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The Role of Sustainability for Enhancing Third-Party Logistics Management Performance

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Abstract

Technological development and globalization made the supply chain more complex in today's business environment. In competitive market conditions, shippers tend to outsource most of their logistical activities to Third-Party Logistics (3PL) service providers. These activities have drawn attention of decision makers regarding sustainability concerns. This study examines sustainability initiatives which have been implemented particularly for the 3PL functions namely; transportation, warehousing and packaging services and their influence on performances. Empirical data have been collected through a worldwide online survey which has been sent to industrial experts working in logistics and supply chain management fields. The results were analyzed through the Structural Equation Modelling (SEM). The analysis indicated that, the 3PL functions significantly affect environmental, economic, social and operational performance, except packaging which had no significant impact on economic, operational and social performance, in addition to transportation which had no significant impact on social performance. Regarding the performance outcome and its impact on logistics efficiency, logistics effectiveness and competitiveness, empirical results indicated that there is no significant impact between the variables except, social performance which had a significant impact on logistics efficiency and competitiveness, operational performance which had a significant impact on logistics efficiency, logistics effectiveness and competitiveness. The proposed model and hypotheses developed give further understanding regarding 3PL industries thereby help decision makers in solving the problems related to 3PL sustainability initiatives.

Keywords: 3PL, performances, quantitative research, structural equation modelling (SEM), sustainability

1. Introduction

Sustainability is a concept that has been derived to fill the gap between the development and environment. World Commission on Environment and Development (WCED) has defined sustainable development as, "It is not fixed state of harmony, but rather a process of change in which, exploitation of resources, the direction of investments, the orientation of technological development, and the institutional change are made consistent with future as well as present needs." (Brundtland, 1987). Third-party logistics is outsourcing philosophy in logistics and supply chain industry. 3PLs has become worldwide industry that fulfills customer needs through a host of primary and value-added services (Gardner, 2004).

Sustainability causes various impact in all the logistics function of 3PL, it has become a challenging area for 3PL for a highly competitive market. Sustainability is a Holistic approach towards developing solution against challenges and created direct or indirect impact on the logistical performances. The selection of sustainability initiatives is already taken into practice; however there are many aspects that should be considered based on the

effects on performance in 3PL. Furthermore, the available information does not give a clear image about the impact of sustainability in various management performances. This requires a further study to understand better insights. Therefore, sustainability in 3PL has become more interesting area for further research. Performance related sustainability initiatives should be considered when the major strategic decisions are made in 3PL industries (Evangelista, Huge-Brodin, Issaksson, & Sweeney, 2013).

The main logistics functions in 3PL are transportation, warehousing, packaging which is mainly focused in this part of the research. This research will further contribute the advance knowledge in literature. It will provide an idea to develop strategic solution within the 3PL industry. The impact of sustainability initiatives will be explained. This research could be helpful to create make decisions for logistics service providers to select sustainability initiatives in future.

2. Role of 3PL in Logistics and Supply Chains

3PL has very broad meaning in supply chain and it can be applicable to any contract that includes the storing or shipping of goods. Therefore, 3PL is also known as "contract logistics" (Rouse, 2010), "logistics provider", "third party logistics supplier", "logistics outsourcing" and "logistics alliances" (Selviaridis & Spring, 2007). Sometimes a single service like transportation, warehousing or many multiple services can be managed by 3PL in the entire supply chain (Rouse, 2010).

Today's global supply chains are facing multiple challenges which includes coordination of supplies in inbound and outbound, storage of goods, inventory management, distribution of finished products through various modes of transport across the countries. Therefore, these types of challenges could become more difficult due to delays, mistakes, miscommunications, human error and accidents (Plunkett, 2009).

Logistics services could be outsourced to satisfy customer demand at low cost and risk. Outsourcing of logistical services have become critical for big industries due to the reason that industries can focus their energies on their core operations which are very important to survive in global competition and give the rest of the responsibility to 3PL providers. The overall scenario about buying logistics service has been increased by following two reasons (Bhatnagar, Sohal, & Millen, 1999):

- Increase in the number of service provided by 3PL.
- The number of customers of 3PL services has been increased.

3PL act as intermediator between manufacturer or supplier (the party which purchase the service known as shipper) and the end user is customer (consumes the product or service). In this way, 3PL will have to focus on both side and should face challenges which are unique to its operations (Cheong, 2004).

In today's business, it has become difficult to concentrate on methods to increase customer service along with cost controlling. 3PL has become essential to outsource such type of activities and that provides wide range of benefits which are (Evans, 2015):

- Utilization of resources: 3PL can help to save time and cost and make the business efficient in all manners. 3PL reduce the cost of investment in warehouse space, transportation and skilled manpower to execute the logistics process.
- Expertise: 3PLs are very much familiar about the latest developments in logistics, technology and other related fields. They have updated knowledge about the best practices in industry which is useful for the users. Much software used for monitoring entire logistics process, advance reporting, and inventory management improves visibility and makes the process transparent.
- Flexibility and scalability: With the use of 3PL, organizations become more flexible because that made it easier to scale transportation, staff and other resources according to inventory demand. 3PL provider takes all burdens, which make you take seasonal advantages and handle all the transactions smoothly.
- Continuous improvement: Logistics service providers are highly flexible with fluctuations. 3PLs have ability to make the adjustments according to the different circumstances faced in supply chain so that the customer need can be fulfilled as fast as possible in an efficient and in effective manner. In short, 3PL can help to reduce lead time, maximize the profit and improves the quality.
- Use of latest technology: for a complex supply chain process, 3PL offers latest software and technology. Therefore, user should not have to invest in latest developments.

- Improves growth rate: 3PL allows you to develop your market not only up to state or county, but also to the world. Therefore, business can be expanded with minimal cost which directly affects to growth rate of business.
- Safety: An experienced 3PL provider ensures security by preventing from making huge mistake in decision-making process and assures higher return on investments.
- Customer satisfaction: advanced technology, skilled manpower and multiple asset in 3PL assure that all logistical international level will be satisfied. Therefore, the business can mainly focus on the customer services.

Hence, logistics functions become clearer and faster due to the benefits of using 3PLs.

3. Sustainability Initiatives in 3PL

3.1 Sustainable Transport Initiatives

3PLs provide transportation services locally and globally to small, medium and large-scale industries and these services have been carried out using a variety of sustainable approaches (Evangelista et al., 2013). See Table 1.

