

Investigating the impact of green technology investment and waste management on distributor firm performance

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Abstract

The current study is an attempt to assess the impact of green technology investment and waste management on distributor firm performance in case of Pakistani FMCG firms. The study analyzed the relationship between a relationship between green packaging and improved green packaging materials, green distribution and elimination of environmental damages, green marketing and increased green promotion, hazardous waste handling and improved safe disposal of chemicals. Surveys have been carried out from SCM experts who are involved in implementing green technology practices within their supply chain while reducing waste in their supply chains. Also, interviews were carried out from senior executive/senior manager in SCM and finance operations. The sample size of surveys was 100 while for interviews, it was 5 respondents. Through regression analysis, the significant values were found to be less than 0.05 which concluded that there is a significant impact of green technology investment and waste management on the distributor firm's environmental performance.

Introduction

Green Logistics is understood as the efforts to measure and minimize the environmental impact of logistics activity. Green Logistics integrates environmental respect, social sensitivity, and economic functionality, and aims to create sustainable business value, balancing economic and environmental efficiencies (Bag, Anand, & Pandey, 2017). The current lifestyle and the habits of consumption as a society have caused an increasing generation of waste. However, this problem has led to the creation of coherent waste management, since it has become an integral part of the economy (Mirhedayatian, Azadi, & Saen, 2014). On the other hand, technological advances have improved quality of life considerably, although in the same way, this has contributed in parallel to the degradation of the environment.

According to Eltayeb et al., (2011), the notion of the green supply chain is a multifaceted issue which has emerged from the development of such management practices which are environment-friendly in the area of supply chains. In this sense, technology investment for firms in their supply chain is an integral part that allows companies to make their supply chains sustainable. In this sense, the problem lies in the fact that fewer studies have focused on the impact of green technology investment on firm performance in the Pakistani context, specifically in the context of FMCG manufacturing firms. The key reason to select distributor firms in FMCG industry is due to its wide-range of operations all over Pakistan.

Therefore, the key research aim is to investigate the impact of green technology investment and waste management on the performance of firms. In this regards, the research will focus on the following research objectives:

- ❖ To assess the reasons why FMCG distributor firms invest in green technology in their supply chains
- ❖ To discuss the factors impacting on waste management strategy in FMCG distributor's supply chain
- ❖ To find out the impact of green technology investment on distributor firm performance in FMCG sector Pakistan
- ❖ To evaluate how waste management of FMCG distributor firms impact their performance in Pakistan

