Usage of Business Analytics and Supply Chain Performance -An Empirical Study of Sri Lankan Apparel Sector

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Abstract

Advances in technology and innovation require companies to embrace these new trends to compete and stay ahead in the business world. In particular, there is a need for companies to incorporate Business Analytics practices within their organizations. Business Analytics consists of two components: Information Systems and Business Process Orientation. This study aims to investigate the impact of the use of Business Analytics on the Supply Chain Performance in apparel companies in Sri Lanka. This research focuses on discussing the objectives developed to achieve the purpose of the study. To achieve this objective, this current study investigates the relationship between the Information System, Supply Chain Performance and the effect of the use of the Information System in the supply chains of Sri Lankan apparel companies. The study uses a quantitative approach. In this study, for quantitative analysis study performs regression analysis and decision tree analysis. This study identifies a positive relationship between the Information System and the Supply Chain Performance. For further future studies, it is advisable to extend this study by examining the performance of medium-and large-scale companies in the country.

Index terms— business analytics, supply chain performance, information system

1 Introduction

usiness Analytics (BA) provides a strong foundation for organizations to gain a competitive advantage through 1) cost reduction, 2) improving the operations, and 3) automating business activities, which lead towards the achievement of the organizational objectives. BA methods help to retrieve and analyze large volumes of data, which facilitates strategic decision-making. The adoption of BA practices gradually transforms the current business world (Shao et al., 2018). BA is an umbrella concept, which consists of two components: Information Systems (IS) and Business Process Orientation (BPO) (Trkman et al., 2010).This research intends to study the role of BA and their usage on Supply Chain Performance (SCP) in Sri Lankan apparel companies, examined from the point of view of the company employees. In particular, we focus on the relationship of IS on SCP. With the advances in technology and innovation, the necessity to incorporate BA practices has increased within the business world in particular; this is true for the Sri Lankan garment industry, where there is a lot of intense pressure and competition (Weeratunge, 2017).

Previously there are several studies conducted in Sri Lanka regarding SCP and its importance towards the country's economy. To the best of our knowledge, there have not been any studies on the role of BA on SCP within the Sri Lankan context. We aim to address this gap with this research.

2 a) Problem Statement

The garment industry in Sri Lanka is one of the main contributors to industrial production, foreign exchange earnings, and employment. In 2006, the textile sector was considered the country's key foreign exchange earner: USD 2.97 billion, which was around 45% of the country's export revenues (Weeratunge, 2017). In 2008, the clothing industry contributed 40% of the industrial production of the country and was the largest contributor to

the economy with 8% of the Gross Domestic Production (GDP).Recently, Sri Lanka's share of foreign exports has declined due to the GDP.Sri Lanka faced a decline in its total export earnings in 2012. The increase in the trade deficit in 2011 and 2012 is explained by the performance of the export market (Kelegama, 2013). Based on the existing research, the supply chain in the apparel sector faces critical competitive threats in the volatile market. Designs are changing rapidly in the apparel industry, and suppliers use the lawfulness strategy to maintain their competitiveness in the market (Weeratunge, 2017).

The industrial sector of Sri Lanka marked a significant drop of 3.2% in 2019 compared to 2018. The majority of the plunge was accounted from the apparel sector while the other sectors (Agricultural and Rubber Products) managed to retain their performance. The primary reasons identified for this fall arethe low-quality of products and the high cost of production (Dheerasinghe, 2009). A decline of 50% is predicted from the apparel sector during the coming quarterdue to the global pandemic situation occurred, which led to a pause in operations in the apparel sector. With the prevailing situation in the country, it is expected to have an export decline of 30% in 2021 (Rodrigo, 2020).The recent statement released by the Chairman of Joint Apparel Association Forum, A. Sukumaran, states that a 1.5 billion dollars of exports are to contract within the coming months. In 2019, apparel sector records a decline with their contribution. Further, the viral outbreak aroused in 2020 had a significant impact on the country's day-to-day activities. It severely affected the apparel sector operations, which led to a downfall of its performance furthermore.

3   b) Scope of the Study

The scope generalizes the use of BA methods, in particular, IS to increase the efficiency of the supply chain by reducing high costs and improving the quality of manufacturing products relative to the foreign market. The study investigates the relationship between IS and SCP, and its effect on SCP.

