A STUDY ON SUSTAINABILITY OF PORT OPERATIONS: THE CASE OF PORT OF COLOMBO

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The term "sustainable" as a broadly used phenomenon, consists of three dimensions: environmental, social and economic, which are known as triple bottom lines of the concept of sustainability. All United Nations (UN) Member States adopted the 2030 agenda for achieving Sustainable Development Goals (SDGs) which can be addressed by any industry. The preliminary intention of the International Maritime Organization related to sustainability is "The conservation and the sustainable use of oceans and their resources". Seaports are complex transport nodes in the global transportation network. Further, seaports are disreputable as one of the most polluting industries due to their complex operations as an interface between sea and land. Lack of implementation of sustainability growth-led port policies is an identical problem in the maritime sector in many developing countries. This paper investigates the three dimensions of sustainability in relation to seaport operation selecting the Port of Colombo (PoC) as a case. The main research objective is to determine the extent to which the focused port is aligned with the most relevant 11 SDGs out of all 17 SDGs in UN 2030 agenda from 2015 to 2020. A questionnaire was developed and data were gathered from both operational and management level port employees (n=182). Hypothesis testing and paired sample t-test were performed. Analysis results indicated that PoC is only aligned with 9 SDGs out of the all relevant 11 SDGs related to port industry. All the 8 Core SDGs (Good health-well-being, Affordable-clean energy, Industry innovation-infrastructure, Sustainable cities-communities, Responsible consumption-responsible production, Climate action, Life below water, Partnerships for the goals) have been developing during the period from 2015 to 2020. However, only one secondary SDG (Gender Equality – SDG 5) has developed well over other 4 Core SDGs. Clean water-sanitation and Decent work economic growth have not been developing from 2015 to 2020 inside PoC. A conceptual model/framework connected with 4 SDGs (Life below water, Industry-innovation-Infrastructure, Good health-well-being and Affordable-clean energy) which is specified for sustainability of PoC was derived using Exploratory Factor Analysis and Confirmatory Factor Analysis and Model Fit Analysis. The paper provides policy implications for sustainability policy design in port sector in Sri Lanka.

1. Introduction

Sea port is an industrial & commercial tool equipped with infrastructure & technical facilities to shelter different types of ships. This case study is based on Port of Colombo which is famous as the main container port of Sri Lanka even it handles bulk cargo and other cargo types as well. A sea port is a node link between sea & land & it is a clear example for intermodality (Tarantola, 2005). Globalization, deregulation, logistics integration and containerization have reshaped the port and shipping industry (Notteboom, 2014). Sustainability concept sharpens the shape of it as a new trend.

UN's 2030 global agenda consists of 17 sustainable development goals (SDGs). This research was conceptualized on a structure of sustainability practices in port operations with reference to the 17 SDGs. Economic stability and corporate social responsibility are among the main drivers for sustainability hence, port functions or operations behave as an economic catalyst and international trade's midpoint (Cheon & Deakin, 2010; Kim & Chiang, 2014). Other driver is the continuation of environmental standards under all rules & regulations (Dinwoodie *et al*., 2012; Adams *et al*., 2010; Kim & Chiang, 2014).

The incline on the significance of sustainability issues has been increased throughout the decades & Ports' sustainability concept was not studied or researched for 10 years from the beginning of 1987 where the pure concept of sustainability was dawned (Ozispa & Arabelen, 2018). 2008 is a highlighting year which shows a start-up of the higher rising of several focused studies on sustainability issues of ports (Ozispa & Arabelen, 2018). South Asia which is the region of Port of Colombo has a rivalry based on the sustainability of port operations in each port (Kim & Chiang, 2014). This research has been carried out to evaluate the best practical sustainability criteria suitable for Port of Colombo & to identify the gap between the existence of concerned SDGs in 2015 & the existence of the same concerned SDGs in 2020. The gap analysis was to identify a stagnation or development of the focused SDGs from 2015 to 2020.

2. SDG's for Port Operations

A classification of SDGs of a leading Australian web-based practice serving private & public sector clients across a range of markets within Australia and abroad called Sprott Planning (http://www.sprottplanning.com/about-us.html) was used in this research.