Research Model and Hypothesis

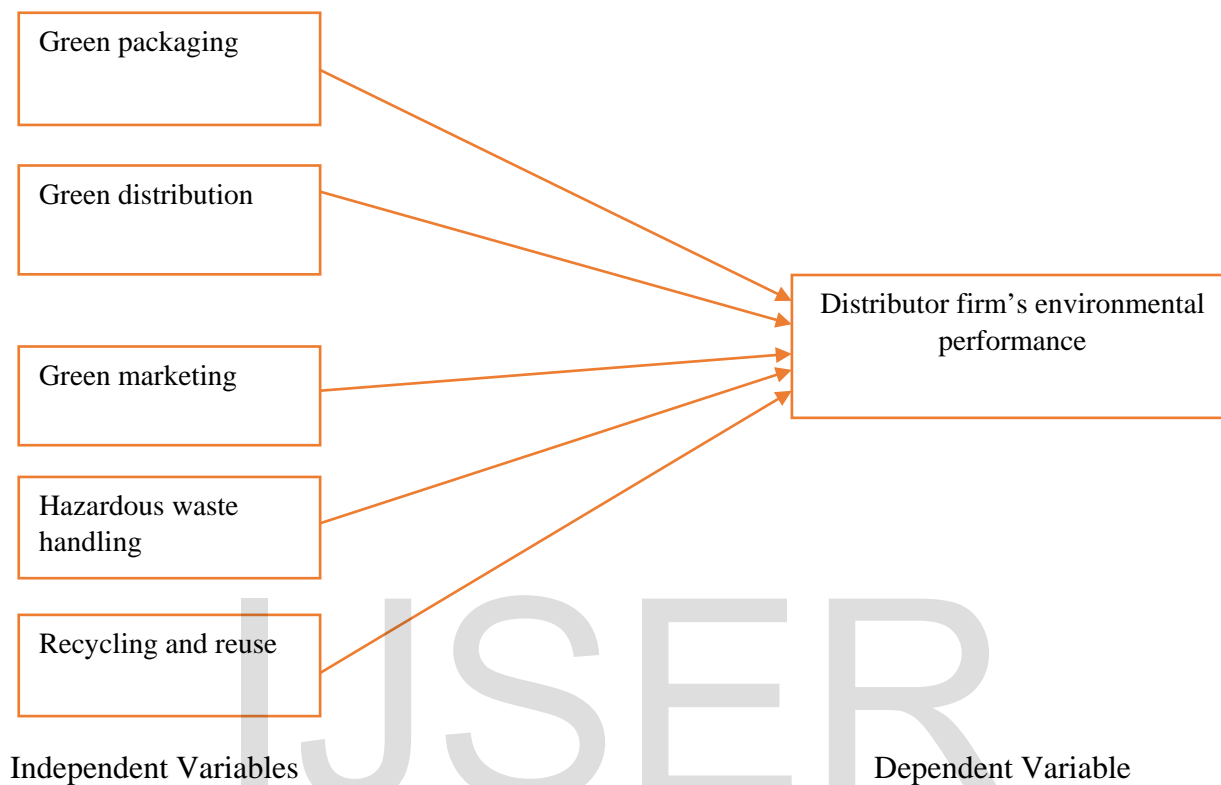
H1: There is a significant relationship between green packaging and improved green packaging materials in FMCG distributor firms

H2: There is a significant relationship between green distribution and elimination of environmental damages in FMCG distributor firms

H3: There is a significant relationship between green marketing and increased green promotion in FMCG distributor firms

H4: There is a significant relationship between hazardous waste handling and improved safe disposal of chemicals in FMCG distributor firms

H5: There is a significant relationship between recycling and reuse and decreased waste in FMCG distributor firms



Literature Review

Green Technology in Logistics

Qu et al. (2017), have investigated why do companies decide to adopt Green Logistics practices? In response to this query, it has been indicated that 64% of European companies state that environmental issues are important within the framework of their strategy, 60% measure their emissions and 21% are resorting to techniques to reduce their negative environmental impacts. There are two main areas of work in Green Logistics: one, related to internal efforts to achieve greater energy efficiency and a lower negative environmental impact (Misni & Lee, 2017). And another, with the efforts to achieve compliance with national and foreign environmental regulations, in the case of exports.

The concern for the Green Logistics has been present in the last congresses and forums on Logistics and Supply Chain Management. There has been raised that this does not necessarily mean higher costs. A recent study in the USA with transport companies showed

that, in some cases, they had managed to reduce emissions to the atmosphere by up to 28% and, at the same time, achieving a 4% lower cost (Voica, Panait, & Radulescu, 2015). This optimization of the logistics process may be enough to pay for new technologies, cleaner than the current ones. Other keys are the adoption of cheaper and less polluting cargo vehicles, to use less fuel per unit transported; and the emergence of new technologies, such as hybrid and electric vehicles, whose adoption will become increasingly important in the 21st century.

Managing environmentally-friendly (green) supply chains is a major innovation that is being introduced in organizations around the world to develop strategies to achieve goals. Green supply chain management is usually defined as a type of management that effectively takes into account all environmental aspects and resource utilization. Organizations apply these strategies to demonstrate that they adhere to the correct principles of work in relation to the environment. Environmental issues put a lot of pressure on organizations, forcing them, for example, to accept their products after the end of their service life for reuse, recycling or proper destruction of the entire product or its parts (Zhu, et al. 2017). Supply chain management with feedback - effective, an effective and economically optimal strategy aimed at maintaining environmentally friendly working methods in the industrial sector. The logistics network of returning goods from the end consumer back to producers is usually associated with numerous conflicting tasks.

