

**THE IMPACT OF GREEN MANUFACTURING PRACTICES ON PERCEIVED
FINANCIAL PERFORMANCE OF THE LISTED MANUFACTURING COMPANIES
IN SRI LANKA**

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Abstract

The main purpose of this study is to examine the relationship between green manufacturing practices and perceived financial performance of listed manufacturing companies in Sri Lanka. Thirty- six listed manufacturing companies in Colombo Stock Exchange (CSE) were selected based on the highest market capitalization as at 4th April 2018. This study assessed four green manufacturing practices; green products, green process, green use and green end life management and how those practices impact the perceived financial performance of the listed manufacturing companies in Sri Lanka. It was found that all the green manufacturing practices considered in this study affect the perceived financial performance of the listed manufacturing companies in Sri Lanka. Further, a positive relationship found between green manufacturing practices and perceived financial performance of the listed manufacturing companies in Sri Lanka. This study is expected to contribute all the society, decision makers and policy makers to identify regarding the financial performance and green practices in organization.

Keywords: Perceived Financial Performance, Green Manufacturing Practices, Manufacturing Industry

1 Introduction

In relation to the Sri Lankan economy, the manufacturing industry plays a major role that needs more emphasis on development of the industry further. There are 41 companies listed on Colombo Stock Exchange in the manufacturing sector as at 04th April 2018. Rising demand and expectations of stronger sales have led to sustain growth in Sri Lankan manufacturing sector over the past few years. The latest Purchasing Managers' Index (PMI) released by Central Bank of Sri Lanka has shown continued expansion in manufacturing which stood at 56.2 points in January. The existing literature suggests that to boost and maintain growth and performance, organizations should adopt green manufacturing practices. Manufacturing firms are more likely to face the increased pressure from public than other sector firms and required green manufacturing practices to reduce such problems and improve firm financial performance. The organizations that use manufacturing practices shall use the renewable energy systems and clean technology. Green manufacturing should reduce environmental pollution and waste by minimizing harmful resource usage, recycling and reusing. The green manufacturing practices focus not only about the design and development of the product but also the maintenance and disposal of the product. Hence, green manufacturing practices guide manufacturers to focus on their products from cradle to grave.

Developing economies including Sri Lanka, place greater emphasis and focus on green manufacturing practices and its impact to the financial performance in the face of increased pressure from the public to ensure social and environmental protection. Meanwhile the researchers have observed a dearth of studies that examines the relationship between green manufacturing practices and financial performance in the manufacturing industry all over the world. Thus the problem addressed in this is whether green manufacturing practices influence perceived financial performance in the manufacturing industry. Accordingly this research addresses two main objectives namely; to identify the existing green manufacturing practices in the listed manufacturing companies in Sri Lanka and to examine the relationship between green manufacturing practices and perceived financial performance in the manufacturing industry. The findings of our study are expected to be useful to all stakeholders of the Sri Lankan manufacturing sector including investors, policy makers, regulators and society as a whole in decision making, improving and implementing policies to establish green manufacturing practices within the firms and there by influence the firm financial performance.

The remaining sections of this study are structured as follows. The next section discusses the existing literature followed by a discussion of the approach, sample and the analysis in section three. Section four discusses the key findings of the study. The final section presents the conclusion and limitations of our study.

2 Literature review

2.1 Introduction

Main objective of this chapter is to review previous research papers with the purpose of identifying empirical evidence for the relationship between independent variable (Green Manufacturing Practices) and dependent variable (Perceived Financial Performance of listed manufacturing companies). Further, deeply understanding about green manufacturing practices and financial performance can be obtained through different dimensions. Other purpose of this chapter is getting a sound understanding about variables, sample size, methods used to collecting and analyzing data through previous researches.

2.2 Green manufacturing practices

Today green manufacturing has become common jargon used by almost one-third of manufacturing specialists and researchers (Dubey & Ali, S 2015). Green Manufacturing has emerged in the last few years and covers all phases of product's life cycle from design, production and distribution phases to the use of products by the end users and its disposal at the end of product's life cycle (Tagalpallewar & Sunnapwar 2017). Green manufacturing is a method for manufacturing that minimizes waste and pollution for all industries. It slows down the depletion of natural resources as well as lowers the extensive amounts of trash that enter landfills. Its emphasis is on reducing parts, rationalizing materials, and reusing components, to help to build products more efficiently (Shrivastava & Shrivastava, RL 2017) and also it describes a problem of global warming, gas, water and other wastages emissions at the time of cement manufacturing and put forward a path that enables decision makers to assess the perception of GM in their organization and in prioritizing GM efforts. It is a term used for describing practices that do not harm the environment during any part of the manufacturing and includes recycling, conservation, waste reduction management, environmental protection, regulatory compliance, pollution control and allied issues (Seth & Shrivastava 2016). Hence, green manufacturing practices has been identified as one of the most

important parts in manufacturing activities in almost all the countries. As a developing country green manufacturing is important to Sri Lanka because it minimizes the wastage and pollution and on the other hand it builds products more effectively.

