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Assessing Port Sustainability Criteria and Stakeholder's Retention in Hong Kong

LU Chin-Shan* KWONG Kwan Yu LO Kam Wai** SHUM Mei Ying****

Abstract: The purpose of this study is to assess crucial sustainability and its impact on stakeholders in the context of container port in Hong Kong. Data collection was based on a questionnaire survey from 144 respondents from nearby residents, shipping company employees and container terminal workers. An exploratory factor analysis and confirmatory factor analysis were conducted to identify crucial sustainability criteria of container port. In addition, a structural equation modeling was applied to examine the relationships between sustainability dimensions such as environment sustainability, social sustainability, economic sustainability and stakeholder retention. Results indicated that social aspects with respect to "employee job security and safety" and "terminal traffic accidents prevention" were ranked as the most important sustainability criteria, followed by economic aspects of "ensuring cargo handled safely and effectively", "offering employment opportunities" and "facilitation of economic activities". Results also showed that environmental and economic dimensions had a significant impact on stakeholder retention. Practical implications for port sustainability practices were discussed in this study.

Keywords: Port Sustainability Stakeholder Retention

I. Introduction

With rapid development of international trade, the growth rate of world container throughput increased by 2.6% and reached 152 million TEUs in 2018.[1] A container port serves as a vital role in the supply chain networking and provides a major connection between the sea transport and in-land transport. However, the massive demand reflecting in the increase of the volume of container cargo raises concern about the negative impact on environment, safety and human health. Port authorities, therefore, need to take sustainability as one of their organizational goals, maintaining a balance between environment, social and economic issues. Recently, port sustainability has paid increasing

*LU Chin-Shan is currently a Professor and Associate Head at the Department of Logistics and Maritime Studies of the Hong Kong Polytechnic University and a Director of the C.Y Tung International Center for Maritime Studies, E-mail:chin-shan.lu@polyu.edu.hk

**KWONG Kwan Yu, LO Kan Wai and SHUM Mei Ying are currently students at the Department of Logistics and Maritime Studies of the Hong Kong Polytechnic University.

[1] United Nations Conference on Trade and Development (UNCTAD). Review of Maritime Transport 2019. United Nations Publication: New York and Geneva (2019).

attention to port organizations[1] and extant port studies.[2] Most extant studies examined sustainability at seaports from port authorities' or carriers' point of view, however, nearby port residents' opinions have rarely been discussed in previous literature. To the best of our knowledge, the impact of port sustainability on stakeholder retention have not been examined and validated in the context of port sustainability research.

Thus, this research aims to identify crucial sustainability criteria and its impact on stakeholder retention at container port in Hong Kong. The Kwai Tsing is the major container port, located along Rambler Channel between Tsing Yi Island and Kwai Chung, Hong Kong. It covers an area of 279 hectares with a total quay depth of 7684 meters. There are 24 container berths, providing for an approximated 18.3 million TEUs in 2019.[3] However, activities of Kwai Tsing Container Terminal are causing severe air pollution. The annual average of nitrogen dioxide of Kwai Chung area is 54 micrograms per cubic meter in 2019, which is higher than the annual limit value (40 micrograms) of Hong Kong.[4] In 2017, the emissions of SO_2, NOx, RSP and FSP from marine vessels accounted for 52%, 37%, 34% and 41% of the total emissions, respectively. In 2019, there were 459 cases of accidents within and outside Hong Kong waters, whereas 9 persons were killed and 31 persons missing, respectively.[13] This reflects the need for port authorities in Hong Kong to face and address the issue of sustainability.

There are five sections in this paper. After the introduction, follows the review of literature and previous researches. The background of the study, deals with the selection of a number of sustainability criteria that will be factored in the research. The research

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[1] International Association of Ports and Harbors (IAPH), IAPH 2018-2019 Annual Report (2020). Retrieved from http://www.iaphworldports.org/iaph/wp-content/uploads//publications/Annual_Report_2018-2019.pdf Maritime and Port Authority of Singapore (MPA), Maritime Sustainability Reporting Guide, Best Practices for Creating A Maritime Sustainability Report, Vol. 01 (2019). Retrieved from https://api2.sgx.com/sites/default/files/2019-09/MPA_Sustainability_Guidebook.PDF. The Port of Los Angeles, Port of Los Angeles Inventory of Air Emissions-2018 (2019). Retrieved from https://kentico.portoflosangeles.org/getmedia/0e10199c-173e-4c70-9d1d-c87b9f3738b1/2018_Air_Emissions_Inventory.

[2] Acciaro, M., Corporate responsibility and value creation in the port sector, International Journal of Logistics Research and Applications, 18 (3), 291–311 (2015). Ashrafi, M., Acciaro, M., Walker, T. R., Magnan, G. M., and Adams, M., Corporate sustainability in Canadian and US maritime ports, Journal of cleaner Production, 220, 386-397 (2019). Darbra, R. M., T. Pittam, K. A. Royston, J. P. Darbra, and H. Journee, Survey on environmental monitoring requirements of European ports, Journal of Environmental Management 90 (3), 1396–1403 (2009). Lim, S., Pettit, S., Abouarghoub, W. and Beresford, A. Port sustainability and performance: A systematic literature review, Transportation Research Part D: Transport and Environment, 72, 47-64 (2019). Lu, C. S., Shang, K. C. and Lin, C. C., Identifying crucial sustainability assessment criteria for container seaports. Maritime Business Review, 2(1), 90-106 (2016). Oh, H., Lee, S.W. and Seo, Y. J., The evaluation of seaport sustainability: The case of South Korea, Ocean and Coastal Management, 161, 50-16 (2018). Seuring, S. and Muller, M., From a literature review to a conceptual framework for sustainable supply chain management, Journal of Cleaner Production, 16(15), 1699-1710 (2008). Wooldridge, C. F., Mcmullen, C. and Howe, V. 1999. Environmental management of ports and harbours—Implementation of policy through scientific monitoring." Marine Policy 23 (4–5): 413–425.

[3] Marine Department, Container Throughput of Hong Kong Port, the Government of the Hong Kong Special Administrative Region (2020). Retrieved from https://www.mardep.gov.hk/en/publication/portstat.html#5.

[4] Environmental Protection Department, Air Quality in Hong Kong 2019: Data & Air Pollutant Emission Inventory, The Government of the Hong Kong Special Administrative Region (2020). Retrieved from https://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html#emission_trends

methodology section will discuss the main data collection method that will be employed to obtain the relevant information needed to conduct the analysis. The results section provides the result and interpretation of factor analysis and structural equation modeling. The discussion and conclusions for sustainability policy suggestions are explored in the final section.

II. Literature Review

A. Definition of Sustainability

Sustainability concerns meeting the needs of the present without compromising the ability of future generations to also meet their needs. There are three pillars with regard to the concept of sustainability: environment, social and economic. Port sustainability is port business activities protect and sustain human and natural resources that meets ports and the stakeholders present and future needs.[1] Container port sustainability is critically germane for three main reasons which are social sustainability, economic sustainability and environment sustainability - related to container port operations.[2]

B. Sustainability Assessment Criteria

A number of international organizations have different principles on sustainable development (e.g., The UN Global Compact, OECD etc.) Sustainability assessment criteria have been developed by different international ports. ISO (International Standard Organization) evaluated sustainable development includes environmental regulation and policy as well as self-evaluation management mechanism system (ISO website). However, the opinions from local residents and carriers were not considered in the study. There are several aspects to measure social sustainability such as human rights, employee and workplace security and safety, social development etc.[3] Therefore, the sustainability assessment consists of social sustainability, economic sustainability and environmental sustainability.