Table 1. Sustainable transportation initiatives

Sustainability initiative	Examples
Alternative fuels	Use of bio fuels, use of renewable energy sources, limitation on fossil fuels or its usage base on environmental class specific fuel consumption.
Vehicle usage	Replace old fleets, modern and efficient vehicles, regular maintenance.
Choice of transport mode	Selection of transport mode that that give sustainable benefit (air, sea, rail transport or intermodal transport), load optimization.
Modify logistical system design	Use direct transport, improvements in distribution network, decrease average length of haul, route planning-Transport management system (TMS).
Choice of partners	Ask for support of customer to achieve your own environmental targets, selection of environmental transport provider.
Emissions and energy data	CO2 reports, consumption from external transportation.
Driving behavior	Driver training for consistent performance.

Note. Adapted from (Martinsen & Björklund, 2012).

3.2 Sustainable Warehousing Initiatives

Storage is a key function of warehouses. Sustainability in warehousing can be focused on several aspects. From designing of the warehouse to its management and maintenance, sustainability criteria can be considered at various stages. Several sustainability initiatives can be classified based on warehouse design, warehouse management and handling of goods. Initiatives and their examples are listed in Table 2.

Table 2. Sustainable warehousing initiatives

Sustainability initiative	Examples
Warehouse design	
Location	Environment-friendly facility location.
Construction materials	Recycled concrete, asphalt, and other materials.
Lighting	Skylight installation, clerestory windows, Energy efficient lighting.
Warehouse management	
Education	Training, awareness programs, seminars.
Working condition	Ergonomic working environment according to safety and security of employee.
Alternative energy source	Use of solar or photovoltaic panels or other renewable energy sources.
Waste management system	Waste water recycling plants, water storage system, solid waste management system.
Handling of goods	
Material handling	Installation of equipment– Automated guided vehicles (AGV) and automated storage and retrieval system (ASRS).
Warehouse management system	Pick-by-light technology, voice technology, RFID, and other automated solutions.

Note. Adapted from (Furtado, 2017; Perotti, Zorzini, Cagno, & Micheli, 2012).

3.3 Sustainable Packaging

Packaging plays an important role in storing, handling and transportation of goods, for the individual who is concerned about efficiency and effectiveness of logistical activities. When it comes to sustainable packaging, it

must be beneficial from the environmental, economic and social point of view. The major sustainable initiatives in packaging are; recycle and reuse of packaging, eco-friendly packaging design, biodegradable packaging materials and customer cooperation (Perotti et al., 2012).

4. Research Methodology

A quantitative method is used to investigate relationships between variables through developing a research questions or hypotheses and analyze collected data to test this hypothesis or questions (Creswell, 2014). Since this research is trying to investigate the relationship between two variables, quantitative method will be adapted, through formulated questionnaires in the survey to collect data from the participants. However, before carrying out with the empirical analysis research hypotheses must be developed by examining the theories, the relationships between the sustainability criteria and performance.

4.1 Hypotheses and Model Development

Sustainability initiatives in 3PL have an influence on performance outcomes. Environmental performance, economic performance, social performance, operational performances are determined as the four performance measures which have direct relations to the 3PL sustainable initiatives (Gunasekaran, Patel, & McGaughey, 2004). Indicators of all performance measures are derived. Performance indicators reflect the influence of 3PL function on a specific performance measure. Their relationship is established with each 3PL function. It is also assumed that Logistics efficiency, logistics effectiveness and competitiveness are the other measures on which there is an influence of performances.

Environmental Performance reflects the consequences of 3PL sustainable initiatives on the environment. These initiatives are influencing internally as well as externally to the company. To measure environmental performance following indicators are derived (Ageron, Gunasekaran, & Spalanzani, 2012; Perotti et al., 2012);

- Reduction of air emission
- Reduction of wastes (solid and liquid waste)
- Decrease of hazardous material consumption
- Decrease of environmental accidents
- Reduction in energy and fuel consumption
- Environment management (ISO 14001 certification and EMAS)

The above indicators describe the changes that occur in the environment due to incorporating sustainability initiatives into 3PL. To check their influence on environment following hypotheses are considered.

H1: Environmental performance improves with the adoption of 3PL sustainable transport initiatives.

H2: Environmental performance improves with the adoption of 3PL sustainable warehousing initiatives.

H3: Environmental performance improves with the adoption of 3PL sustainable packaging initiatives.

Economic performance is defined as the financial achievements that a company gains after adopting sustainable initiatives. To measure economic performance following indicators are derived (Geng, Mansouri, & Aktas, 2017; Perotti et al., 2012);

- Improvement of market share
- Improvement in revenue
- Increase of investments
- Increase the cost of Eco-friendly materials
- Increase of training cost
- Decrease cost of energy consumption
- Decrease cost of waste treatment
- Decrease fine of environmental accident

Companies recognize economic improvement through company's current situation in the market. Sustainability initiatives could give profits. Therefore, following hypotheses are assumed:

H4: Economic performance improves with the adoption of 3PL sustainable transport initiatives.

H5: Economic performance improves with the adoption of 3PL sustainable warehousing initiatives.

H6: Economic performance improves with the adoption of 3PL sustainable packaging initiatives.

Social performance: Following social performance indicators are selected to measure impact of sustainability in 3PL (Ashby, Leat, & Hudson, 2012; Geng et al., 2017; Zailani, Eltayeb, Hsu, & Tan, 2012);

- Increasing product and company image
- Protecting employee health and safety
- Ensuring customer loyalty and satisfaction
- Short term relationship (in terms of contract)
- Long term relationship (in terms of contract)
- Social responsibility
- Government support

The above factors describe many big organizations are seeking continuously to convince people through adopting sustainable initiatives. Sustainable outcomes could influence on relationships and a company image in their market. To identify the relationship with social performance, following hypotheses are proposed:

H7: Social performance improves with the adoption of 3PL sustainable transport initiatives.

H8: Social performance improves with the adoption of 3PL sustainable warehousing initiatives.

H9: Social performance improves with the adoption of 3PL sustainable packaging initiatives.

Operational performance: "…defined as operational level measures, which include the ability in day-to-day technical representation, adherence to developed schedule, ability to avoid complaints and achievement of defect free deliveries." (Gunasekaran et al., 2004). Following operational performance indicators are selected to measure impact of sustainability in 3PL (Geng et al., 2017; Perotti et al., 2012; Zhu, Sarkis, & Lai, 2012);

- Improvements of timeliness of goods delivery
- Reduction in inventory levels
- Scrap rate increase
- Improvement in quality of product
- Increase of productivity
- Improvement in capacity utilization

The definition suggests that daily operations are affected through adopting green initiatives. Various operations like storing, maintaining and delivery are affected through sustainability initiatives. Lots of waste can be eliminated through which processes are optimized. Better utilization of resources results in smoother operations in the logistics functions. Therefore, following hypotheses are created to check the influence of 3PL sustainability initiatives on operational performance.