Previous researchers have identified key green manufacturing drivers to measure the green manufacturing practices. Followings are some of them.

1. Green marketing, together with eco-design and green purchasing (Zhu, Sarkis & Geng 2005)
2. Internal Environmental Management, Green Information System, Environmental Performance green design and eco purchasing (Green, J, Zelbst, Meacham & Bhadauria 2012)
3. Green reputation through environmental disclosure practices (Longoni & Cagliano 2018)
4. Eco-friendly design, raw materials, packaging, distribution and even reuse/retreatment after the useful life of a product (Seth & Srivastava 2016)

However, in this research green product, green process, green use and green end of life management can be used as drivers to measure the green manufacturing practices as they have directly affected to measure the green manufacturing practices in previous researches.

2.3 Organizational sustainability performance

The term “sustainability” was proposed by Elkington (1994) and it is defined as the expansion of the corporate perspective which considers environmental, social and economic aspects. According to Rashid, Sakundarini, Ghazilla & Thurasamy (2017) sustainability performance can be defined under following categories.

- 1) Environmental performance: Environmental performance is highly dependent on the use of efficient and cleaner sustainable energy resources.
- 2) Economic performance: Economic performance is measured on the basis of economic growth while protecting the environment and improving the quality of life. This can be divided into two groups.
 - Economic outcomes: Economic outcomes are financial benefits that reflect the whole organization and these outcomes are mostly related to a reduction in industrial costs

- Operational outcomes: The adoption of sustainable manufacturing can serve as a driver to improve operational efficiency, which will increase the potential long-term profitability.

3) Social performance: Social performance refers to the organization's actual achievement in improving and maintaining the quality of life without neglecting environmental aspects.

Although sustainability performance considers all these three aspects, manufactures normally perform their manufacturing activities based only on economic performance. If there is no any economic (financial) advantage, any organization does not follow green manufacturing practices even though it fulfills social and environmental performances. Hence, it is better to measure financial performance resulted of the green manufacturing practices because when this aspect is affected positively by the green manufacturing practices, manufactures tend to follow this concept and after other both aspects are fulfilled automatically.

Commonly financial performance measure emphasizes return on sales (ROS), return on assets (ROA), return on equity (ROE), and return on invested capital (ROIC) (Chen, Ngniatedema & Li, S 2018).

2.4 Relationship between green manufacturing practices and financial performance

According to the previous researches, it can be identified that three types of relationships between green manufacturing practices and financial performance: positive relationship, negative relationship and neutral (there is no any relationship).

Positive relationship between green manufacturing practices and financial performance

Younis, Sundarakani, & Vel, P (2016) said that as a green manufacturing driver only green purchasing plays a role in improving the economic performance. Effective implementation of GM will improve organization performance in terms of product cost and quality. For effective implementation of GM, management should not ignore development of people, product and processes (Digalwar, Mundra, Tagalpallewar & Sunnapwar (2017). According to Green, J, Zelbst, Meacham, & Bhadauria (2012) the adoption of green supply chain manufacturing practices by manufacturing organizations leads to improved environmental performance and economic performance, which, in turn, positively impact operational performance. Operational performance enhances organizational performance. Rashid, A, Sakundarini, Ghazilla, Thurasamy (2017) has found that manufacturing process is the manufacturing stage that gives the most impact on the improvement of sustainability performance. Hence, it is concluded that manufacturing

companies in Malaysia are highly focused on the production bound when implementing sustainable manufacturing practices. In here, green manufacturing is a part of sustainability manufacturing. According to Longoni, Cagliano, & Milano (2018) shows that the more inclusive the environmental disclosure practices the greater and positive is the impact on financial performance in presence of GSCM practices. Chen, Ngniatedema, & Li, S (2018) show that green initiatives have a positive impact on green performance, which in turn has a positive impact on financial performance. Environmental regulations is fundamental to achieve not only a reduction of ecological damage, but also to overall economic performance such as cost saving, quality, reliability, energy efficiency etc.(Cosimato, Troisi & Fisciano 2015)

No Relationship between green manufacturing practices and financial performance

Zhu, Sarkis & Geng (2005) were finding a way to increase competitiveness, marketing and performance of the organization through green manufacturing. However, they found that there was no strong relationship between the green manufacturing practices and financial performances.

