production (Asif & Jarral, 2010).	Skilled labor, automated machinery, raw material quality, and energy issues impact the production of yarn or fabric.
Determined the current state of data management in the United States (U.S.) cotton spinning industry by travelling to several U.S. cotton spinning facilities (Hamilton et al., 2011).	Micronaire and short fibre index were determined to be the best HVI properties for predicting final yarn characteristics, such as uniformity and work to break.

<b>Objective</b>	<b>Findings</b>
<p>Explore the Turkish cotton spinning industry's status and prospects on the global market (Erdumlu, 2009).</p>	<p>Enhancing the competitiveness of the Turkish cotton spinning industry is unavoidable so that the Turkish textile and clothing industry becomes competitive once again as a whole on a global scale. Government support through regulations, incentives, and policies, as well as the efforts of non-governmental organizations, should be developed by considering the interactions among all subsectors, aiming to reconstruct the Turkish textile and clothing industry entirely.</p>
<p>Understanding different departments' problems from the quality point of view and how to reduce the problems by taking preventive action against any defects produced during the process (Gupta, 2013).</p>	<p>A lot of faults to achieved regarding process problems during the manufacturing of yarn in different departments. It is necessary to work systemically and improve the organization's financial condition. It is vital to reduce or eliminate defects in every department to achieve the final yarn product according to the desired specifications of the consumers. The product should positively impact quality and service to compete successfully in today's market and meet customers' requirements.</p>
<p>Identify the relative significance of "technology" and "management" and the balance of these dimensions in the long-term sustainability of the U.S short staple yarn manufacturing industry (Tangboonritruthai et al., 2014).</p>	<p>Instead of looking at each component individually, that is "technology" or "management", it makes more sense to look at it as an integrated combination of both. In the current climate of rapid changes in most aspects of the global economy, it is crucial to consider the new "technology" and "management" integrated system as a carefully balanced sphere sitting at the top of a pivot, representing both internal and external pressures that have a direct effect on the competitiveness of the U.S. yarn manufacturing industry.</p>

Objective	Findings
Evaluate the suppliers' ability to the raw materials and the customers, identify the production requirements from the existing customers and prospective customers, and the market conditions, and analyze the risk involved in implementing the Just-in-Time (JIT) technique (Kumar & Baskaran, 2020).	Proper management of the inventories will increase the efficiency of any business. Cutting down the resources, effort, and time spent on maintaining the unnecessarily high levels of raw materials and finished goods will yield more significant benefits in the overall business operations.

Source: Authors' compilation.

### ***B. The Sri Lankan Apparel Industry and its Challenges***

The industrial sector of Sri Lanka recognizes the textile and apparel industry as the most important manufacturing sub-sector, as it contributes significantly to industrial production, foreign exchange earnings, and employment generation (Gunathilake & De Mel, 2016). The primary objective in the apparel industry is to enhance the productivity of both employees and operations. To achieve this, a significant amount of training and development is needed. Table 2 mentions the major challenges identified through the systematic literature review and the reasons for them in the Sri Lankan apparel industry. Moreover, according to (Kelegama, 1999), Sri Lanka has a larger labour force and has not yet developed the necessary conditions for capital-intensive industrial production. In addition, multinational enterprise (MNE) buyers face challenges in establishing long-term commercial relationships with local suppliers, limiting the formation of backward linkages (Kelegama, 1999).

**Table 2. Challenges in Sri Lankan Apparel Industry**

Issue	Reason
Insufficient product diversification (Dheerasinghe, n.d.)	Labor unavailability, limited capacity on available machines, and existing technological capabilities on the production floor.
Heavy dependence on a few large-scale industries (Dheerasinghe, n.d.)	26% are small-scale factories with less than 100 employees, 51% are medium-scale factories, and 23% are large-scale factories with 500 or more employees, accounting for 62% of total employment
Wage differentials (Kelegama, 2004)	The labor cost is about 15–16% of the total cost of production. Cambodia, Vietnam, Caribbean nations, and sub-Saharan countries are emerging as lower-cost producers and have preferential access to U.S. and E.U. markets

Issue	Reason
Lack of skilled labour (Kelegama, 2004)	Lack of sufficient employees to recruit in operational grades. 8% of vacancies in managerial grades are available due to a lack of suitable people. The operational category represents 94% of the workforce, 90% are female employees, and most leave the industry after marriage. The average labor turnover per factory is 60% annually. The net number of workers leaving the industry is 25% annually. More than 64% of the labor force in the operational grade is 18-24 years old.
Lack of solid raw material base (Kelegama, 2004)	More than 70% of the raw materials and 70-90% of the accessories are imported. Lack of backward integration.
Lead time (Kelegama, 2004)	Raw material suppliers are based in overseas locations. Fast response is demanded by U.S. and E.U. buyers.

Source: Authors' compilation.

### ***C. Environmental and Social Impact of Cotton Growing in Developing Countries***

Cotton is the most extensively used natural fibre globally, constituting more than 82% of the global consumption of natural fibres. Cotton plants are grown in over 75 countries, occupying approximately 32.4 million hectares of agricultural land (Baydar et al., 2015). Developing nations encounter several challenges in cultivating cotton, including social factors like rural-urban migration, which leads to high levels of unemployment. Secondly, economic limitations such as a market-based economy, fierce labour competition, and the high cost of eco-friendly technology. Lastly, structural hurdles include inadequate irrigation systems and drainage canals (Oral, 2019).