H10: Operational performance improves with the adoption of 3PL sustainable transport initiatives.

H11: Operational performance improves with the adoption of 3PL sustainable warehousing initiatives.

H12: Operational performance improves with the adoption of 3PL sustainable packaging initiatives.

Logistics efficiency: Efficiency describes that how well the resources are utilized economically. The companies are expecting maximum output from the system they are using. Therefore, sustainable initiatives should prove efficient results (Pazirandeh & Jafari, 2013);

- Administrative cost
- Transport cost
- Inventory cost
- Warehousing cost
- Total logistics cost
- Cost of obsolescence

Companies are expecting high logistics efficiency by improving environmental, economic, social and operational performances. The focus on such performance requires huge amount of investment in terms of times and costs. Sometimes, operation costs are reduced when we are focusing on such performances. On the other side, some

disadvantages may create the extra costs. Therefore, it is questionable that how this performance affects the logistics efficiency. Hence, the following hypotheses are assumed:

H13: Logistics efficiency improves with environmental performance

H14: Logistics efficiency improves with economic performance

H15: Logistics efficiency improves with social performance

H16: Logistics efficiency improves with operational performance

Logistics effectiveness: It is described as how much extent our objective is accomplished. Following are the indicators selected to measure 3PL effectiveness of various performances (Pazirandeh & Jafari, 2013);

- Order lead time
- Delivery consistency
- Backorders
- Loss and damage of goods
- Overall reliability

Various performances have their effect on delivery and its timings. They have a direct or indirect effect on 3PL process. Furthermore, performances could have their influence on reliability too. Therefore, following hypotheses are assumed:

H17: Logistics effectiveness improves with environmental performance

H18: Logistics effectiveness improves with economic performance

H19: Logistics effectiveness improves with social performance

H20: Logistics effectiveness improves with operational performance

Competitiveness: Many companies are using performance outcomes as a marketing tool to attract new customers. Improvement is the main tool to achieve competitiveness. Many other indicators can be described as (Ageron et al., 2012; Pazirandeh & Jafari, 2013);

- Improvement in efficiency
- Quality improvements
- Improvement in productivity/ productivity enhancement
- Cost savings
- Product price
- Flexibility
- Responsiveness
- Develop innovative solutions

Many companies have recognized that their competitiveness is improved by improving performances (Ageron et al., 2012)

To identify which performance influencing competitiveness, following hypotheses are assumed:

H21: Competitiveness improves with environmental performance

H22: Competitiveness improves with economic performance

H23: Competitiveness improves with social performance

H24: Competitiveness improves with operational performance

Based on the above developed hypotheses the proposed model is constructed in Figure 1.

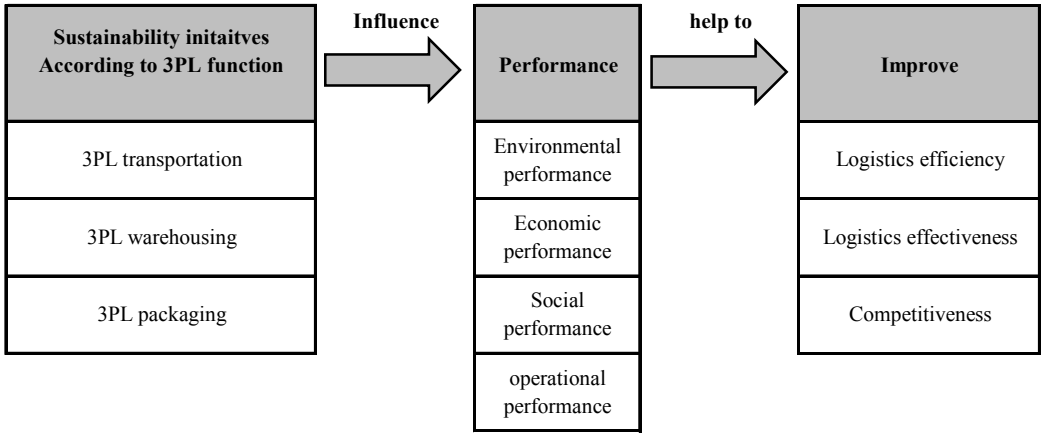

Figure 1. Proposed model—Self-illustrated

4.2 Formulation of Questionnaires

Questionnaires are formulated in the survey to collect the data from the participants. Questionnaire is mainly formed in the English language. To contact local respondents, a separate link of questionnaire was generated in the German language.

In all there are 17 number of questions formulated. Questionnaire contains open-ended question in which a participant can easily respond to the maximum number of questions (Creswell, 2014). Those are by using the marking of a radio button or in one-two words or with checklist. The questions 1 to 7 focus on the demographic findings. These questions will collect basic information of the respondent. Questions 8 to 17 represent main part of survey and which are mandatory to be answered. Questions 8 to 10 are formulated to collect the opinions to estimate which sustainability initiative is more effective in a 3PL function. The indicator is represented as a sustainable initiative in a particular logistics function. Questions 11 to 17 collect the opinion about influence of sustainability on various performances. The sub questions are performance indicators. These questions are asked to collect ratings. For this purpose, 5-point Likert scale is used (Brace, 2008). In this method of research, ratings are varied with options “highly effective” to “very less effective” and “very high degree” to “very low degree”. However, there was also “no opinion” option available for the respondent. It can be select if they have no specific idea of the question. This form of questions is easy to answer and interpret the data during the analysis.

4.3 Survey

Several target groups were searched through keywords like “3PL”, “3PL providers”, “Contract logistics” and contacts were formed on social professional networks prior to conduct the survey. Participants were also searched according to region or name of some famous logistics service providers or according to the type of industry e.g. Supply chain, Manufacturing, Automotive etc. Most of the requested persons were from logistics, transportation, industrial engineering, material management, packaging, procurement.

Survey questionnaire had been created on Google forms, which offers great flexibility by providing updated data and the use of this service is totally free of cost. The questionnaire was sent to various persons who are associated with 3PL field and have high experience.

5. Data Analysis and Results

5.1 Pilot Study

In the first phase of the survey, questionnaire was sent to the two hundred industry experts and the first 21 responses were selected to perform the pilot test. Figure 2 and 3 and Table 3 and 4 shows the results of the pilot study regarding composite reliability, average variance extracted (AVE), Fornell-Larcker criterion, and outer loading respectively.