2.5 Importance of green manufacturing practices for manufacturing companies

Currently, manufacturing industry plays a vital role in the world coincide the greater development of technology. The activities of the manufacturing industry have significantly contributed towards strengthening the economy of many nations including developing countries, and they play a vital role in the global economy by supplying goods and services. However, in the absence of positive environmental initiatives, manufacturing activities will lead to the creation of enormous amounts of wastes, exploitation of natural resources as well as overconsumption of energy (Rashid, A, Sakundarini, Ghazilla, & Thurasamy 2017). This calls for the development and implementation of environmental initiatives in the manufacturing industry. Previous researchers has identified this issue and they have done several researches on this topics based on some manufacturing industries that highly affect to the natural environment. Shrivastava and Shrivastava, RL (2017) describe a problem of global warming, gas, water and other wastages emissions at the time of cement manufacturing and put forward a path that enables decision makers to assess the perception of green manufacturing in their organization and in prioritizing green manufacturing efforts.

Seth, Shrivastava and Shrivastava, RL (2016) have done the first research on Indian Cement Industry because of their highly environment unfriend situation. Prasad, Khanduja, & Sharma have done an empirical study on green practices in the foundry industry in 2016. All of these research papers show the importance of the green manufacturing performance for manufacturing companies.

According to the research paper findings, it is very important to the society to doing research on manufacturing sector in developing country as Sri Lanka. Hence, it is expected to find the relationship of the green manufacturing practices and perceived financial performance of listed manufacturing companies in Sri Lanka with the purpose of giving valuable information to the society to improve the environmental awareness through this research.

3 Research methods

This section includes how the research was carried out in terms of research design, data collection method, sampling design, conceptual framework and operationalization and validation measurement.

3.1 Research approach

Quantitative Approach

Justification:

This research study looks at the relationship between green manufacturing practices and perceived financial performance. Therefore, by performing this kind of research study, it gives the possibility to identify what sort of relationship exists and it can be identified through the quantitative approach. The researcher is trying to test the hypotheses that were developed to explain the association among Independent and Dependent variables. Therefore, appropriate research approach of the study could be identified as the quantitative approach.

Research setting

Because of the correlational nature of the study this can be carried out in normal environment where work proceeds normally by giving necessary freedom to the respondents who answer the questionnaire. Therefore, the study will be carried out under non-contrived settings. The respondents will be asked to fill the questionnaire in a more natural setting without any interference by the researcher with only minimal interference to explain how the questionnaire should be filled.

Data sources used for the study: primary and secondary

This study was based on both primary and secondary data. The data necessary for testing the hypothesis will be basically on primary data and the definitions and discussions of concepts were on the literature, which included the books, periodicals and journals.

In this research, as primary data collection method, a self-administered questionnaire was used. This type of a questionnaire is completed by the respondent himself once we distributed to the company's operational managers and will be collected once they finish answering the questionnaires.

As secondary data collection methods, Emerald, Research Gate and other databases like Google Scholar were used to obtain data due to cost and time saving as well as easy accessibility to it. Published annual reports of the selected companies downloaded from the Colombo Stock Exchange were used to have better understanding and to gather firm's performance.

3.2 Questionnaire design

A self-administered questionnaire is used for the survey purposes of this research. In designing the questionnaires, extra caution has been taken for better clarification of each question. Besides, the questionnaire is formed through the adaptation of questionnaires from journals written by previous researchers.

The questions used in the questionnaire are fixed alternative questions. As a result through this questionnaire, this research can get direct response and feedback from the respondents. Thus, more accurate information will be collected from the respondents.

As the layout of the questionnaire, a brief introduction and purpose of conducting this research are attached at the beginning. The survey instrument was divided into two sections. Section one includes demographical criteria.

- **Age** - Age level was divided into five categories as below 20, 21-30, 31-40, 41-50, above 50.
- **Level of education** - This was categorized as, passed up to G.C.E (O/L), passed up to G.C.E (A/L), graduate and up to professional or other qualification.
- **Experience** – Level of experience was categorized as below 3 years, 3-5, 5-8, 8-12 and more than 12 years.

Section two includes 27 items which are used to measure predictors with a 5 point Likert Scale. (Where 1=strongly disagree, and 5=strongly agree) (Appendix 2)

3.3 Population and sample

The population for this research consists of all companies listed in the Colombo Stock Exchange under manufacturing sector. As of April 2018, there were 41 listed companies under manufacturing sector of which top 36 were selected based on the market capitalization as at 04th April 2018 (Appendix 1)

The unit of analysis is individual level and in this study unit of analysis is the selected company’s operation manager or finance manager who will be answering the questionnaire provided.