Social dimension, economic dimension and environmental dimension were interrelated in sustainable development as long as most of the previous researches only focused on the environmental dimension, included quality of air, emission of green gas, emission of CO_2, recycling and waste, lightning mitigation, noise pollution, quality of water etc. Meanwhile, economic dimension consists of sustainable assessment criteria, for example local economic activities development, employment development, fair competition etc. For the social dimension, there are several assessment items included-port accessibility, employee safety and security, port partners communication etc. Shiau and Chuang (2015) pointed out 34 port sustainability assessment criteria indicators selected by local residents and legislators.[4] Hence, a total of 14 sustainability assessment criteria indicators were adapted from previous studies which included environmental dimension, social dimension and economic dimension, used in this study.

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[1] Gul, D.S. and Cimen, K.C., Port sustainability and stakeholder management in supply chains: a framework on resource dependence theory, The Asian Journal of Shipping and Logistics, 28, 301-320 (2012).

[2] Yap, W.Y. and Lam, J.S.L, 80 million-twenty-foot-equivalent-unit container port? Sustainability issues in port and coastal development, Ocean & Coastal Management, 71(2), 13-25 (2013).

[3] McIntosh, M., Thomas, R., Leipziger, D. and Coleman, G., Living Corporate Citizenship – Strategic Routes to Socially Responsible Business, Prentice Hall, London (2003).

[4] Shiau, T.A. and Chuang, C.C., Social construction of port sustainability indicators: a case study of Keelung Port, Maritime Policy and Management, 42(1), 26-42 (2015).

III. Methodology

This study aims to investigate and identify the crucial sustainability criteria of the Kwai Tsing Container Terminal through examining the importance of the sustainability criteria and assessing the current performance of the terminal by port workers, shipping company workers and residents. It was done by conducting a questionnaire survey, followed by personal interviews with the shipping company managers.

A. Questionnaire Design and Determination of Measures

The sustainability assessment criteria were selected from sustainability reports and researches. The questionnaire surveys were designed and issued to port workers, shipping company and residents. For the questionnaire design, the general information was first specified and the issues were listed- type of questionnaires, contents of individual questions, form of response. In order to be clearer, the wordings of the questionnaire, sequence of the questions and the characteristics of the sustainability criteria will be precise and orderly arranged in the questionnaire.

Moreover, the questionnaire content validity was checked by literature review and interviews with several port experts and academics. The questionnaire was translated into Chinese for the port workers, shipping company and residents in order to ensure the meaning remains the same as the original English questionnaire. The interview resulted in some minor modifications in the assessment criteria wordings and they were accepted after amending the sustainability criteria. A five-point rating scale was used for each factors- 1 = very unimportant, 2 = unimportant, 3 = neither agree nor disagree, 4 = important and 5 = very important to identify and rank the importance of sustainability assessment criteria according to port workers, shipping company and residents standpoint. The SPSS 25.0 software was used for statistics analyses.

B. Research Sample

In this study, the sample of the research was focused on residents, port workers, shipping company workers and managers who are important indicators in the identification and determination of the sustainability assessment criteria as they live around the ports and participate in front line port activities.

A total of 150 questionnaire surveys were done in Google Form and delivered in March 2019. The surveys received a total of 50 each for residents and shipping company workers and 44 for port workers. Ultimately the total usable responses were 144 out 150.

Man-on-the-street interview was carried out for the port workers and resident's questionnaire interviews. The Google Form questionnaire was showed on the tablet and iPad and invited residents who live in Tsing Yi and Lai King as well as port workers who work in the Kwai Tsing Container Terminal completed the questionnaire. The questionnaire was illustrated and a total of 100 street interviews with 50 residents and 50 port workers were done in the afternoon of 19 March, 2019.

C. Research Methods

There are numerous researches adapted in this study. Descriptive statistics and exploratory factor analysis are used to categorize a great deal of sustainability attributes

into a concrete set of underlying factors and dimensions.[1] Furthermore, our research carries out a reliability test to evaluate whether these dimensions are reasonable. In addition, Confirmatory Factor Analysis (CFA) was adapted to verify measurement models. The involvement of structural equation modelling software AMOS helps to analyze the measurement models, review psychometric properties and extinguish the relationship between the latent variable and the proposed measures. Eventually, one-way analysis of variance (ANOVA) is also adapted to figure out the diversity existing between the port workers, shipping companies and residents in the level of significance of the sustainability criteria.

From the AMOS software, the model can show the relationship between the factors and retention for residents, shipping company and port operators. The retention for the Kwai Tsing Container Terminal is important for those three stakeholders. There are three questions designated for finding out the tendency of residents continuously living in Kwai Tsing District. There are "To what extent, I feel satisfied with the living environment of Kwai Tsing District / working environment of Kwai Tsing District/the service offered by Kwai Tsing container terminals" , "To what extent, I have no plan of leaving Kwai Tsing District / quitting the job at Kwai Tsing container terminals/using other port services located in different location." and " To what extent, I recommend people to live in Kwai Tsing District / work in Kwai Tsing container terminals / use the service in Kwai Tsing container terminals." respectively. The above questions are aimed to evaluate the retention of Kwai Tsing container terminals with different stakeholders. For the viewpoint of residents, the level of desirability to stay in Kwai Tsing District represents the level of retention towards Kwai Tsing container terminals. For the viewpoint of shipping companies, the willingness of continuously consuming the services provided by Kwai Tsing container terminals represents the level of retention towards Kwai Tsing container terminals. From the viewpoint of port workers, the level of willingness to work in Kwai Tsing container terminal in the long term stands for the level of retention towards Kwai Tsing container terminals.

IV. Results

A. Respondents' Profile

As shown in Table 1, the profile of respondents shows a vast majority of the respondents are residents and port workers (50 % each) followed by 44 % shipping company workers. As long as this study attempted to identify and evaluate the sustainability criteria in the environment, social and economic aspects, the three main types of respondents play an important role by introducing their opinions.

In this statistics, majority of respondents- with 38 per cent of residents, port workers and shipping company workers aged 30 – 49 years old followed by 33 per cent residents, port workers and shipping company workers aged 18-29 years old, whereas 23 per cent aged

[1] Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E., Multivariate Data Analysis, 7th edition, Prentice-Hall, Upper Saddle River, New Jersey (2010).

50 – 64 years old and 3 per cent aged 65 years old or above and 17 years old or below were identified.

For tenure, the result revealed that 29 per cent of them have served in company for 5 to 9.99 years, 26 per cent served for 10 to 14.99 years, 27 per cent served for more than 15 years, whereas 15 per cent have only worked for 1 to 4.99 years and 3 per cent, for less than one year.