Cotton cultivation has many challenges and constraints regarding the environmental impacts of cotton growing in developing countries. They are the high price of natural manure, absence of state incentive, high consumption of electric power and diesel fuel by agricultural machinery during cultivation and harvesting, inadequate technology for measuring water usage, lack of infrastructure, and improper disposal of chemical packaging. These effects impact the increase of global warming and decrease in crop productivity.

Following the industrialization process of the post-WWII era, agriculture experienced a significant shift towards mechanization. As a result, the proportion of agricultural labour in total employment has significantly decreased since the 1950s, notwithstanding factors like rural-urban migration and loss of arable lands. However, in some developing countries, the rate of agricultural mechanization remained low until recently, creating a structural obstacle that compelled cotton cultivation to rely on manual labour, primarily through the employment of unregistered seasonal agricultural workers. According to Oral (2019), the Southeastern region has experienced a surge in population due to high birth rates, increasing unskilled labour and unemployment. The competitive

labour market has made agricultural workers susceptible to exploitation by capitalist systems. Consequently, cotton farming has led to social issues like child labour, unfair wages, health problems caused by hazardous chemicals, and occupational accidents resulting from unsafe transportation (Wanniarachchi & Dissanayake, 2020).

#### ***D. The Economy of Sri Lanka***

Sri Lanka's free-market economy's nominal gross domestic product (GDP) was \$84 billion in 2019. Tourism, tea, apparel and textile, agriculture, IT, and mining are the major economic sectors in Sri Lanka. The textile and clothing industry is the primary gross export earner in Sri Lanka, generating over 52% of the country's total export revenue since 1986. Since 1992, it has also been the nation's top net earner of foreign currency. Around 15% of Sri Lanka's workforce works in the apparel industry, contributing to half of the nation's overall exports.

Regarding population, Sri Lanka ranks among the top countries in the world for producing textiles. The United States and Europe are the two main export destinations for Sri Lanka's apparel sector. About 900 factories nationwide serve companies such as Liz Claiborne, Victoria's Secret, and Tommy Hilfiger. Based on the Sri Lanka Export Development Board's statistics and categorization, textiles and apparel represented more than 44% of Sri Lanka's merchandise exports in 2017.

Embuldeniya (2015) has identified the apparel industry's significance and impact on the economy of Sri Lanka. However, the economy of Sri Lanka was the dependent variable of this study, and its measurement was based on the Gross Domestic Product. On the other hand, the apparel industry was treated as the independent variable, and its performance was measured based on its exports. The results indicate a steady increase in the export performance of the apparel industry, and the revenue generated from garments exports in 2014 was approximately Rs. 5 billion is the primary source of foreign revenue compared to traditional exports such as tea, coconut, and tourism. Furthermore, the relationship between export performance in the apparel industry and the Gross Domestic Product of Sri Lanka indicates a weak positive relationship between these two variables for the past decade.

#### ***E. Impact of Currency Depreciation on the Sri Lankan Apparel Industry***

Due to ongoing concerns over Sri Lanka's slowing growth, government debt, and money printing, the COVID-19 epidemic has resulted in several sovereign rating downgrades. After increased monetary instability brought on by debt monetization, import restrictions and import substitution have become stricter. One of the top ten nations in the world for how it has handled the COVID-19 pandemic is Sri Lanka. The government officially declared the biggest economic crisis to hit Sri Lanka in 73 years in 2021. After two years of money printing to support tax cuts, Sri Lanka reported that most foreign debt repayments had been halted as of April 12. This marked the end of an unblemished debt servicing track record.

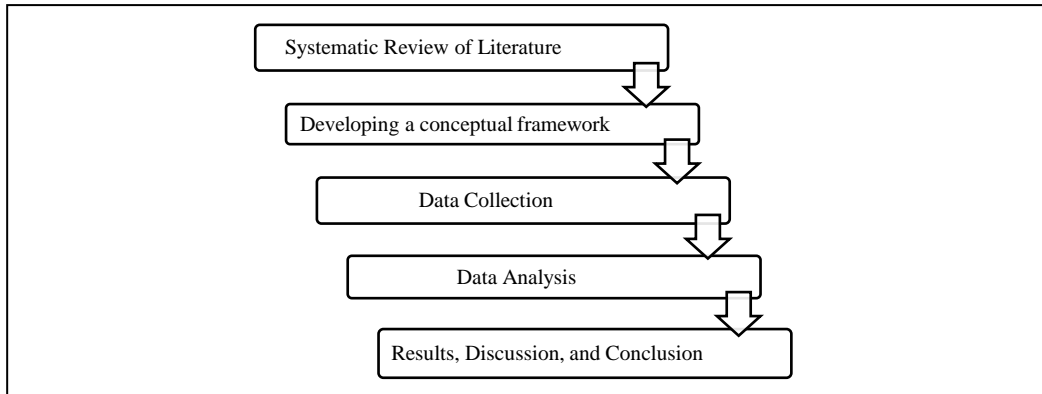
Regarding the impact of Currency Depreciation on the Sri Lankan Apparel Industry (Ramanayake, 2019), it is evident that too much depreciation, in the long run, causes a declining growth process and exports in Sri Lanka. At the same time, long-run depreciation negates the industrialization process. Furthermore, this study found that long-run depreciation caused a decline in Foreign Direct Investment, increased inflation, and harmed the country's social welfare.