3.4 Conceptual framework

The conceptual diagram is shown in Figure 1 below based on the literature review (see section 2)

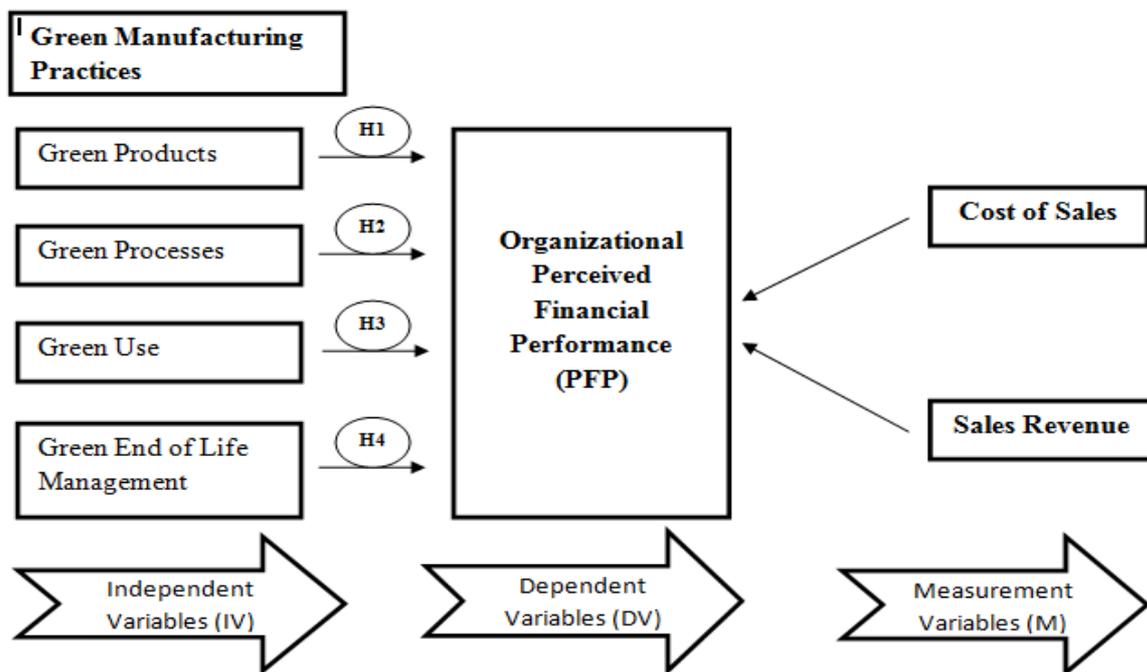


Figure 1 : Conceptual framework (Developed by researchers)

3.5 Operationalization

The following table elaborates on the operationalization of the variables stated in this study.

Table 1: Operationalization

Variables	Measurement	Sources	Type
Green Products (GPRODUCT_{i,t})	Green Products, Green processes, Green Use, Green End of Life Management	Silvia Cosimato, Orlando Troisi, (2015), Abhijeet K. Digalwar, NidhiMundra, Ashok R. Tagalpallewar, Vivek K.Sunnapwar, (2017) Ngniatedema, Li, & Illia, (2014)	Independent
Green Processes (GPROCESS_{i,t})	Environmental impact score	Silvia Cosimato, Orlando Troisi, (2015), Abhijeet K. Digalwar, NidhiMundra, Ashok R. Tagalpallewar, Vivek K.Sunnapwar, (2017) Ngniatedema, Li, & Illia, (2014)	Independent
Green Use (GUSE_{i,t})	Public perception of a firm's attitudes, Actions toward , environmental issues	Abhijeet K. Digalwar, NidhiMundra, Ashok R. Tagalpallewar, Vivek K.Sunnapwar, (2017) Ngniatedema, Li, & Illia, (2014)	Independent
Green End of Life Management (GEOLMGT_{i,t})	Public perception of a firm's attitudes, Actions toward , environmental issues	Abhijeet K. Digalwar, NidhiMundra, Ashok R. Tagalpallewar, Vivek K.Sunnapwar, (2017) Ngniatedema, Li, & Illia, (2014)	Independent
Organizational Perceived Financial Performance (FPF_{i,t})	Margin improvement (pricing power, cost saving) Revenue growth (Market share, New market entry)	Silvia Cosimato, Orlando Troisi, (2015), Abhijeet K. Digalwar, NidhiMundra, Ashok R. Tagalpallewar, Vivek K.Sunnapwar, (2017)	Dependent

3.6 Hypotheses

The following four hypotheses were derived in order to investigate the impact of green manufacturing practices on organizational perceived financial performance.