They have categorized SDGs as "Core", "Secondary" and "Case-Specific". Core SDGs consist with a direct relevance for ports. It means they are common to all port communities & serve as a means of comparison among ports throughout the world. Therefore, main focus to be upon Core SDGs; SDG 3 (Good Health & Well-being), SDG 7 (Affordable & Clean Energy), SDG 9 (Industry, Innovation & Infrastructure), SDG 11 (Sustainable Cities & Communities),

SDG 12 (Responsible Consumption & Production), SDG 13 (Climate Action), SDG 14 (Life below Water) & SDG 17 (Partnerships for the Goals). Number of core SDGs are eight.

Secondary SDGs also have some sort of in-direct relevance with seaports. They are the SDGs considered for compliance beyond social, economic & environmental responsibility. Only, 3 Secondary SDGs affects for seaport operations; SDG 5 (Gender Equality), SDG 6 (Clean Water & Sanitation) & SDG 8 (Decent Work & Economic Growth).

Case-specific SDGs own a case/port specific relevance for seaports which differentiate from port to port globally, depending on port context, port setting, and ownership status, country's development status & support programs. Sprott Planning.com has identified 6 case-specific SDGs for seaport operations. They are SDG 1 (No Poverty), SDG 2 (No Hunger), SDG 4 (Quality Education), SDG 10 (Reduced Inequalities), SDG 15 (Life on Land) & SDG 16 (Peace, Justice & Strong Institutions).

3. Significance of the Study

This research was conducted on the plan of action for people, planet & prosperity (3Ps) which is the 2030 agenda for sustainable development by United Nations; "transforming our world". The Agenda emphasizes the need to consider simultaneously the three dimensions of sustainable development: social, economic, and environmental (which are aligned with 3Ps) (IMO). Therefore, all these three pillars which is laid on 17 SDGs under the agenda were considered on the port operations of Port of Colombo and were checked their availability via doing a Likert scale questionnaire.

Importance in making a paradigm shift towards considering sustainable climate adaptation; searching for peak optimization while considering the balance between PPP (above mentioned as 3Ps) indicators is the value of qualitative analysis of SDGs (Schipper, , 2019). The main benefits of this research are that port authorities & port operators can further work on the identified unsustainable areas to make them aligned with the expected level of the SDGs, also finding the most practiced SDGs inside Port of Colombo in order to highlight the reputation of this globally attractive port & the significance or contribution of port operations' sustainability towards world sustainability as a whole.

4. Conceptual Framework

11 major independent variables are shown in each outer circle above and the main dependent variable is included in the middle circle. The 11 major independent variables are the accumulation of 8 core SDGs & 3 Secondary SDGs (Sprott Planning & Environment, 2017). Each major independent variable again is considered as a dependent variable (SDG) which is affected by three other independent variables (SDG indicators) set or one independent variable (SDG indicator).