Table 1 Respondents' profile (N = 144)

Respondents' Profile		Frequency	Percentage
Type	Residents	50	35
	Shipping Company	44	30
	Port Workers	50	35
Age	17 years old or below	4	3
	18-29 years old	48	33
	30-49 years old	55	38
	50-64 years old	33	23
	65 years old or above	4	3
Tenure	Less than one year	5	3
	1-4.99 years	21	15
	5-9.99 years	42	29
	10-14.99 years	37	26
	15 years or above	39	27
Education	Junior Secondary or below	15	10
	Senior Secondary	36	25
	Diploma or Associate Degree	44	31
	Undergraduate Degree or above	49	34
Income (HKD)	Below $10000	12	8
	$10000-14999	15	10
	$15000-19999	48	34
	$20000-29999	32	22
	$30000-49999	21	15
	$50000 or above	16	11

For education, 34 per cent of respondents have obtained undergraduate certificates or above followed by 31 per cent of respondents having diploma or associate degree, 25 per cent graduated in senior secondary and only 10 per cent graduated from junior secondary or below.

For income, a vast majority of 34 per cent of respondents earn $15,000 – 19,999 income a month, 22 per cent of respondents earn $20,000 – 29,999, 15 per cent of

respondents earn $30,000 – 49,999, 11 per cent earn $50,000 or above, 10 per cent earn $10,000 – 14,999 and 8 per cent earn below $10,000.

B. Importance – Performance Analysis

Importance-performance analysis (IPA) is a widely accepted method for measuring service quality, and aims at identifying which criteria have larger effect towards customer satisfaction and affect customer loyalty. In implementing IPA analysis, it is crucial to clearly determine the criteria of sustainability. In this study, there are twelve sustainability criteria chosen to investigate. Based on the predetermined criteria, two dimensions are classified: (1) the importance of each criteria and (2) judgments of its performance.

B-1 Relative importance of container terminal sustainability assessment criteria

The level of relevance of container terminal sustainability assessment criteria has been under our analysis and ranked by the mean scores. The mean ranges from not important at all (score = 1) to very important (score = 5) which is shown in Table 2. The three criteria with highest scores are "employee job security and safety", "Terminal traffic accidents prevention" and "Ensuring cargo handled safely and effectively" which scores over 4.4. In addition, the majority of the criteria scores more than 4.0 in general such as offering employment opportunities. On the other hand, the two criteria with the lowest score are "Enhancing terminal landscape" and "Providing a fair job opportunity" with mean of 3.33. In the light of the ranking, it is shown that all three dimensions of sustainability are highly appreciated in the view of respondents including port workers, Kwai Tsing residents and shipping companies.

B-2 Relative performance of container terminal sustainability assessment criteria

The research investigated container terminals' sustainability criteria performance in three sustainable aspects: economic, social and environmental aspects. Respondents are requested to provide their perception on the sustainability performance of Kwai Tsing Terminals and 14 sustainable criteria are ranked. The mean ranges from not important at all (score = 1) to very important (score = 5) which is shown in Table 3. The three criteria with highest score for its performance are "Ensuring cargo handled safely and effectively", "Offering employment opportunities" and "Facilitating to economic activities" which scores 4.15, 3.97 and 3.87 respectively. After the integration of the data from three parties, the respondents' perceptions ranged from 2.35 to 4.15 which indicates Kwai Tsing container terminals have mixed performance in the light of the three-dimension measured by sustainability. In contrast, respondents showed the following three sustainability indicators' performance is the least "Decreasing noise pollution in Kwai Tsing District", "Mitigating light influence on neighboring residents" with mean of 2.83 and "Considering 3R (reduce, reuse, recycle) when handling cargo" with a mean of 2.35.

Table 2. Respondents' importance of port sustainability assessment criteria

Rank	Code	Criteria	Mean	SD

1	I4	Employee job security and safety.	4.47	0.68
2	I5	Terminal traffic accidents prevention.	4.42	0.73
3	I2	Ensuring cargo handled safely and effectively.	4.40	0.74
4	I3	Offering employment opportunities.	4.38	0.73
5	I1	Facilitating to economic activities.	4.25	0.77
6	I12	Maintaining air quality in Kwai Tsing District	4.20	0.79
7	I11	Considering 3R (reduce, reuse, recycle) when handling cargo.	4.17	0.89
8	I14	Ensuring proper waste disposal.	4.15	0.84
9	I13	Ecological environment protection in terminal area.	4.06	0.85
10	I9	Disposing of effluents and maintaining water quality in Kwai Tsing District.	4.05	0.94
11	I10	Mitigating light influence on neighboring residents.	3.76	0.84
12	I7	Decreasing noise pollution in Kwai Tsing District.	3.65	0.95
13	I6	Enhancing container terminal landscape.	3.33	0.88
14	I8	Providing a fair job opportunity.	3.33	0.94

Table 3 Respondents' assessment on performance of port sustainability assessment criteria

Rank	Code	Criterias	Mean	SD
1	P2	Ensuring cargo handled safely and effectively.	4.15	0.70
2	P3	Offering employment opportunities.	3.97	0.74
3	P1	Facilitating to economic activities.	3.87	0.77
4	P4	Employee job security and safety.	3.26	1.25
5	P5	Terminal traffic accidents prevention.	3.25	1.19
13	P6	Enhancing container terminal landscape.	3.02	0.78
6	P9	Disposing of effluents and maintaining water quality in Kwai Tsing District.	2.95	1.06
7	P12	Maintaining air quality in Kwai Tsing District.	2.94	1.12
8	P14	Ensuring proper waste disposal.	2.93	1.17
9	P13	Ecological environment protection in terminal area.	2.89	0.99
14	P8	Providing a fair job opportunity.	2.89	1.08
10	P7	Decreasing noise pollution in Kwai Tsing District.	2.83	1.12
11	P10	Mitigating light influence on neighboring residents.	2.83	1.08
12	P11	Considering 3R (reduce, reuse, recycle) when handling cargo.	2.35	1.00

4.2.3 Importance and Performance Relations

Figure 1 shows that the central tendency of each criteria's importance and performance will be paired and used as coordinates for plotting respective attribute in two-dimensional grid that has been divided into four quadrants:

Each quadrant in the matrix is divided by the mean score of importance of criteria [4.05] from high to low (in vertical axis) and the mean score of performance

of criteria [3.15] from high to low (in horizontal axis). The divergence between importance and performance are therefore clearly shown in the figure. It points out that the respondents' satisfaction on the sustainability assessment criteria by locating each criterion into appropriate quadrant according to its relative importance and performance. The location of criteria will translate different impact upon the strategic interpretation within each quadrant, four quadrants in IPA indicate four situations with different potential strategy for each quadrant. The quadrants are:

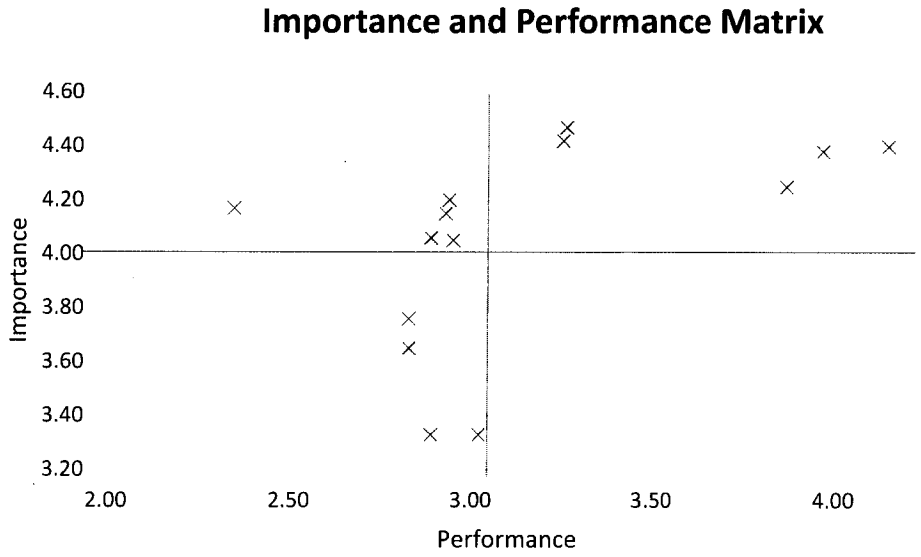

Figure 1. Importance and performance matrix of port sustainability

I.Quadrant I: High importance and high performance

In this study, there are five criteria fall in this quadrant, showing that, both their importance and performance are above mean (4.04 for importance and 3.15 for performance). These criteria are "Employee job security and safety" which scores 4.47 and 3.26 in importance and performance respectively; "Terminal traffic accidents prevention" which scores 4.42 and 3.25; "Ensuring cargo handled safely and effectively" which 4.40 and 4.15; "Offering employment opportunities" which scores 4.38 and 3.97; and "Facilitating to economic activities" which scores 4.25 and 3.87.

II.Quadrant II: High importance and low performance

Five criteria fall in this quadrant, showing high importance but low performance compared to the mean score. These criteria are "Maintaining air quality in Kwai Tsing District" which scores 4.20 and 2.94 in importance and performance respectively; "Considering 3R (reduce, reuse, recycle) when handling cargo" which scores 4.17 and 2.35; "Ensuring proper waste disposal" which scores 4.15 2.93; "Ecological environment protection in terminal area" which scores 4.06 and 2.89; and "Disposing of effluents and

maintaining water quality in Kwai Tsing District" which scores 4.05 and 2.95.Quadrant III: Low importance and low performance

Four criteria fall in this quadrant, representing both their importance and performance are below mean. These criteria "Mitigating light influence on neighboring residents" which scores 3.76 and 2.83 in importance and performance respectively; "Decreasing noise pollution in Kwai Tsing District" which scores 3.65 and 2.83; "Enhancing container terminal landscape" which scores 3.33 and 3.02; and "Providing a fair job opportunity" which scores 3.33 and 2.89.

III. Quadrant IV: Low importance and high performance

Criteria fall in this quadrant show low importance but high performance compared to the mean score. No criteria fall in this quadrant in this study.

4.3 Correlations between the sustainability assessment criteria

The correlation coefficient is computed to measure the strength and direction of the linear relationship between two criteria (see Table 4). It is calculated as the covariance of the variables divided by the product of their standard deviations. The higher the value, the closer the relationship between two variables. Criteria 1 "Facilitating to economic activities", criteria 2 "Ensuring cargo handled safely and effectively" and criteria 3 "Offering employment opportunities" are mostly interrelated, with values of 0.373 and 0.364 between criteria 1 to 2 and 1 to 3 respectively, as well as 0.787 between criteria 2 to 3. Criteria 4 "Employee job security and safety" and criteria 5 "Terminal traffic accidents prevention" are interrelated, with correlation value of 0.592, however the correlations of criteria 6 "Enhancing container terminal landscape" with criteria 4 and 5 are not significant, at -0.140 and - 0.043 respectively. For criteria 7 to 14, the correlations are ranging from 0.206 to 0.695.

Table 4 Correlations between port sustainability criteria

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
I1	1													
I2	0.373**	1												
I3	0.364**	0.787**	1											
I4	0.297**	0.570**	0.458**	1										
I5	0.235**	0.201*	0.247**	0.592**	1									
I6	0.106	0.012	0.022	-0.140	-0.043	1								
I7	0.036	-0.044	-0.086	-0.090	0.057	0.190*	1							
I8	0.012	-0.060	-0.081	-0.054	-0.030	0.116	0.421**	1						
I9	0.320**	0.332**	0.197*	0.293**	0.298**	0.108	0.497**	0.307**	1					
I10	0.016	0.042	0.011	-0.015	-0.018	0.154	0.581**	0.420**	0.619**	1				
I11	0.222**	0.233**	0.199*	0.248**	0.189*	-0.010	0.297**	0.301**	0.660**	0.649**	1			
I12	0.227**	0.326**	0.291**	0.150	0.180*	0.127	0.273**	0.166*	0.580**	0.517**	0.608**	1		
I13	0.296**	0.216**	0.120	0.193*	0.173*	0.133	0.206**	0.247**	0.663**	0.525**	0.497**	0.640**	1	
I14	0.266**	0.276**	0.296**	0.198*	0.275**	0.049	0.344**	0.266**	0.695**	0.594**	0.647**	0.585**	0.555**	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

4.4 Factor analysis and reliability test

Exploratory Factor Analysis (EFA) was used for analyzing the data structure, as well as removing the latent factors from measured variables.[1] The sample size of this study is 144 respondents and the quantity of items is 14, which is very close to the suggested level. For Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO), the values should be above 0.5 with a P value smaller than 0.05 in order to be regarded as significant (Pearce and Yong, 2013). The KMO in this study is 0.781 and Bartlett's Test of Sphericity was significant [$X^2 = 991.450$, $P < 0.00$], which is above the level required.

The minimum levels for eigenvalues and factor loadings are 1.0 and 0.5 to be regarded as significant; and the higher the factor loadings, the better the factors being explained by the measured variables (Pearce and Yong, 2013). Among the variables, two variables from two factors with factor loadings lower than 0.5 were removed from advance analysis – "I6: Enhancing container terminal landscape" and "I8: Providing a fair job opportunity (employment will not be affected by race, gender, etc.)".

As can be seen in Table 5, results indicated that twelve remaining variables accounted for 68.81% of the total variance. Cronbach's Alpha is applied to test the reliability, to guarantee the reliability and consistency, and the index is regarded as satisfactory when above 0.7.[2] The index of all the three factors in this study was above 0.74, which are concerned to be acceptable. The factors are labelled and described as following:

Factor 1, environmental sustainability, containing seven criteria: "I7: Decreasing noise pollution in Kwai Tsing District", "I9 : Disposing of effluents and maintaining water quality in Kwai Tsing District", "I10 : Mitigating light influence on neighboring residents", "I11 : Considering 3R (reduce, reuse, recycle) when handling cargo", "I12 : Maintaining air quality in Kwai Tsing District", "I13 : Ecological environment protection in terminal area", and "I14 : Ensuring proper waste disposal". Referring to Table 6, I10 has the highest factor loading of 0.86, among the 40.19 % of the total variance.

