航　運　季　刊
第二十四卷　第三期
民國 104 年 9 月
頁 83～頁 98

Maritime Quarterly
Vol. 24 No. 3
September 2015
pp. 83–98

臺灣定期航運業的綠色航運能力與績效

Green Shipping Capability and Performance of Liner Shipping Firms in Taiwan

劉穹林 (*Chiung-Lin Liu*)❶、林泰誠 (*Taih-Cherng Lirn*)❷*

摘要

本研究歸納出幾類的綠色航運能力，並以定期航運公司的觀點來檢測這些能力與其績效間之關係。透過問卷調查及因素分析，本研究首先總結三種綠色航運能力構面，分別為：綠色船舶、綠色員工與綠色供應商。其次，藉由集群分析，本研究將受訪企業依其綠色航運能力分為三型，分別為：全綠色航運作為型、無綠色航運作為型與具綠色航運作為型。結果顯示，相較無綠色航運作為型，全綠色航運策略作為型的定期航運公司具有較佳的企業形象、營收與顧客滿意度。研究結果顯示，企業的經營者應持續改善其公司的綠色航運能力以獲取長期的競爭優勢。

關鍵字：綠色航運能力、定期航運公司、分類

Abstract

This study identifies several taxonomies of green shipping capability and examines their relationships with performance from the perspective of a liner shipping company. Using factor analysis, three green shipping capability dimensions were identified: the green ship dimension, green employee dimension, and green supplier dimension. Cluster analysis was subsequently used to assign

❶ Assistant Professor, Department of Shipping and Transportation, Management National Taiwan Ocean University, No.2, Beining Rd., Jhongjheng District, Keelung City 202, Taiwan (R.O.C). E-mail: realsky@mail.ntou.edu.tw.

❷* Corresponding Author and Associate Professor, Department of Shipping and Transportation, Management National Taiwan Ocean University, No.2, Beining Rd., Jhongjheng District, Keelung City 202, Taiwan (R.O.C). E-mail: tedlirn@email.ntou.edu.tw.

respondents into three groups, namely, the strategic green shipping practice group, the undeveloped green shipping practice group, and the capable green shipping practice group, on the basis of their factor scores for three green shipping capability dimensions. The results indicate that the strategic green shipping practice firms had a better firm performance index in relation to image improvement, sales and customer satisfaction than the undeveloped green shipping practice firms. Thus, the findings suggest that top managers should constantly seek to enhance and refine their firms' three green shipping capability factors in relation to those of their competitors in order to acquire and maintain long-term superior performance.

Keywords: Green shipping capability, Liner shipping firms, Taxonomy.

1. INTRODUCTION

In accordance with the current dramatic changes in the world situation, the international liner shipping industry is facing social, environmental and economic challenges. In particular, when governments and businesses continuously raise the bar on air emissions, ballast water discharge, ship design, and ship recycling, international liner shipping companies must raise the environmental issues to a corporate strategy level (Pruzan-Jorgensen and Farrag, 2010; Kontovas, 2014; Lister, 2015).

For example, in 1973, IMO adopted the International Convention for the Prevention of Pollution from Ships, now known universally as MARPOL, which addresses pollution from ships by oil; by noxious liquid substances carried in bulk; by harmful substances carried by sea in packaged form; sewage, garbage; and the prevention of air pollution from ships (IMO, 2012). International liner shipping companies have thus begun to take relevant green actions, such as slow steaming strategies, new ballast water management methods, the prevention of air pollution from ships, greenhouse gas emissions action, sustainable development training courses, and the choice of suppliers based on environmental criteria (MOL, 2011; IMO, 2012; Jorgensen, 2012; Lu et al., 2014).

Executives are becoming increasingly aware of the importance of successful integration and the management of essential green shipping capability (GSC), for acquiring long-term superior performance (Lai et al., 2011; Lirn et al., 2014; Lun et al.,

2014).