H1: There is a significant impact of green products on perceived financial performance

H2: There is a significant impact of green processes on perceived financial performance

H3: There is a significant impact of green use on perceived financial performance

H4: There is a significant impact of green end of life management on perceived financial performance

3.7 Analytical strategies

Using the SPSS (Statistical Package for Social Sciences) version 22 software, the following will be the test types that will be used to analyze the data collected under the study. The techniques are intended to use to test the hypothesis, solve research question and achieve goals and objectives of this study

- **Reliability analysis** – Checks the consistency and reliability of the construct
- **Correlation analysis** -Explains the relationship between variables.
- **Multiple linear regression analysis**- Evaluates the effect of two or more independent variables on a single dependent variable. The regression model that will be applied is as follows:

$$PFPI_{i,t} = \alpha + \beta_{GPRODUCT} i,t + \beta_{GPROCESS} i,t + \beta_{GUSE} i,t + \beta_{GEOLMGT} i,t + \epsilon_{i,t}$$

Definitions of each variable are mentioned in the operationalization table. The findings obtained by using above analysis strategies are discussed in the next section.

- **Simple linear regression analysis** - Evaluates the effect of each independent variable on a single dependent variable. The regression model that will be applied is as follows:

$$PFPI_{i,t} = \alpha + \beta_{GPRODUCT} i,t + \epsilon$$

$$PFPI_{i,t} = \alpha + \beta_{GPROCESS} i,t + \epsilon$$

$$PFPI_{i,t} = \alpha + \beta_{GUSE} i,t + \epsilon$$

$$PFPI_{i,t} = \alpha + \beta_{GEOLMGT} i,t + \epsilon$$

- **Factor Analysis** - Summarizes information contained in a large number of original variables into a smaller set of new composite dimensioned with a minimum loss of information.

4 Data analysis & result

4.1 Reliability analysis

To measure the reliability of the measurement and to verify the internal consistency of the constructs, Cronbach's alpha was used as displayed in the Table 2. The result indicates that all the values are above 0.6 and this confirms that the construct is acceptable.

Table 2: Reliability analysis

Case Processing Summary				Reliability Statistics	
		N	%		
Cases	Valid	36	100.0	Cronbach's alpha	N of Items
	Excluded ^a	0	.0		
	Total	36	100.0		

a. Listwise deletion based on all variables in the procedure.

4.2 Correlation analysis

Pearson's bivariate correlation indicates the relationship between two variables. Table 3 depicts the result of this bivariate analysis, which enables identifying the green manufacturing practices which have a significant systematic relationship with the level of perceived financial performance.

It is noted that the green product and green use show a systematic (moderate) significant ($p < 0.01$) positive relationship with the perceived financial performance. It indicates that when the firm implements green product and green use, the financial performance is more likely to increase.

Moreover, green process and green end of life management have systematic (weak) significant ($p < 0.05$) positive relationship with the perceived financial performance. It is clear that when green process and green end of life management are implemented, it positively affects the firm perceived financial performance.

Table 3: Correlation analysis

		Correlations				
		GPRODUCT	GPROCESS	GUSE	GEOLMGT	PFP
GPRODUCT	Pearson Correlation	1	.386 [*]	.557 ^{**}	.200	.502 ^{**}
	Sig. (2-tailed)		.020	.000	.243	.002
	N	36	36	36	36	36
GPROCESS	Pearson Correlation	.386 [*]	1	.557 ^{**}	.031	.377 [*]
	Sig. (2-tailed)	.020		.000	.856	.023
	N	36	36	36	36	36

GUSE	Pearson Correlation	.557**	.557**	1	.285	.469**
	Sig. (2-tailed)	.000	.000		.092	.004
	N	36	36	36	36	36
GEOLMGT	Pearson Correlation	.200	.031	.285	1	.359*
	Sig. (2-tailed)	.243	.856	.092		.031
	N	36	36	36	36	36
PFP	Pearson Correlation	.502**	.377*	.469**	.359*	1
	Sig. (2-tailed)	.002	.023	.004	.031	
	N	36	36	36	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

4.3 Multiple linear regressions analysis

Multiple regressions analysis was used to test the relationship between the independent variables and the dependent variable because it assists to analyze the relationship between a single dependent variable (**PFP**) and several independent variables (**GPRODUCT**, **GPROCESS**, **GUSE**, and **GEOLMGT**).

When green product, green process, green use, and green end of life management are considered altogether the table depicts that the overall model is valid ($p < 0.05$).

However, as shown in the coefficient table the independent variables are not significant in an individual basis.

