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Exploratory and Conformity Factor Analysis of the Green logistics practices in Textile Sector of Pakistan

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Abstract: Green logistics practice has emerged as a key strategy for organizations to become environmentally friendly and become more sustainable. This paper aims to identify the important factors for successful implementation of green logistics in textile sector of Pakistan and to measure the effect of green logistics practices on performance of textile. There are four main objectives of this research work. 1) to find out the factors that help in the implementation of green logistics practices, 2) to find out the effect of those green logistics practices on cost-effectiveness, 3) to analyze the effect of green logistics practices on environmental performance and 4) to analyze the effect of green logistics practices on operational performance. The results will show the effect of green logistics practices on cost-effectiveness, environmental performance, and operational performance of the textile sector of Pakistan.

Keywords: Green logistics, Environmental performance, Operational performance, Exploratory factor analysis, Confirmatory factor analysis.

1. INTRODUCTION

According to (Srivastava. 2007) Green logisticspractices has acted as a significant approach that can help to maintain sustainability and performance enhancement for the purpose of reducing environmental problems and the need for cost-effective methods. In detail, the green logistics idea is to participate in the environmental concept into logistics. In Pakistan green logisticspractices is quiet in its developing stages subsequently textile sector is not ready to adopt green logistics practices at their workplaces. On the other side the increase of the environmental restraint it becomes central for companies to take away the green logistics factors resourcefully and to rally its environmental status (Sheu. *et al.,* 2005).

This research work aims to achieve the objectives from the textile sector perspective as the textile sector in Sindh Pakistan are still less aware of the concept of green logistics and they have not appropriate knowledge to solve the environmental issues and they do not know that which green logistics practice is more suitable for their organization and what is its effect on their performance outcomes. Therefore, it is important for the textile sector to incorporate green logistics practices in their organizations to resolve the difficulty about the selection of suitable green logistics practices and to know the effect of those factors on environmental, cost-effective and operational performances this research has carried in the textile sector.

2. LITERATURE REVIEW

Various studies explored the different factors in implementing green logistics practices, for example Memon, *et al.*, (2015) considered product recall factor to optimize logistics operations. Hsu.*et al.*,(2008) have conducted the research in electrical and electronic sector in Taiwan and selected twenty factors for implementation of green logistics practices under four main dimensions supplier supervision, organizational involvement, recycling, and life cycle assessment. Zhu. *et al.*, (2004) identified external drivers i.e. government regulations, users and competitors and internal drivers such as organizational elements as well he has been selected internal and external barriers. Geng. *et al.*, (2016) focused on environmental improvement and explored seven critical factors. Gandhi. *et al.* (2015) have selected fourteen factors on the implementation of green logistics practices and analyzed the effect on overall performance. Nema. N., (2013) identified twenty five factors that help in successful implementation of green logistics practices and to achieve sustainability in the automobile sector India. Considering above research, this study finds the factors (**Table 1**) that successfully implement green logistics practices and then analyze the factors to observe the effect on performance outcomes in the textile sector of Pakistan.

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2.2. Green LogisticsPractices

Table 1. Green logistics/GSCM factors and its description

Factors	Description	Source
Green Administration	The dedication from administration is the main element in the execution of GSCM	Dashore. K. (2013)
Green Production	It insurances an extensive variety of extents from little to great, invention lines, new production expansion, and additions to present invention lines.	RajabianTabesh*et al.*, (2016)
Green Delivery	Green delivery involves green packaging and green logistics. Packaging features such as size, shape, and materials have an effect on delivery because of their consequence on the transference characteristics of the product.	Ninlawan. C., (2010)
Reverse logistic	Reverse logistic is a piece of GSCM. Organizations can earn more benefits by setting up the turnaround coordination and in a way help the preservation of assets.	Rao. P., and D. Holt, (2005)
User Requirement	Because of expanded mindfulness between the users the interest of green concept has prolonged.	Gandhi.S.*et al.* (2015)
Green Procurement	Green procurement can recover the quickness at which an organization is capable to answer back to altering purchaser requirements.	Mumtaz. U., *et al.* (2018)
Adoption of new Technology	Receiving new procedures and innovation will consequence in expanding proficiency and development of the association. Executing GSCM is essential for the great importance of the company.	Hsu. C. W., and A. H. Hu, (2008)
Green Design	It helps the manufacturers to design the products that minimize the energy and consumption of material, it facilitates the recycling of parts.	Choi. S., H. Min, *et al*. (2017)

3. CONCEPTUAL MODEL AND RESEARCH HYPOTHESIS

A conceptual model shows the direct linkage between green logistics practices and organizational performance. The effect of these GSCM/green logistics factors on the performance outcomes that help the textile sector to successfully implement GSCM factors in their workplace so that they can improve their performance outcomes.