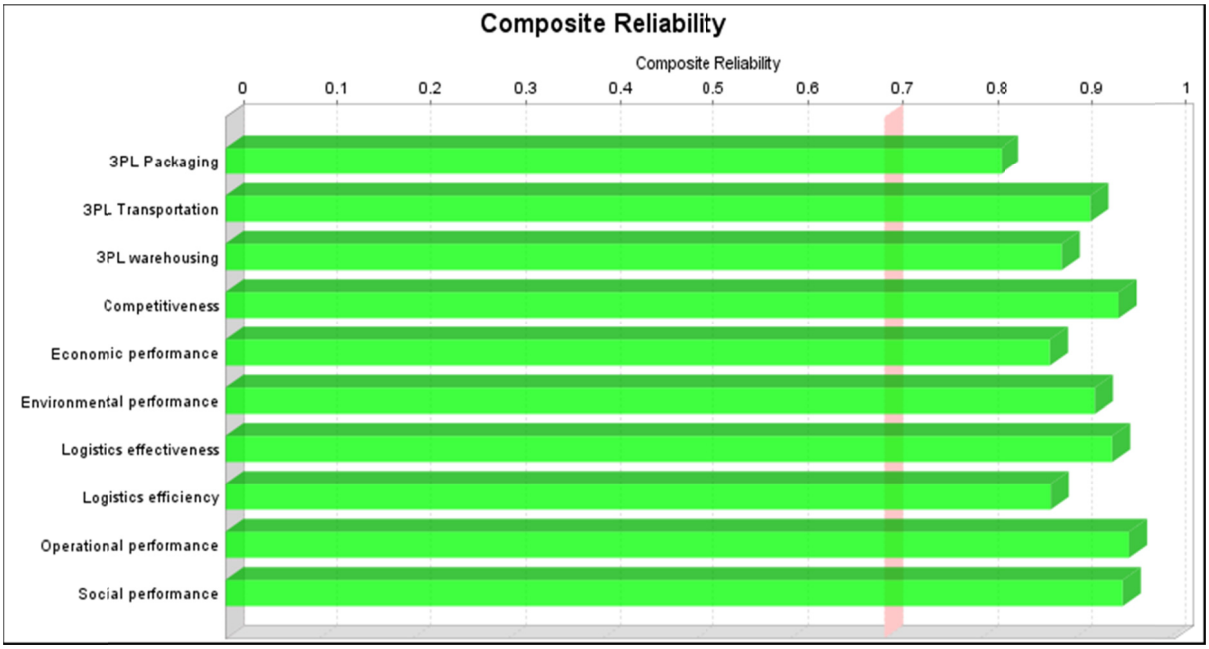

Figure 2. Composite reliability for pilot study

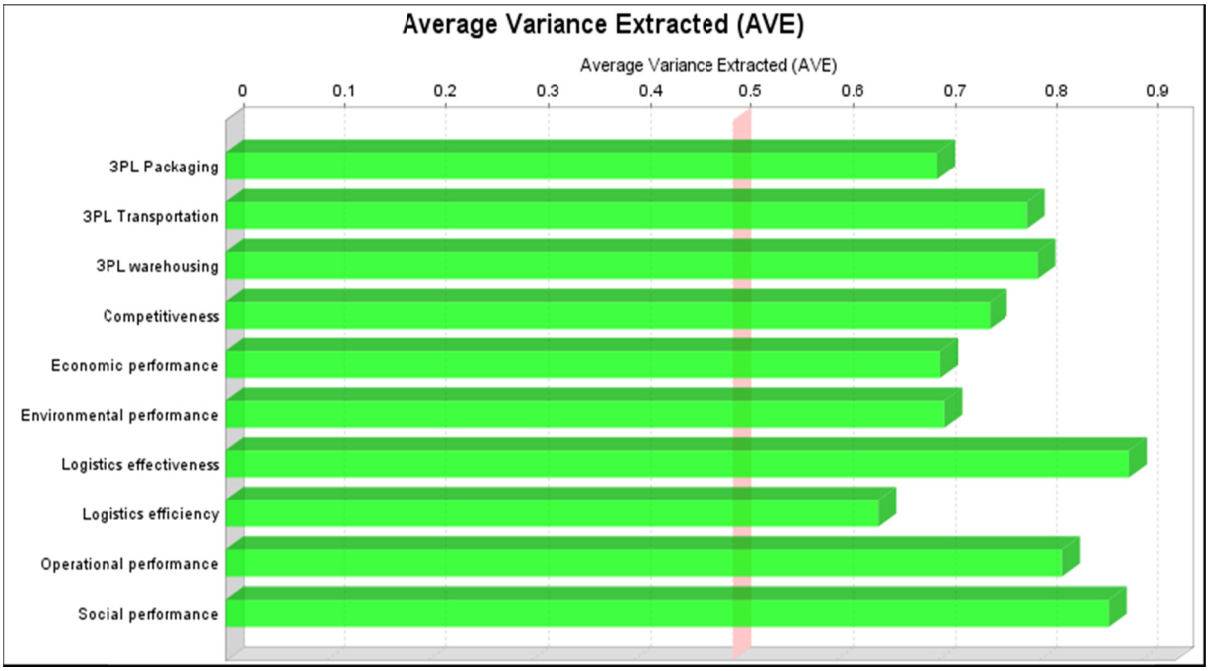

Figure 3. Average variance extracted for pilot study

Table 3. Fornell-Larcker criterion for pilot study

	3PL packaging	3PL transportation	3PL warehousing	Competitiveness	Economic performance	Environmental performance	Logistics effectiveness	Logistics efficiency	Operational performance	Social performance
3PL packaging	0.836									
3PL transportation	-0.15	0.888								
3PL warehousing	0.127	0.575	0.894							
Competitiveness	-0.114	0.73	0.654	0.867						
Economic performance	-0.183	0.444	0.601	0.426	0.838					
Environmental performance	0.451	0.355	0.511	0.253	0.645	0.84				
Logistics effectiveness	-0.122	0.632	0.431	0.849	0.251	0.021	0.942			
Logistics efficiency	-0.417	0.553	0.405	0.723	0.454	0.075	0.733	0.801		
Operational performance	-0.424	0.559	0.321	0.434	0.706	0.344	0.433	0.583	0.907	
Social performance	-0.002	0.652	0.457	0.559	0.668	0.593	0.491	0.471	0.635	0.932