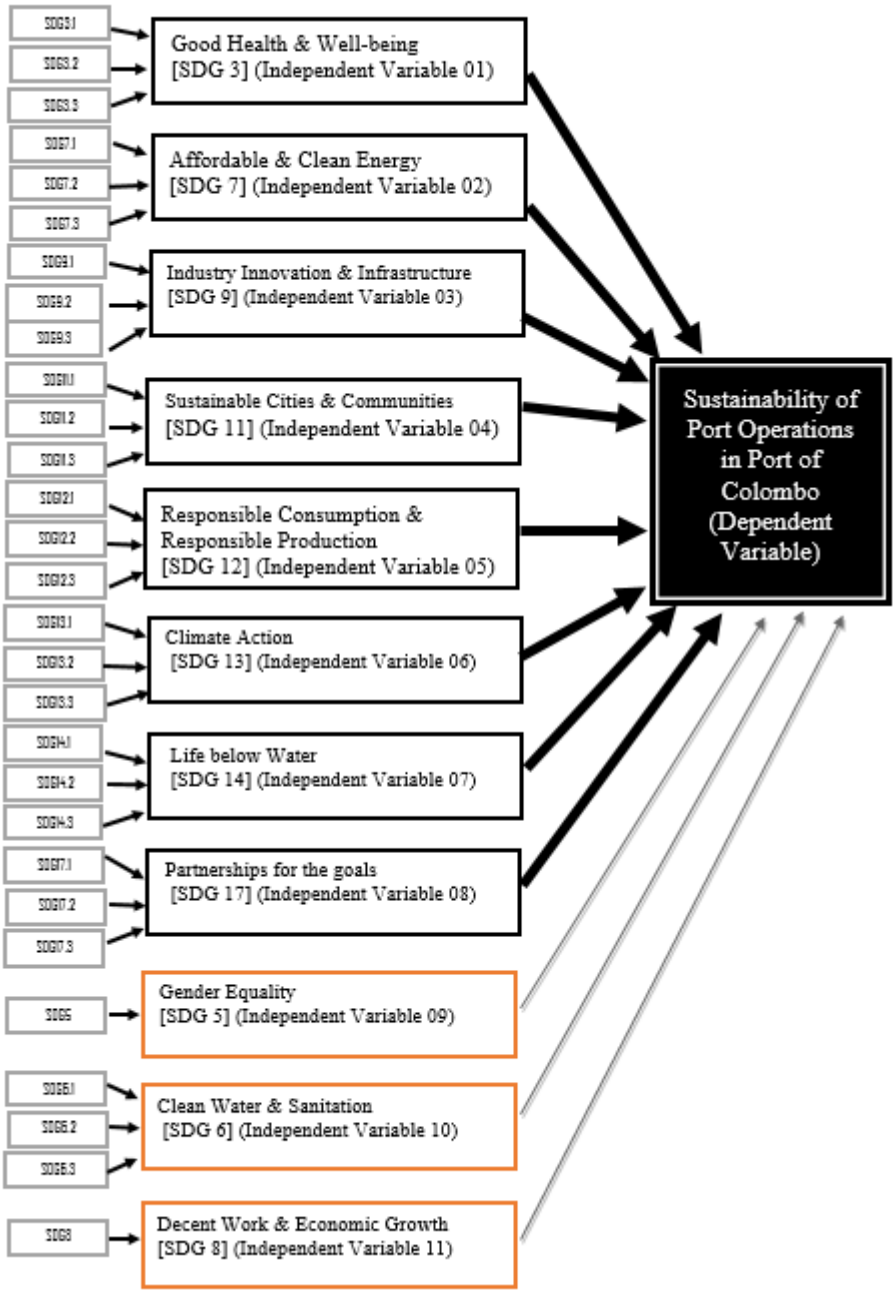

Figure 1-Conceptual Framework

5. Operationalization

3 levels of variables were used in the research.

- Main dependent variable = Sustainability of Port operations; LEVEL 1
- Major independent variables = Sustainability Development Goals/ SDG; LEVEL 2
- Other independent variables = Indicators of each relevant SDG; LEVEL 3

LEVEL 3 variables were collected as required primary data. Therefore, both operational level & management level employees inside Port of Colombo (Sample I) were targeted to gather primary data with relation to the current (2020) & earlier (2015) performance of the selected SDGs inside Port of Colombo. From Table 1 to Table 11 in Appendix was formulated from the studied information from UN's 2030 agenda's 17 SDGs & SDG targets and information in the referred web practice; Sprott Planning (2017).

But another sample (Sample II) was taken to collect data via another Likert scale questionnaire. That Likert scale questionnaire was questioned gender, age groups, working experience, job positions & relevant departments, academic qualifications, current performance of each SDG & attitude towards few changes/sustainable solutions to be implemented in PoC.

Current Performance of each SDG was measured with 5 points of scale; No.1 depicted "Not in Practice", No.2 depicted "Very Less in practice", No.3 depicted "Not aware", No.4 depicted "More in Practice' & No.5 Depicted "Mostly in Practice". Like this main 8 questions were asked with same 5 point- scale and 3 dependent variables were used to measure one independent variable (Each Core SDG). Other supplementary questions were used with the same scale to measure Secondary SDGs.

6. Methodology

The collected data was analyzed systematically by using SPSS (Statistical Package for the Social Science - Version 13.0 & Version 23) which provide charts and tables. Different statistical analysis techniques including mean, median, mode, range, standard deviation, coefficient of variance, frequency distributions, skewness measures, correlation measures and regression analysis were used to interpret results. Sample adequacy was measured using Kaiser-Meyer-Olkin Measure of Sampling Adequacy Test. Reliability of the data set was checked using Cronbach's Alpha test which is the in-built feature of SPSS.