Waste management

In modern conditions of globalization of business, there is a marked increase in the negative influence of man on the biosphere, which is caused by the growth in the scale of industrial and economic activities of industrial enterprises and service companies. As a result, the ecological situation characteristic of certain regions of the country enters an acute phase associated with the degradation of the main physical components of the biosphere, such as the lithosphere, the atmosphere and the hydrosphere (Kumar, Agrahari, & Roy, 2015). Among the factors that have a negative impact on the general state of the environment can be identified: air pollution by industrial and other emissions; pollution of surface and groundwater; soil pollution by industrial emissions and household waste; noise (acoustic) pollution, sources of which are industrial enterprises and transport; and reduction of biological diversity of living beings, etc.

Traditionally, ecological logistics includes aspects related to the collection and sorting of waste generated during production and consumption, their transportation, disposal or safe storage in the environment (Roy & Khastagir, 2016). However, it should be noted that the

management of material and related flows, based on the principles of logistics, already initially entails a reduction of the environmental burden on the environment, for example: the choice of suppliers of raw materials according to the criterion of maximum reduction of production waste, as well as the elimination of losses from marriage (the policy of "zero defects") and reduction of inventories, due to the improvement of the system of planning and regulation of consumption, implies a corresponding reduction in the need for storage space and, as a consequence, a decrease in the amount of waste generated during the same period of time (Voica, Panait, & Radulescu, 2015).

It is obvious that the waste arising in the process of product promotion, as well as the operations for their disposal, increase the cost of goods without adding value to end users. Consequently, the more a company produces waste, the lower the profitability of its business (Hottenrott, Rexhäuser, & Veugelers, 2016). Therefore, the use of environmental principles in the distribution of products in the network can provide additional competitive advantages, by reducing the component associated with the waste in the total unit cost of the inventory.

Thus, ecological logistics should use traditional methods and models of the general theory of logistics, but taking into account the minimal negative impact on the environment. And the application of the principles of environmental management should help the company turn the logistics system, starting with the delivery of raw materials for the production of the final product and ending with the disposal and/or safe recycling of waste, into an environmentally safe process (Zhu, et al. 2017).

Green Technology Investment and Firm Performance

Tsai et al. (2016) carried out an empirical study that explored the relationship between environmental and firm performance. The methodology adopted was mainly a meta-analysis of sixty-four empirical studies which have been published 1978-2008. The results depicted that 55% of the researches showed a positive while 15% showed a negative effect of environmental performance in firm performance. However, 30% of papers have shown null or no effect (Horváthová, 2010). On the other hand, some studies which have specifically focused on green innovation or concepts relating to it, such as environmental innovation or sustainable innovation remained indecisive.

However, some of the empirical researches and theoretical viewpoints have posited that green innovation has a negative impact on the performance of the firm. The study of Driessen et al. (2013) posited that green product innovation was found to be linked with the low financial performance of the firm. Another study by Aguilera-Caracuel and

Ortiz-de-Mandojana (2013) observed that firms focusing on green innovation do not experience improvement in financial performance as compared to the those who do not follow green practices. Dangelico (2016) also found that firm's focus on green innovation has led to an increase in total costs.

The study of Doran and Ryan (2016) reflected on a more complex reality where researchers carried out a comprehensive study which was conducted on a sample of 2181 organizations which have been following green process innovation. The results found that two out of nine firms were positively impacted due to environmental innovation efforts. The findings were found to be consistent with the perspective of traditional economic which posited that green innovation is costly and that it negatively impacts on firm performance.

The study of Dangelico and Pujari (2010) conducted a review of literature where researchers have uncovered a wide range of benefits that emerge from integrating issues of environmental sustainability with business operations and product development, such as return on investment, increased resource efficiency, improved sales, development of new markets, better corporate image, improved competitive advantage, and product differentiation. The aspects which have addressed this association were based on van der Linde and Porter's hypothesis which is related to the effect of environmental regulation on economic performance and technological innovation. The theory posited that innovation offsets could take place with technological change (Petroni, Bigliardi & Galati, 2019).