Table 4. Outer loading for pilot study

	3PL packaging	3PL transportation	3PL warehousing	Competitiveness	Economic performance	Environmental performance	Logistics effectiveness	Logistics efficiency	Operational performance	Social performance
q10.1	0.808									
q10.3	0.864									
q11.1						0.879				
q11.2						0.755				
q11.4						0.795				
q11.5						0.956				
q11.6						0.802				
q12.1					0.758					
q12.2					0.823					
q12.6					0.925					
q13.3										0.922
q13.4										0.962
q13.6										0.911
q14.1									0.889	
q14.2									0.923	
q14.3									0.83	
q14.5									0.916	
q14.6									0.972	
q15.2								0.72		
q15.3								0.825		
q15.4								0.932		
q15.5								0.708		
q16.3							0.959			
q16.4							0.926			
q17.1				0.923						
q17.2				0.887						
q17.3				0.904						
q17.5				0.786						
q17.7				0.853						
q17.8				0.84						
q8.6		0.909								
q8.7		0.89								
q8.8		0.864								
q9.4			0.954							
q9.6			0.829							

The results of the pilot study insures the validity of the model as composite reliability is above 0.7, AVE is above 0.5, Fornell-Larcker criterion is fulfilled as the square root of AVE of a construct is greater than the correlations between the construct and other constructs in model, finally outer loadings criterion is also fulfilled as constructs is always greater than any other loadings of the other constructs (Hair, Hult, Ringle, & Sarstedt, 2017).

5.2 Survey Results

The survey questionnaire was sent to 1080 participants on social professional network. Total 155 persons had participated by filling up this questionnaire. Two of these participants are eliminated because of their positions were unidentified. Total 153 responses were considered for the further tests of the data. Overall response rate was 14.17%. Figure 4 shows classification of respondents according to the type of industry. Table 5 shows the respondents position in their company, company size and characteristics and whether companies has activities on a global level.

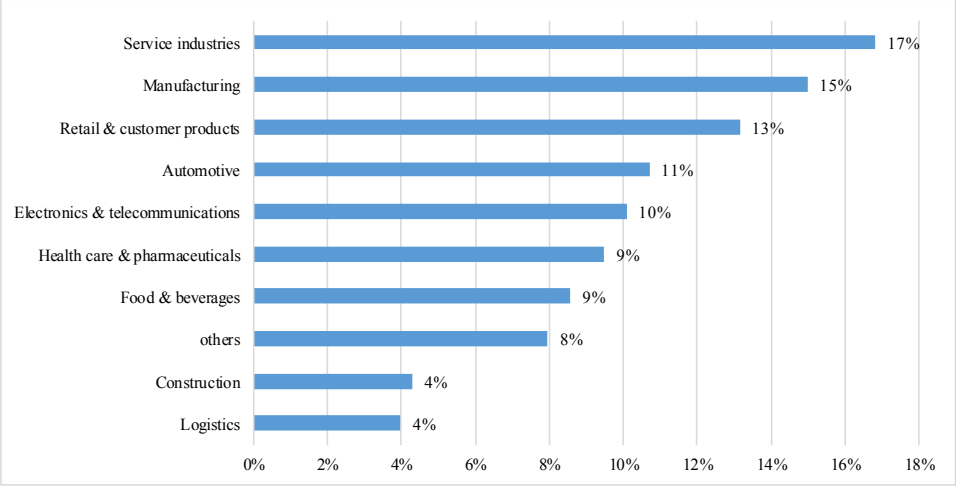

Figure 4. Industry specifics of respondents

Table 5. Demographics findings

Type of Demographic finding	number of respondents (n =153)	Percentage
Company size		
Large (above 5000)	67	44%
Medium (from 1000 to 5000)	23	15%
Small (up to 1000)	63	41%
Company characteristics		
3PL provider	79	52%
3PL User (Customer or Shipper)	63	41%
Non-user/ past user or past customer or past shipper	11	7%
Geographical coverage		
Global / International	128	84%
Local	25	16%
Respondent profile		
Manager	60	39%
Director	24	16%
Others	12	8%
Head	11	7%
Vice president	9	6%
Leader	9	6%
CEO	8	5%
Sr. Executive	4	3%
Supervisor	4	3%
Deputy manager	3	2%
Specialist	3	2%
Jr. Manager	2	1%
Assistant director	1	1%
Engineer	1	1%
Controller	1	1%
Consultant	1	1%

5.3 Model Evaluation

Research model can be analyzed in two phases. First, there are several tests followed in the measurement model validation, which includes internal consistency reliability, indicator reliability, convergent validity and discriminate validity tests are conducted to validate the measurement model. In the second phase, the model is validated by determining path coefficients and coefficient of determinations through which hypotheses is tested to determine whether it will be accepted or rejected. Table 6 shows the tests performed for the measurement and structural model and their guidelines.

Table 6. Validation criteria

Type	Guidelines
Measurement model validation	
Internal consistency reliability	
Composite reliability (CR)	Above 0.7 (For exploratory research)
Convergent validity	
Indicator reliability	All indicator's value Above 0.7
Average variance extracted (AVE)	Above 0.5
Discriminant validity	
Cross loading	Indicator value should be highest for the respective construct than other indicators of other constructs
Fornell-Larcker criterion	The square root of AVE of a construct must be greater that correlations between the construct and other constructs in model
Structural model validation	
Path coefficient (ß)	Ranges between +1 and -1
t value	1.96
Coefficient of determination (R^2)	Ranges between 0 and 1
Note: Significance level 0.05	

Note. Adapted from (Hair et al., 2017).

Structural equation modeling (SEM) is used in SmartPLS software which allows a researcher to analyze variables which are not directly measurable (Hair et al., 2017).

First step of research analysis is to prepare a path model; a path model is a graphical representation of variables based on theory and logic that visually describes the hypotheses to be examined. It has two elements namely a structural model and a measurement model (Hair et al., 2017).

Figure 5 shows the structural model which shows the sequence of research model from left to right and three types of variables. It has independent variables on the left side which are predictor. These are the constructs which are termed as exogeneous latent variables. These variables have arrows pointing out of them. Dependent variables are the outcomes constructed at the right side and they have arrows pointing into them. Mediator variables always appear in the middle as they have dual relationship. They have arrows coming in from the one side and coming out from the other side. In this research model, all the 3PL functions are independent variables as they are predicting influence on performances and the mediator variables are performances.