EFA was initially employed to recognize the underlying factors from a set of observed variables (survey questions) without applying a preordained framework or structure on the recompense. (Child, 2006). Secondly, CFA was used to check the validity of the latent constructs gained in EFA and their relationships (Bandara et al., 2016). There were three main reasons for selecting EFA & CFA for the factor analysis of this research; first reason was EFA & CFA are famous for analyzing

Likert scale data, second reason was identifying the key underlying factors from a number of survey questions/variables should be done definitely by EFA because of the exploratory nature of this qualitative research, third reason was the execution of CFA is essential to get an insight into the relationship between the key factors in sustainability because EFA is not able to test hypotheses concerning the relationships between the underlying factor/variables.

Cudeck (2000) mentioned that EFA determines a number of unobserved influences underlying a domain of variables being investigated & EFA admeasures the extent of each variable associated with factors. Further, EFA provides details about the nature of the variables from observing which factors contribute to the performance of which variable. For this research, the Varimax rotation method was exercised under EFA because it supports to gain a simple structure for data than other rotation methods (Bryant and Yarnold, 1995).

Analyzing the relationship between the latent variables identified by EFA is a task done by CFA. The simultaneous regression equations are an alternation to CFA (Bandara et al, 2013). It could analyze the effect of various factors on port sustainability using secondary data. However, this method could not be used in this research case due to the latent variables. Descriptive analysis (both tabular & graphical) data presentation techniques were created to showcase the research findings and other details.

7. Results of Exploratory Factor Analysis

The study relies on the data collected from a survey conducted with port workers of PoC carried out in January 2020 to March 2020.The questionnaire was designed based on the literature on 11 SDGs out of all 17 SDGs of the UN 2030 agenda. To identify and analyze what sustainability aspects (indicators/factors) under the selected 11 SDGS are aligned with sustainability in port operations of PoC or to formulate a specific sustainability framework for PoC, this study applied both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) in evaluating the factors influential to sustainable port operations specialized for PoC.

This analysis helps to find the level of Sri Lankan port sector practices which focus to achieve the Core & Secondary SDGs (Totally 11). This section presents the results of EFA and CFA based on questions covering 29 unique variables under the selected 11 SDGs. First EFA based Principle Component Analysis (PCA) was executed to identify the underlying latent construct for the 29 variables and second CFA was conducted to test the stability of the latent construct & analyze the latent sustainability indicators or factors underlying port operations of PoC.

Table 12 in Appendix reports the results of EFA concerning the variables which were previously referred as SDG indicators affecting the port operations' sustainability. As shown in Table 12 of

Appendix, the first five factors have the initial eigenvalues of 4.863, 1.704, 1.451, 1.184 and 1.081, which are larger than 1; and they explain 79.106% of the total variance of the variables. Therefore, according to the Kaiser criterion, these factors can be retained for further analysis.

Further the Table 13 in Appendix is taken from Extraction Method under Principal Component Analysis. Rotation Method is Varimax with Kaiser Normalization. Rotation Converged in 7 iterations.

The result of EFA suggests that Colombo port followed specific sustainability indicators which is particular and relevant to SL context. A number of factors/indicators may influence its sustainability of port operations and hence those indicators should be included into the proposing sustainability framework of Port of Colombo. These include 5 components. The component 1 includes three variables and they are the SDG indicators named SDG14.2, SDG14.1 & SDG14.3 in order. Therefore, the component 1 can be named as **Life below Water** which is SDG 14. Next three variables in the rotated component matrix construct the component 2 collectively. They are SDG9.2, SDG9.3 & SDG9.1 in order. Based on that, the component 2 can be demonstrated as **Industry Innovation & Infrastructure** which is SDG 9. Third component is only built from 2 variables. They are SDG3.1 & SDG3.2 in order. Therefore, the component 3 can be represented by **Good Health & Well-being** (SDG3). 4th component is created by three variables & they are SDG7.2, SDG7.3 & SDG7.1 in order. Because of that, the component 4 can be named as **Affordable & Clean Energy** which is SDG 7 under Core SDGs. Finally, another two factors/variables construct final component. They are, SDG6.3 & SDG6.2. Therefore, the fifth component can be declared as **clean water & Sanitation** (SDG6).

