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Structural Equation Modeling for Sustainable Logistics Operation: Study on Practices by Organized Retail Sector

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Abstract

Organized retail sector is witnessing growth of late and its core operation is Logistics. The adverse effect of Logistics results in degradation of the environment with higher emissions of Green House Gases (GHG) into the atmosphere.

Assessment of the level of adoption of Green Logistics and identification of the main drivers for adoption of Green Logistics practices by the organized retail players enumerated. Primary data collected and analyzed using **Structural Equation Modeling (SEM).** Confirmatory Factor Analysis indicates that the correlation coefficient values were more than the adequate level. The complete measurement model for Goodness of Fit and incremental indices for the model analyzed and the Chi-Square/df value of 1.864 and 1.804 respectively indicates very good fit of the model and the Root Mean Square Error of Approximation (RMSEA) is 0.06 and 0.058 respectively which indicates that the SEM measurement model adequately supports the various constructs and is over identified.
The key driver for adoption of Green Logistics are the Government Policy and Regulations, Environmental Degradation and assuming Leadership in Sustainability by the retail organizations. Adoption of Green Logistics by Retail players would benefit the organization by reducing the operational cost in the long run, build the organizations brand value, enhance the employee morale and improve the sustainability performance.

Key Words: Sustainability, Green Logistics, Retail, Green House Gas Emission,

Introduction

Logistics operation is very much essential to ensure Goods and Services are available at the point of use at the right time with optimal cost. Globally the logistics spend on an annual basis varies between 9% to 20% of an individual country's GDP and the global average for Logistics spend is about 10 % of GDP. The adverse effect of Logistics operation is the release of Green House Gas(GHG) into the atmosphere and it is one of the prime air pollutant. The transportation contributes 12 % of total GHG

emissions. The Logistics service providers as well as users give top priority for the commercial viability aspect and least priority towards environmental sustainability.

Green Logistics aims to perform all the Logistics related operations in a more sustainable manner taking into account environmental and social factors. Thus, the objectives of Green Logistics are to render the Logistics operation greener and to reduce the negative impact of logistics on the environment. Retail and e-tail sectors are witnessing double-digit growth year on year and Logistics plays an important role for the Retail & e-tail sector to be very effective operationally.

The world body related to environment protection and sustainability is driving every country to be conscious and be concerned about the environment for the protection and preservation of eco system. Each country is committed towards reducing the adverse impact of industrial activities on the environment. Greening the logistics operation has become imperative and it is the only way forward for making the logistics operations economically functional as well as environmentally friendly.

Literature Review

Heavy traffic, poor choice of transport modes and lack of infrastructure makes logistics industry, one of the major contributor to environmental deterioration as per Banister and (Button, 1993)**. (**Taniguchi, 1999) conducted study on the effects of urban congestion due to heavy traffic which increases the consumption of fuel and affects both economic and environmental aspects of the business. However, the advantages of Intermodal transport solutions such as lower cost and emissions is outweighed by disadvantages such as increased probability of damage to the goods and lower levels of service due to lack of integrated networks and the risk involved with diverse means of transport and carriers as per (Vellanga et al., 1991). Less polluting modes such as ships and rail has bad reputation regarding customer satisfaction and speed of delivery (Rodrigue, et al., 2001).

The Logistics Service Providers, took many initiatives to enhance their service value according to (Murphy and Daley, 2001). In addition, some of the logistics service providers have improved the efficiency and efficacy of the services provided to the customers through better information technology and automation as per (Sauvage, 2003). There is a role for Logistics service providers in making the Logistics green and these companies should design green logistics solutions for the clients based on their specific requirements according to (Murphy and Poist, 2003); (Sarkis, et al., 2004).

The amount of distance traversed by a material or product to finally reach the user is known as food mile and food mile increases if the suppliers are far away and the material has to travel a long distance as per the study by (Paxton, 1994).

Environmental issues affect Logistical decisions along the supply chain and indicates relationships between company characteristics and type of strategy employed in managing Logistics operation and its environmental impacts as per (Murphy, and Poist, 2000).

(Beamon, B.M, 1999) termed logistics industry “dirtier” than other service sectors with regard to environment sustainability aspect and due to which, Green Supply Chain is assuming importance and organizations need to keenly observe the processes for adopting Green technologies wherever possible. Many companies were beginning to make efforts to comply with the regulation with regard to pollution control and highlighted the growing importance of environmental sustainability across the globe and companies are trying to reduce the adverse effects on environment through suitable modification of their processes as per (Bacallan, 2000); (Srivastava, 2007). This change and improvement was also noticed by (Zhu, et al., 2010) and there were visible concern about the environment among the people and business entities. Only 14 % of the organized retail sector were aware of Green Logistics concepts

and have initiated few measures towards environmental friendly logistic activities as per (Dakshina Murthy and Leena James, 2014).