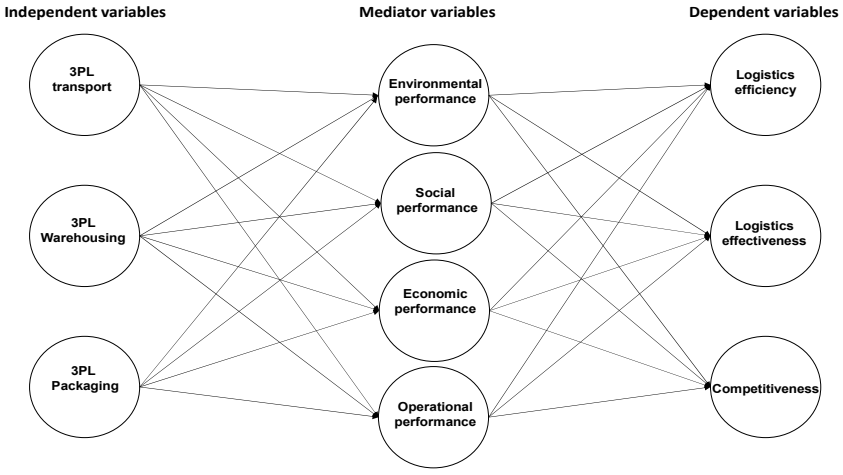

Figure 5. Structural model

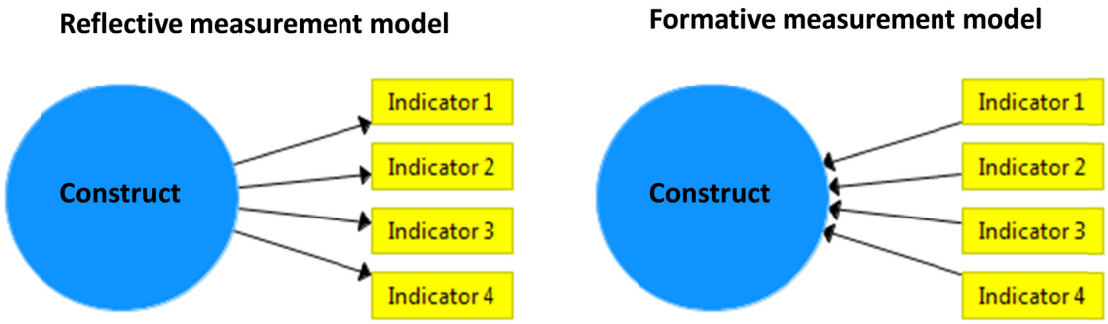

Figure 6. Types of measurement model

5.3.1 Internal Consistency Reliability

Reliability describes how the results are close to each other. There are two criterions to measure internal consistency. Typically, Cronbach's alpha is a traditional criterion to measure internal consistency reliability. The test gives an estimation of reliability by checking inter-correlations of the observed indicator variables. Reliability tests were conducted in SPSS statistical software. Ideally, the value of Cronbach's alpha should be above 0.7 (Hair et al., 2017). Error! Reference source not found.7 describes the test results. Cronbach's alpha is dependent on the number of indicators in each construct. Therefore, it can be improved by removal of certain indicators to reduce measurement error in the analysis Once a value reaches to a certain threshold point, it is impossible to improve the value. However, only in some constructs, it was required to improve the values. The other constructs have already a threshold values which can't be improved further. For example, Cronbach's alpha is improved to 0.751 by eliminating usage of alternative fuel in 3PL transport.

Table 7. Cronbach's alpha test

Construct	Indicators deleted	Cronbach's alpha	Improved Cronbach's alpha
3PL transportation	Usage of alternative fuel	0.745	0.751
3PL warehousing	-	0.833	0.833
3PL packaging	-	0.628	0.628
Environmental performance	-	0.810	0.810
Economic performance	-	0.855	0.855
Social performance	Short term relationship, Government support	0.816	0.838
Operational performance	-	0.915	0.915
Logistics efficiency	Administrative costs, Inventory costs, Costs of obsolescence	0.841	0.887
Logistics effectiveness	-	0.905	0.905
Competitiveness	-	0.894	0.894

Cronbach's alpha does not give an appropriate detail about individual reliability of indicator. SmartPLS overcomes this limitation by prioritizing the indicators according to individual reliability. Therefore, it is more suitable to apply composite reliability to measure internal consistency reliability. This measure is dependent on the outer loadings of indicator variables. The value of composite reliability varies between 0 and 1. Higher value indicates higher composite reliability. Normally, values between 0.60 and 0.70 are accepted in exploratory research. However, values above 0.70 are considered as satisfactory (see Table 6).

5.3.2 Convergent Validity

Convergent validity is the extent to which an indicator correlates positively with the other indicator of the same construct. For convergent validity, outer loadings of indicators and average variance extracted (AVE) are considered (Hair et al., 2017). From the use of Smart-PLS algorithm function, the values of all criterions were obtained. If the values were below the recommended guidelines shown in table 4, then the indicator with lowest loading value was eliminated at each algorithm run. In this way, CR, indicator reliability and AVE values were

improved and measurement model has been validated. The final values and average variance of all constructs are displayed in Table 8 and 9 respectively.

Table 8. Model validation

Cross loadings	Construct and indicators	Outer loading	t values
	3PL transportation (CR = 0.852) (AVE = 0.657)		
q8.6	Emission and energy data	0.818	20.980
q8.7	Choice of partners	0.815	17.914
q8.8	Driving behavior	0.799	19.341
	3PL warehousing (CR = 0.843) (AVE = 0.642)		
q9.1	Education	0.797	18.975
q9.2	Environment friendly facility location	0.808	16.875
q9.3	Consideration of construction materials	0.798	16.992
	3PL packaging (CR = 0.840) (AVE = 0.725)		
q10.1	Recycle or reuse of packaging	0.799	8.082
q10.2	Eco-friendly packaging design	0.900	14.987
	Environmental performance (CR = 0.853) (AVE = 0.592)		
q11.1	Reduction of air emission	0.816	23.090
q11.2	Reduction of wastes	0.751	15.700
q11.4	Decrease of environmental accidents	0.773	18.942
q11.5	Reduction in energy consumption / fuel consumption	0.734	12.797
	Economic performance (CR = 0.882) (AVE = 0.599)		
q12.1	Improvement of market share	0.749	13.974
q12.2	Improvement in revenue	0.742	13.733
q12.6	Decrease cost of energy consumption	0.815	26.582
q12.7	Decrease cost of waste treatment	0.785	14.091
q12.8	Decrease fine of environmental accident	0.775	15.044
	Social performance (CR = 0.891) (AVE = 0.674)		
q13.2	Protecting employee health and safety	0.751	14.625
q13.3	Ensuring customer loyalty and satisfaction	0.755	13.904
q13.4	Length of relationship	0.894	47.803
q13.6	Long term relationship	0.873	36.217
	Operational performance (CR = 0.934) (AVE = 0.703)		
q14.1	Improvements in timeliness of goods delivery	0.858	33.611
q14.2	Reduction in inventory levels	0.859	37.851
q14.3	Scrap rate increase	0.729	16.166
q14.4	Improvement in quality of product	0.764	19.325
q14.5	Increase of productivity	0.909	63.343
q14.6	Improvement in capacity utilization	0.898	48.054
	Logistics efficiency (CR = 0.931) (AVE = 0.817)		
q15.2	Transport costs	0.875	27.628
q15.4	Warehousing costs	0.903	36.741
q15.5	Total logistics costs	0.933	54.981
	Logistics effectiveness (CR = 0.930) (AVE = 0.726)		
q16.1	Order lead time	0.881	31.777
q16.2	Delivery consistency	0.890	38.143
q16.3	Back orders	0.849	28.825
q16.4	Loss and damage of goods	0.792	20.017
q16.5	Overall reliability	0.845	24.605
	Competitiveness (CR = 0.912) (AVE = 0.599)		
q17.1	Improvement in efficiency	0.819	21.407
q17.2	Quality improvements	0.791	16.127
q17.3	Improvement in productivity	0.862	33.682
q17.5	Product price	0.716	13.859
q17.6	Flexibility	0.719	12.035
q17.7	Responsiveness	0.774	15.444
q17.8	Develop innovative solutions	0.727	13.921