4   c) Significance of the study

As highlighted in the introduction, there has not been any work done previously about the use of BA in the Sri Lankan Apparel Industry, which looks at the employee perception of BA. In particular, this study aims to look at the usage of BA in terms of the IS and BPO components and its impact on SCP. As per the third objective developed, this current study examines the relationship of IS on SCP from the perception of employees in depth.

In the Sri Lankan context, apparel manufacturers are exploring new IS to compete with global market competitors in the export sector. A few international academic studies investigated on the usage of IS and its impact on SCP. The findings in these articles lay out the broad and deeper understandings of the effect of IS on SCP and how to improve the supply chain operation. The current literature indicates that supply chains in the garment sector have to face competitive and critical challenges in a very volatile market (Weeratunge, 2017). Apparel companies have rapidly evolved to maintain competitiveness using IS and the new technologies (Weeratunge, 2017). Coordinating IS to manage SCP must result in improving the performance of the supply chain, which deliver (high quality) new choices of garments at a rapid replacement cycle (Kincade et al., 2001). Also, researchers should study how IS has an impact on each SCP area, which leads toward the advancement of the apparel sectors SCP (Trkman et al., 2010). Our research will help assess the role and impact of BA, specifically the IS component, in SCP for Sri Lankan apparel companies.

5   d) Research Questions e) Research Objectives

The objectives developed for the research are as follows:

6   Primary Objective

To determine the overall effect of BA on SCP from the perception of employees in Sri Lankan apparel companies.

7   Sub-Objectives

8   II.

9   Literature Review a) Business Analytics

BA is an application of various advanced data analytical techniques to answer questions or solve problems related to Supply Chain Management (SCM). BA is not a technology, but a set of strategic approaches, organizational procedures, and tools used in combination with each other to gather information, analyze that information and predict the outcomes of the problem as solutions related to the four areas of the Supply Chain Operations Reference (SCOR) Model (Plan, Source, Make, Deliver) (Trkman et al., 2010). Monitoring and optimizing the SCP has been a progressively complex activity. It involves several management processes, such as the selection of measures, the definition of goals, preparation, communication, monitoring, reporting, and feedback.Thus, an approach based on conventional wisdom in the decision-making withinthe supply chain makes it impossible to manage the use of benchmark or better business practices of the supply chains. Therefore, data analytics becomes the backbone of decision-making in all business practices. Likewise, in supply chain, as accurate decision-making

is dependent on large volumes and quantities of external and internal data, facilitated by BA. This ensures and enables the study of gathered data in large capacities (Nyamasege and Oteki, 2015).

10 b) Information System

IS plays a vital role in BA, and IS has an impact on SCP (Ravichandran et al., 2005). Also, companies benefit from the use of IS to increase their effectiveness of cost. However, the implementation of IS should be more closely related to the firm's strategies ??Fairbank et al., 2006). Bourgeois (2014) states IS as a set of interlinked components in an operational chain that gathers, processes, stores, and exchange information to support the effective decision-making process, which systems are facilitated through analysis and graphical visualization. Moreover, IS is define as a combination of RQ 1 -What is the relationship of employees' perception about the role of IS on SCP? compilation, storage, and processing of information and dissemination of information within the organization (Trkman et al., 2010). The processes involved with IS includes various information technologies such as computers, applications, databases, networking networks, the Internet, and mobile devices. Some performs various functions to interact with and to inform people in different operational or social contexts (Boell and Cecez-Kecmanovic, 2015). IS evaluates big data in the company using the systems and is the most efficient tool for improving efficiency and achieving difficult outcomes. The use of IS enhance the capability of the internal information processing of the enterprise.

11 c) Supply chain performance

The reasons for the drop in global exports (and thus of its contribution to the Sri Lankan GDP as a percentage) stated by the past studies are; 1) the quality of the operations and 2) the performance in the supply chain of the companies (Weeratunge, 2017). Competition is high, with exporters needing to deliver high-quality products at lower prices, thus placing a lot of pressure on the operations and SCP (Weeratunge, 2017). According to Cousin's strategic supply wheel model, there are several financial and non-financial factors affecting the SCP of the companies (Cousins et al., 2007). Tracing and improving the performance of a Supply chain has become an increasingly complex task for which BA is one of the current trending solutions. Most of the businesses within the world use BA as a bridge to seek solutions for their problems and investigate new ways to gain a competitive advantage (Flynn et al., 2016). According to the globally conducted studies, a positive relationship is observed and analyzed between BA and SCP (Trkman et al., 2010). BA can help with the following factors ??Wachira, BA improves the quality of the supply chains through proper integration and collaboration. BA deployment enables the management of large volumes of data (Mithas et al., 2011), thus allowing to make the supply chain activities within the company more productive and effective. BA facilitates knowledge sharing and strategic decision-making, which reduces the operational cost and helps in identifying the proper market trends of the industry (Hedgebeth, 2007).