8. Final Results of Confirmatory Factor Analysis

For further improvement of the model, next variable was SDG7.3 to be removed. It was done as the third run. Finally, CMIN/DF, RMSEA & PCLOSE value gained values in the expected level & all were acceptable. Figure 2 & 3 shows it clearly. CMIN/DF value has further reduced than before. It is 1.064 & of course it should be less than 3. RMSEA is 0.023 & of course its acceptable level was less than 0.05. PCLOSE is 0.752 & of course, it should be greater than 0.05. Table 14 of Appendix shows all the variables in this final AMOS model are significant. When comparing with the secondly improved AMOS model, both CMIN/DF and RMSEA have improved significantly with their values from 1.674 to 1.064 and from 0.075 to 0.023 respectively and PCLOSE related to RMSEA has been improved from 0.106 to 0.752.

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	36	30.860	29	.372	1.064
Saturated model	65	.000	0		
Independence model	20	593.281	45	.000	13.184

Figure 2-CMIN output table for AMOS Last Successful Run-Third Run

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.023	.000	.074	.752
Independence model	.317	.295	.340	.000

Figure 3-RMSEA output table for AMOS Last Successful Run-Third Run

The above analysis results reveal that the factors most influential to sustainability of port operations are SDG14, SDG9, SDG3 & SDG7 which are particular to SL context since the research was done with port workers of Port of Colombo. Therefore, it can be confirmed that the SDG14 factor (Component 1 in finally derived model) is related to all the three variables. SDG 9 also (Component 2 in finally derived model) is related to all the three variables. SDG 3 factor is left with only two practices (the SDG indicators – SDG3.1 & SDG3.2) while the SDG 7 factor also is included with only two practices (the SDG indicators –SDG7.2 & SDG7.3).

This final AMOS model was derived based on the responses given in SL context. This factor analysis supports to discover the most focused sustainable practices in SL port sector (especially in PoC) which support to achieve the relevant SDGs of the UN 2030 Agenda. Last acceptable drawing model generated from SPSS AMOS is attached as Figure 4 in Appendix.

9. Findings & Conclusion

The main research objective was successfully achieved. It was to determine how far Port of Colombo aligned with the most relevant 11 SDGs out of all 17 SDGs in the UN 2030 agenda from 2015 to 2020.This research results conclude that Port of Colombo has been aligning only with 9 SDGs out of the most relevant 11 SDGs. All the 8 Core SDGs have been developing during the period from 2015 to 2020. Amazingly, only one Secondary SDG (Gender Equality – SDG 5) has developed more than 4 Core SDGs. Other Secondary SDGs has not been developing from 2015 to 2020 inside PoC.

From 5 out of 9 developed Core SDG have 5 SDG indicators to be more focused. The reason is their contribution for relevant main Core SDG was very low & the research findings present them as owning insignificant development. They are consideration of mental health of all employees, provision of onshore power supply (OPS) which allows ships to effectively “plug in” to a land-based electrical grid while at port docks, supporting technology development, research and innovation, being proactive to not to contaminate basin’s seawater area & maintaining a clean basin water area with zero oil spillage.

Another objective of this research was to formulate a framework relevant to sustainable operations of Port of Colombo. The formulation of conceptual framework with only Core SDGs & Secondary SDGs based on the SDG classification given by “United Nations

SDGs & Sea Ports" (2017) was congenial to PoC's port operations. It is because both factor analysis combined with EFA & CFA and Model Fit Analysis supported with positive results. Finally derived model/framework was connected with 4 SDGs out of the concerned 11 SDGs & it is specialized for SL context only. Life below Water, Industry Innovation & infrastructure, Good Health & Well-being & Affordable & Clean Energy are the main SDGs which are mostly focused by PoC currently. Also the Modal Fit Analysis results confirm the fitness of the benchmarked conceptual framework for the sustainability of port operations of PoC. It was benchmarked from *United Nations SDGs & Sea Ports-Assessing Relevance & Finding Opportunities* [Brochure] (2017).