Table 9. Average variance of all constructs

Construct	Average variance Extracted (AVE)
3PL transportation	0.657
3PL warehousing	0.642
3PL packaging	0.725
Environmental performance	0.592
Economic performance	0.599
Social performance	0.674
Operational performance	0.703
Logistics efficiency	0.817
Logistics effectiveness	0.726
Competitiveness	0.599

5.3.3 Discriminant Validity

It tests empirically whether constructs are significantly different form each other, in other words, each construct must be unique (Hair et al., 2017). Results of Fornell-Larcker criterion in table 10 indicate that values are higher than the rest of the correlation with the specific constructs. Hence, Fornell-Larcker criterion is fulfilled and all the constructs have discriminant validity.

Table 10. Fornell-Larcker criterion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3PL Transportation (1)	0.811									
3PL Warehousing (2)	0.492	0.801								
3PL packaging (3)	0.135	0.393	0.851							
Competitiveness (4)	0.209	0.291	0.149	0.774						
Economic performance (5)	0.357	0.388	0.211	0.446	0.774					
Environmental performance (6)	0.381	0.461	0.325	0.350	0.588	0.769				
Logistics effectiveness (7)	0.152	0.196	0.075	0.671	0.423	0.356	0.852			
Logistics efficiency (8)	0.018	0.316	0.019	0.574	0.395	0.275	0.528	0.904		
Operational performance (9)	0.352	0.301	0.012	0.469	0.667	0.448	0.546	0.446	0.839	
Social performance (10)	0.337	0.466	0.201	0.465	0.538	0.524	0.419	0.395	0.502	0.821

Note. Square root of AVE on the diagonal.

Cross loading analysis is another criterion to check discriminant validity. Error! Reference source not found. 8 shows the cross loadings where indicators are specified in rows and constructs are displayed in column. Indicator's outer loadings with the associated constructs must be always greater than any other loadings of the other constructs. For example, 3PL transportation has q8.6, q8.7, q8.8 associated indicators. These indicators have greater loading value then other constructs.

5.3.4 Hypotheses Testing

After validation of the measurement model, the hypotheses are tested through the construct model. Structural model represents hypothesized relationships between the constructs. The value of t and path coefficient (ß) has been obtained. The minimum t value is 1.96 at significance level of 5% and the path coefficient values vary between -1 and +1. However, t values below 1.96 and path coefficient values below 0 are not statistically significant and represent weak relations between the two constructs (Hair et al., 2017). Therefore, if any of the obtained values falls below the criteria, then hypotheses must be rejected. Hypotheses are supported where both t-value is above 1.96 as well as path coefficient is positive and above 0.

Error! Reference source not found.11 shows the hypothesized relationship between the constructs in research model. Hypotheses results of H1, H4, and H10 explain that the sustainable transport initiatives have a positive impact on environmental, economic and operational performance.

Hypothesis H7 has ß=0.144 which fulfills criteria but t=1.521 which was lower than 1.96 therefore hypothesis has been rejected. That explains that social performance does not improve with adopting 3PL transport initiatives.

Hypothesis H7 has ß=0.144 which fulfills criteria but t=1.521 which was lower than 1.96 therefore hypothesis has been rejected. That explains that social performance does not improve with adopting 3PL transport initiatives

3PL sustainable warehousing has a great positive impact on 3PL performances as all the hypotheses H2, H5, H8, and H11 related to 3PL warehousing and performances have been supported.

On the other hand, only environmental performance has been improved by adopting sustainable packaging initiatives which has been proved by hypothesis H3.

Furthermore, from the results of hypotheses H13, H14, H15, H16, it can be concluded that the logistics efficiency is only improved in hypothesis H16 from social and operational performance. The values of hypothesis H20 explain that the logistics effectiveness has been improved by operational performance. Environmental performance, economic performance and social performance do not have influence on the logistics effectiveness which is proved by rejection of hypotheses H17, H18, H19 respectively.

The values of hypotheses H21 and H22 are not statistically significant. Therefore, it can be proved that the environmental. Performance and the economic performance do not help to improve the competitiveness. Meanwhile, competitiveness can be improved by social and operational performance which is identified by hypotheses H23 and H24 respectively.