Table 4: Multiple linear regression analysis

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.577	4	.644	4.644	.005 ^b
	Residual	4.300	31	.139		
	Total	6.878	35			

a. Dependent Variable: PFP

b. Predictors: (Constant), GEOLMGT, GPROCESS, GPRODUCT, GUSE

Coefficients ^a					
Model		Unstandardized Coefficients		Standardized	Sig.
		B	Std. Error	Coefficients	
1	(Constant)	.142	.922		.878
	GPRODUCT	.452	.248	.314	.078
	GPROCESS	.187	.181	.180	.309
	GUSE	.113	.184	.121	.546

GEOLMGT	.220	.129	.256	1.704	.098
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a. Dependent Variable: PFP

4.4 Simple linear regression

Simple linear regression analysis were conducted with four explanatory variables from green manufacturing practices and firm perceived financial performance as responsive variable to test the relationship between each independent variable and the dependent variable.

Green product

Table 5 summarizes the relationship between green product (**GPRODUCT**) and perceived financial performance (**PFP**). The analysis shows the significant relationship between green product and perceived financial performance ($p < 0.05$).

Table 5: simple linear regression analysis – green product ANOVA^a

Model		Sum of Squares	df	Mean Square	Sig.
1	Regression	1.735	1	1.735	11.470
	Residual	5.143	34	.151	.002 ^b
	Total	6.878	35		

a. Dependent Variable: PFP

b. Predictors: (Constant), GPRODUCT

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	.965	.863		1.118
	GPRODUC	.723	.213	.502	3.387
	T				

a. Dependent Variable: PFP

Green process

Table 6 summarizes the relationship between green process (**GPROCESS**) and perceived financial performance (**PFP**). The analysis shows the significant relationship between green process and perceived financial performance ($p < 0.05$).

Table 6: Simple linear regression analysis – green process

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.978	1	.978	5.634	.023 ^b
	Residual	5.900	34	.174		
	Total	6.878	35			

a. Dependent Variable: PFP

b. Predictors: (Constant), GPROCESS

Coefficients ^a						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.965	.863		1.118	.271
	GPRODUCT	.723	.213	.502	3.387	.002

a. Dependent Variable: PFP

Green use

Table 7 summarizes the relationship between green use (**GUSE**) and perceived financial performance (**PFP**). The analysis shows the significant relationship between green use and perceived financial performance ($p < 0.05$).

Table 7: Simple linear regression analysis – green use

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.516	1	1.516	9.612	.004 ^b
	Residual	5.362	34	.158		
	Total	6.878	35			

a. Dependent Variable: PFP

b. Predictors: (Constant), GUSE

Coefficients ^a						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.214	.542		4.089	.000
	GUSE	.437	.141	.469	3.100	.004

a. Dependent Variable: PFP

Green end of life management

Table 8 summarizes the relationship between green end of life time (**GUSE**) and perceived financial performance (**PFP**). The analysis shows the significant relationship between green end of life management and perceived financial performance ($p < 0.05$).

Table 8: Simple linear regression analysis – green end of life management
ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.888	1	.888	5.041	.031 ^b
	Residual	5.989	34	.176		
	Total	6.878	35			

a. Dependent Variable: PFP

b. Predictors: (Constant), GEOLMGT

Coefficients^a

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	2.759	.504		5.469	.000
	GEOLMGT	.308	.137	.359	2.245	.031

Dependent Variable: PFP

4.5 Factor analysis

The purpose of factor analysis to find a way of summarizing information contained in a large number of original variables into a smaller set of new composite dimensioned with a minimum loss of information. The Bartlett's test of sphericity and the KMO measure of sampling adequacy were employed to test the appropriateness of the data for factor analysis. According to the Table 9, Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.574 (> 0.5) is a measure of to test the appropriateness of the data for factor analysis.

Table 9: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.574
Bartlett's Test of Sphericity	Approx. Chi-Square	463.141
	df	351
	Sig.	.000

For reliability estimation, Cronbach's alpha value exceeding 0.6 was considered to have high internal consistency of the scale.

Table 10: Factor analysis

Variable	No of Items	Cronbach's α
Green product	4	61.6%
Green process	2	60.6%
Green use	4	75.3%
Green end of life management	2	82.3%
Perceived financial performance	6	70.7%

4.6 Multiple linear regressions

After the factor analysis, multiple linear regression analysis was used to test the relationship between the independent variables and the dependent variable because it assists to analyze the relationship between a single dependent variable (**PFP**) and several independent variables (**GPRODUCT**, **GPROCESS**, **GUSE**, and **GEOLMGT**). When green product, green process, green use, and green end of life management are considered altogether the table depicts that the overall model is valid ($p < 0.05$). As shown in the coefficient table, green process (**GPRODUCT**) and green end of life management (**GEOLMGT**) is significant ($p < 0.05$). Green product, green process, green use, and green end of life management (independent variables) explain 62.8% of total variances in perceived financial performance (dependent variable).