There are five possible environmental practices in managing supply chain; These are environmental certification, pollution prevention, reverse logistics, the life cycle assessment and environmental design as per study by (Klassen and Johnson, 2004). (Jiuh, B.S, et al., 2005), formulated a linear multi-objective program model that optimizes the operations of both integrated Logistics and user product reverse logistics in a Green Supply Chain. (Diabat and Simchi-Levi, 2010), proposed a similar MIP model for the design of a supply chain but imposing a cap on the amount of CO_2e emitted in various transactions in the warehouses, manufacturing and transportation of goods to the customers. This model indicated that if the Co_2e cap becomes tighter, the cost of operation increases.

Although vehicle manufacturers are constantly developing new vehicles with lower emission levels with greener technologies, but it has failed to catch up with the growing volume of logistics requirements as per (Aronsson and Brodin, 2006).

Online etailers emit lower environment foot print as compared to conventional retailers per study by (Smithers, 2007); (Matthews, et al., 2001). (Thompson, 2007) said Retailers can save 10-25 % of energy cost by following simple steps. Proper disposal of waste is essential to reduce pollution of the environment especially that of air and water as per study by (Murphy et al., 1994 ;1995 ;1996). Eco friendly packaging offer vast benefit to retailer in cost reduction and resource conservation per study by (Verghese and Lewis, 2007). Materials used all along the supply chain must be environmentally friendly and the processes should be clean and green according to (Corbett and Kleindorfer, 2003).

Shipping liners taking the responsibility of clearing the goods from customs and dispatch them directly to the shop after consolidation and bypassing the DC have cut down the GHG emissions per study by (Bradley, 2007). (McKinnon, A. 2011) proposed some key measures to bring down GHG emissions; Vehicle routing through networking and optimization of trips through proper planning of transport requirements, avoiding congested traffic routes, which would contribute less Co_2e emissions to the environment. Firms should work closely with suppliers both upstream and downstream for better environmental goals and sustainability per study by (Chiou, et al., 2011). The key driver for implementing the Energy Saving and Pollution Reduction(ESPR) program by the Chinese manufacturers is the regulatory pressure as per (Zhu et al., 2011). Implementation of extended supply chain (ESC) practices for achieving Energy Saving and Emission Reduction (ESER)goals by the Chinese manufacturers, the main drivers are the stricter regulations and enhancing the enforcement levels. The normative drivers are the creation of awareness on environment; the mimetic drivers are through promoting sustainable purchase and buying as per (Zhu and Geng, 2013).

Operations Research concepts can be used for developing model for Logistics operation. (Dekker, R. et al,, 2012). Companies should constantly work towards reduction of energy requirement and GHG emissions in all aspects of Logistics operation that includes transportation, warehousing, packaging etc. as per study by (Zheng, et al., 2015). Governance measures have positive impact on implementation of Green Logistics by the users of Logistics services though logistics service providers rejected this as this could lead to increase in Logistics cost as per (Francesco Russo and Antonio Comi, 2016).

Methodology:

The study aims to identify the key drivers and benefits of adoption of Green Logistics by organized retail players. The sampling frame consists of organized retail players dealing with Grocery, Food & Beverage, Apparel, consumer electronics goods and FMCG. Developed Structural Equation Model and

the confirmatory measurement model used for estimating the relationship between the measured variable and the pertinent construct and then the structural model tested for estimating the relationship between constructs. The analysis carried out using AMOS 20 software. Validation of the model was established based on the acceptable levels of "Goodness-of-fit" for the model.

Result Analysis:

Conceptual Frame work:

The conceptual framework in Fig. 1 shows three critical factors or dimensions namely *GOVERNMENT POLICY AND REGULATIONS, ENVIRONMENTAL DEGRADATION and CORPORATE LEADERSHIP IN SUSTAINABILITY AND CSR ACTIVITIES* that influence the ***sustained adoption of Green Logistics.*** Similarly, on the benefits or the reflection arising out of implementation of green logistics are the, *reduction in OPERATIONAL COST IN THE LONG RUN, enhancement in the BRAND BUILDING* AND *EMPLOYEE MORAL and enhancement in the ENVIRONMENTAL SUSTAINABILITY PERFORMANCE in the organization.*
Based on the conceptual framework, the following hypotheses formulated;

H_1: *Government Policy and Regulations* has significant influence towards *Sustained Adoption of Green Logistics*.