Factor 2, economic sustainability, containing three criteria, "I1: Facilitating to economic activities", "I2: Ensuring cargo handled safely and effectively: and "I3: Offering employment opportunities". Referring to Table 6, I2 has the highest factor loading of 0.89, among the 19.90 % of the total variance.

Factor 3, social sustainability, containing two criteria, "I4: Employee job security and safety" and "I5: Terminal traffic accidents prevention". Referring to Table 6, I5 has the highest factor loading of 0.93, among 8.73 % of the total variance.

Table 5 Factor analysis to identify factors for port sustainability criteria

Code	Statements	Factor 1	Factor 2	Factor 3
I1	Facilitating to economic activities	0.19	0.54	0.19

[1] Courtney, M. G. R., Determining the number of factors to retain in EFA: Using the SPSS R-Menu v2.0 to make more judicious estimations. Practical Assessment, Research and Evaluation, 18(8) (2013).

[2] DeVellis, R.F., Scale development: Theory and applications. Los Angeles: Sage. 109–110 (2012).

I2	Ensuring cargo handled safely and effectively	0.12	0.89	0.14
I3	Offering employment opportunities	0.04	0.88	0.11
I4	Employee job security and safety	0.04	0.48	0.74
I5	Terminal traffic accidents prevention	0.12	0.09	0.93
I7	Decreasing noise pollution in Kwai Tsing District	0.65	-0.27	0.01
I9	Disposing of effluents and maintaining water quality in Kwai Tsing District	0.83	0.19	0.25
I10	Mitigating light influence on neighboring residents	0.86	-0.08	-0.12
I11	Considering 3R (reduce, reuse, recycle) when handling cargo	0.78	0.20	0.11
I12	Maintaining air quality in Kwai Tsing District	0.78	0.20	0.11
I13	Ecological environment protection in terminal area	0.74	0.18	0.09
I14	Ensuring proper waste disposal	0.78	0.22	0.16
	Eigenvalues	4.82	2.39	1.05
	Percentage variance (%)	40.19	19.90	8.73
	Accumulated percentage variance (%)	40.19	60.08	68.81
	Cronbach's Alpha	0.75	0.74	0.89
	Mean	4.34	4.44	4.01
	S.D.	0.75	0.70	0.89

Note: S.D. = standard deviation.

1.5 Confirmatory Factor Analysis (CFA)

The confirmatory factor analysis (CFA) is a quantitative data analysis model of structural equation modeling (SEM) which specifies the number of factors, error terms and the relationship among variables and factors. Before, testing the hypotheses, a CFA was performed to ensure the validity of measurement scales by AMOS. A number of goodness-of-fit indices recommended by the different researchers were adequate fit and uni-dimensionality of the model.[1,2] The result which meets the statistical analysis in this required six scopes shows the adequate model fit: Root mean square error of approximation (RMSEA): cut value of < 0.08, Root Mean Square Residual (RMR) : cut value of < 0.05, Tucker-Lewis Index (TLI): cut value of ≥ 0.9, the comparative fit index

[1] Bagozzi, R.P. and Yi, Y., On the evaluation of structural equation models, Academy of Marketing Science, 16(1), 74-93 (1988).

[2] Kline, R., Principles and Practice of Structural Equation Modeling, The Guilford Press, New York, NY (1998).

(CFI): cut value of ≥ 0.9, Goodness of fit (GFI): cut value ≥ 0.9 and Adjusted Goodness of fit (AGFI): cut value ≥ 0.9.

As shown as Table 6, revealed an adequate model fit indicates the model was credible and purified (goodness-of-fit index (GFI) = 0.885; adjusted goodness-of-fit index (AGFI) = 0.836; Tucker–Lewis index (TLI) = 0.943; normed fit index (NFI) = 0.954; root – mean – square residual (RMR) = 0.052; root – mean – square error of approximation (RMSEA) = 0.072).

Table 6 Goodness of fit indicators

Indicators	Criteria	Results
GFI	> 0.9	0.885
AGFI	> 0.9	0.836
TLI	> 0.9	0.943
CFI	> 0.9	0.954
RMR	< 0.05	0.052
RMSEA	< 0.08	0.072

Convergent validity is found by examining significant factor loading on each construct. Convergent validity is examined by t-value which is equal to the critical ratio (CR) in AMOS. If a t-value is greater than - 1.96 or lower than 1.96, it accepts its statistical significance. Since Critical ratio is significant at the level of 0.05, it confirms that the construct measured by all indicators are identical and offered rewarding proof of the unidimensional of each construct and convergent validity. Discriminant validity is analyzed by the comparison of Average Variance Extracted (AVE) with the squared correlation between each construct. If the indicators have more common variance with their own construct than any variance that the constructs have with other constructs, it indicates that discriminant validity appears. According to Table 7, it is known that the highest squared correlation is lower than the square roots of AVE of all constructs. Therefore, discriminant validity is confirmed.

Table 7. Parameter estimate, standard errors, critical ratio, and R2

Factors and scale items	Unstandardized factor loading	Completely standardized factor loading	Standard error (SE)	Critical ratio (CR)	R^2
Economic issue					
P1	1.328	0.753	0.225	5.894	0.568
P2	1.377	0.867	0.198	6.965	0.751
P3	1.000	0.591	--	--	0.349

Social issue					
P4	1.000	0.893	--	--	0.798
P5	1.087	1.015	0.062	17.420	1.031
Environment issue					
P7	1.000	0.712	--	--	0.506
P9	1.057	0.788	0.114	9.232	0.621
P10	1.106	0.810	0.116	9.563	0.656
P11	0.722	0.571	0.109	6.626	0.326
P12	1.196	0.851	0.121	9.907	0.725
P13	1.105	0.887	0.108	10.235	0.787
P14	1.325	0.902	0.128	10.321	0.814
Retention					
L1	1.000	0.861	--	--	0.742
L2	0.732	0.577	0.126	5.862	0.333
L3	0.954	0.703	0.134	7.165	0.494

Composite reliability (CR) was investigated to assess the reliability and internal consistency within a factor (Awang, 2016). Composite reliability is calculated as (sum of standardized loadings)^2/[(sum of standardized loadings)^2+(sum of indicator measurement error)], where indicator measurement error is 1 - (standardized loadings)^2. A minimum level of 0.6 is required for a CR to be acceptable. As shown in Table 8, CR values of environmental sustainability, economic sustainability and social sustainability are 0.814, 0.786, and 0.955 respectively, which mean that all the CRs are higher than the required level.

Average Variance Extracted (AVE) was computed to measure the amount of variance that is captured by a factor in relation to the amount of variance due to measurement error. It is calculated as (sum of squared standardized loadings) / [(sum of squared standardized loadings) + (sum of indicator measurement error)], where indicator measurement error is 1 - (standardized loadings)^2. A minimum level of 0.5 is required for an AVE to be adequate. As shown in Table 8, AVE values of environmental sustainability, economic sustainability and social sustainability are 0.595, 0.556, and 0.914 respectively, which mean that all the AVEs are reaching the required level.