### III. METHODOLOGY

#### A. Proposed Research Framework

The main objective of this study is to identify the essential factors for the advancement of the yarn manufacturing sector in Sri Lanka under the current socio-economic context. Through a thorough literature review, four important factors were identified. Figure 1 illustrates the process of methodology.

**Figure 1. Proposed Methodology**



Source: Authors' compilation.

#### B. Theoretical Framework and Hypotheses Development

The nature of this study is quantitative research, which needs quantitative data. Quantitative research aims to understand the relationship between an independent and dependent variable in a population (Ayanyemi, n.d.). So, the nature of this study is a quantitative approach for the following reasons.

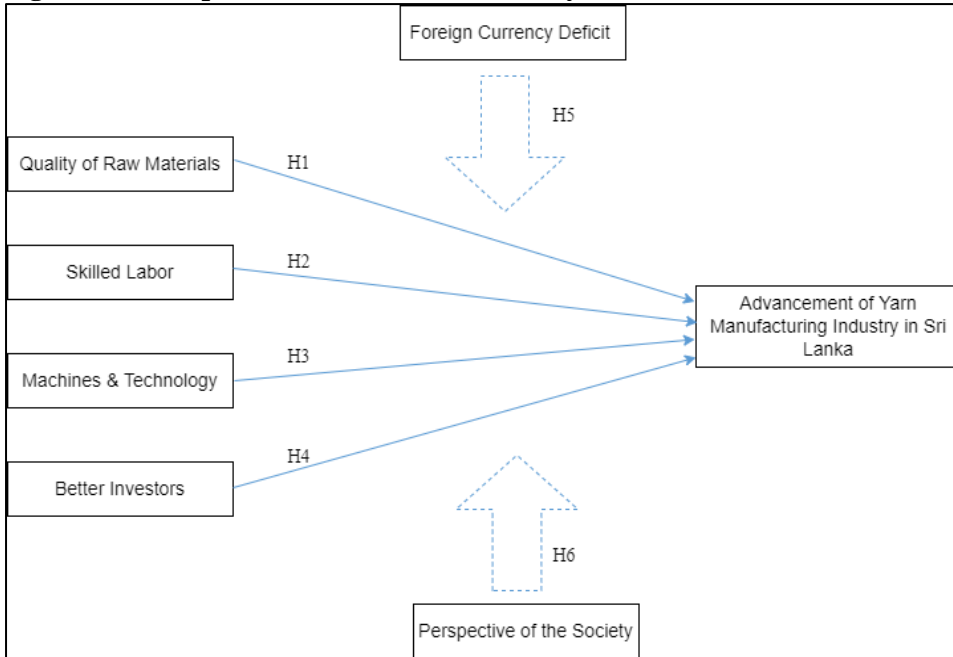
According to the research problem, this study focuses on the whole Sri Lankan context, and this is not only for one or two yarn manufacturing firms. So, by having respondents in different areas, then we are in a better position to generalize our findings. Because quantitative research is used to quantify behaviors, opinions, attitudes, and other variables and generalize from a larger population (Ayanyemi, n.d.). Therefore, the nature of this study is a quantitative approach.

Apart from the other reasons, since the conceptual framework is coming up with the hypotheses, the best approach is to test hypotheses using a quantitative rather than qualitative approach. (Ayanyemi, n.d.) implies that quantitative research aims to make predictions, establish facts, and test hypothesis that have already been stated. It looks for evidence which supports or does not support an existing hypothesis.

Since this study uses a quantitative research approach, the data collection method used for data analysis is an online questionnaire survey with close-ended questions to analyze the essential factors for the advancement of the yarn manufacturing sector in Sri Lanka and to analyze the impact of the foreign currency deficit and the effect of the current perspective of the society upon the advancement of the yarn manufacturing sector in Sri Lanka. Figure 2 illustrates the conceptual framework developed for the study based on the identified factors.



**Figure 2. Conceptual Framework of the Study**



Source: Authors' compilation.

**1) Hypotheses for Direct Associations:**

*H1: The availability of quality raw materials positively influences the advancement of the yarn manufacturing industry in Sri Lanka.*

Raw material has a significant impact on yarn quality and production. Cotton is mainly used in yarn manufacturing. When selecting cotton, the characteristics that should consider are fibre length, short fibres percentage, fibre maturity, and fibre strength. Manufacturers can use high-quality cotton for a reasonable price for their yarn (Asif & Jarral, 2010). Quality improvement is the area where Sri Lanka can maximize its potential for winning buyer's confidence which is essential for retaining customers. Therefore, to increase product quality, yarn quality is essential, and to have high-quality yarn, the quality of raw material is important.

*H2: The availability of skilled labour positively influences the advancement of the yarn manufacturing industry in Sri Lanka.*

At the start of the industry, it absorbed many skilled and semi-skilled workers (Farhana et al., 2022). Labor is exceptionally significant, particularly in spinning mills, as nothing can be accomplished without their involvement. So, to improve productivity, manufacturers should take adequately skilled workers, arrange training sessions for workers for their improvement, and, most importantly, increase their wages time after time (Asif & Jarral, 2010).