The third research objective was to identify what type of perceptional difference is available between Operational level & Management level employees (Port workers) about the availability/current performance of each selected SDG inside PoC. The conducted Independent Sample T-test resulted that the mean for management-level employees is always slightly higher than the mean for operational level employees. It concludes that always management level port workers gave higher perceptional positive response than operational level port workers about the availability/current performance of each selected SDG inside PoC. Perceptional attitudes between operational level & management level workers towards the availability/performance of SDG3, SDG7, SDG9, SDG11, SDG12 & SDG13 were statistically & significantly different. But both group had same the perceptional attitude about SDG14 & SDG17. Therefore, the management-level & operational level employees had different levels of perceptions towards the availability of 6 Core SDGs out of all 8 Core SDGs. When concerning Secondary SDGs, the both groups of port workers has similar perceptions about SDG 5 & SDG8. But towards SDG 6, they had different perceptions about the availability.

The explored literature was sufficient to extract sustainability challenges in Maritime Logistics & Shipping Industry & the suitable strategies to mitigate the above challenges. Therefore, the final objective also was achieved satisfactorily.

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Appendix

Table 1-Operationalization of SDG 3

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 3; Good Health & Well-being	SDG3.1; Port terminal provides prompt medical care services under occupational health	5 point Likert Scale
	SDG3.2; Port terminal does health monitoring (or Check-Ups) of employees	5 point Likert Scale
	SDG3.3; Port terminal considers mental health of all employees	5 point Likert Scale

Table 2-Operationalization of SDG 7

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 7; Affordable & Clean Energy	SDG7.1; Port terminal has an onshore power supply (OPS) which allows ships to effectively "plug in" to a land-based electrical grid while at port docks	5 point Likert Scale
	SDG7.2; Port terminal uses clean, affordable, reliable, renewable & modernized energy sources like Solar energy/ Wind energy/ Tidal & Wave energy	5 point Likert Scale
	SDG7.3; Port terminal conducts awareness sessions to employees about sustainable energy	5 point Likert Scale

Table 3-Operationalization of SDG 9

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 9; Industry Innovation & Infrastructure	SDG9.1; Port terminal tries to apply artificial intelligence to do port operations	5 point Likert Scale
	SDG9.2; Port terminal tries to mitigate the traffic congestion inside the port via new technological developments	5 point Likert Scale
	SDG9.3; Port terminal supports technology development, research and innovation	5 point Likert Scale

Table 4-Operationalization of SDG 11

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 11; Sustainable Cities & Communities	SDG11.1; Port terminal's gas emissions is not causing law air quality & it never affects the nearby citizens/communities livelihood	5 point Likert Scale
	SDG11.2; Port terminal never receives environmental complaints from local community	5 point Likert Scale
	SDG11.3; Port terminal supports local communities' diversity & minorities via good CSR (Corporate Social Responsibility) Practices	5 point Likert Scale

Table 5-Operationalization of SDG 12

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 12; Responsible Consumption & Responsible Production	SDG12.1; Port terminal has achieved ISO 140001- (Promote continual improvements by encouraging ports to adopt and implement EMS; assists systematic development of formalized management process, and evaluate effectiveness of activities, operations, products And services)	5 point Likert Scale
	SDG12.2; Port terminal consists energy saving device usage	5 point Likert Scale
	SDG12.3; Port terminal focuses on Recyclable Resource usage as a major objective of their consumption policies	5 point Likert Scale

Table 6-Operationalization of SDG 13

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 13; Climate Action	SDG13.1; Port terminal reduces the carbon dioxide emissions on yearly basis	5 point Likert Scale
	SDG13.2; Port terminal identifies climate change risks & takes necessary actions to mitigate climate change	5 point Likert Scale
	SDG13.3; Port terminal is proactive to not to contaminate basin's seawater area	5 point Likert Scale

Table 7-Operationalization of SDG 14

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 14 Life below Water	SDG14.1; Port terminal maintains a clean basin water area with zero oil spillage	5 point Likert Scale
	SDG14.2; Port terminal identifies the need for marine conservation & taking necessary actions against marine pollution	5 point Likert Scale
	SDG14.3; Port terminal improves ocean health and contribution of marine biodiversity	5 point Likert Scale