The resource-based view (RBV) of the firm (Wernerfelt, 1984) was first introduced by Penrose in the late 1950s, largely reintroduced by Wernerfelt in the 1980s, and became a dominant framework in the 1990s (Hoskisson et al., 1999). The RBV mainly emphasizes firms' internal strengths and weaknesses, because when the external environment is dynamic, the firm's own resources and capabilities may be easier to control (Grant, 1991). The RBV contends that the idiosyncratic resources and capabilities of firms are the key sources of sustained competitive advantage (Lynch et al., 2000). To apply the RBV methods, the GSC may also be the key sources of sustained competitive advantage.

To the author's knowledge, empirical studies have rarely focused on the GSC of the liner shipping industry based on the RBV. For example, Lai et al. (2011) only propose a conceptual framework for evaluating green shipping practices. This study fills this gap in the GSC literature by examining whether there are different groups of liner shipping firms in terms of the GSC, and the relationship of group with firm performance, within the theoretical framework of the RBV.

Research on taxonomy is one of the most fundamental steps in the generation of scientific research (Autry, 2005). Taxonomy provides parsimonious descriptions (Sum et al., 2004) and clusters them into groups without losing the main characteristics that exist within the type (Ketchen et al., 1993; Shang et al., 2010).

Given the academic and practical importance of developing a GSC in the liner shipping industry, the objective of this study is to investigate crucial GSC dimensions, and to classify liner shipping firms in Taiwan into various groups depending on their GSC. On the basis of the GSC or environmental management literature, dimensions such as the green ship dimension, green employee dimension, and green supplier dimension are assessed in this research. In particular, differences in firm performance among groups are examined in this study.

The objectives of our study are:

1. To identify a taxonomy of GSC for Taiwan liner shipping firms.
2. To examine the differences among taxonomies of GSC by means of a firm performance index.

In the following section, the existing literature is reviewed to build the theoretical base presented in Section Two. Section Three describes the questionnaire design and responses. The collected data are examined

using factor analysis and cluster analysis. The results of the statistical analysis are detailed in Section Four. Section Five concludes the paper. It provides an overall review of the study's findings and identifies the study's contributions to the literature.

2. LITERATURE REVIEW

Shipping – which transports 90 per cent of global trade – is, statistically, the least environmentally damaging mode of transport when its productive value is taken into consideration (IMO, 2012). However, navigating and operating a vessel requires various inputs, including fuel and materials, resulting in a number of environmental impacts (Maersk Group, 2015). Thus, the way in which international liner shipping companies can enhance their GSC for acquiring long-term superior performance has become an important issue. The GSC includes three factors, namely, the green ship, green supplier, and green employee as detailed below.

The green ship factor focuses on greening shipping capability and includes the prevention of air pollution (i.e., carbon dioxide (CO_2), sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matters (PM)) from ships, improved ships' ballast water management methods to tackle invasive species, the adoption of non-ozone depleting refrigerated containers to protect the Earth's ozone layer, the use of Tributyltin (TBT) -free anti-fouling paint in order to increase speed and reduce fuel consumption, as well as designing new ships based on energy saving and environmental protection concepts (Pruzan-Jorgensen and Farrag, 2010; Maersk Line, 2011; K Line, 2015). Sulaiman et al. (2013) indicated the concept of green ship design should include the construction, operation, and disposal of the ship. Tzannatos (2010) studied Costs and benefits of reducing SO2 emissions from shipping and found the application of seawater scrubbing offers a substantially lower private cost alternative than that of using ultra-low (0.1 per cent) sulphur fuel. Dumitru et al. (2013) used the RBV technique to study the inter-variables for boosting green shipment, they found from the connection between the green environment arrangement, the pleasant of labors, and companies' productivity. (Fernandez Soto et al., 2010) argued the use of alternative energy sources on the transport of goods by sea is becoming reality due to the stricter environmental regulations and the risen bunker cost.

The green employee factor focuses on greening the employees' capability including the provision of training programs for managers and employees, and encouraging employees to report all violations of sustainable development based on the relevant conditions of the incident (Evergreen Line, 2015).

The green supplier factor focuses on greening supplier capability including guiding suppliers to establish their own environmental programs, pressuring suppliers to take environmental action, and choosing suppliers according to the company's environmental criteria (IMO, 2012; Maersk Group, 2015; NYK Line, 2015).