H_2: *Environmental Degradation* has significant influence towards *Sustained Adoption of Green Logistics*.

H_3: *Corporate Leadership in Sustainability and CSR Activities* has significant influence towards *Sustained Adoption of Green Logistics*.

H_4: *Sustained Adoption of Green Logistics* significantly reduce O*perational Cost in the long run.*

H_5: *Sustained Adoption of Green Logistics* significantly enhances B*rand Building and Employee Morale*.

H_6: *Sustained Adoption of Green Logistics* significantly enhance the *Environmental Sustainability Performance.*

Test of Assumptions:

Primary data first checked for Normality test and Table 1 shows the Normality and Collinearity test results for all the constructs. The values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George, D, and Mallery, M. 2010). Thus, ***Normality holds as the values are within the specified range of skewness and Kurtosis for all the items.*** Hence, the assumption of normality holds for item under components of *Government Policy & Regulations, Environmental Degradation, Corporate Leadership in Sustainability and CSR Activities, Operational Cost in the long run, Brand Building & Employee Morale, and Environmental Sustainability Performance.* Furthermore, the Variance Inflation Factor (VIF) of all the items are below the acceptable value of 5 and also tolerance value is less than 1. This indicates that there is very low collinearity and there is no possibility of inflated variance of the items. With regard to *autocorrelation,* Durbin Watson statistics was calculated. A rule of thumb is that test statistic values in the range of 1.5 to 2.5 are relatively normal & outside of this range could be cause for concern (Field, 2009). The Durbin

Watson statistics for all dimensions are within the acceptable value. As can be seen from the results, all the indicators hold the assumptions that are required for SEM.

Convergent Validity:

Convergent Validity is "the degree to which a test measures what it claims, or purports, to be measuring". The correlation value range is from zero and one (0 – 1). If the value is more than 0.7, this indicates high level of convergence and 0.60 is considered to be an acceptable level (Barclay et al., 1995). It can be seen from the Fig 2 that the observed value is greater than 0.60 in almost all the parameters for each construct. However, Hair et al., (1995) suggested that when items have factor loadings greater than 0.30, it is inferred that the item has achieved a minimum level of convergence and if the loadings are 0.40 and above, then items are considered as important. When the items have loadings 0.50 and above, then they are considered to be significant (Ndubisi, 2006).

Discriminant Validity:

The Discriminant or the Divergent validity checks whether the measured variable differ from each other, when they are supposed to be unrelated. Yet, the rule of thumb is that the average variance extracted (AVE) values should be greater than corresponding squared inter-construct correlation estimates in the model [Fornell and Larcker, 1981]. Ideally, the square root of AVE value for each construct should be greater than 0.50 (Hair et al., 2011).

From the Table 2, it can be seen that the square root of AVE's of all the constructs are greater than 0.5 and are greater than the inter item correlations between any two latent variables together which shows that all the constructs are having discriminant validity (Fornell-Larcker,1981). For example, Square root of AVE of Envir dgrad dimension is 0.597 and the inter correlation between Envir_dgrad & Govt_Poli dimension is 0.245 and between Envir_dgrad & Cor_ldr_csr is 0.486 which indicate that they are less than the AVE of Envir dgrad. Similarly, the discriminant Validity results for the benefits aspects of Green Logistics implementation is shown in Table 3. For example, square root of AVE of Brnd_img_mor dimension is 0.567 and the inter correlation between Brnd_img_mor & Opr_cost dimension is - 0.276 and between Brnd_img_mor & Env_sust is 0.558 which are less than the AVE of Brnd_img_mor which is 0.567.

From the above table it can be inferred that there is divergence among various constructs indicating discriminant validity of the model and statistically there is no overlap among the different constructs and are free from the problem of multi-collinearity.

Speaking about the Reliability factor, it is observed from Table 4 that for all the constructs, composite reliability value is more than 0.6, the required reliability value and hence, we can conclude that majority of the items (questions), grouped to a particular construct completely converge to its respective sub dimensions. Furthermore, the Cronbach alpha values across each of the dimension depicted in the Table 4 have value more than 0.60, which is again higher than the required threshold value. Hence, we can again conclude that there is a consistency in the data, the questionnaire has relevant questions with regard to the research topic, and it has been administered to the relevant respondents.