Table 8-Operationalization of SDG 17

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 17; Partnerships for the goals	SDG17.1; Port terminal signs partnership agreements with employee committees for successful & effective port operations	5 point Likert Scale
	SDG17.2; Port terminal accepts the connectivity of all stakeholders via the new developments of ASYCUDA system (Automated System for Customs Data – for Sea Cargo)	5 point Likert Scale
	SDG17.3; Port terminal is positive to support national plans to implement all the sustainable development goals	5 point Likert Scale

Table 9-Operationalization of SDG 5

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 5; Gender Equality	SDG5.1; Maintains gender balance within the entire work force	5 point Likert Scale

Table 10-Operationalization of SDG 6

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 6; Clean Water & Sanitation	SDG6.1; Practicing a Water Quality contingency plan (to provide safe and affordable drinking water for all)(	5 point Likert Scale
	SDG6.2; Provision of port waste reception services for ships	5 point Likert Scale
	SDG6.3; Adequate and equitable sanitation and hygiene for all and maintaining related issues of defecation, paying special attention to the needs of Women	5 point Likert Scale

Table 11-Operationalization of SDG 8

Level 2 Variables (as independent)	Level 3 Variables (as dependent)	Measurement
SDG 8; Decent Work & Economic Growth	SDG8.1; Maintains gender balance within the entire work force	5 point Likert Scale

Table 12-Total Variance Explained in PCA for 29 SDG indicators

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.863	37.411	37.411	4.863	37.411	**37.411**
2	1.704	13.110	50.521	1.704	13.110	**50.521**
3	1.451	11.162	61.683	1.451	11.162	**61.683**
4	1.184	9.110	70.793	1.184	9.110	**70.793**
5	1.081	8.313	79.106	1.081	8.313	**79.106**
6	.514	3.956	83.062			
7	.461	3.550	86.612			
8	.437	3.359	89.971			
9	.323	2.486	92.457			
10	.294	2.264	94.721			
11	.262	2.016	96.737			
12	.249	1.915	98.652			
13	.175	1.348	100.000			

Source – SPSS analysis results particular to EFA analysis

Table 13-Rotated-rescaled Component Matrix of these underlying factors in PCA output taken from SPSS

	Component				
	Life below	Industry Innovation & Infrastructure	Good Health & Well-being	Affordable & Clean Energy	Clean water & Sanitation
Identifies the need for marine conservation & taking necessary actions against marine pollution.	.869				
Maintains a clean basin water area with zero oil spillage.	.832				
Improves ocean health and contribution of marine biodiversity.	.811				
Mitigate the traffic congestion inside the port via new technological developments.		.838			
Technology development, research and innovation.		.775			
Artificial intelligence to do port operations.		.653			
Prompt medical care services under occupational health.			.894		
Health monitoring (or Check-Ups) of employees.			.858		
Clean, affordable, reliable, renewable & modernized energy sources like Solar energy/ Wind energy/ Tidal & Wave energy.				.863	
Awareness sessions to employees about sustainable energy.				.748	
Onshore power supply (OPS) which allows ships to effectively "plug in" to a land-based electrical grid while at port docks.				.619	
Provision of port waste reception services for ships					.888
Adequate and equitable sanitation and hygiene for all and maintaining related issues of defecation, paying special attention to the needs of Women			.		.558

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 7 iterations.

Source –SPSS analysis results particular to EFA analysis

Table 1411-Regression Weights: (Group number 1 - Default model)

Factor		Main SDG	Estimate	S.E.	C.R.	P	Label
SDG14_3	<---	SDG14(Life below Water)	1.000				
SDG14_1	<---	SDG14(Life below Water)	.934	.107	8.720	***	par_1
SDG14_2	<---	SDG14(Life below Water)	1.138	.101	11.241	***	par_2
SDG9_1	<---	SDG9(Industry, Innovation & Infrastructure)	1.000				
SDG9_3	<---	SDG9(Industry, Innovation & Infrastructure)	1.389	.207	6.713	***	par_3
SDG9_2	<---	SDG9(Industry, Innovation & Infrastructure)	1.294	.198	6.544	***	par_4
SDG3_2	<---	SDG3(Good Health & Well-being)	1.000				
SDG3_1	<---	SDG3(Good Health & Well-being)	.822	.138	5.950	***	par_5
SDG7_3	<---	SDG7(Affordable & Clean Energy)	1.000				
SDG7_2	<---	SDG7(Affordable & Clean Energy)	.579	.113	5.131	***	par_9