Methods and materials

In this study, the researcher has adopted the mixed research methodology. As Kusi-Sarpong, Sarkis, & Wang, (2016) suggested that mixed research methodologies allow the researchers to draw sound conclusions because they involve the triangulation of data from multiple sources. It means that both qualitative information and quantitative information are collected and compared. Surveys have been carried out from SCM experts who are involved in implementing green technology practices within their supply chain while reducing waste in their supply chains (Kusi-Sarpong, Sarkis, & Wang, 2016). However, interviews were carried out from senior executive/senior manager in SCM and finance operations. The sample size of surveys was 100 while for interviews, it was 5 respondents. The collected data for surveys were analyzed through SPSS using regression to assess the impact of variables. To analyze qualitative data, which is interviews, the content analysis technique has been used.

Today, consumers when buying FMCG products also look for whether the company is implementing green practices in making their products. Selecting the chosen sector that is

the FMCG sector is most suitable for the researcher as data can be collected with ease from representatives working in this industry (Kanda, Sakao, & Hjelm, 2016). Another reason to select distributor firms in FMCG industry is due to its wide range of operations all over Pakistan. On the other hand, the chosen research method is also suitable for the study because surveys will help to gather large amounts of data from SCM experts while highlighting the green technology and waste management practices of firms. However, conducting interviews will focus on the aspect of firm performance from the past few years as a result of implementing green technology and waste management practices in their respective supply chains.

Results and Discussion

Results from Surveys

Following table shows the demographic profiles of respondents.

Statistics				
		Your Gender	Your Age	Your educational qualification
N	Valid	100	100	100
	Missing	0	0	0
Mean		1.5800	3.7300	3.6800
Median		2.0000	4.0000	4.0000
Mode		2.00	4.00	4.00
Std. Deviation		.49604	.80221	1.09986

Table 1 - Demographic Profiles of Respondents

As per the table above, it is apparent that most of the participants were males in the survey. The age of the majority of respondents was between 30 and 40 years. Most of the participants in the study were having post-graduate and diploma as per the qualification of education.

Appendix D shows the results from the regression analysis of findings. From those tables, the following is the summary of results and hypotheses.

Hypothesis	Significance Value	Accept/Reject Decision for Ho	Regression Equation
H1: There is a significant relationship between green packaging and improved green packaging materials in FMCG distributor firms	.037	Rejected	FMCG distributor firm performance = $-.094 + .105(\text{Green purchasing})$
H2: There is a significant relationship between green distribution and elimination of environmental damages in FMCG distributor firms	.043	Rejected	FMCG distributor firm performance = $-.095 + .125(\text{Green manufacturing})$
H3: There is a significant relationship between green marketing and increased green promotion in FMCG distributor firms	.050	Rejected	FMCG distributor firm performance = $-.058 + .097(\text{Green distribution activities})$
H4: There is a significant relationship between hazardous waste handling and improved safe disposal of chemicals in FMCG distributor firms	.049	Rejected	FMCG distributor firm performance = $-.002 + .115(\text{Green marketing})$
H5: There is a significant relationship between recycling and reuse and decreased waste in FMCG distributor firms	.0491	Rejected	FMCG distributor firm performance = $-.017 + .120(\text{environmental education})$

Table 2 - Summary from Regression Analysis

Being the significance value of all variables is less than 0.05 which reveals that null hypotheses have been rejected and alternate hypotheses have been accepted. This indicates that the change in an independent variable would bring a significant change in dependent variables.

Results from Interviews

All of the interviewees believed that green packaging and improved green packaging materials in their organization help in managing the waste. One of the participants said that *“the green packaging reduces the waste because it does not involve any additional material and reasonable covers on the product packaging are made (Respondent No. 3).”* The opinion of the participant one with regard to the question asked above was *“yes.... Hmmm, I agree that green distribution allows the elimination of environmental damages in FMCG distributor firms”*. Further to this, the other participants opined that this helps in reducing the damages. Hence, it can be said that green distribution does not involve any material or activity through which the risk of environmental damage could exist.