Goodness of Fit:

Goodness of Fit test results are indicated in Table 5(For Influencing Factors) and Table 6(For Benefiting Factors). As per Table 5, the Chi-square/df ($\chi 2$/df) is 1.864 (which is less than 3). To minimize the influence of sample size on the Chi-Square model, normed chi-square ($\chi 2$/df) is used as a statistic and

value below 3 is considered as suggesting good fit and for the full-fledged study the value is less than 2 suggesting very good fit of the model.

Goodness of Fit index (GFI) value obtained is 0.932 and it is more than 0.9, which suggest very good fit of the measurement model. As GFI is very sensitive to the sample size, we can consider taking the values of Adjusted GFI (AGFI) which adjusts the GFI taking into consideration the degrees of freedom. AGFI value obtained is 0.9 and it suggest very good fit of the measurement model for the full-fledged data.

Root Mean Square Error of Approximation, which is most commonly used index for judging the goodness of fit shows a value of 0.06 and this value is well below the stringent cut off 0.07. Normally RMSEA parameter is predominantly used for assessing the goodness of fit of the structural model of SEM and for the full-fledged study related to the aspect of influencing factors for sustained adoption of Green Logistics, the value of RMSEA supports the model indicating very good fit.
As per Table 6, the Chi-square/df ($\chi 2$/df) is 1.804 (which is less than 3). To minimize the influence of sample size on the Chi-Square model, normed chi-square ($\chi 2$/df) is used as a statistic and value below 3 is considered as suggesting good fit and for the full-fledged study the value is less than 2 suggesting very good fit of the model.

Goodness of Fit index (GFI) value obtained is 0.949 and it is more than 0.9, which suggest very good fit of the model. As GFI is very sensitive to the sample size, we can consider taking the values of Adjusted GFI (AGFI), which adjusts the GFI taking into consideration the degrees of freedom. AGFI value obtained is 0.917 and it suggest very good fit of the measurement model for the full-fledged data.

Root Mean Square Error of Approximation, which is most commonly used index for judging the goodness of fit shows a value of 0.058 and this value is well below the stringent cut off 0.07. Normally RMSEA parameter is predominantly used for assessing the goodness of fit of the structural model of SEM and for the full-fledged study related to the aspect of influencing factors for sustained adoption of Green Logistics, the value of RMSEA supports the model indicating very good fit.

Considering that many of the parameters of the goodness of fit and incremental indices, it suggest that the measurement model is overall acceptable fit and the model can be considered as Over -Identified.

Table 7 indicates the Model fit in terms of identification, which is the output from AMOS software. As can be seen from the table, the model is Over-Identified as the degrees of Freedom is more than zero.

The number of variables considered in this study is 33 and with the error component, the total number of variables in the model is 63. Out of this, the number of parameters estimated considering both the influencing and benefits parameters of Sustained Adoption of Green Logistics are 13 + 3 + 11 + 3 + 24 E + 3 E + 1 E = 58 parameters.

For calculating the Number of moments, the formula that can be used is;

P*(p+1)/2 and in this case p = 26, hence the number of sample moments = 351.
Degrees of Freedom = No. of sample moments – No. of estimated parameters.

Df = 351 – 58 = 293 which is greater than zero. Of-course it is obvious that the model is over identified when the number of parameters estimated is less than the number of sample moments.

From the Table 7, it can be inferred that the degrees of freedom value of 293 which is positive indicates that the model is over-identified. An over-identified SEM model indicates that the model is identified and it can be termed as a successful depiction of the structural model using the SEM statistical tool.

SEM MODEL

The SEM model is presented in Fig 2 with and the actual loading from the AMOS output of SEM model. From the Figure 2, following are deduced;