*H3: The better usage of machines & technology positively influences the advancement of the yarn manufacturing industry in Sri Lanka.*

Machines matter a lot in productivity. So, using new machines rather than old ones provides more production and consumes less energy than old ones (Asif & Jarral, 2010). Further, proper maintenance of the machine is necessary. Otherwise, it results in many problems like sudden shutdowns and significant production losses. So, acceptable maintenance results in the efficient working of the machine and good outputs. Apart from that, technological improvements in this industry will also affect the quality of the yarn and its productivity. As mentioned above, yarn quality and its productivity are essential for the advancement of the yarn manufacturing sector in Sri Lanka.

*H4: Better investors positively influence the advancement of the yarn manufacturing industry in Sri Lanka.*

Another critical factor affecting the advancement of the yarn manufacturing sector is better investors. High profit or high investment is the first preference of a business (Asif & Jarral, 2010), and it is essential that both local and foreign investors come forward to increase the yarn manufacturing sector in Sri Lanka. High-quality yarn can be produced through better investments and high profit can be earned by increasing productivity.

## **2) Hypotheses for Moderation Effect of Foreign Currency Deficit:**

*H5 (a): The foreign currency deficit would negatively influence the association between the quality of raw materials and the advancement of the yarn manufacturing industry in Sri Lanka.*

The quality of cotton, the primary raw material of yarn production, positively affects the advancement of yarn manufacturing in Sri Lanka. But, due to the current foreign currency deficit, inflation has risen. Furthermore, inflation leads to a higher price for each good (Ramanayake, 2019), valid for cotton. Therefore, even if quality cotton is available, it adversely affects the enhancement of the yarn manufacturing industry in Sri Lanka. Other than that, the cotton farmers do not have a favourable socio-economic environment because the import of agrochemicals, fertilizers, etc., needed for cotton cultivation is reduced due to the shortage of dollars, and the materials to produce them locally are unavailable in the country. It may lead to the creation of scarcity of raw materials. Therefore, the foreign currency deficit would negatively influence the association between the quality of raw materials and the advancement of the yarn manufacturing industry in Sri Lanka.

*H5 (b): The foreign currency deficit will weaken the association between skilled labour and the advancement of the yarn manufacturing industry in Sri Lanka.*

The presence of skilled laborers positively impacts the advancement of the yarn manufacturing industry, and worker health is also influenced. The country's current foreign currency deficit is negatively impacting its health sector, and due to the increase in inflation, many industries have cut the incentives given to their employees. However, taking care of employee health is very important in industries. Neglecting it can see skilled laborers to leave their job because job opportunities in foreign countries suit their skills. Then there will be a shortage of skilled laborers to enhance the yarn manufacturing industry. Apart from that, labour migrated from rural areas to towns and created economic problems as residential facilities are expensive in these areas. Owing to the high cost of living concerning their income, female employees leave employment to stay with their families after marriage (Dheerasinghe, n.d.). Due to the foreign currency deficit, the

inflation rate has risen more than in the past, so the laborers' economic problems also increase. Therefore, these reasons show that the foreign currency deficit will weaken the association between skilled labour and the advancement of the yarn manufacturing industry in Sri Lanka.

*H5 (c): The foreign currency deficit would negatively influence the association between the machines & technology and the advancement of the yarn manufacturing industry in Sri Lanka.*

Emerging countries use advanced machinery and automation to generate an extensive range of fibres and yarns for stylish and unique garments. Air conditioners, lighting, office equipment, and various machines (for spinning, knitting, weaving, and sewing) depend on electricity. Most of the time, the amount of electricity used in each machine varies depending on the type of machinery and the factory scale (Farhana et al., 2022). According to the current socio-economic conditions of Sri Lanka, electricity is a big issue. Nowadays, Sri Lanka generates electricity from fuel, so fuel must be imported. Due to the current foreign currency deficit, fuel import is limited, and therefore there are daily power cuts. Consequently, it seems that the lack of electricity needed to operate the machines affects the enhancement of the yarn manufacturing industry. The foreign currency deficit affects the relationship between the advancement of the yarn manufacturing industry and machines. Furthermore, the lack of foreign currency required to purchase modern technology machinery also has a negative impact on the enhancement of this industry.

*H5 (d): The foreign currency deficit will weaken the association between better investors and the advancement of the yarn manufacturing industry in Sri Lanka.*

Regarding foreign investments, investment decisions may consider political stability, the macroeconomic environment, the trade policy regime, the host country's attitudes towards foreign enterprise participation, and stability and clarity of rules governing foreign investment (Athukorala & Menon, 1995). But due to the lack of foreign currency, Sri Lanka's economy is in a risky situation. The tax rates applicable to the manufacturing industries are increasing, and the presence of foreign investors is doubtful. Furthermore, due to the foreign currency deficit resulting in rising inflation, lending to businesses has decreased, and therefore the number of local investors is very low. Because the exchange rate-inflation relationship has vital importance, especially in emerging economies, and there is a significant correlation between the exchange rate and inflation (Ramanayake, 2019). Therefore, it has an adverse effect on the growth of businesses, and the same is true for the yarn manufacturing industry.