The respondents demonstrated that green marketing and green technology and their use have the main role in the sustainable development of an organization. In addition, the respondent one believed that *“I believe that green technology and green marketing are the main factors that could help in reducing the waste within FMCG distributor firms and improving their performance.”* The respondents were of the view that their organizations were using these strategies. One of the participants in the interview said that *“Our organization uses recycling strategy and reuse strategy as an end to achieve competitive advantage and reduce the harm to the environment (Respondent No. 5).”*

Discussion

Logistics processes are an integral part of the activities of any enterprise operating in the global economy. The deepening processes of globalization of the world economy objectively actualize the problems of improving measures to protect the environment. Of particular interest to the greening of logistics operations on the part of companies is due to increased environmental literacy and consumer awareness, as well as the growing importance of economic factors supporting the environment, political influence, and regulation in this area.

As a result, eco-logistics is seen as a promising direction for improving the industry of supply chain management. Analysis of the economic activities of most trade organizations suggests that they operate without taking into account environmental protection issues. The term green logistics appeared in the late 80s - early 90s of the last century to denote new approaches to structuring the activities of logistics companies in the context of tightening environmental measures (Xin-gang, et al. 2016).

Based on the potential results of introducing green logistics technologies, including: rational and efficient use of all enterprise resources, increasing the degree of environmental safety, reducing the level of environmental damage due to the application of the aforementioned methods and technologies of green logistics, environmental personnel training, etc (Voica, Panait, & Radulescu, 2015). In the context of the globalization of the world economy and the optimization of all areas of foreign economic activity, the transition to environmentally friendly production and the continuous improvement of environmental protection measures seem to be the most important condition for the preservation of national competitiveness.

The main objects of eco-logistics regulation are flows of raw materials, semi-finished products, finished products, waste products; logistics operations and processes, etc. Green technologies also include innovative solutions for the processing and recycling of materials, wastewater treatment, energy conservation, regulation and protection of the environment, etc. The subjects that influence the development of green logistics are: the state, whose functions include regulation and development of basic various-time programs and strategies for environmental protection and environmental management; manufacturers using innovative eco-technologies in the management of the main chains; consumers, who increase the demand for goods and services with a green image, due to their extraordinary characteristics (Saha, Nielsen, & Moon, 2017). Despite the positive trends in the development of eco-logistics technologies, a number of points can be identified that significantly slow down the development of green technologies.

In addition, it is necessary to design waste-free (low-waste) and closed technological cycles that minimize emissions and discharges of harmful and polluting substances into the environment, to introduce high-tech production, which as a result will help to increase the competitiveness of the final product. Thus, for the effective use of environmental principles in logistics, it is necessary to set and solve the following tasks: use of the system of separate collection of production wastes, as well as waste packaging and packaging with further targeted use; the development of small businesses capable of solving problems associated with the separate collection, recycling and disposal of solid waste (Hottenrott, Rexhäuser, & Veugelers, 2016).

Conclusion

This study was conducted to assess the impact of green technology investment and waste management on distributor firm performance in case of Pakistani FMCG firms. The

study analyzed the relationship between a relationship between green packaging and improved green packaging materials, green distribution and elimination of environmental damages, green marketing and increased green promotion, hazardous waste handling and improved safe disposal of chemicals. Through regression analysis, the significant values were found to be less than 0.05 which concluded that there is a significant impact of green technology investment and waste management on the distributor firm's environmental performance.

Therefore, it is concluded that having a green supply chain is not an easy task for companies. The key to this is to make good logistics management through the involvement of each of the areas of the company and collaboration between the main actors in the chain, including the logistics provider, who plays a key role in the green logistics or green logistics. Eco-logistics or green logistics involves the integral transformation of logistics strategies, their structures, processes, and systems, to companies and business networks that manage their activities and processes. Logistics in an environmentally sound way and, without punishing the productive end, characterized by the efficient use of resources. In one way or another, government concern and interest in the environment has reached companies, many of which are already incorporating environmental protection policies into their daily activities. Also, many companies already think about how to recover their products once their useful life has finished. This alternative of recovery of the products is looking mainly to reduce the impact on the environment, through reuse and recycling.