- *GOVERNMENT POLICY AND REGULATIONS* has a significant influence on *SUSTAINED ADOPTION OF GREEN LOGISTICS* (ß =0.275). Thus, H_1 could be fully asserted. Thus, for one-unit increase in the rating scale of agreement on *GOVERNMENT POLICY AND REGULATIONS* construct, one could expect about 0.275 times (approximately one fourth times) increase in *SUSTAINED ADOPTION OF GREEN LOGISTICS* dimension.
- *ENVIRONMENTAL DEGRADATION* has a significant influence on *SUSTAINED ADOPTION OF GREEN LOGISTICS* (ß = - 0.237). Thus, H_2 could be fully asserted. Thus, for one-unit increase in the rating scale of agreement on *ENVIRONMENTAL DEGRADATION* construct, one could expect about 0.237 times (approximately one fourth times) increase in *SUSTAINED ADOPTION OF GREEN LOGISTICS* dimension.
- *CORPORATE LEADERSHIP IN SUSTAINABILITY AND CSR ACTIVITIES* has a significant influence on *SUSTAINED ADOPTION OF GREEN LOGISTICS* (ß = - 0.260). Thus, H_3 could be fully asserted. Thus, for one-unit increase in the rating scale of agreement on *CORPORATE LEADERSHIP IN SUSTAINABILITY AND CSR ACTIVITIES* construct, one could expect about 0.26 times (approximately one fourth times) increase in *SUSTAINED ADOPTION OF GREEN LOGISTICS* dimension.
- *SUSTAINED ADOPTION OF GREEN LOGISTICS* by retail sector will result in reduction in OPERATIONAL COST IN THE LONG RUN and the hypothesis is accepted (ß = - 0.308). Thus, H_4 could be fully asserted. Thus, for one-unit increase in the rating scale of *SUSTAINED ADOPTION OF GREEN LOGISTICS* construct, one could expect about 0.308 times (approximately one third times) reduction in Operation Cost in the long run.
- *SUSTAINED ADOPTION OF GREEN LOGISTICS by retail sector will result* in *improving the BRAND BUILDING & EMPLOYEE MORALE of the retail company and the hypothesis* is accepted (ß = 0.456). Thus, H_5 could be fully asserted. Thus, for one-unit increase in the rating scale of *SUSTAINED ADOPTION OF GREEN LOGISTICS* construct, one could expect about 0.456 times (close to one half times) improvement in Brand Building and Employee Morale.
- *SUSTAINED ADOPTION OF GREEN LOGISTICS by retail sector will result in enhancing the ENVIRONMENTAL SUSTAINABILIT*Y PERFORMANCE of the organization (ß = 0.219). Thus, H_6 could be fully asserted. Thus, for one-unit increase in the rating scale of *SUSTAINEDADOPTION OF GREEN LOGISTICS* construct, one could expect about 0.219 times enhancement in the environmental sustainability performance of the organization.

Conclusion:

Government Policy & Regulation has a major influence and can be considered as one of the main drivers for the adoption of Green Logistics by the organized retail sector.

The respondents fully asserted that if Green Logistics is not adopted, eventually it would lead to Environmental Degradation as the Logistics operation adversely affects the environment with release of Green House Gas emissions to the environment. Environmental degradation causes many hazards such as health hazards, global warming and its cascading ill effects on the climate.

As sustainability has become one of the leading issue which is being raised at many platforms and industry forums, the industry is positively responding to this call and few corporates are assuming leadership in sustainability and driving such programs as part of their corporate social responsibility.

The Sustained adoption of Green Logistics by organized retail sector can bring in many positive effects and benefits to the organization. Green Logistics may cost more than the regular logistics solutions, but in the long run, the company will benefit from the reduction in the Operational cost due to savings in energy and fuel. Secondly, the company brand image and employee morale get enhanced if the company adopts Green Logistics practices. Customers feel proud about the retail sector if the customers are aware of the activities taken up by the company in enhancing the environment sustainability. This is because the consumer feels that the environment is very important for their existence and the company from whom they buy the products, feel that the company should not engage in activities that adversely affect the environment. Lastly, the adoption of Green Logistics will lead to enhanced environmental sustainability performance of the organization. Of late, the awareness about green operation and efforts to make the processes green have enhanced and many organizations are working on reduction of the carbon emissions and are monitoring the carbon credit aspects of their entire operational activities.

The respondents feel that the Government should upgrade the emission norms for vehicles from time to time as a policy in order to reduce the air pollution and protect the environment. This may as well provide direction to the automobile manufacturers to look for green technologies or solutions and come up with vehicles meeting the emissions norms as set by the government. Secondly, Government should introduce energy tradable certificates for the industry which will work in a manner that the energy provided by the government in the form of electricity power connection is offset with the efforts taken by the industry to reduce the GHG emissions in their operations to that extent. Thirdly, if the government would make disclosures of carbon (GHG) emission mandatory for companies, then, one can expect sea change in the way corporate entities strategize as regards to the environmental sustainability. This will make the corporates owning up and becoming responsible entities.

In addition, the automotive industries manufacturing vehicles including the commercial vehicles used for transport of goods should constantly make efforts to develop more fuel-efficient vehicles as this would reduce the consumption of fuel and thus reduce the GHG emissions. In addition, the manufacturers should work on newer technologies to improve the design, power trains, reduced vehicle weight, reduced air drag and other frictions in the transmission that will facilitate better fuel efficiency. Improving the fuel efficiency even by $1/3^{rd}$ can reduce the GHG emissions by about 50 million tonnes of Co_2e.