3. METHODOLOGY

3.1 Sample

The sample of liner companies was selected from the Directory of the National Association of Shipping Agencies and Companies in Taiwan. Questionnaires with accompanying cover letters and stamp-addressed envelopes were initially mailed to 180 potential respondents in 2010. There are 35 copies of valid response in the first round of the survey. A follow-up mailing was sent two weeks after the initial mailing to the un-responded surveyees and an additional 45 valid responses were received. The total number of valid responses was 80. To detect any potential non-response bias, Lambert and Harrington (1990) recommend ensuring that the second wave of respondents' responses is most similar to that of the non-respondents. T-test analysis results revealed no significant differences (at $p < 0.05$) as regards all GSC variables analyzed and non-response bias was therefore not a problem.

With regard to the profiles of respondents, more than 51% of the respondents were classified according to title as being either a manager or above. Thus, the high percentage of responses from managers or above endorsed the reliability of the survey findings. Over half of the respondents were from liner shipping companies (35%) with the remainder coming from shipping agencies (65%). Around 22% of responding firms had over 500 employees in Taiwan, whereas 53% of responding firms had below 50 employees in Taiwan. Over 30% of respondents reported that their company's 2009 annual revenue was over 500 million New Taiwan (NT) dollars, while 48% and 22% of the respondents' company's revenue was below NT$50 million and between NT$51 million and NT$500 million, respectively. (One U.S. dollar is

equal to approximately 29.5 New Taiwanese dollars.)

3.2 Research methods

The measurement items for the respondents' evaluation of sustainability in liner shipping companies were mainly adapted from published sustainability or corporate social responsibility reports of shipping companies (Pruzan-Jorgensen and Farrag, 2010; K Line, 2011; Maersk Line, 2011; MOL, 2011; Hanjin Shipping, 2013; NYK Line, 2013) and green supply chain management research (Lai et al., 2011; Wuisan et al., 2012; Cheng et al., 2013; Lai et al., 2013; Lun et al., 2013; Yang et al., 2013). In order to ensure the accuracy and content validity of the questionnaire, a comprehensive review of the literature was undertaken, i.e., the questions were based on previous studies, and interviews were conducted with two academic experts, and four practitioners, namely, two managers in shipping agencies, and two managers in liner shipping companies, in order to obtain their valuable suggestions for questionnaire improvement. Some minor revisions were necessary after the interviews.

For each GSC item, respondents were asked to indicate the extent to which they agreed that the item described its prospective content domain. Seven-point Likert-type scale anchors were used. Respondents were asked to indicate their level of implementation of each item, where 1 represented "Strongly Disagree" and 7 represented "Strongly Agree". In addition, firm performance has also frequently been measured by logistics researchers (Liu and Lyons, 2011; Ellinger et al., 2003). Accordingly, in this study, respondents were asked to rate their firm's performance relative to its major competitors by indicating their level of implementation with items on a seven-point scale, where 1 represented "Much Worse" and 7 represented "Much Better".

3.3 Research steps

Factor analysis was conducted to summarize and reduce the large number of GSC into a smaller set of underlying factors or dimensions. In addition, in order to develop the empirical taxonomy based on GSC dimensions, a two-stage cluster procedure was employed to take advantage of the strengths of hierarchical and nonhierarchical clustering approaches (Hair et al., 2010). A hierarchical algorithm (Ward's method) was first used to define the number of clusters and cluster centroids, which then served as the

starting points for subsequent nonhierarchical cluster analysis. Discriminant analysis was also used to confirm the correct assigned rate. One-way analysis of variance (ANOVA) and the Scheffe test were then performed between the groups (clusters) and firm performance outcomes in order to identify differences between groups.

4. RESULTS

4.1 Perceptions of GSC

In order to evaluate the GSC, respondents were asked to rate 21 GSC as shown in Table 1. The results show that the most agreement attributes (those having a mean score greater than 5.81) of the GSC from the perception of the container shipping carrier are as follows: (1) Pays attention to all kinds of methods that can reduce ship fuel consumption; (2) The ship has adhered to the company's strict compliance with applicable laws or regulations of an international or regional nature, e.g., MARPOL or SOLAS; and (3) The ship has been an effective solution to the improper discharge of ballast water or harmful substances, and its impact on marine ecology.