### **3) Hypotheses for Moderation Effect of Perspective of the Society:**

*H6 (a): The positive perspective of society will strengthen the association between the quality of raw materials and the advancement of the yarn manufacturing industry in Sri Lanka.*

In Sri Lankan society, the quality of cotton can be prevalent in the country since the farmers are focusing more on cotton cultivation. This study focuses on cotton, a widely used raw material in yarn manufacturing in Sri Lanka. Cotton cultivation is a very important factor in enhancing the yarn manufacturing sector. Due to the abundance of farmers in society to carry out cotton cultivation, competition is significant for quality

cotton production. Therefore, the positive perspective of society will strengthen the association between the quality of raw materials and the advancement of the yarn manufacturing industry in Sri Lanka.

*H6 (b): The positive perspective of society will strengthen the association between skilled labor and the advancement of the yarn manufacturing industry in Sri Lanka.*

The shape of contemporary society is often characterized as a knowledge society, meaning that knowledge has become the major constitutive element of modern societies. Knowledge society shifted from a Fordist phase of capitalism (based on mass production, mass consumption, strong labour unions, and high wages) to a post-Fordist phase (centred on niche production, declining unionization as well as increased female labour-force participation) (Woll, 2006). So, it indicates that society's perspective is positive concerning the labour force. Because it highlighted that especially female labour force participation has increased in society. So, when it comes to the yarn manufacturing industry, the labour force is crucial for the sector's advancement. Moreover, part-time work, fixed-term contracts, and temporary work arrangements are quite widespread in the clothing and textile industry (Woll, 2006). So, because of that, the perspective of society will be positive because nowadays, industries have increased working flexibility. Therefore, the positive perspective of society concerning the yarn manufacturing sector strengthens the association between skilled labour and the advancement of the yarn manufacturing industry in Sri Lanka.

*H6 (c): The positive perspective of society will strengthen the association between machines & technology and the advancement of the yarn manufacturing industry in Sri Lanka.*

In terms of educational knowledge, Sri Lanka ranks high compared to other nations in the world. Due to this educational development, the creation of innovators in the country will encourage manufacturing machines inside the country, which is required to advance the yarn manufacturing sector in Sri Lanka. For instance, due to the development of the R&D sector, people in society, especially school students, can be seen turning to technical education. Therefore, the positive influence of society on the development of machines & technology is significant. Furthermore, the positive influence of society to strengthen the relationship with machines and technology is very important for advancing the yarn manufacturing industry in Sri Lanka.

*H5 (d): The positive perspective of society will strengthen the association between better investors and the advancement of the yarn manufacturing industry in Sri Lanka.*

Better investors are significant for advancing the yarn manufacturing industry. They can be local as well as foreign investors. There should be a positive perspective for this industry in society to create better investors. Therefore, investors come forward more because the community knows the benefits of investing in the yarn manufacturing industry. Even now, local, and foreign investors are present in Sri Lanka's textile and apparel industry, so their perspective is essential for advancing the yarn manufacturing industry in Sri Lanka.

### **C. PLS-SEM**

Collected data was be evaluated using a statistical method called Partial Least Square Structural Equation Modelling (PLS-SEM). Out of the many reasons that qualify PLS-

SEM as the best quantitative approach to answer the research questions, the following are some of the reasons that can be highlighted. First, this technique employs proxies to represent the construct, weighted composites of indicator variables for a particular construct (Hair et al., 2017). Second, PLS-SEM allows the analysis of complex models with direct and indirect effects. Third, when compared to other statistical analysis tools, PLS-SEM suits the complexity of this study's conceptual model. Forth, the effect of moderators can be easily identified through PLS-SEM. Fifth, in case of the sample size decreases, PLS-SEM will give a higher statistical power than other tools, and it provides room to introduce control variables as well. Considering the data's operationalization and past literature, PLS-SEM is the best fit for this study to analyze and validate the above conceptual framework. Moreover, it is essential to mention that this study uses SmartPLS4 as the analyzing tool application to analyze data with PLS-SEM.

#### **IV. DATA COLLECTION**

Previous studies on the same subject, research articles, journals, and books were used to identify the essential factors for advancing the yarn manufacturing sector in Sri Lanka under the current socio-economic context. The theoretical framework for the study has been developed based on the identified factors. An online questionnaire survey was used as the data gathering instrument for collecting primary data. To achieve the objective of the research, data was collected from the people working in the yarn manufacturing sector, people in the textile industry, and people in society who are enthusiastic about the yarn manufacturing sector in Sri Lanka, such as students who are studying fashion designing and textile engineering, and scholars who are engaging in this area. Responses from around 259 respondents were collected.

According to this research study, non-probability sampling is suitable, and the sampling method would be a combination of convenience and snowball sampling. A convenience sample includes the individuals who are most accessible to the researcher. Acquiring preliminary data is an easy, quick, and affordable method. If the population is hard to reach, snowball sampling can be used to find participants by using existing participants as recruiters. Due to resource constraints, a combination of convenience and snowball sampling, which are non-probability sampling techniques, were selected considering the convenient accessibility to the researcher. As in Figure 3, according to (Hair et al., 2017), based on the proposed research model, considering 4 (maximum) independent variables and two moderating variables, the structural model needs a sample size of 130 observations to achieve a statistical power of 80% for detecting  $R^2$  values of at least 0.1, with 5% probability of error.