Early adoption of Green Logistics ensures lowering the amount of GHG emissions leading to better environment which provide safe existence for future generations of mankind.

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Figures

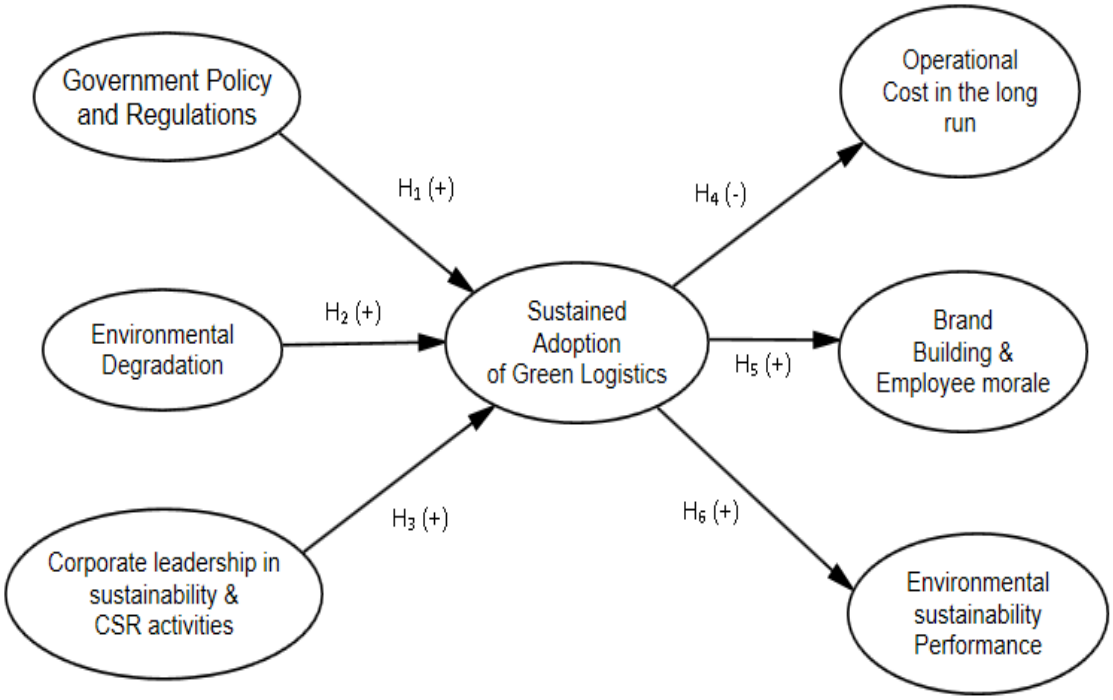

Fig 1: Conceptual Framework of the Research Study

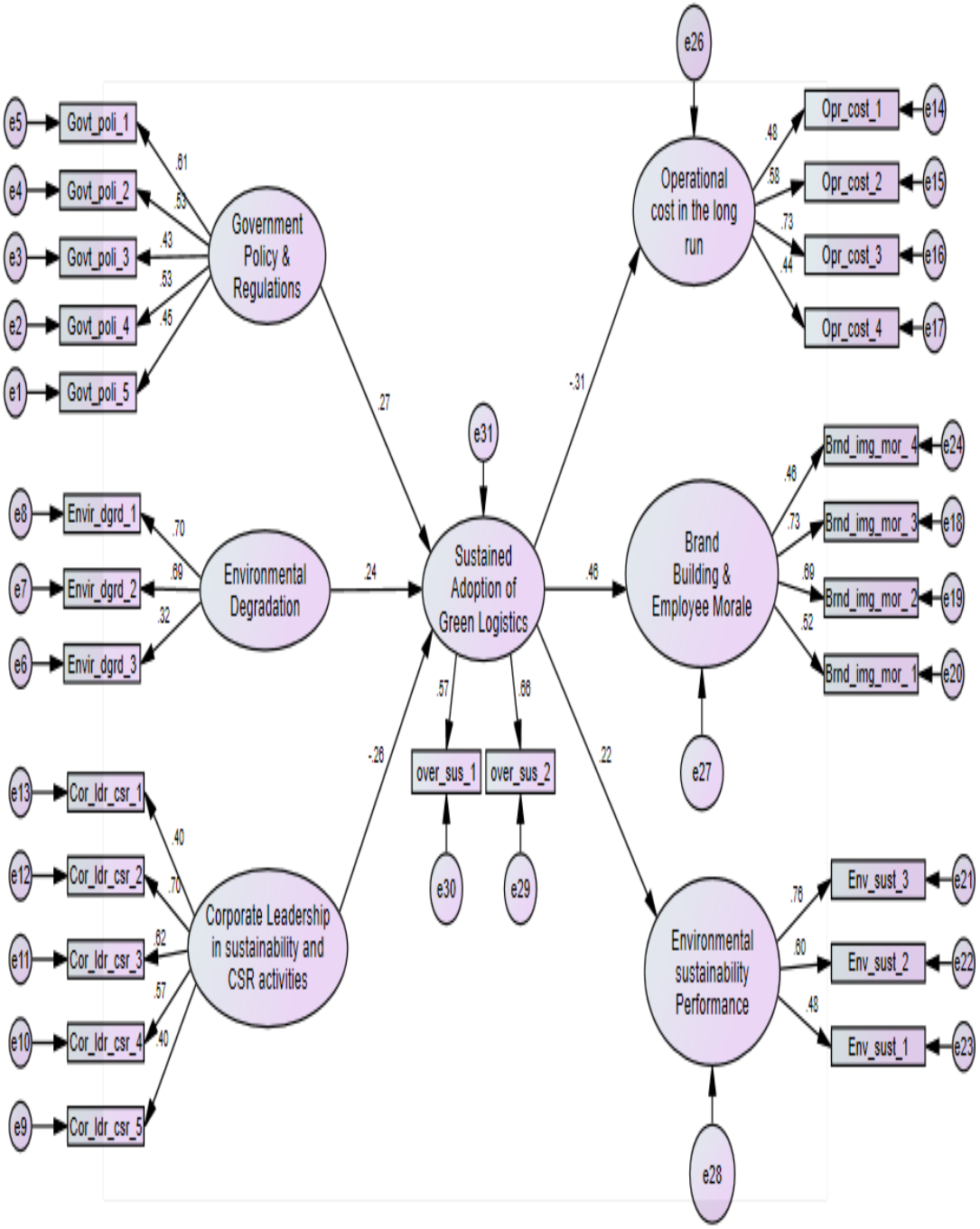

Fig 2: AMOS output of SEM Result for Adoption of Green Logistics in Retail Sector

Tables

Table 1: Normality and Collinearity test results by item wise under all dimensions

Item Label	Normality test		Collinearity & Autocorrelation Statistics			
	Skewness	Kurtosis	Tolerance	VIF	Condition Indices	Durbin-Watson Statistic
Government Policy & Regulations						
Govt_poli_1	-0.732	0.627	0.777	1.286	8.554	1.867
Govt_poli_2	-0.639	-0.520	0.821	1.218	11.254	
Govt_poli_3	-0.114	-1.001	0.883	1.132	12.998	
Govt_poli_4	-0.401	-0.675	0.821	1.218	17.095	
Govt_poli_5	-0.670	0.842	0.872	1.147	19.053	
Environmental Degradation						
Envir_dgrad_1	-0.798	0.395	0.756	1.323	9.140	1.982