*Estimates (Group number 1 - Default model)

*Scalar Estimates (Group number 1 - Default model)

*Maximum Likelihood Estimates

Source- SPSS/AMOS results of CFA analysis

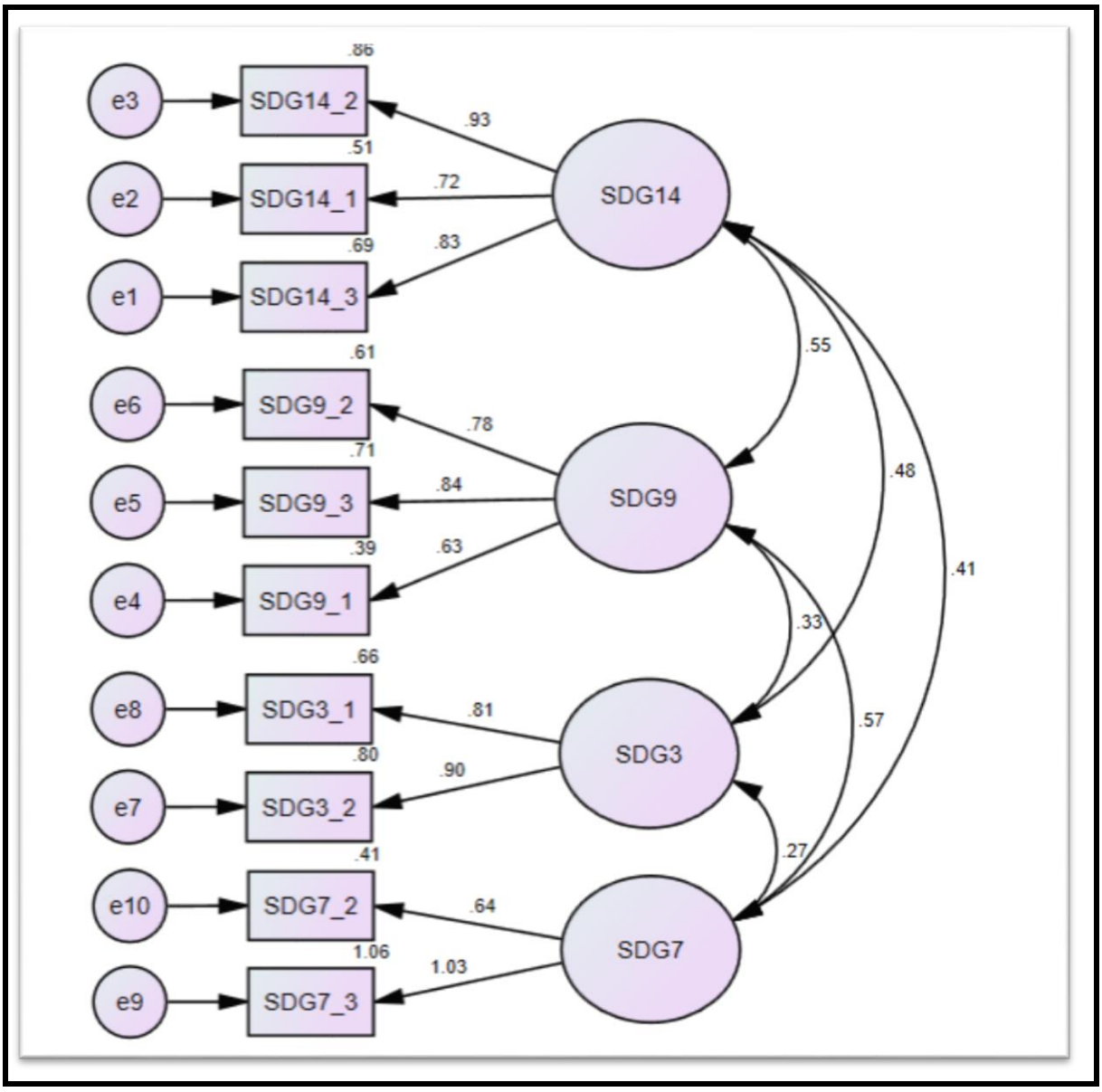

Figure 4-Last acceptable drawing model in SPSS-AMOS