12 III.

13 Conceptualization Framework

The conceptualization framework describes the research objectives by interpreting the interaction between BA and SCP with their dimensions derived from past literature. BA functions as an independent variable, while SCP acts as a dependent variable. The BA dimension is IS, and SCP has six dimensions, which include efficiency, goal achievement, cost reduction, flexibility, product quality, and customer satisfaction.

14 Hypotheses

The hypotheses tested in this study are;

V.

15 Data and Methodology of the Study

This research study used a deductive approach since the study constructed hypotheses at the beginning. The sample consists of eight key players out of the thirteen key players listed in the apparel sector in the EDB report published in the Industry Capability Report in January 2020. This current study uses the total number of supply chain professionals in each sample company in deciding the number respondents for the data collection. The design proceeds with both quantitative based on primary and secondary data sources. The study conducted surveys for the data collection. Due to the current Covid-19 pandemic situation, the questionnaire sent via e-mail to the respondents. The Krejcie and Morgan sampling technique facilitated in selecting the number of respondents of each sample company. The study utilized SPSS version 25 and R software for quantitative data evaluation.

The study began with a pilot study to assess the reliability and validity of the data collected. Therefore, the study used Cronbach's Alpha in achieving this purpose. The application of the decision tree analysis, the regression analysis in the research achieved the quantitative analysis objectives. The study conducts binary logistic regression since the data obtained are categorical and ordinal. The dependent variable related questions

152 are categorical, that is, "Yes or No" questions. Therefore, the responses are categorical. Independent variables
153 consist of symmetrical one to five Likert scale questions. It consist of ordinal responses. The Likert scale degrees
154 are as follows;1 -? Extremely Disagree 2 -? Disagree 3 -? Neutral 4 -? Agree 5 -? Extremely Agree VI.

16   Results and Discussion

17   a) Decision Tree Analysis

157 The decision tree analyses the best predictor of the independent variable IS, with each question inside the six
158 dimensions of the SCP. Binary regression analysis measures the impact of IS on SCP. The rattle () package in
159 R software performed the decision tree analysis. Figure 2 shows the best predictors resulted from the decision
160 analysis; The alpha value in determining the significance is 0.05. If the Significant coefficient is less than the
161 standard significant coefficient, which is the P-value, the hypothesis is true and if the coefficient result is higher
162 than the standard significance value, then the observation is false.

18   IS1-IE

164 According to the chi-square test allocation, the p-value of IS and IE is 0.002. It concludes that the relationship
165 between IS and IE is significant, since the pvalue between IS and the selected question (IE) through the decision
166 tree is smaller than the alpha value of 0.05. This concludes that the organizations IS currently supports the
167 supply chain process, and it significantly increased the efficiency of the supply chain of the company.

19   IS2 -QG

169 The p-value of IS and QG is 0.007. Therefore, there is a significant relationship between IS and QG since the
170 p-value of IS and the selected question (QG) is lesser than the alpha value of 0.05. The organizations IS currently
171 supports the order commitment process, and it is significantly increases the quality of goods produced in the
172 company.

20   IS3 -CR

174 The P-value between IS and CR is 0.001, which is lower than the standard alpha P-value therefore, there is a
175 significant statistical relationship between IS and cost reduction in the supply chain. In other words, the proper
176 distribution management within the production with the use of IS reduces the supply chain cost.

21   IS4 -GA

178 0.000 is the P-value between IS4 and GA; this is lower than the alpha value. Therefore, there is a significant
179 relationship between IS4 and GA. The use of IS will facilitate for the goal achievement of the company. When
180 the process of making aligns well with IS, the goal achievements boosts as the manufacturing process is organized
181 and integrated with the technology, which prevents the possible faults and risks in the operations.

22   IS5 -F

183 According to the chi-square test allocation, the P-value of IS and F is 0.000. This concludes a statistical
184 relationship between IS and F since the P-value of IS and the selected question (F) across the decision tree
185 is smaller than the alpha value of 0.05. Finally, we can assume that the IS support source process, and it
186 significantly increased the flexibility.