The costs associated with reducing the impact on the environment must be compensated. In this regard, taking into account the 'environmental protection' requirements is an important element in the development and development of the logistics strategy and the key to the success of the enterprise. Since the increase in competitiveness is achieved by reducing the cost of production for components such as the cost of energy, raw materials, and other natural resources, costs associated with the payment of fines and compensation for exceeding environmental standards.

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A. Frequency Distribution

Statistics								
Construct	N		Mean	Median	Mode	Std. Deviation	Minimum	Maximum
	Valid	Missing						
Providing design specification to suppliers that include environmental requirements for purchased item	100	0	3.8300	4.0000	4.00	.96457	1.00	5.00
Cooperation with suppliers for environmental objectives	100	0	4.1000	4.0000	4.00	.77198	2.00	5.00
Choice of suppliers by environmental criteria	100	0	3.7900	4.0000	4.00	.91337	1.00	5.00
Suppliers' ISO14000 certification	100	0	3.8700	4.0000	4.00	.92829	1.00	5.00
Environmental audit for suppliers' internal management	100	0	3.9900	4.0000	4.00	.74529	2.00	5.00
The manufacturing process will reduce the noise pollution to the minimum	100	0	3.9300	4.0000	5.00	.93479	2.00	5.00
Substitution of polluting and hazardous materials/parts	100	0	3.7100	4.0000	3.00	.96708	1.00	5.00
Filters and controls on emissions and discharges	100	0	3.8500	4.0000	4.00	.98857	1.00	5.00
Production planning and control focused on reducing waste and optimizing materials exploitation	100	0	3.9200	4.0000	4.00	.86082	2.00	5.00
Process design focused on reducing energy and natural resources consumption in operations	100	0	3.7700	4.0000	4.00	.91954	1.00	5.00
Reduction of packaging materials	100	0	3.8600	4.0000	4.00	.98494	1.00	5.00

Ecological materials for primary packaging	100	0	3.8300	4.0000	4.00 ^a	1.03529	1.00	5.00
Recyclable or reusable packaging/containers in logistics	100	0	4.0000	4.0000	4.00	.82878	2.00	5.00
Selection of cleaner transportation methods	100	0	3.8900	4.0000	4.00	.85156	2.00	5.00
Effective shipment consolidation and full vehicle loading	100	0	4.0600	4.0000	5.00	.95155	1.00	5.00
Cross-functional cooperation for environmental improvements	100	0	3.9400	4.0000	4.00	.85067	2.00	5.00
Established an environmental protection index of recycling, gaseous reduction and energy conservation	100	0	3.8700	4.0000	4.00	.96038	1.00	5.00
Environmental management system exists	100	0	3.8300	4.0000	4.00	.95405	1.00	5.00
Support for environmental practices from senior managers and mid-level managers	100	0	3.9100	4.0000	4.00	.94383	1.00	5.00
Supply to customers and institutions of regular voluntary information about environmental management	100	0	3.7600	4.0000	4.00	.85422	1.00	5.00
Sponsoring of environmental events/collaboration with ecological organizations	100	0	3.8300	4.0000	4.00	1.01559	.00	5.00
Use of natural environmental arguments in marketing	100	0	3.9000	4.0000	5.00	1.06837	1.00	5.00
Periodic updating of the website on environmental issues	100	0	3.7700	4.0000	4.00	.95193	1.00	5.00
Holding awareness seminars for suppliers/contractors	100	0	4.0000	4.0000	4.00	.82878	2.00	5.00

Natural environmental seminars for executives	100	0	3.9300	4.0000	4.00	.94554	1.00	5.00
Natural environment training programs for managers and employees	100	0	4.0000	4.0000	4.00	.82878	2.00	5.00
Decrease in cost of materials purchased	100	0	3.9700	4.0000	4.00	.88140	1.00	5.00
Decrease in cost of energy consumption	100	0	3.8200	4.0000	4.00	.89194	1.00	5.00
Decrease in fee for waste discharge	100	0	3.8700	4.0000	4.00	1.01160	.00	5.00
Improvement in occupational health and safety of employees	100	0	3.9600	4.0000	4.00	.98391	1.00	5.00

a. Multiple modes exist. The smallest value is shown

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