4.2 Exploratory factor analysis and reliability test results

Factor analysis was used to reduce the 21 GSC to smaller sets of underlying factors (dimensions). This helped to detect the presence of meaningful patterns among the original variables and to extract the main GSC factors. Principal components analysis with VARIMAX rotation was employed to identify key GSC dimensions (see Table 2). The data were deemed appropriate for analysis, according to the Kaiser–Meyer–Olkin measure of sampling adequacy value of 0.897 (Hair et al., 2010). The Bartlett Test of Sphericity was significant [1577.509, $P < 0.001$], indicating that correlations existed between some of the response categories. Eigenvalues greater than one were used to determine the number of factors in each data set (Field, 2013). The three key GSC dimensions identified accounted for approximately 72.4 percent of the total variance.

To aid interpretation, only variables with a factor loading greater than 0.50 were extracted, a conservative criterion based on Hair et al. (2010). The scores for each of the three GSC dimensions were calculated for each respondent and submitted for subsequent cluster analysis. Three GSC dimensions were

Table 1 Respondents'agreement with GSC

GSC		Mean	S.D.
G22	Pays attention to all kinds of methods that can reduce ship fuel consumption.	6.00[a]	1.09[b]
G16	Ship has adhered to the company's strict compliance with applicable laws or regulations of an international or regional nature, e.g., MARPOL or SOLAS.	5.94	1.17
G17	Ship has been an effective solution to the improper discharge of ballast water or harmful substances, and its impact on marine ecology.	5.81	1.21
G24	Make sure all the crew clearly know what kind of pollution the vessels may cause, and what prevention actions should be taken and implemented in daily operations.	5.80	1.08
G20	Standard operating procedures to control the ship's garbage.	5.80	1.10
G18	Reduce emissions of greenhouse gases or harmful gases (CO_2, SOx, NOx).	5.80	1.23
G23	Use new CFC-free refrigerants (e.g., R134A or R404A) for reefer containers in order to preserve the earth's environment.	5.76	1.24
G19	Use tin-free paint on hulls to protect living organisms in the ocean.	5.58	1.18
G07	Devise sustainable development of the Code of Practice.	5.49	1.10
G01	Release written sustainable development policies.	5.46	1.40
G15	The building of new ships is geared towards energy saving and environmental protection concepts.	5.40	1.45
G34	Choice of suppliers based on environmental criteria.	5.39	1.19
G06	Natural environmental seminars for executives.	5.26	1.27
G33	In purchasing, this company requires suppliers to provide certification of testing for green product conformance.	5.13	1.05
G12	Sustainable development training courses can be applied in my work.	5.05	1.20
G09	The company encourages employees to report all violations of the sustainable development based on the relevant provisions for the incident.	5.03	1.24
G10	Natural environment training programs for managers and employees.	5.03	1.09
G31	Urging/pressuring suppliers to take environmental action.	5.01	1.11
G32	Guiding suppliers to establish their own environmental programs.	4.91	1.15
G13	The efforts made in relation to various environmental affairs have been much more intense than those in relation to the regulations.	4.85	1.29
G11	Companies are to provide sustainable development training programs that are designed well.	4.76	1.27

[a] The mean scores are based on a 7-point Likert scale (1= strongly disagree to 7= strongly agree); [b] S.D. = standard deviation.

found to underlie the various sets of GSC in liner shipping firms in Taiwan. These were labeled, and are described below:

(1) Factor 1 consisted of night items. Reduce the emissions of greenhouse gases or harmful gases (CO_2, SOx, NOx) had the highest factor loading on this factor. Since all night items were related to the green ship, this factor was designated as the green ship