**Figure 3. Sample Size Recommendation in PLS-SEM**

Exhibit 1.7 Sample Size Recommendation in PLS-SEM for a Statistical Power of 80%												
Maximum Number of Arrows Pointing at a Construct (Number of Independent Variables)	Significance Level											
	10%				5%				1%			
	Minimum R <sup>2</sup>				Minimum R <sup>2</sup>				Minimum R <sup>2</sup>			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	72	26	11	7	90	33	14	8	130	47	19	10
3	83	30	13	8	103	37	16	9	145	53	22	12
4	92	34	15	9	113	41	18	11	158	58	24	14
5	99	37	17	10	122	45	20	12	169	62	26	15
6	106	40	18	12	130	48	21	13	179	66	28	16
7	112	42	20	13	137	51	23	14	188	69	30	18
8	118	45	21	14	144	54	24	15	196	73	32	19
9	124	47	22	15	150	56	26	16	204	76	34	20
10	129	49	24	16	156	59	27	18	212	79	35	21

Source: Cohen (1992): A Power Primer. Psychological Bulletin 112: 155-159.

**IV. RESULTS AND DISCUSSION**

**A. Preliminary Data Analysis**

Before examining the measurement and structural models of the PLS-SEM, a preliminary analysis of the data was conducted to guarantee that minimal quality standards were reached after empirical data were gathered utilizing the online survey instrument in the research contexts. The initial data analysis involved checking for missing data/values, identifying, and removing suspicious response patterns and extreme outliers, evaluating data distribution, and assessing response rates to determine the data quality and appropriateness of the measurement items. After the data were screened, two hundred fifty-nine survey responses were considered for further study. According to the literature, normal Skewness and Kurtosis values should be between -1 and + 1, and all data were normally distributed. The study could be assessed using the PLS-SEM approach since PLS-SEM is a nonparametric statistical method and does not make any distributional assumptions.

**B. Assessing Measurement Model**

All constructs and the associated measurement items were evaluated for internal consistency reliability, convergent validity, and discriminant validity before evaluating the structural model to ensure they fulfilled the requirements for measurement quality. The measurement model has been examined for only reflective variables as the model included only reflective typed indicators.

**1) Internal Consistency:** The Cronbach alpha value of 0.5 to 0.9 is adequate to guarantee internal consistency and reliability. As shown in Table 3, five out of the seven constructs in the research had Cronbach’s alpha values above 0.7, and the other two had Cronbach’s alpha values of 0.601 and 0.538, indicating that the internal consistency of most of the constructs is in a satisfactory level. Moreover, according to the literature, internal consistency and reliability are satisfied by composite reliability scores of 0.6 to 0.7 in exploratory research and 0.7 to 0.9 in more advanced research. As can be seen in Table 3, most of the constructs used in this study had reliability scores over 0.7, indicating that most of the constructs are at a good level of internal consistency and reliability.

**Table 3. Summary of Results from Cronbach’s Alpha and Composite Reliability Values**

Latent Constructs	Cronbach's Alpha	Composite Reliability
Quality of Raw Materials (QRM)	0.831	0.884
Skilled Labor (SL)	0.89	0.919
Machines & Technology (MT)	0.601	0.755
Better Investors (BI)	0.766	0.843
Foreign Currency Deficit (FCD)	0.779	0.846
Perspective of the Society (PS)	0.741	0.828
Advancement of the Yarn Manufacturing Industry in Sri Lanka (AYM)	0.538	0.717

Source: Authors' compilation.

**2) Convergent Validity:** Convergent validity is supported when each item has outer loadings above 0.70 and when the average variance extracted (AVE) for each construct is 0.50 or above. Table 4 demonstrates the factor loading values for each indicator. Some values exhibit a high convergent validity with values greater than 0.7 conventionally accepted limit. The rest are above or almost 0.4, which is still acceptable based on the literature. Table 4 shows that all the constructs' AVE values, except skilled labour and foreign currency deficit, are greater than 0.4. Although the Average Variance Extracted (AVE) is greater than 0.5, 0.4 is also acceptable. Fornell and Larcker said that the construct's convergent validity is still sufficient if AVE is less than 0.5 but composite reliability is higher than 0.6. Since the composite reliability value of skilled labour and foreign currency deficit are above 0.6, the construct can be accepted even if its AVE value is less than 0.4. The outer loading of one indicator (SL5) was not sufficient and hence was eliminated to increase the internal consistency reliability of the model. The convergent validity and the internal consistency reliability were analysed after these adjustments, and the values were satisfactory.

**Table 4. Summary of Results from Outer Loadings and AVE Values**

Latent Constructs	Item	Outer Loading	AVE
Quality of Raw Materials (QRM)	QRM1	0.752	0.492
	QRM2	0.737	
	QRM3	0.711	
	QRM4	0.69	
	QRM5	0.61	
Skilled Labor (SL)	SL1	0.607	0.387
	SL2	0.681	
	SL3	0.675	
	SL4	0.804	
Machines & Technology (MT)	MT1	0.766	0.521
	MT2	0.623	
	MT3	0.62	
	MT4	0.793	
	MT5	0.785	

Latent Constructs	Item	Outer Loading	AVE
Better Investors (BI)	BI1	0.808	0.521
	BI2	0.811	
	BI3	0.863	
	BI4	0.834	
	BI5	0.851	
Foreign Currency Deficit (FCD)	FCD1	0.672	0.386
	FCD2	0.692	
	FCD3	0.631	
	FCD4	0.465	
	FCD5	0.62	
Perspective of the Society (PS)	PS1	0.575	0.527
	PS2	0.721	
	PS3	0.707	
	PS4	0.809	
	PS5	0.795	
Advancement of the Yarn Manufacturing Industry in Sri Lanka (AYM)	AYM1	0.804	0.611
	AYM2	0.86	
	AYM3	0.828	
	AYM4	0.843	
	AYM5	0.522	

Source: Authors' compilation.