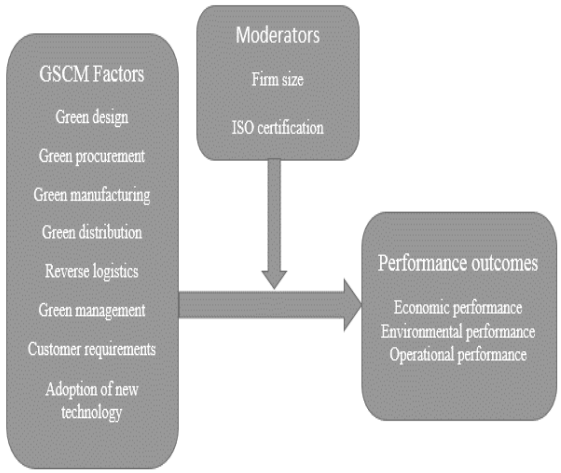

Fig 1. Evaluating the factors to the successful implementation of GSCM/green logistics and its effect on performance outcomes.

4. RESEARCH METHODOLOGY

Research methodology is based on the survey of textile sector in Sindh Pakistan to know the extent of adoption of green logisticspractices and its effect on performance outcomes to test the proposed hypothesis. The questionnaire is designed by studying the different research papers and surveys that help to identify the different factors in the successful implementation of green logisticspractices. A five-point Likert scale-based questionnaire survey was conducted in the textile sector, and around 60 responses were collected from the textile sector. Exploratory factor analysis (EFA) is used to find factorial validity. EFA analysis also helps in factor reduction and final results will impose the set of variables belong to a particular factor of green logistics factors. Finally, a confirmatory factor analysis is used to fit the model and to test the proposed hypothesis.

5. RESULT ANALYSIS AND DISCUSSION

This section presents the results of exploratory factor analysis and confirmatory factor analysis to analyze the factors.

5.1. Exploratory Factor Analysis of green practices and Performance Outcomes

To check the distinctive types of GSCM factors and performance outcomes we conducted an exploratory factor analysis to explore the underlying factors consist a set of variables without imposing an ideal structure of the outcomes (Choi.*et al.,* 2017). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is used to analyze the strength of the relationship between variables, if the value of KMO is between the ranges of 0.6 to 0.69 it shows a moderate or average correlation of variables. But if the value is greater than 0.69 it shows a very good correlation of variables that is acceptable (Choi.*et al.*,2017). Therefore Table.4 shows the results for GSCM factors the KMO value is 0.831 that is acceptable, and for Bartlett's Test of Sphericity the value is 1339.734. For further exploration of structure varimax rotation is used to identify the relation of each variable with a particular set of components, it is an orthogonal rotation of factor axes to identify and minimize cross loadings in factor matrix, each factor either closer to 1 (large) or closer to zero (small).

Table 2. EFA results on the types of Green SCM factors and performances.

Measures	Construct items	Loading Factors	Communalities	Eigen value
Factor 1	CM2	.825	.853	6.388
User requirement and adoption of new Technology	CM3	.774	.707	
	ANT6	.735	.793	
	CM1	.705	.829	
	Ant5	.687	.724	
	ANT3	.676	.866	
	ANT2	.649	.678	
	CM4	.631	.707	
Factor 2	GMGT4	.704	.722	4.671
Green administration and procurement	GMGT5	.692	.704	
	GP8	.613	.683	
Factor 3	GP1	.826	.782	3.494
Green procurement and design	GP6	.610	.723	
	GD2	.607	.656	
Factor 4	GDS4	.706	.772	3.178
Green delivery and production	GM4	.678	.735	
	GM9	.655	.738	
Factor 5	GDS5	.833	.779	2.323
Green delivery and production	GM1	.746	.729	
Performance 1	OP4	.826	.792	4.279
Cost-effective	OP5	.729	.613	
Environmental	OP1	.651	.625	
Operational	ENV5	.627	.635	
	EP3	.620	.510	
	EP2	.602	.588	
	OP6	.582	.579	
Performance 2	EP7	.804	.789	3.647
Cost-effective	ENV2	.787	.724	
Environmental	EP6	.766	.812	
Operational	EP5	.711	.688	
	OP3	.536	.694	
Performance 3	OP7	.811	.692	3.192
Operational	ENV4	.659	.655	
Environmental	OP8	.649	.624	

(Table 2). shows the factor loadings of each variable is greater than 0.5 represents internal validity, all the values of communalities are greater than 0.5 shows majority of factors explained by the scattering of variables within them, each factor named as factor1, factor 2, factor 3, factor4, and factor 5, and each performance is named as performance1, 2, and 3 respectively that contain different variables on the basis of their factor loadings in a factor matrix. The same test is conducted for the performance outcomes as shown in **(Table.4)** in which KMO value is .867 and Bartlett's Test of Sphericity is 612.469. This indicates correlation matrix is not a unit matrix and from EFA results it is clear that there are 15 independent variables of three dependent factors of performance outcomes

5.2. Confirmatory Factor Analysis

In confirmatory factor analysis we consider the given factors and items based on the factor matrix we on ducted CFA and results show standardize loading estimates which should be 0.6 or more.

Table 3. Confirmatory Factor Analysis of Green Logisticspractices and Performance Outcomes.