Table 11. Hypotheses results

Hypothesis		ß values	t values	Testing result
H1	3PL Transportation → Environmental performance	0.218	2.831	Support
H2	3PL Warehousing → Environmental performance	0.281	2.942	Support
H3	3PL packaging → Environmental performance	0.185	2.618	Support
H4	3PL Transportation → Economic performance	0.225	2.736	Support
H5	3PL Warehousing → Economic performance	0.245	2.499	Support
H6	3PL packaging → Economic performance	0.084	0.821	Reject
H7	3PL Transportation → Social performance	0.144	1.521	Reject
H8	3PL Warehousing → Social performance	0.382	4.237	Support
H9	3PL packaging → Social performance	0.031	0.366	Reject
H10	3PL Transportation → Operational performance	0.260	3.228	Support
H11	3PL Warehousing → Operational performance	0.215	2.331	Support
H12	3PL packaging → Operational performance	-0.108	1.246	Reject
H13	Environmental performance → Logistics efficiency	-0.024	0.182	Reject
H14	Economic performance → Logistics efficiency	0.113	0.787	Reject
H15	Social performance → Logistics efficiency	0.208	2.008	Support
H16	Operational performance → Logistics efficiency	0.277	2.412	Support
H17	Environmental performance → Logistics effectiveness	0.076	0.637	Reject
H18	Economic performance → Logistics effectiveness	0.008	0.069	Reject
H19	Social performance → Logistics effectiveness	0.162	1.573	Reject
H20	Operational performance → Logistics effectiveness	0.425	4.425	Support
H21	Environmental performance → Competitiveness	0.031	0.307	Reject
H22	Economic performance → Competitiveness	0.130	1.082	Reject
H23	Social performance → Competitiveness	0.259	2.886	Support
H24	Operational performance → Competitiveness	0.238	2.051	Support

5.3.5 Empirically Validated Model

Basically, the coefficient of determination (R^2) is used as a measure to validate the model. R^2 value indicates the combined effects of independent variables on the dependent variables. In a simplified manner, it describes the amount of variance in dependent variable due to the independent variables connected with it. R^2 value varies from 0 to 1. Higher value indicates the higher level in the prediction accuracy (Hair et al., 2017). The empirically validated model is shown in Figure 7.

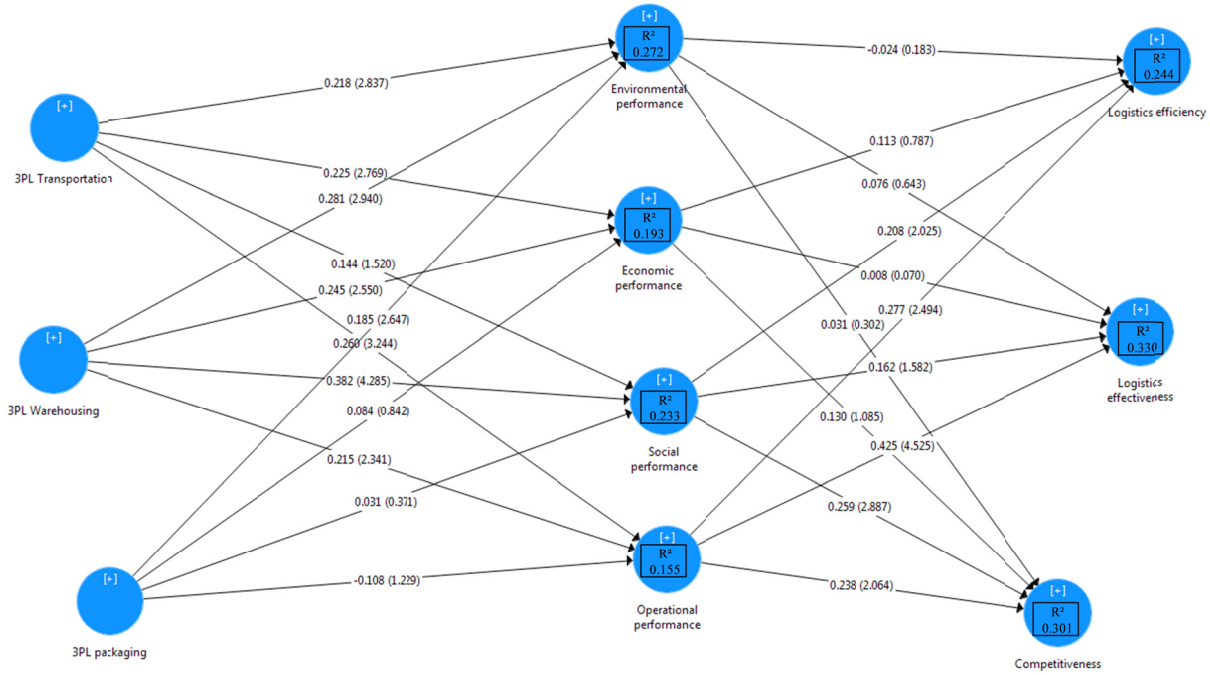

Figure 7. Empirically validated model—Self-illustrated

6. Conclusion

This study has analyzed the sustainability practices in 3PL and its connection with the performances. The aim of this work was to understand the effect on organizations performance measures due to implementation of the sustainability practices. This research extrudes the complex challenges of sustainability initiatives faced by 3PLs in the regular practices. The research findings indicate that the advanced research of sustainability and their outcomes have gained importance which has opened a wide field of research. It has found that the sustainable concerns are key elements of the environmental, economic, social and operational performances. It has also found that the 3PL which uses these sustainability initiatives, have significant influenced the logistics efficiency, effectiveness and competitiveness.

Empirical findings from the survey data analysis indicate that the 3PL sustainability initiatives of logistics functions have an influence over the environmental performance. This means adoption of sustainable initiatives in transportation, warehousing and packaging leads in the improvement of the environmental performance. Positive hypothesized relationships between warehousing and all performances indicate that the adoption of sustainability in warehousing gives performance improvements overall.

From the other results of hypotheses testing, it has been concluded that there is a strong association of operational performance with logistics efficiency, logistics effectiveness and competitiveness. Additionally, the hypotheses results describe that social performance which also improves Logistics efficiency and company's competitiveness.

Theoretically, this research provides the understanding of some 3PL sustainability practices and their effect on the selected performance measures. This study adds more knowledge of the performance measures for sustainability. Practically, this research study is useful for decision makers to select which means of sustainability are most beneficial in a particular logistics function.

6.1 Recommendation for Future Research

Sustainability initiatives in logistical activities are very broad and complex field of research. There are wide range services provided by 3PLs, but this research study was specific to transport, warehousing and packaging. They have also variety of initiatives implemented by different 3PL providers in variety of logistical functions and few of them are considered for the research based on literatures. As a future scope, it is possible to examine the influence of some other sustainability practice with selecting some other performance indicators. The survey

was conducted with variety of industries around the world. Therefore, it can be further extended by analyzing sustainability impacts into a specific industrial sector and for some specific regions through which some other specific potentials can be identified.

This research is based on general perceptions of the industry experts from the survey questionnaire. The performance variables are only beneficial if the organizations have implemented sustainability initiatives which are investigated in this research, but the performance impacts founded in this study will give an overview of the influence of specific initiatives. Therefore, the detailed research is needed for a company before investing in investment in such sustainability programs. The study was exploratory in nature and the analysis was conducted with sample size of 153. Large number of answers will provide more accurate results

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