**3) Discriminant Validity:** All the loadings of the indicators considered in this study are greater than their corresponding cross-loadings, indicating that all the constructs were distinct from other constructs by empirical standards.

### C. Assessing Structural Model

The structural model assessment results have provided answers to the research questions based on the level of influence of two moderators, namely the foreign currency deficit and perspective of society, on the relationship between essential factors and the advancement of the yarn manufacturing sector in Sri Lanka. The assessment evaluated the strength and significance of this relationship.

**1) Testing Hypothesized Effect of Direct Associations:** The path coefficients ( $\beta$ ), confidence intervals (CI), t-values, and p-values used to evaluate the direct correlations are shown in Table 5. The results show that all the hypothesized positive relationships were supported except H2. Thus, the results suggest that three of the selected independent variable factors positively impact the advancement of the yarn manufacturing industry in Sri Lanka without considering moderator effects.

**Table 5. Results of Direct Associations**

Direct effect of variables	$\beta$	95% CI	t value	p-value
QRM → AYM (H1)	0.055	[0.002,0.107]	2.024	0.043



SL→AYM (H2)	-0.024	[-0.065,0.015]	1.198	0.213
MT→AYM (H3)	0.054	[0.014,0.099]	2.488	0.013
BI→AYM (H4)	1.041	[0.986,1.093]	38.54	0

Source: Authors' compilation.

Although the literature shows that skilled labour takes place in a prominent position when advancing the yarn manufacturing sector. But this study dictates that skilled labour negatively influences the advancement of the yarn manufacturing sector in Sri Lanka. However, there may be challenges regarding the availability of skilled labour in specific regions or sectors or issues related to skills mismatches, where the skills possessed by workers may not align with the needs of the industry. It might be essential to allocate resources towards training and education initiatives to ensure the employees possess the necessary skills and expertise to fulfil the industry's demands.

#### **D. Model Fit Evaluation**

To access the model, fit of the selected independent variables [i.e., Quality of Raw Materials (QRM), Skilled Labor (SL), Machines & Technology (MT), and Better Investors (BI)] on the dependent variable [i.e., Advancement of the Yarn Manufacturing Industry in Sri Lanka (AYM)] we assessed the following statistics. 01. Inner VIF values, 02. Multiple regression (i.e.,  $R^2$  value), 03. Effect size  $f^2$  for all direct associations. The following sections outline details concerning the above.

**1) Inner VIF values:** Primarily the structural model was examined for collinearity issues by examining the VIF values of all sets of predictor constructs in the structural model. Table 6 indicates inner VIF values.

**Table 6. Inner VIF Values**

Associations	VIF
BI → AYM	1.951
MT → AYM	2.056
QRM → AYM	1.702
SL → AYM	1.401

Source: Authors' compilation.

As seen in the above table 6, all VIF values are below the threshold of 5. Thus, collinearity among the predictor constructs is not a critical issue in the structural model.

**2) Multiple Regression Analysis:** The  $R^2$  value for the model is 0.973. This indicates that the independent variables – Quality of Raw Materials (QRM), Machines & Technology (MT), and Better Investors (BI) explain 97.3% variation of the dependent variable – Advancement of the Yarn Manufacturing Industry in Sri Lanka (AYM). The findings concerning the  $R^2$  value claim that the stated three independent variables describe a substantial variation of the endogenous latent variable – Advancement of the Yarn Manufacturing Industry in Sri Lanka (Hair et al., 2011; Henseler et al., 2009).

**3) Effect Size  $f^2$  for Direct Associations:** In addition to evaluating the  $R^2$  values of all endogenous constructs, the change in the  $R^2$  value when a specified exogenous construct is omitted from the model, can be used to evaluate whether the omitted construct has a substantive impact on the endogenous constructs. This measure is referred to as the  $f^2$ , effect size. The table 7 below outlines the effect sizes.

**Table 7. Effect Size  $f^2$  for Direct Associations**

Associations	$f^2$
BI → AYM	0.567
MT → AYM	0.334
QRM → AYM	0.216
SL → AYM	0.002

Source: Authors' compilation.

As a general guideline, effect size values ( $f^2$ ) of less than 0.02 indicate no effect (Hair, et al., 2021). Thus, results indicate that Quality of Raw Materials (QRM), Machines & Technology (MT), and Better Investors (BI) have a substantive impact on the endogenous construct – Advancement of the Yarn Manufacturing Industry in Sri Lanka. However, effect size values ( $f^2$ ) confirm that Skilled Labor (SL) does not affect the advancement of the yarn manufacturing sector of the country.