23   IS6 -CS

188 According to the chi-square test allocation, the p-value value of IS and CS is 0.000. There is a significant
189 relationship between IS and CS since the Pvalue of IS and the selected question (CS) across the decision tree is
190 smaller than the alpha value of 0.05. Finally, we can assume that IS currently supports the demand management
191 process, and it significantly satisfy the customers.
192   All dimensions under SCP are significantly improves with the implementation of IS within the supply chain of
193 the apparel company. Thus in the end, we can accept the first hypothesis that is there is a significant relationship
194 between IS and SCP. Binary logistic regression analyzed the impact of independent variables on the dependent
195 variables. This resulted in a positive impact resulted from the independent variable towards each dependent
196 variable through binary logistic regression analysis performed. Omnibus tests of model coefficients interprets
197 that a significant improvement of each dimension of SCP with the use of IS in the company's supply chain.
198 Further, this model shows a good fit in the data; since $R2$ in model summary tables of each variable is lying
199 between 0%-100% and is having a higher value; it indicates that the models are a good fit for the data collected.
200 Finally, the regression coefficient implies that when the independent variable (BA) increased by a unit, the ( )

24 c) Impact from BA on the Dimensions of SCP

25 H

Year 2021 H 2 -There is an impact from BA on each dimension of SCP from employees' perception. This (RQ 2) research objective discusses and explains the findings of the data collected from the survey with the use of binary logistic regression. Further, the objective analyzes how well IS could be used to improve the SCP of apparel companies. dependent variable (SCP) increased by a unit. The summary table in table 2 indicates the coefficients of regression. Therefore, it concludes that there is an impact on each dimension of SCP from employees' perception of IS, which is the second hypothesis of the study.

The use of IS in the supply chains facilitates to increase the efficiency, improve the quality of goods, reduce the cost in the supply chain, for higher and effective goals achievement, improve flexibility, and to improve customer satisfaction. The favorable impact on these dimensions shows an improvement in the supply chain of apparel companies. Since IS is a dimension of BA, a tool used to measure BA, it concludes a higher SCP with the use of BA within the supply chains. This facilitates the improvement in SCP while turning the declining nature of exports to a boost in the exports.

Through the achievement of each sub-objective and answering all the research questions, at the end achieves the primary-objective, that is to determine the overall employees' perception about the role of BA on SCP among the Sri Lankan large-scale apparel companies. There is a positive perception on the role of BA on SCP. Adding more to it, the use of BA in the supply chain has a positive relationship. The use of BA increases the SCP of the organization through increasing the efficiency, reduction in cost, improving the quality standard of the goods produced, which are the financial dimensions of SCP. The non-financial aspects lead to the improvement of SCP as well, and they are improved goals achievement, customer satisfaction, and flexibility.

26 VII.

27 Summary and Discussion of Future Research

As an umbrella concept, BA helps to improve the SCP of apparel firms in Sri Lanka. Based on the analysis undertaken in Sri Lanka using eight sample companies from the thirteen apparel companies identified in the industrial report published by EDB at the end of January 2020.The sample consists of key players in the apparel industry in Sri Lanka. The Integration allows companies to increase their production and productivity, contributing to success in the supply chain of firms. The current study is a discussion on the effect of IS on SCP in detail. Quantitative analysis is use to test the hypotheses and to achieve the objectives set for the current study on the basis of the hypotheses and objectives set for the present study. This quantitative analysis discusses and shows the use of IS had a positive effect on SCP. It also concludes an improvement in performance by integrating the supply chain with BA. The authors suggests further research to determine the efficiency of the supply chain by using medium and small apparel firms in Sri Lanka as a whole.