Table 8 Composite reliability and average variance extracted values

Factor	Composite reliability	Average variance extracted
Economic	0.786	0.556
Social	0.955	0.914
Environment	0.814	0.595

4.6 Structural Equation Modeling (SEM)

Structural Equation Modeling is the combination of factor analysis and multiple regression analysis. It can analyze the relationship between measured variables and represented by path coefficient between the factors.[1]

In this section, the SEM was applied to examine the relationships among environment sustainable, social sustainable, economic sustainable and retention. The data, as shown in Figure 2, supported the estimated model effectively. All the relationships were significant in the expected way. The relationship between environmental sustainability performance with retention was significant (estimate = 0.38, CR = 5.11), economic sustainability performance associated with retention also had significant relationship (estimate = 0.61, CR = 3.58), whereas the relationship between social sustainability and retention was not significant compared to other two sustainability performance (estimate = - 0.02, CR = - 0.38).

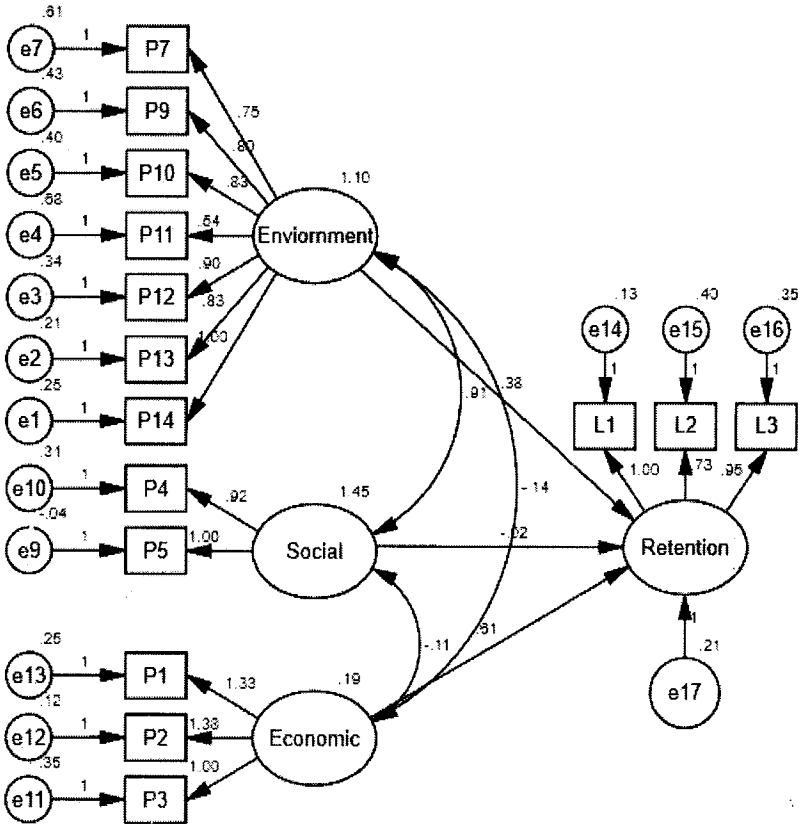

Figure 2 Result of SEM

[1] Hox, J.J, Bechger, T.M., An introduction to structural equation modeling, The Family Science Review, 11, 354-373 (1998).

4.7 Differences of port workers, shipping company employees and nearby residents in the importance and performance of sustainability assessment criteria

An investigation of the opinion differences between different types of respondents (port workers, shipping company employees, and nearby residents) was conducted (see Table 9). For importance, social sustainability (mean = 4.44) was viewed as the most agreed factor by respondents, followed by economic sustainability (mean = 4.34) and environmental sustainability (mean = 4.01) as the least important. For performance, economic sustainability assessment criteria have the best performance (mean = 4.00) by respondents, followed by social sustainability (mean = 3.26), and environmental sustainability as the worst performance (mean = 2.82) (see Table 10). The P values of all criteria in both importance and performance are all smaller than 0.05, meaning the responses difference between the three types of respondents are significant.

4.7.1 The nearby residents' point of view

50 nearby residents have responded to the questionnaire. Regarding importance, environmental criteria have the highest importance of mean scores ranging from 4.26 to 4.38, followed by social criteria with a mean of 4.16 and economic criteria with a mean of 4.09. "Considering 3R (reduce, reuse, recycle) when handling cargo" with a mean of 4.38, is considered as the most important criteria in the view of nearby residents. Regarding performance, social criteria with a mean of 3.66 have the best performance in the view of nearby residents, followed by economic criteria with a mean of 3.57. Environmental criteria which have the highest importance, however, have the lowest performance of mean ranging from 2.78 to 3.08. "Ensuring cargo handled safely and effectively" and "Terminal traffic accidents prevention" have mean of 3.68 are the criteria with the best performance.

4.7.2 The shipping company employees' point of view

44 employees include both office workers and crew members have responded to the questionnaire. Regarding importance, economic and social sustainability with means of 4.77 and 4.75 respectively are more important among shipping company respondents; environmental sustainability is less important with a mean of 4.32. "Ensuring cargo handled safely and effectively" with a mean of 4.91, is considered as the most important criteria in the view of shipping company. Regarding performance, the performance in economic and social sustainability assessment criteria are the same with both means of 3.98; performance in environmental sustainability assessment criteria are relatively lower with a mean of 3.39 in the view of shipping company respondents. "Ensuring cargo handled safely and effectively" has mean of 4.02 are the criteria with the best performance.

Table 9Importance difference between nearby residents, shipping company employees, and port workers

Code	Importance of sustainability Criteria	Nearby residents		Shipping Company		Port Workers				
		Mean	SD	Mean	SD	Mean	SD	F value	P value	Scheffe
I1	Facilitating to economic activities	4.08	0.53	4.57	0.63	4.14	0.99	5.84	0.00	(1,2) (2,3)
I2	Ensuring cargo handled safely and effectively	4.16	0.51	4.91	0.29	4.20	0.97	18.41	0.00	(1,2) (2,3)
I3	Offering employment opportunities	4.04	0.53	4.82	0.45	4.34	0.90	16.35	0.00	(1,2) (2,3)
I4	Employee job security and safety	4.18	0.48	4.75	0.44	4.50	0.89	9.33	0.00	(1,2) (1,3)
I5	Terminal traffic accidents prevention	4.14	0.54	4.75	0.44	4.42	0.95	9.24	0.00	(1,2)
I7	Decreasing noise pollution in Kwai Tsing District	4.28	0.61	3.64	0.78	3.02	0.96	31.36	0.00	(1,2)(1,3) (2,3)
I9	Disposing of effluents and maintaining water quality in Kwai Tsing District	4.36	0.63	4.64	0.49	3.22	0.93	53.04	0.00	(1,3) (2,3)
I10	Mitigating light influence on neighboring residents	4.32	0.51	3.84	0.61	3.14	0.87	38.29	0.00	(1,2)(1,3) (2,3)
I11	Considering 3R (reduce, reuse, recycle) when handling cargo	4.38	0.57	4.41	0.64	3.76	1.15	9.40	0.00	(1,3) (2,3)
I12	Maintaining air quality in Kwai Tsing District	4.36	0.56	4.68	0.47	3.62	0.86	32.81	0.00	(1,3) (2,3)
I13	Ecological environment protection in terminal area	4.26	0.63	4.43	0.70	3.54	0.91	18.84	0.00	(1,2)(1,3) (2,3)
I14	Ensuring proper waste disposal	4.34	0.52	4.64	0.49	3.52	0.97	32.34	0.00	(1,2)(1,3) (2,3)