Table 2 Factor analysis for GSC

GSC		Factor1	Factor2	Factor3
G18	Reduce emissions of greenhouse gases or harmful gases (CO_2, SOx, NOx).	**0.835**	0.206	0.292
G16	Ship has adhered to the company's strict compliance with applicable laws or regulations of an international or regional nature, e.g., MARPOL or SOLAS.	**0.825**	0.149	0.280
G22	Pays attention to all kinds of methods that can reduce ship fuel consumption.	**0.802**	0.181	0.091
G23	Use new CFC-free refrigerants (e.g., R134A or R404A) for reefer containers in order to preserve the earth's environment.	**0.800**	0.291	0.230
G17	Ship has been an effective solution to the improper discharge of ballast water or harmful substances, and its impact on marine ecology.	**0.790**	0.255	0.420
G20	Standard operating procedures to control the ship's garbage.	**0.788**	0.210	0.345
G24	Make sure all the crew clearly know what kind of pollution the vessels may cause, and what prevention actions should be taken and implemented in daily operations.	**0.768**	0.186	0.258
G19	Use tin-free paint on hulls to protect living organisms in the ocean.	**0.749**	0.273	0.218
G15	The building of new ships is geared towards energy saving and environmental protection concepts.	**0.735**	0.445	0.078
G11	Companies are to provide sustainable development training programs that are designed well.	0.071	**0.900**	0.163
G10	Natural environment training programs for managers and employees.	0.131	**0.861**	0.168
G12	Sustainable development training courses can be applied in my work.	0.232	**0.778**	0.239
G13	The efforts made in relation to various environmental affairs have been much more intense than those in relation to the regulations.	0.423	**0.704**	0.092
G09	The company encourages employees to report all violations of the sustainable development based on the relevant provisions for the incident.	0.269	**0.658**	0.342
G07	Devise sustainable development of the Code of Practice.	0.280	**0.641**	0.296
G06	Natural environmental seminars for executives.	0.463	**0.544**	0.358
G01	Release written sustainable development policies.	0.473	**0.538**	0.092
G32	Guiding suppliers to establish their own environmental programs.	0.177	0.275	**0.899**
G33	In purchasing, this company requires suppliers to provide certification of testing for green product conformance.	0.355	0.237	**0.798**
G31	Urging/pressuring suppliers to take environmental action.	0.420	0.287	**0.699**
G34	Choice of suppliers based on environmental criteria.	0.435	0.297	**0.500**
Eigenvalues		**11.68**	**2.23**	**1.31**
Percentage Variance		**33.15**	**23.72**	**15.57**
Cronbach's alpha		**0.96**	**0.92**	**0.88**
Mean		**5.77**	**5.12**	**5.11**

dimension. It accounted for 33.15% of the total variance.

(2) Factor 2 consisted of eight items. Companies are to provide sustainable

development training programs that were well designed had the highest factor loading on this factor. This factor was called the *green employee* dimension and accounted for 23.72% of the total variance.

(3) Factor 3 comprised four items. Guiding suppliers to establish their own environmental programs had the highest factor loading on this factor. Since all four items were related to green suppliers, this factor was named the *green supplier* dimension. It accounted for 15.57% of the total variance.

Table 2 also shows the respondents' level of agreement with each GSC dimension in the current situation. The results revealed that the green ship dimension elicited the highest agreement level (factor 1), followed by the green employee dimension (factor 2), and green supplier dimension (factor 3).

A reliability test based on Cronbach's alpha, was used to assess whether these dimensions were consistent and reliable. The Cronbach alpha values for each dimension are shown in Table 2. The reliability value of each factor was well above 0.88, suggesting consistency and reliability (Saunders et al., 2009).

4.3 Results of two-stage cluster and discriminant analyses

The 80 liner shipping firms of respondents were categorized into three groups based on their factor scores in GSC dimensions from factor analysis using two-stage cluster analysis techniques. A Hierarchical cluster analysis, by way of Ward's partitioning method with Squared Euclidean Distance, was used to split the respondents in the sample into most suitable number of clusters. A K-means clustering algorithm was subsequently used to re-assign the firms into the most appropriate clusters. 25 were assigned to Group 1, 27 to Group 2, and 28 to Group 3. Canonical discriminant functions (Klecka, 1980) demonstrated the nature of segment differences, and 92.5% of original grouped cases correctly classified.