Envir_dgrad_2	-0.657	-0.186	0.753	1.329	12.478	
Envir_dgrad_3	-0.499	-0.604	0.932	1.073	14.439	
Corporate Leadership in Sustainability and CSR Activities						
Cor_ldr_csr_1	-0.196	-1.053	0.873	1.146	9.211	1.961
Cor_ldr_csr_2	-0.324	-0.720	0.701	1.426	9.916	
Cor_ldr_csr_3	-0.307	-0.854	0.742	1.347	11.968	
Cor_ldr_csr_4	-0.394	-0.779	0.771	1.298	12.967	
Cor_ldr_csr_5	-0.024	-1.205	0.869	1.150	14.962	
Operational Cost in the long run						
Opr_cost_1	0.093	-1.184	0.867	1.154	8.486	1.947
Opr_cost_2	-0.076	-0.805	0.729	1.373	10.693	
Opr_cost_3	-0.088	-0.820	0.779	1.283	11.738	
Opr_cost_4	-0.089	-0.826	0.832	1.202	13.584	
Brand Building & Employee Morale						
Brnd_img_mor_1	-0.713	-0.116	0.788	1.269	9.473	2.000
Brnd_img_mor_2	-0.244	-0.923	0.692	1.444	10.768	
Brnd_img_mor_3	-0.115	-1.168	0.671	1.490	12.270	
Brnd_img_mor_4	-0.654	-0.461	0.831	1.203	14.176	
Environmental Sustainability Performance						
Env_sust_1	-0.907	1.230	0.848	1.179	13.450	1.993
Env_sust_2	-1.006	1.379	0.774	1.292	15.977	
Env_sust_3	-1.091	1.419	0.723	1.383	17.718	