Table 10 Performance difference between nearby residents, shipping company employees, and port workers

Code	Criteria	Nearby residents		Shipping Company		Port Workers		F value	P value	Scheffe
		Mean	SD	Mean	SD	Mean	SD			
P1	Facilitating to economic activities	3.40	0.50	3.82	0.58	4.48	0.83	28.24	0.00	(1,2)(1,3) (2,3)
P2	Ensuring cargo handled safely and effectively	3.68	0.55	4.20	0.63	4.58	0.58	29.86	0.00	(1,2)(1,3) (2,3)
P3	Offering employment opportunities	3.62	0.49	3.91	0.64	4.38	0.83	16.39	0.00	(1,3) (2,3)
P4	Employee job security and safety	3.64	0.56	3.95	0.53	2.28	1.55	37.05	0.00	(1,3) (2,3)
P5	Terminal traffic accidents prevention	3.68	0.47	4.00	0.53	2.16	1.33	60.08	0.00	(1,3) (2,3)
P7	Decreasing noise pollution in Kwai Tsing District	2.88	0.87	3.43	0.55	2.24	1.39	16.25	0.00	(1,2)(1,3) (2,3)
P9	Disposing of effluents and maintaining water quality in Kwai Tsing District	2.94	0.71	3.61	0.54	2.38	1.35	19.77	0.00	(1,2)(1,3) (2,3)
P10	Mitigating light influence on neighboring residents	3.08	0.88	3.36	0.49	2.10	1.27	23.60	0.00	(1,3) (2,3)
P11	Considering 3R (reduce, reuse, recycle) when handling cargo	2.78	0.65	2.52	0.55	1.76	1.30	16.90	0.00	(1,3) (2,3)
P12	Maintaining air quality in Kwai Tsing District	2.92	0.85	3.64	0.49	2.34	1.38	19.95	0.00	(1,2)(1,3) (2,3)
P13	Ecological environment protection in terminal area	3.06	0.65	3.41	0.50	2.26	1.24	21.82	0.00	(1,3) (2,3)
P14	Ensuring proper waste disposal	3.02	0.99	3.73	0.69	2.14	0.45	30.95	0.00	(1,2)(1,3) (2,3)

4.7.3 The port workers respondents' point of view

50 port workers have responded to the questionnaire. Regarding importance, social and economic criteria with 4.46 and 4.23 respectively are more important among port workers respondents, environmental sustainability is less important with a mean of 3.40. "Employee job security and safety" with a mean of 4.50, is considered as the most important criteria in the view of port workers. Regarding performance, the performance of economic sustainability with a mean of 4.48 has the best performance in the view of port workers. Social and environmental sustainability criteria with a mean of 2.22 and 2.17 have weaker performance. "Ensuring cargo handled safely and effectively" has mean of 4.58 are the criteria with the best performance.

Discussion and Conclusions

Since port is one of the main nodes in the global supply chain networking, the number of cargo shipped by sea and the amount of waterborne commerce has been growing gradually. Suppose the acceleration of human economic development is greater than the recovery rate of natural resources, it will form a destructive impact on the planet in long run. Therefore, the port operators have an obligation to maintain a balance among profit maximization, social concern and environment which is as known as "sustainability". Given sustainability is a complex issue, it is necessary to break down the issue into a smaller-scale indicator for measurement and assessment.

Our research aims to identify various crucial sustainability criteria and its impact on stakeholder's retention at Hong Kong container port. The key findings of the research are found via the questionnaire survey conducted in Kwai Tsing container terminals and Kwai Tsing District and are summarized as below.

In this research, the questionnaire was initially undergone to evaluate the level of agreement / satisfaction from the point of view of the respondents in terms of the importance and performance of different sustainability criteria. Then, factor analysis has been adapted to reduce, re-arrange and thus test the variables into critical factors. In addition, the implication of AMOS establishes a structural equation model (SEM) to examine the significance of the criterion.

Data collection are constructed by a questionnaire of 144 respondents including 44 shipping companies' employees, 50 employers at Kwai Tsing container terminals and 50 residents living in Kwai Tsing District. A total of 14 relevant sustainability assessment criteria were selected from the past researches conducted by several scholars. It is revealed that our respondents regarded social dimension such as "Terminal traffic accidents prevention" as the most important sustainability dimension. It can be generalized as labor's right and equality in port. It is followed by economic dimension including criteria like "ensuring cargo handled safely and effectively". The economic dimension concerns itself with profit maximization and operational efficiency. Lastly, environmental dimension concerning environmental policy such as "maintaining air quality in Kwai Tsing District" is regarded as the least important dimension among the three dimensions. In terms of the performance, the performance of economic dimension has the best-ranking, followed by social dimension and then environmental dimension. According to

information - performance matrix, 14 sustainability criteria has been categorized into three quadrants respectively. There are five sustainability criteria which fall into Quadrant I "Keep up the good work". Regarding the indicators in Quadrant I, it is suggested to focus on the reformulation of labor safety policy and the offering of welfare and allowance. There are five sustainability criteria which fall into Quadrant II "Concentrate Here". Regarding the criteria in Quadrant 2, it is highly advised that the investment should be involved in this area. Also, four sustainability criteria which fall into Quadrant III "Lower Priority". Regarding the criteria in Quadrant III, it is suggested to implement more cost-effective measures to deal with the problems. Since Quadrant III is not prioritized, the resources are relatively less allocated to Quadrant III.

Based on Confirmatory Factor Analysis (CFA), it is known that SEM indicators are eligible to meet all the criteria requirements, confirming the validity of three dimensions to undergo AMOS model analysis. Furthermore, with the help of the usage of AMOS, it is found that all relationship between all three dimensions is significant as expected. With that said, it is also found that environmental dimension and economic dimension shares a significant relationship with the retention while social dimension shares an insignificant relationship with the retention.

In the difference between shipping companies' employees, residents and port workers, it is essential to address and acknowledge the difference in the responses of the three types of respondents. It is because the P-value of all sustainability criteria in both importance and performance are less than 0.05.

Theoretical and practical implication obtained from the results of the assessment for sustainability criteria is discussed in the study. Even though there is a great deal of sustainability assessment research conducted by the researchers, there are still having lack on the evaluation of sustainability criteria at Hong Kong port from a stakeholder's perspective. The study facilitates the development of different indicators for sustainability and emphasizes the important criteria for future investigation. Furthermore, the research can serve as the ground for sustainability policy-making in port operation for a more precise regulation.

Important contributions are made from the research. From the practical perspective, spotting out the strengths and weaknesses of current operation provides a major implication for business decision making in the foreseeable future. In order to have a successful implementation of sustainability policy, it is necessary to highlight the weakness and focus on the improvement for these areas. Another contribution made is to enlighten the board of directors to raise the awareness of environmental protection with solid and scientific evidence. Since the research evaluates the actual situation in Kwai Tsing container terminals and includes many stakeholders, it reflects and presents the reality with actual data and facts. Therefore, it is fair to state that the research has made important practical contribution.