4.4 Interpretation of clusters

ANOVA and a Scheffe test were used to examine whether the GSC dimensions differed among the three groups. Table 3 shows ANOVA test results in terms of factor score coefficients. All three GSC dimensions (including green ship, green employee, and green supplier) were found to differ significantly among the three groups at the $p < 0.05$ significance level. The results,

which are given in Table 3, indicate that the GSC dimensions significantly differed across the three groups. The Scheffe test results indicated that the GSC dimensions significantly differed between Groups 1, 2 and 3. Analysis results revealed that Group 1 (n = 25) had the significantly highest mean scores for all three dimensions. Group 1 could therefore be said to be a "*strategic green shipping practice*" group. Group 2 (n = 27) had the significantly lowest mean scores for all three dimensions. Thus, this group could be described as an "*undeveloped green shipping practice*" group. Group 3 (n = 28) had the relatively middle mean scores between Group 1 and Group 2 for all three dimensions. Group 3 could be labeled a "*capable green shipping practice*" group.

A one-way ANOVA was used to test differences in performance among the three groups on the basis of the Scheffe tests. The respondents were also asked to provide information on their firm's performance in terms of the degree of image improvements, profit, sales, market share, and customer satisfaction (see Table 3). Since the statistically significant level was less than 0.05, it was concluded that firm performance indices significantly differed among the three groups. The results indicated that the strategic green shipping practice group (group 1) had better firm performance with respect to image improvement, sales and customer satisfaction than the undeveloped green shipping practice (group 2). The capable green shipping practice (group 3) had better firm performance

Table 3 One-way ANOVA analysis of GSC differences among the three groups

Groups / Dimensions	Group 1 N = 25	Group 2 N = 27	Group 3 N = 28	*F*	Scheffe Test
GSC dimensions					
Green ship	6.58	4.77	6.00	44.53**	1>3>2
Green employee	5.95	4.06	5.40	73.73**	1>3>2
Green supplier	6.14	4.16	5.11	87.96**	1>3>2
Firm performance					
Image improvements	6.04	4.59	5.43	15.99**	1>2; 3>2
Profit	5.28	4.59	5.18	2.83	-
Sales	5.36	4.63	5.32	3.86*	1>2
Market share	5.16	4.52	5.14	2.83	-
Customer satisfaction	5.88	5.11	5.61	4.95**	1>2

a. The description of groups is based on mean scores.
b. *Significance level $p < 0.05$; **Significance level $p < 0.01$

with respect to image improvement than undeveloped green shipping practice (group 2).

5. CONCLUSIONS AND DISCUSSIONS

This study has examined the GSC in the context of Taiwan's liner shipping industry. The three GSC dimensions conducted by factor analysis were labeled the green ship, green employee, and green supplier. Cluster analysis subsequently assigned respondents into three groups, namely, the strategic green shipping practice group, the undeveloped green shipping practice group, and the capable green shipping practice group. Subsequent ANOVA analysis revealed that the strategic green shipping practice liner shipping firms had a better firm performance index in terms of image improvement, sales and customer satisfaction than the undeveloped green shipping practice liner shipping firms. Thus, the findings suggest that green ship, green employee, and green supplier factors should not exist in a vacuum, but should leverage each other to create a sustained competitive advantage.

Therefore, managers in the shipping companies should constantly seek to enhance and refine their firms' three GSC factors, namely, the green ship, green employee, and green supplier in relation to those of their competitors, in order to acquire and maintain long-term superior performance.

The amount of sales value and the degree of customer satisfaction of carriers in the "strategic green shipping practice group" are significantly greater than the carriers in the "undeveloped green shipping practice group". This could be evidenced by the Maersk Lines' practices. Maersk Lines is one of the leading liner companies that launch the triple E ships. Thus it can be perceived as a member in the "strategic green shipping practice" group which have the highest market sales value in the liner shipping industry. Carriers of "the capable green shipping practice" group are found not significantly outperform the carriers of "the undeveloped green shipping practice" group. It is very important for shipping companies to have the best green capabilities to generate the prominent sales values and excellent customer satisfaction. Shipping companies with the average green capabilities in the "capable green shipping practice" group who spend average amount of budget to improve their green practices cannot outperform the carriers in the "undeveloped green shipping practice" group.

This research only focuses on the

different groups according to the GSC factors. However, the structural equation modelling (SEM) technique also can be used for identifying cause and effect relationships between GSC factors and performance.