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Table 2: Discriminant Validity result for Components of S*ustained Adoption of Green Logistics* Dimension

	Govt_Pol	Envir_dgrad	Cor_ldr_csr
Govt_Pol	**0.512***		
Envir_dgrad	0.245	**0.597***	
Cor_ldr_csr	0.478	0.486	**0.553***

* Square root of original AVE values shown in Table 4

Table 3: Discriminant Validity Result for Dimensions Reflecting the Benefits of Sustained Adoption of Green Logistics

	Opr_cost_	Brnd_img_mor	Env_sust
Opr_cost_	**0.567***		
Brnd_img_mor	- 0.276	**0.611***	
Env_sust	0.312	0.558	**0.621***

* Square root of original AVE values shown in Table 4

Table 4: Reliability and Item Loadings of Items under each Construct of *Sustained Adoption of Green Logistics*

Latent Variable	Items	Standardized Loadings	Composite Reliability	Cronbach Alpha	Average Variance Explained (AVE)
Government Policy& Regulations (Govt_Pol)	Govt_poli_1	0.570	**0.637**	**0.640**	**0.262**
	Govt_poli_2	0.528			
	Govt_poli_3	0.485			
	Govt_poli_4	0.538			
	Govt_poli_5	0.425			
Environmental Degradation (Envir_dgrad)	Envir_dgrad_1	0.637	**0.607**	**0.624**	**0.356**
	Envir_dgrad_2	0.728			
	Envir_dgrad_3	0.364			
Corporate Leadership in Sustainability and CSR Activities (Cor_ldr_csr)	Cor_ldr_csr_1	0.397	**0.678**	**0.688**	**0.306**
	Cor_ldr_csr_2	0.711			
	Cor_ldr_csr_3	0.613			
	Cor_ldr_csr_4	0.573			
	Cor_ldr_csr_5	0.406			
Reduction in Operational Cost in the long run (Opr_cost)	Opr_cost_1	0.443	**0.647**	**0.655**	**0.322**
	Opr_cost_2	0.711			
	Opr_cost_3	0.605			
	Opr_cost_4	0.471			
Enhanced brand building & employee morale (Brnd_img_mor)	Brnd_img_mor 1	0.518	**0.696**	**0.704**	**0.373**
	Brnd_img_mor 2	0.712			
	Brnd_img_mor 3	0.714			
	Brnd_img_mor 4	0.453			

Environmental Sustainability Performance (Env_sust)	Env_sust_1	0.508	**0.649**	**0.653**	**0.386**

Table 5: Goodness-of-fit & Incremental Indices of Measurement Model Influencing *Sustained Adoption of Green Logistics*

Fit Indices	Accepted Value	Model Value
Absolute Fit Measures		
$\chi 2$ (Chi-square)		115.592
df (Degrees of Freedom)		62
Chi-square/df ($\chi 2$/df)	< 3	1.864
GFI (Goodness of Fit Index)	> 0.90	0.932
RMSEA (Root Mean Square Error of Approximation)	< 0.10	0.060
Incremental Fit Measures		
AGFI (Adjusted Goodness of Fit Index)	> 0.90	0.900
Parsimony Fit Measures		
PCFI (Parsimony Comparative of Fit Index)	> 0.50	0.694
PNFI (Parsimony Normed Fit Index)	> 0.50	0.612

Table 6: Goodness-of-fit & Incremental Indices of Measurement Model of Components Under Benefits of Sustained Adoption of Green Logistics

Fit Indices	Accepted Value	Model Value
Absolute Fit Measures		
$\chi 2$ (Chi-square)		73.954
df (Degrees of Freedom)		41
Chi-square/df ($\chi 2$/df)	< 3	1.804
GFI (Goodness of Fit Index)	> 0.90	0.949
RMSEA (Root Mean Square Error of Approximation)	< 0.10	0.058
Incremental Fit Measures		
AGFI (Adjusted Goodness of Fit Index)	> 0.90	0.917
Parsimony Fit Measures		
PCFI (Parsimony Comparative of Fit Index)	> 0.50	0.688
PNFI (Parsimony Normed Fit Index)	> 0.50	0.631

Table 7: Computation of Degrees of Freedom for Identification of Model for Sustained Adoption of Green Logistics and Benefits Arising out of Green Logistics

Model	No of variables	No of sample moments	No of estimated parameters	DF	Remarks	Model
Adoption of Green Logistics	**63**	**351**	**58**	**293**	**DF > 0**	**Over Identified**