Table 11: Multiple linear regression

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.628 ^a	.394	.316	.39160

a. Predictors: (Constant), GEOLMGT, GPROCESS, GPRODUCT, GUSE

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.088	4	.772	5.034	.003 ^b
	Residual	4.754	31	.153		
	Total	7.842	35			

a. Dependent Variable: PFP

b. Predictors: (Constant), GEOLMGT, GPROCESS, GPRODUCT, GUSE

		Coefficients ^a				
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.866	.811		1.067	.294
	GPRODUCT	.360	.239	.261	1.507	.142
	GPROCESS	.359	.149	.443	2.414	.022
	GUSE	-.131	.171	-.150	-.766	.450
	GEOLMGT	.190	.078	.345	2.449	.020

a. Dependent Variable: PFP

4.7 Discussion

According to multiple linear regression analysis, green manufacturing factors (**GPRODUCT**, **GPROCESS**, **GUSE**, and **GEOLMGT**) have a significant positive impact on the perceived financial performance ($p < 0.05$). However, when green manufacturing practices are considered separately, there is no significant impact on the perceived financial performance of the listed manufacturing companies in Sri Lanka.

Simple linear regression analyses were carried out to test whether there are significant relationships among green manufacturing practices and perceived financial performance of the listed manufacturing companies. Based on simple linear regressions analysis on green product (**GPRODUCT**) and perceived financial performance (**PFP**), there is a significant positive impact of green product on perceived financial performance ($p < 0.05$). A significant positive relationship ($p < 0.05$) was identified through performing a simple linear regression analysis between green process (**GPROCESS**) and perceived financial performance (**PFP**). As same in the cases of green product and green process, green use (**GUSE**) and green end of life management (**GEOLMGT**), there are significant relationships ($p < 0.05$) were identified between green use and perceived financial performance (**PFP**), green end of life management and perceived financial performance (**PFP**).

After processing factor analysis, multiple linear regressions has shown a significant relationship among green manufacturing practices and perceived financial performance while green process and green end of life management are significant.

During the study, valuable insights were found from the respondents' answers. Green manufacturing practices assists to get various quality certifications (ISO, SLS, etc.) in the Sri Lankan context, green manufacturing practices have positive impact and it is positively affecting to the company's perceived financial performance (by increasing sales, can get more discounts from suppliers, attracting new capital sources (share investments, bank loans,

overdrafts, etc.). In the Sri Lankan context, most of the listed manufacturing companies in our sample have implemented and further focusing on generating energy for their manufacturing plant by using solar power.

5 Conclusion

The Green concept in manufacturing has received great attention in recent years. Nowadays, there is a critical need for the manufacturing industry to preserve the environment without neglecting economic growth and social alleviation. The Sri Lankan manufacturing sector is noted to be fast growing and the literature has identified lack of green manufacturing is one of the reasons for big disasters and break downs of continuous improvement of organizational financial performance. Accordingly, this study was carried out to identify existing green manufacturing practices and to examine which green manufacturing practices mostly influence the financial performance of listed manufacturing companies in Sri Lanka while examining what is the relationship between them. A sample of 36 listed companies of a population of 41 listed companies under the manufacturing sector was chosen based on the total market capitalization of CSE.

The 36 listed manufacturing companies surveyed in this study offer their perspective of the green manufacturing practices currently implemented in Sri Lanka and their relationship with financial performance of their companies. The Cronbach's alpha value is 0.82 and that implies internal consistency and reliability of the questionnaire developed using Likert scale is acceptable. The correlation between green manufacturing practices and perceived financial performance indicated that green product and green use show a systematic (moderate) significant ($p < 0.01$) positive relationship with the perceived financial performance. It is noted that when manufacturing firms implements green product and green use, the financial performance is more likely to increase. On the other hand green process and green end of life management have systematic (weak) significant ($p < 0.05$) positive relationship with perceived financial performance. It is clear that when green process and green end of life management are implemented, it positively affects the listed manufacturing firms' perceived financial performance.

Multiple and Simple Regression analysis indicated that when green product, green process, green use, and green end of life management are considered altogether the overall model is valid ($p < 0.05$) but independent variables are not significant in an individual basis. In general, the correlation results indicate that the listed manufacturers in Sri Lanka perceive that green

product and the green use are key factors which can significantly improve firm financial performance.