**4) Testing Hypothesized Effect of the Foreign Currency Deficit Moderator:** The researcher considered the foreign currency deficit a continuous moderator variable and was assessed accordingly. Table 8 demonstrates the path coefficient ( $\beta$ ), confidence interval, and t and p values required to assess the moderator effect of foreign currency deficit on the identified variables. As given in Table 8, the moderation effect of foreign currency deficit on the quality of raw materials, skilled labour, machines & technology, and better investors had no significant impact on the advancement of the yarn manufacturing industry in Sri Lanka. Hence the hypotheses H5(a), H5(b), H5(c), and H5(d) were rejected.

**Table 8. Results for Foreign Currency Deficit**

Direct effect of variables	$\beta$	95% CI	t value	p-value
FCD x QR→AYM (H5a)	-0.005	[-0.04,0.028]	0.263	0.793
FCD x SL→AYM (H5b)	-0.02	[-0.054,0.016]	1.152	0.25
FCD x MT→AYM (H5c)	0.048	[-0.002,0.1]	1.839	0.066
FCD x BI→AYM (H5d)	0.027	[-0.013,0.07]	1.265	0.206

Source: Authors' compilation.

Although the literature supports hypotheses H5(a), H5(b), H5(c), and H5(d), the results of the study did not agree with these hypotheses. Thus, a foreign currency deficit does not change the strength or direction of the relationships between the quality of raw materials, skilled labour, machines & technology, better investors, and the advancement of the yarn manufacturing industry in Sri Lanka.

However, in a practical approach, the Sri Lankan government and industry stakeholders must collaborate and find ways to tackle the foreign currency deficit. They

must ensure adequate funding to invest in raw material quality and develop skilled labour, machines, and technology.

**5) Testing Hypothesized Effect of the Perspective of the Society:** The researcher considered the perspective of society as a continuous moderator variable and hence was assessed accordingly. Table 9 demonstrates the path coefficient ( $\beta$ ), confidence interval, and t and p values required to assess the moderator effect of the perspective of the society on the identified variables. As given in Table 9, the moderation effect of the perspective of the society on the quality of raw materials, skilled labour, machines & technology, and better investors had not shown any significant impact on the advancement of the yarn manufacturing industry in Sri Lanka. Hence the hypotheses H6(a), H6(b), H6(c), and H6(d) were rejected.

**Table 9. Results for Perspective of the Society**

Direct effect of variables	$\beta$	95% CI	t value	p-value
PS x QRM→AYM (H6a)	-0.031	[-0.076,0.018]	1.321	0.186
PS x SL→AYM (H6b)	0.012	[-0.029,0.044]	0.624	0.533
PS x MT→AYM (H6c)	-0.026	[-0.07,0.013]	1.232	0.218
PS x BI→AYM (H6d)	0.003	[-0.034,0.04]	0.141	0.888

Source: Authors' compilation.

Although the available literature supports hypotheses H6(a), H6(b), H6(c), and H6(d), the results of the study did not agree with these hypotheses. Hence, the perspective of the society does not change the strength or the direction of the relationships between the quality of raw materials, skilled labour, machines and technology, better investors, and the advancement of the yarn manufacturing industry in Sri Lanka.

## V. CONCLUSION

This study examined how the expected outcomes can be achieved in the advancement of the yarn manufacturing sector in Sri Lanka. This identified four key pillars that will facilitate the advancement of the yarn manufacturing industry in Sri Lanka and recognized that the foreign currency deficit and the society's perspective moderate the relationship between these four key pillars and the advancement of the yarn manufacturing industry in Sri Lanka. The study presented the relationships as a conceptual framework through a theoretical view based on past literature. However, this study shows that only three key pillar affects the advancement of the yarn manufacturing sector in Sri Lanka. There can be different factors other than those mentioned in past scholarly work affecting the advancement of the yarn manufacturing industry in Sri Lanka.

Policymakers and industry players must prioritize the raw materials of the yarn manufacturing sector, notably cotton, which often receives inadequate attention. This oversight significantly impacts the sector's progress. Both public and private sectors should now focus on bolstering the cotton industry to advance yarn manufacturing in Sri Lanka. The study also highlights the need for updated machinery and technology in the sector. Presently, manufacturers lack state-of-the-art equipment, which hinders progress given current economic conditions. The government could play a vital role by facilitating

the sector with subsidized bank loans or financial support for acquiring necessary machinery. Additionally, the industry requires increased investment, given its small to medium scale. Despite this, it holds substantial potential in the global market. To address this, policymakers can encourage foreign investment, possibly from established players like Chinese manufacturers, to elevate the industry from its current scale to a larger, more competitive one.

So, this concluded that the implications of the moderate variables do not have a great implication on this. So, these are not crucial elements that condition these factors. But instead, the policymakers and the industry practitioners must focus on the quality of the raw materials, machines and technology, and better investors.

This research has a few limitations. While the study derived four critical factors influencing the progression of Sri Lanka's yarn manufacturing industry from the literature review, there may be inherent biases based on individual perspectives and interests. The PLS-SEM analysis relied on data gathered through a questionnaire administered to employees in both the yarn manufacturing sector and textile industry in Sri Lanka, potentially introducing human biases or judgments. Moreover, the outcomes of the PLS-SEM analysis could potentially evolve with the inclusion of new factors. This study primarily drew data from small and medium-scale yarn manufacturing and textile firms, potentially limiting its scope. Future research could benefit from a larger and more diverse sample size, encompassing employees from all scales of yarn manufacturing and textile enterprises. This approach would enable a comprehensive comparison of factors crucial for advancing the sector to a more competitive position.

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