In the light of theoretical contribution, this paper makes major contribution as well. Firstly, it deepens the understanding of sustainability performance. It is found that there is not a lot of academic paper specializing in the performance of a certain dimension in sustainability. Yet, a lot of papers focus on the idea of "sustainability" as a whole as the

discussion topic. Our research can serve as a guideline for further investigation into the operation and management of ports in different major ports in Hong Kong. This is significant because it offers different insight and useful input to future researchers by displaying different adaptation of analysis models and data collection methods. Therefore, it is acceptable to claim that productive contribution has been done from the theoretical perspective.

The following specific recommendations and suggestions are developed for terminal operators' reference. It is vital for port operators to include the interest of external consumers and supply chain partners such as transportation companies in their sustainability policy to advance the sustainability performance. This should be done so that, the implementation of sustainability practices could encounter less friction and can be effectively carried out. Secondly, port operators are suggested to encourage transparent and effective communication among the staffs, allowing the involvement of the employees in the sustainable development policy. A tight cooperation with the employees allows the company to have a better design for the sustainability goals and regulations and better engagement in the training programs for the implementation of new policies. An internal sustainability practice and the collaboration with the external organization in sustainability action are positively linked to a positive change in the performance of sustainability. Therefore, it is essential to introduce an adequate sustainability practice within the container terminal.

In the quadrant I: High importance and high performance, there are five main criteria in this quadrant: Employee job security and safety, terminal traffic accidents prevention, ensuring cargo handled safely and effectively, offering employment opportunities and facilitating to economic activities. These five main criteria were essential and performed well in the Kwai Tsing Container Terminal according to the questionnaire completed by residents, port workers and shipping companies. As long as they are effective and efficient in port sustainability development, some recommendations will be given to keep up on those five criteria in order to achieve improvement of port sustainability. For the employee job security and safety, 'Work Safe Behavior Program' can be launched. In order to enhance workers health consciousness, the program will be a group of safety observers received training from the Occupational Safety and Health Council then went to different shipping companies to observe and identify any improper work behavior. Providing advice and encouraging the operators to stretch before operations to increase the flexibility, joint of movement and relax muscle. This can lower the risk of injury during the operation e.g. back injury, knee injury and wrist injury etc. For the terminal traffic accidents prevention, a "Safe Driving Event" can be rolled out to raise staff awareness on safe driving practices. In order to drive awareness and equip drivers with techniques to prevent accidents, the container port can be cooperated with the Hong Kong Police Force to conduct a safe driving talk. In this event, hazard perception in driving and safe driving behavior will be trained for the drivers to eliminate the risk of accidents in the container port. For the ensuring cargo handled safely and effectively and facilitating to economic activities, enhancing turnover can improve the terminal handling cargo faster and safer to achieve facilitating economic activities by increasing automation in the port operation. To

commission a 'ghost ship' with fully automated berths with ship – to – shore cranes, stacking cranes associated with automated guided vehicles (AGV), it can enhance the cargo handling efficiency and safely with enhancing turnover rate to achieve facilitating economic activities. For the offering employment opportunities, the container port can promote the jobs and provide allowances for the employees. As long as the Kwai Chung Container Terminal is far from the city and MTR station, only minibus and taxi can enter the terminal area. It is hard to get access into it, therefore, promoting the job is important with higher allowances for the employees can attract people to get a job in the container port.

In quadrant II: High importance and low performance, there are five main criteria in this quadrant: Disposing of effluents and maintaining water quality in Kwai Tsing District, considering 3R (reduce, reuse, recycle) when handling cargo, maintaining air quality in Kwai Tsing District, Ecological environment protection in terminal area and Ensuring proper waste disposal. These five main criteria were essential but poorly performed in the Kwai Tsing Container Terminal according to the questionnaire completed by residents, port workers and shipping company. Some suggestions are given to these criteria correspondingly. For disposing of effluents and maintaining water quality in Kwai Tsing District, it is suggested that port operators can cooperate with the public sector in the Harbor Area Treatment Scheme. With the aid of the scheme, port operators can examine the water quality from time to time and identify the main source of water pollution. So that, port operators can make an adequate adjustment to its operational activities to reduce the impacts imposed to the environment. For maintaining air quality in Kwai Tsing District, it is suggested to invest on the improvement of the facilities at ports. For example, installing cutting edge filtering technology to improve air quality. High-efficiency air filtering can help the ports to have a better control of their pollutant outputs and provide a better workplace environment to low-ranking port workers, creating a win-win situation by cutting edge filtering system. For ecological environment protection, it remains unknown how much responsibility port operators are to bear. Therefore, it is highly advised that port operators should have consultations with environmentalist organizations. Environmentalist organizations would offer different professional recommendations for ecological environment protection, in order to maintain the biodiversity near the ports at a steady level. For considering 3R (reduce, reuse, recycle) when handling cargo and ensuring proper waste disposal, it is recommended that the company can implement a new waste disposal policy. The staffs have different arrangement and requirement while dealing with waste. There should be a self-monitoring policy within the port operation to ensure that waste is handled appropriately. Also, it is essential to conduct regular training and education to educate port workers about proper disposal measures and by so doing, raise the awareness of environmental protection and clarify the procedures of the waste disposal.

Regarding criteria with low importance and low performance, they will have lower priority in the development plan. Due to the low priority, resources allocated for these criteria will be less. Thus, lower cost measures should be adopted. For decreasing noise pollution in Kwai Tsing District and mitigating light influence on neighboring residents,

port operators can cooperate with the property companies in Kwai Tsing districts to use noise barrier material and thick curtains in the renovations of apartments so that the influences from excessive light or noise can be reduced. For enhancing container terminal landscape and providing fair job opportunities, the port operators should supervise and control the behavior of their outsourcing labor supplier, ensuring the service quality in maintaining a clean and tidy terminal area, and a fair hiring process.

While the paper makes a valuable contribution in the light of theoretical and practical implications, there are still a number of limitations in this study. Firstly, the scope of the research is limited to time and financial restriction. Since the duration of the project is one year, the focus group needs to be narrowed down for the context of the research. As a result, there are three types of parties involved in the research while there are still a number of stakeholders' opinions that should be included in the sustainability of port operation. Also, the sample size is relatively small which has 144 respondents in our questionnaire. Therefore, the authority and representability of the questionnaire could be challenged and doubted since the number of respondents might not be sufficient to represent the stakeholders as a whole. Besides, the data collected from the respondents are their subjective opinions towards the sustainability performance. The result might not be reliable since the respondents are very likely to be unwilling to review the performance truthfully for the sake of their interest and the avoidance of unnecessary backlash against the respondents themselves. It is suggested to adopt more objective measures for information accuracy.

In order to evaluate the sustainability of Hong Kong port operation, it is necessary to level up on the scale of the research. The timeframe of the research can be lengthened to conduct a longitudinal study to assess sustainability. Moreover, the research should involve more stakeholders to increase the validity of the survey.

Editor (English): Nii Sowah