Construct	Questionnaire item	SD: loading estimates	Critical Ratio
Factor 1	CM2: Firm frequently follows up and monitor users for quality service feedback.	0.814	
	CM3: Firm frequently measures and evaluate user satisfactions.	0.630	7.33
	ANT6: Increased productivity.	0.824	7.644
	CM1: Firm frequently interacts with users.	0.898	10.065
	Ant5: Reduced the cost of processing user orders.	0.777	7.394
	Ant3: Adoption of new technology leads to improve delivery services.	0.877	8.776
	Ant2: Adoption of new technology makes it easy for users	0.739	6.881
	CM4: Firm frequently ties to determine future user expectations.	0.792	
Factor 2	GMGT4: Environmental training and awareness programs for employees.	0.796	
	GMGT5: Reward and incentives for environmental initiatives taken by employee.	0.837	8.270
	GP8: Providing design specification to suppliers that include environmental requirements for purchased items.	0.838	
Factor 3	GP1: Ensure suppliers meet their environmental objectives.	0.669	
	GP6: Collaboration between organization and suppliers/vendors to reduce and eliminate environmental effects.	0.811	6.198
	GD2: Production process is according to environment	0.695	
Factor 4	GDS4: Cooperating with suppliers to standardize packaging.	0.796	
	GM4: Replacing hazardous substances with that are environmentally friendly.	0.843	7.775
	GM9: Use of lean/flexible production.	0.764	
Factor 5	GDS5: Sale of excess inventories/materials.	0.747	
	GM1: Produce products that have packages which can be Recycled.	0.832	
Performance 1	OP4: Achieving long term benefits.	0.791	
	OP5: Permitting of products and process.	0.697	5.916
	OP1: Improvement in process quality.	0.703	5.989
	Env5: Reduce environmental burdens.	0.758	6.703
	EP3: Increase in price of dividends.	0.685	5.775
	EP2: Increase share.	0.739	6.457
	OP6: Increase in the amount of goods delivered on time.	0.745	
Performance 2	EP7: Enhancement of corporate image.	0.758	
	Env2: Decrease of consumption for hazardous and toxic materials.	0.726	7.485
	EP6: Reduce environmental expenses with the help of GSCM implementation.	0.887	9.333
	EP5: Gained efficiency during production of products.	0.812	7.780
	OP3: Innovation in process design.	0.819	
Performance 3	OP7: Decrease in inventory levels.	0.652	
	ENV4: Decrease the frequency for environmental accidents.	0.829	6.456
	OP8: Decrease in scrap rate.	0.673	

It is observed from the **(Table 3)** that the standardized factor loading of all variables is significant and it confirms the convergent validity. Critical ratio is the ratio of estimate values and standard error if the estimated value is equal to 1 the standard error is zero and the ratio is undefined. For CFA factor we conducted EFA to reduce the variables and to choose the most appropriate variables that fit the model, the overall model fit statistics for Green SCM factors to performance outcomes are given under the **(Table 4)** which shows that all three proposed hypotheses are true.

Table 4. Summary of Hypothesis Testing

Hypothesis	GSCM factor Constructs	Performance outcome constructs	Std. coefficients	Model fit values	Result
H1= GSCM factors are positive correlate with cost-effective performance.	**Factor 1** **Factor2** **Factor3** **Factor 4** **Factor 5**	Cost-effective performance EP3 EP7 EP6 EP5	 0.536 0.772 0.948 0.764	CHI^2= 318.405 DF= 231 GFI= 0.72 AGFI= 0.636 CFI= 0.907 NFI=0.739 TLI= 00.889 RMSEA=0.083	supported
H2= GSCM factors are positive correlate with environmental performance.	**Factor 1** **Factor2** **Factor3** **Factor 4** **Factor 5**	Environmental performance Env5 Env2 Env4	 0.735 0.619 0.870	CHI^2= 279.322 DF= 205 GFI= 0.729 AGFI= 0.635 CFI= 0.981 NFI= 0.759 TLI= 0.899 RMSEA=0.081	supported
H3= GSCM factors are positive correlate with operational performance.	**Factor 1** **Factor2** **Factor3** **Factor 4** **Factor 5**	Operational performance OP4 OP5 OP7 OP1	 0.786 0.660 0.548 0.743	CHI^2=308.196 DF= 225 GFI= 0.720 AGFI=0.627 CFI=0.910 NFI=0.743 TLI=0.890 RMSEA=0.082	supported

6. CONCLUSION

This study is based on a questionnaire survey filled by appropriate authorize representing different textile sector from Sindh. Based on the results of this article, it is observed that green design, green procurement, green production, green delivery, adoption of new technology, reverse logistics, and user requirement factors successfully implement green logisticspractices in textile sector while green administration does not help in successfully implementation of green logisticspractices in the textile sector. The conclusion of this paper is textile sector can successfully implement Green design, green procurement, green production, green delivery, and reverse logistics, adoption of new technology and user requirements from moderate to large extent. It is also observed that the effect of these green logistics factors on cost-effective, environmental and operational performance outcome is positive. In terms of future studies, the limited work on green logistics factors and performance outcomes indicate that more work is needed, further studies could be conducted in different regions of Pakistan and one can choose the different sector for research such as hospital or automobile sector.

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