Acknowledgement

We would like to thank both reviewers for their insightful comments on the paper. Thanks also go to the participants of ICASL 2012 who provides useful comments to improve the quality of this manuscript. This paper is a revised version of an earlier paper presented at the 5th Annual Conference of International Conference of Asian Shipping and Logistics (ICASL 2012), held at The Korean Association of Shipping and Logistics in Yeosu, Korea, 9-10 July. 2012.

REFERENCES

Autry, C.W., 2005. Formalization of reverse logistics programs: a strategy for managing liberalized returns. *Industrial Marketing Management*, 34(7), 749-757.

Cheng, T.C.E., Lai, K.H., Lun, Y.H.V. and Wong, C.W.Y., 2013. Green shipping management. *Transportation Research Part E-Logistics and Transportation Review*, 55, 1-2.

Dumitru, T.S., Coserin, P. and Laurentiu, M.D.D., 2013. RBV integrated framework for empowering taught shipping inwards. In: *Global Conference on Business & Finance Proceedings*, 330-335, Hilo.

Ellinger, A.E., Lynch, D.F. and Hansen, J.D., 2003. Firm size, web site content, and financial performance in the transportation industry. *Industrial Marketing Management*, 32(3), 177-185.

Evergreen Line, 2015. Environmental Project. Available at: http://www.evergreen-line.com/tbi1/jsp/TBI1_Index.jsp# (accessed 1 September, 2015)

Fernandez Soto, J.L., Garay Seijo, R., Fraguela Formoso, J.A., Gregorio Iglesias, G. and Carral Couce, L., 2010. Alternative sources of energy in shipping. *Journal of Navigation*, 63(3), 435-448.

Field, A.P., 2013. *Discovering Statistics Using IBM SPSS Statistic*, Forth Edition, Sage: Los Angeles.

Grant, R.M., 1991. The resource-based theory of competitive advantage: implications for strategy formulation. *California Management Review*, 33(3), 114-135.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E., 2010. *Multivariate Data Analysis*, Seventh Edition, Pearson Education: Upper Saddle River, N.J.

Hanjin Shipping, 2013. Hanjin Shipping 2013 Sustainability Report. Available at: http://www.hanjin.com/hanjin/downloadFile.jsp?downLoadName=DocRoot/upload/2013_gri_en.pdf (accessed 1 July, 2013)

Hoskisson, R.E., Hitt, M.A., Wan, W.P. and Yiu, D., 1999. Theory and research in strategic management: swings of a pendulum. *Journal of Management*, 25(3), 417-456.

IMO, 2012. IMO's Contribution to Sustainable Maritime Development. Available at: http://www.imo.org/OurWork/TechnicalCooperation/Documents/Brochure/English.pdf (accessed 1 May, 2012)

Jorgensen, R., 2012. Slow Steaming: The Full Story. Available at: https://www.yumpu.com/en/document/view/7803715/slow-steaming-the-full-story-maersk (accessed 15 October, 2014)

K Line, 2011. Social and Environmental Report 2011. Available at: http://www.kline.co.jp/en/csr/report/ (accessed 1 May, 2012)

K Line, 2015. K Line Report 2015. Available at: http://www.kline.co.jp/en/csr/report/ (accessed 1 September, 2015)

Ketchen, D.J., Jr., Thomas, J.B. and Snow, C.C., 1993. Organizational configurations and performance: a comparison of theoretical approaches. *The Academy of Management Journal*, 36(6), 1278-1313.

Klecka, W.R., 1980. *Discriminant Analysis*, Sage: Beverly Hills.

Kontovas, C.A., 2014. The green ship routing and scheduling problem (GSRSP): a conceptual approach. *Transportation Research Part D-Transport and Environment*, 31, 61-69.

Lai, K.H., Lun, V.Y.H., Wong, C.W.Y. and Cheng, T.C.E., 2011. Green shipping practices in the shipping industry: conceptualization, adoption, and implications. *Resources, Conservation and Recycling*, 55(6), 631-638.

