MARITIME GREEN SUPPLY CHAIN MANAGEMENT (MGSCM) AND FINANCIAL PERFORMANCE: A MEDIATING EFFECT OF ENERGY EFFICIENCY AND LOW CARBON PERFORMANCE

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I hereby declare that I have checked this thesis and, in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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MUHAMAD FAIRUZ BIN AHMAD JASMI

Thesis submitted in fulfillment of the requirements for the award of the degree of Doctor of Philosophy

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ABSTRAK

Atas kesedaran mengenai kesan negatif ekologi meningkat dikalangan industri, organisasi di seluruh dunia telah termotivasi untuk mewujudkan operasi yang lebih mampun. Ini telah menyebabkan perkembangan minat yang luas dalam bidang pengurusan rantaian bekalan (SCM) dan pengurusan rantaian bekalan hijau (GSCM) di kalangan sarjana dan pengamal industri sejak kebelakangan ini disebabkan isu-isu alam sekitar, kemerosotan bahan mentah dan pengeluaran sisa yang berlebihan. Walau bagaimanapun, kerja yang dilakukan dalam membangun dan menggabungkan langkah-langkah hijau ke dalam kesusasteraan rantaian bekalan maritim sedia ada agak terhad. Hanya beberapa artikel yang telah diterbitkan dalam literasi dekad yang lalu mengenai konsep hijau dalam konteks maritim. Matlamat utama dalam kajian ini adalah untuk menangani cabaran ini secara empirikal dan menguji langkah-langkah dan prestasi pengurusan rantaian bekalan maritim hijau (MGSCM) dalam konteks rantaian bekalan maritim. Berdasarkan tinjauan literasi, lapan soalan penyelidikan telah dicadangkan untuk untuk menangani jurang semasa dalam bidang ini. Oleh itu, kajian ini telah mencadangkan 5 pembolehubah MGSCM dan 3 pembolehubah prestasi yang boleh digunakan oleh organisasi untuk mengukur kesan MGSCM terhadap organisasi maritim. Walau bagaimanapun, 2 daripada tiga pembolehubah prestasi yang terdiri daripada prestasi kecekapan tenaga (EEP) dan prestasi karbon rendah (LCP) akan bertindak sebagai pemboleh ubah pengantara untuk mengkaji hubungan antara MGSCM dan prestasi kewangan (FP). Satu kaji selidik dalam talian telah dihantar kepada pelbagai syarikat rantaian bekalan maritim di Malaysia. 160 set soal selidik dianalisis dengan menggunakan kaedah kuadrat separa terendah (PLS) melalui pemodelan persamaan struktur (SEM) dengan perisian Smart PLS dan perisian IBMSPSS untuk analisis deskriptif. Penemuan itu mengesahkan bahawa dari perspektif rantaian bekalan maritim, beberapa amalan MGSCM tertentu (seperti GICS dan GSIP) memang mempengaruhi hasil prestasi kewangan. Hasil kajian juga menunjukkan sokongan kepada hipotesis bahawa EEP dan LCP memediasi kesan diantara GICS, GVALS, dan SDC terhadap prestasi kewangan. Hasil kajian ini juga membuktikan keberkesanan rangka kerja yang dicadangkan berdasarkan teori NRBV dan GSCM dalam memahami impak lestari dari perspektif rantaian bekalan maritim. Akhirnya, kajian ini telah membentangkan cadangan praktikal untuk para pengamal industri dan pembuat polisi yang menekankan perlunya mengamalkan amalan hijau dalam rantaian bekalan maritim untuk mencapai operasi mampun dan keuntungan berpanjangan.
ABSTRACT