Further, to explore whether BA could even improve SCPs in other sectors. [1] [2]
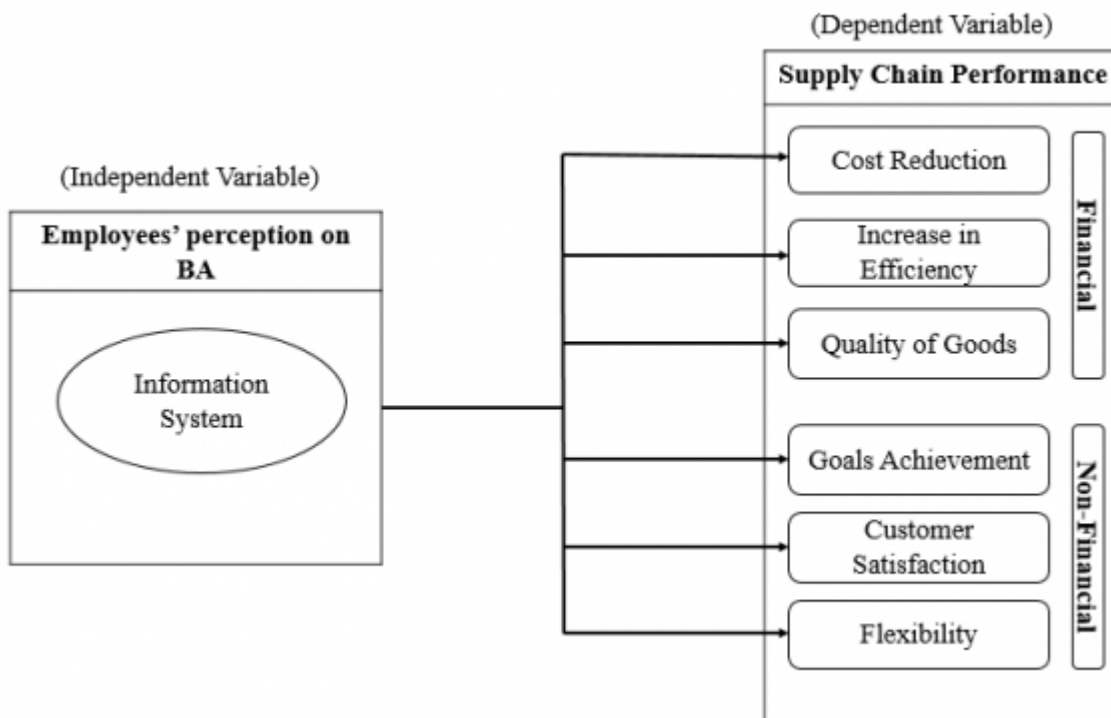
Figure 1:

Dimension	Best Predictor
IE1	IS2
IE2	IS2
IE3	IS5
IE4	IS5
QG1	IS2
QG2	IS4
QG3	IS1
QG4	IS6
CR1	IS3
CR3	IS1
CR4	IS5

Dimension	Best Predictor
GA1	IS6
GA2	IS2
GA4	IS5
F1	IS4
F2	IS4
F3	IS4
F4	IS4
CS1	IS4
CS4	IS1

Figure 2:

1

Variable	Dimension	Question
	IE1	Reduced lead time in manufacturing
	IE2	Improve Resource Planning ability
	IE3	Increase operational efficiency
	IE4	Increased efficiency of distribution planning
	QG1	Quality of goods delivered has improved
	QG2	Decreased supplier rejection rate
	QG3	Market share has increased
	QG4	Increased ability to respond to and accommodate new
	CR1	Decreased operational cost per operational hour
	CR2	Inventory carrying out cost has decreased
	CR3	Improve Cost effectiveness of products
Dependent (SCP)	CR4	Total cost of distribution, including transpor tation and handling Profitability has increased
	GA1	
	GA2	Return on investment has increased
	GA3	Market share has increased
	GA4	Our company can quickly introduce new products, new
	F1	Has a higher flexibility of service systems to meet particular
	F2	Increased flexibility in ope rational plans
	F3	Adjust delivery capacity/ capability and quickly respond to
	F4	Improve responsiveness to changing market needs
	CS1	Improvement of rapid handling of customer complains
	CS2	Our company can quickly modify products to meet our major
	CS3	Our company has an outstanding on time delivery records to
	CS4	Our company provide a high level of customer's services to
	IS1	Organization's Information System Currently suppor t the
	IS2	Organization's Information System currently suppor ts the order
Independent (IS)	IS3	Information System suppor ts the distribution management The Information System currently
	IS4	
	IS5	The Information System support this process (Source)
	IS6	Information System currently suppor t the demand management

Variables		Significance value (P- value)
	IS1-IE	0.002
IS2-QG		0.007
IS3-CR		0.001
IS4-GA		0.000
	IS5-F	0.000
IS6-CS		0.000

Figure 3: Table 1 :

2

Variables	Omnibus Tests of Model Coefficients	R Square %	Coefficient of the regression (B) %
IS1-IE	0.44	2%	0%
IS2-QG	0.015	1.2%	83.1%
IS3-CR	0.008	1.5%	84.2%
IS4-GA	0.007	1.5%	87.7%
IS5-F	0.000	4.7%	20%
IS6-CS	0.000	6%	78.7%

Figure 4: Table 2 :

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