Lai, K.H., Lun, Y.H.V., Wong, C.W.Y. and Cheng, T.C.E., 2013. Measures for evaluating green shipping practices implementation. *International Journal of Shipping and Transport Logistics*, 5(2), 217-235.

Lambert, D.M. and Harrington, T.C., 1990. Measuring nonresponse bias in customer service mail surveys. *Journal of Business Logistics*, 11(2), 5-25.

Lirn, T.C., Lin, H.W. and Shang, K.C., 2014. Green shipping management capability and firm performance in the container shipping industry. *Maritime Policy & Management*, 41(2), 159-175.

Lister, J., 2015. Green shipping: governing sustainable maritime transport. *Global Policy*, 6(2), 118-129.

Liu, C.L. and Lyons, A.C., 2011. An analysis of third-party logistics performance and service provision. *Transportation Research Part E-Logistics and Transportation Review*, 47(4), 547-570.

Lu, C.S., Liu, W.H. and Wooldridge, C., 2014. Maritime environmental governance and green shipping. *Maritime Policy & Management*, 41(2), 131-133.

Lun, Y.H.V., Lai, K.H. and Cheng, T.C.E., 2013. An evaluation of green shipping networks to minimize external cost in the Pearl River Delta region. *Technological Forecasting and Social Change*, 80(2), 320-328.

Lun, Y.H.V., Lai, K.H., Wong, C.W.Y. and Cheng, T.C.E., 2014. Green shipping practices and firm performance. *Maritime Policy & Management*, 41(2), 134-148.

Lynch, D.F., Keller, S.B. and Ozment, J., 2000. The effects of logistics capabilities and strategy on firm performance. *Journal of Business Logistics*, 21(2), 47-67.

Maersk Group, 2015. Sustainability Report 2014. Available at: http://www.maersk.com/en/the-maersk-group/press-room/press-release-archive/2015/2/press-release-sustainability-report-2014 (accessed 15 May, 2015)

Maersk Line, 2011. Sustainability Progress Report 2010. Available at: http://admin.csrwire.com/system/report_pdfs/1205/original/http---www.maerskline.pdf (accessed 1 May, 2012)

MOL, 2011. Environmental and Social Report. Available at: http://www.mol.co.jp/csr-e/report/download/index.html (accessed 1 May, 2012)

NYK Line, 2013. CSR Report 2013. Available at: http://www.nyk.com/english/csr/report/book/index.html (accessed 1 July, 2013)

NYK Line, 2015. NYK Report 2015. Available at: http://www.nyk.com/english/csr/report/book/index.html (accessed 1 September, 2015)

Pruzan-Jorgensen, P.M. and Farrag, A., 2010. Sustainability Trends in the Container Shipping Industry: A Future Trends Research Summary. Available at: http://www.bsr.org/reports/BSR_Sustainability_Trends__Container_Shipping_Industry.pdf (accessed 1 May, 2012)

Saunders, M., Lewis, P. and Thornhill, A., 2009. *Research Methods for Business Students*, Fifth Edition, Financial Times Prentice Hall: Harlow.

Shang, K.C., Lu, C.S. and Li, S., 2010. A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. *Journal of Environmental Management*, 91(5), 1218-1226.

Sulaiman, O., Saharuddin, A. and Kader, A., 2013. Towards sustainable green ship technology. *African Journal of Business Management*, 7(2), 96-118.

Sum, C.C., Kow, L.S.J. and Chen, C.S., 2004.

A taxonomy of operations strategies of high performing small and medium enterprises in Singapore. *International Journal of Operations & Production Management*, 24(3), 321-345.

Tzannatos, E., 2010. Costs and benefits of reducing SO2 emissions from shipping in the Greek seas. *Maritime Economics & Logistics*, 12(3), 280-294.

Wernerfelt, B., 1984. A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171-180.

Wuisan, L., van Leeuwen, J. and van Koppen, C.S.A., 2012. Greening international shipping through private governance: a case study of the Clean Shipping Project. *Marine Policy*, 36(1), 165-173.

Yang, C.S., Lu, C.S., Haider, J.J. and Marlow, P.B., 2013. The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. *Transportation Research Part E-Logistics and Transportation Review*, 55, 55-73.