As awareness and consciousness regarding the negative ecological impacts that industry bring to the environment increases, more organizations around the globe have motivated in establishing sustainable operations. As a result, a cross-disciplinary interest in the field of supply chain management (SCM) and green supply chain management (GSCM) has grown amongst scholars and practitioners in recent years due to environmental issues, deteriorating raw materials and excess of waste production. However, there has been little work done in developing and incorporating green measures into the existing maritime supply chain literature. Only a handful of articles has been published in the last decade on the green concept in maritime context literature. The aim of this study is thus, to address this challenge by empirically developing and testing maritime green supply chain management (MGSCM) measures and performance for the maritime supply chain. Based on an extensive literature review, eight research questions were proposed for this study to address current gaps in the body of knowledge. Hence, this study has proposed five (5) MGSCM variables and three (3) performance constructs that can be used by organizations to measure MGSCM impact on the maritime organization. However, two (2) out of three (3) constructs which consists energy efficiency performance (EEP) and low carbon performance (LCP) will act as mediating variables to study inter-relationship that might be influenced the single performance outcome construct of financial performance (FP). An online survey was administrated to various maritime supply chain companies in Malaysia. One hundred sixty (160) sets of questionnaires were analysed using the partial least squares method through structural equation modelling (SEM) with Smart PLS software and IBMSPSS software for descriptive analysis. The findings confirmed that from the maritime supply chain perspective, certain MGSCM practices (such as GICS and GSIP) facilitated financial performance outcome. The results also showed support for the hypotheses that EEP and LCP mediate the effect of GICS, GVALS, and SDC on financial performance. To a certain extent, the findings of the study validated the robustness of the MGSCM framework based on the extended natural resource-based view (NRBV) and GSCM theory to study the sustainability impact from maritime supply chain perspective. Finally, this study has presented a practical suggestion for practitioners and policymakers which highlighted a need to adopt green practices in the supply chain operation to achieve sustainable operation and long-term competitive advantage.
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<td>Average variance extracted</td>
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<td>Composite reliability</td>
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<td>Earnings before Interest and Taxes</td>
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<td>LCA</td>
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<td>National Policy on the Environment</td>
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<tr>
<td>NRBV</td>
<td>Natural resource-based view</td>
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<td>OPRC</td>
<td>Oil Pollution Preparedness, Response, and Co-operation</td>
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<td>PERS</td>
<td>Port environmental review system</td>
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<td>Radio Frequency Identification</td>
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<td>Shipping design and compliance</td>
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<td>Self-diagnosis</td>
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<td>Ship Energy Efficient Management Plan</td>
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<td>Ship Energy Efficiency Operational Indicator</td>
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<td>Structural equation modelling</td>
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<td>Sustainable maritime supply chain</td>
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<td>International Convention for the Safety of Life at Sea</td>
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<td>Twenty-Foot Equivalent Unit</td>
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REFERENCES


259


Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming.* Routledge.


Lincoln, Y., & Guba, E. (2000). The only generalization is: There is no generalization. *Case Study Method*, 27–44.


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Rugman, A. M., & Verbeke, A. (2002). Edith Penrose’s contribution to the resource-
based view of strategic management. *Strategic Management Journal, 23*(8), 769–
780. https://doi.org/10.1002/smj.240

based perspective*. Oxford University Press on Demand.

Russo, M. V. (2016). A Resource-Based Perspective on Corporate Environmental
559.

Saade, R., Thoumy, M., & Sakr, O. (2019). Green supply chain management adoption in
Lebanese manufacturing industries: an exploratory study. *International Journal of

supply chain management literature. *International Journal of Production

Production Economics*. https://doi.org/10.1016/j.ijpe.2010.11.010

*European Journal of Operational Research, 107*(1), 159–174. https://doi.org/10.1016/S0377-
2217(97)00160-4

Sarkis, Joseph, Bai, C., Jabbour, A. B. L. de S., Jabbour, C. J. C., & Sobreiro, V. A.
(2016). Connecting the pieces of the puzzle toward sustainable organizations.
*Benchmarking: An International Journal, 23*(6), 1605–1623. https://doi.org/10.1108/BIJ-04-
2015-0033

Sarkis, Joseph, Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and
the adoption of environmental practices: The mediating effect of training. *Journal of

organizational theoretic review of green supply chain management literature. *Intern.

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