The findings of this study are expected to benefit various stakeholders of firms and contribute to the process of implementing sustainable development in Sri Lanka. Green manufacturing can help to reduce waste and harmful emissions and work towards preserving resources that are finite and non-renewable. Shareholders could identify which green manufacturing practices improve financial performance vastly and how to develop existing green manufacturing practices in order to maximize their financial performance. Potential investors who are interested in investing in green manufacturing companies can identify the most well-known green manufacturing companies in Sri Lanka. Due to the reason of that public's consensus about the need to protect the environment, a company can directly enhance its public relations by implementing green manufacturing. Ultimately this approach towards environmental friendly, can impact on us as individuals by diverting us to a healthy life style

The study however has certain limitations such as using a single industry allows greater specificity in describing the forms of green practicing, but potentially limits generalizability. This research study can be tried and tested in other developing and developed countries in different industries, to assess which industries would more impact by Green Manufacturing practices and how results vary from developing to developed country perspectives. Future research is likely to benefit from a methodology that investigates how different corporate performance dimensions beyond the financial performance such as environmental, operational, social performances are impacted over Green Manufacturing practices.

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Appendix 2: Sample – Top 36 Companies in CSE Based on the Market Capitalization as at 04th of April 2018

1. Singer Industries (Ceylon) PLC
2. Lanka Ceramic PLC
3. Agstar PLC
4. Bogala Graphite Lanka PLC
5. Swadeshi Industrial Works PLC
6. B P P L Holdings PLC
7. Kelani Tyres PLC
8. Lanka Aluminium Industries PLC
9. Acl Plastics PLC
10. Richard Pieris Exports PLC
11. Hayleys Fibre PLC
12. ACL Cables PLC
13. Piramal Glass Ceylon PLC
14. Swisstek (Ceylon) PLC
15. Tokyo Cement Company (Lanka) PLC
16. Sierra Cables PLC
17. Ceylon Grain Elevators PLC
18. Central Industries PLC
19. Dipped Products PLC
20. Dankotuwa Porcelain PLC
21. Alumex PLC
22. Royal Ceramics Lanka PLC
23. Lanka Cement PLC
24. Teejay Lanka PLC
25. Lanka Walltiles PLC
26. Chevron Lubricants Lanka PLC
27. Lanka Tiles PLC
28. Regnis(Lanka) PLC
29. Printcare PLC
30. Kelani Cables PLC
31. Bogala Graphite Lanka PLC
32. Samson International PLC
33. Blue Diamond Jewellery Worldwide PLC
34. Acme Printing and Packaging PLC
35. Laxapana Batteries PLC
36. Abans Electricals PLC

Appendix 2: Statements used in the questionnaire

<u>Green Product</u>
Products of the company are reusable, recyclable, and biodegradable.
Products of our company do not contain toxic and unapproved chemicals.
Products of our company less harmful to the environment.
Numbers of customer complaints are less regarding the impact of the product.
Our products do not negatively affect the customer health.
<u>Green Process</u>
Our organization uses renewable energy sources as hydro, wind, solar etc.
We promote and support for initiatives for the development of technical solution to improve the recyclability and reusability of packaging waste.
We consciously avoid actions causing changes to the climate, water infrastructure and forestry.
Our organization optimizes transportation to reduce carbon footprint.
<u>Green Use</u>
Our organization use recyclable material for packing the products.
Our organization uses high efficiency equipment and machinery to reduce the energy consumption.
Our organization uses space-saving warehousing or storage facilities to reduce environmental impact.
Our organization buys products only from suppliers who have less impact to environment
<u>Green End of Life Management</u>
We use reusable containers when distributing the products.
We provide necessary guidance to the customers to use the product through customer handbook and oral conversation at the point of sales.
Our organization produces durable products from design to disposal by decreasing ecological damage to ensure sustainable development.
Our organization gives priority to manage product recalls by reconditioning, reselling etc.
Our organization has adopted ecological waste management and disposal procedures to dispose the manufacturing waste.
Our organization focuses on recycle returned products or scrap material.
Our organization has a procedure for manage disposal waste by land filling.
<u>Perceived Financial Performance</u>
The use of renewable energy sources has led to decreased cost for energy consumption.
Purchasing the raw material from suppliers those who positively affect the environment has led to decrease raw material purchasing.
The use of eco-friendly packages such as paper packages and their reusability has led to attract new customers and increment in sales.
Reducing potable water used by considering alternative on-site water sources has led to the increment in public acceptability and further attract new customers and to expand the market share.
Designing and producing products which are less harmful to the environment has led to increment in sales growth.
Production efficiency has been increased by improving resource efficiency and preservation.
Investment in on site renewable energy systems, including solar, wind, and geothermal has led to decrease cost of production per unit and to increase sales.