Quality Green Energy Supply Chain Management Practices in Malaysian

Argustina Zainuddin, Nur Asiah Kuzaiman,
Noor Azlina Mohd Salleh[*]*, Salmiah Kasolang*
Faculty of Mechanical Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Joerg Hoffmann
Faculty of Engineering and Computer Science,
Hochschule Osnabrück , University of Applied Sciences,
Albrechtstr. 30
49076 Osnabrück, Germany

asiah.kuzaiman@gmail.com,
noorazlinamohdsalleh@gmail.com,
salmiahkasolang@gmail.com
j.hoffmann@hs-osnabrueck.de

ABSTRACT

This study proposed the integrated framework consisted of the supply chain management system of Total Quality Management System(TQM), Lean Manufacturing(LM) and Green Management System (EMS) with the Energy Management System(EnMS) policy. The objective of the system is to provide the organization a way to improve their environmental, energy and economic performance, which also would impact on their operational performance. A survey questionnaire was developed and distributed to 30 highly active and recommended automotive vendors in Malaysia by Malaysian Automotive Institute (MAI) and the data was analyzed by using Statistical Package for the Social Sciences (SPSS) v.19. From the survey, it was found that most vendors have been practicing TQM, LM and EMS due to customer requirement, however, there only a few vendors that are aware of Energy Management System (EnMS). This study focuses only on highly active companies that involved in MAJAICO program and the Proton Vendor Development Program. The objective of this research is to study on the status of integrated management system in the automotive companies. The proposed framework practice includes green purchasing, green manufacturing, materials management, green distribution/marketing and reverse logistics). This is the

ISSN 1823- 5514, eISSN 2550-164X
Received for review: 2017-03-24
Accepted for publication: 2017-04-17
Published: 2018-12-15

preliminary study of integrating Energy Management System in managing and design a new framework toward a sustainable environment. Besides, to promote less consumption of energy in order to preserve a better future for the next generation. The future studies can be steered to access the status of supply chain management practices in other companies and industries.

Keywords: – *Automotive industry, Supply chain practices, operational management, lean manufacturing and energy management system.*

Introduction

More than two decades, the theory and practice of supply chain management (SCM) has resulted to numerous studies and suggestion from academics and practitioners. The SCM designed to achieve high- volume flexible production using minimal inventories of raw materials (2). In Lean Manufacturing(LM), the supply chain section is focusing on continuous improvement in processes. Which is a philosophy of eliminating all non-value adding activities and reducing waste within an organization (2)(3)(4)(5). In the previous study (6), supply chain management has been considered as one of the key of business processes. Nowadays, im order to compete in challenging business most manufacturing companies are becoming technologically advanced, implemented more value-added products and upgrade workers' skills in their workforce. The manufacturing industry is starting to approaching into green energy manufacturing. The practice in SCM usually focusing on process producing and distributing products and services to customers so that the result will be more effective and efficient. For global intensifies, the manufacturing companies must have greater knowledge on how their suppliers and customers conduct business so that they have to monitor on the critical impact on enhancing product quality performance and business performance. (2)

From the previous study, they mention that the success of the organization no longer depends only the product itself, but it will depend on management' ability to integrate the organization's intricate network of business relationships (5)(7)(8). Hervani e al, (2005) proposed that green supply chain management practices include the purchasing, manufacturing, materials management, distribution/marketing and reverse logistics refer to involvement of environmental thinking into the supply chain management from the extraction of raw materials to product design, manufacturing processes, delivery of the final products to the consumers and end-of life management (10). The objective of this study is to emerge an approach to reduce environmental risk, environmental burdens, energy efficiency, reduce energy cost, Demonstrate that the organization implemented sustainable energy management systems, completed a baseline of energy use, and

committed to continuously improve their energy intensity and disposal as well as enhance profit and competitive advantages (11)

The current framework for the SCM is intended to reduce costs and improve quality and services (12). Ford Motor Company's requirement for all supplier to apply for the certification of the ISO 14001 standard and the inclusion of supplier activities in statements of environmental responsibility for Toyota, BMW and Mitsubishi (13). The current practice is to extending production goals from customers to their suppliers as to improve overall performance in a supply chain (14) (15). Organizations have used a range of supplier-relationship management styles to improve production processes or introduce new technologies into the supply chain, such as purchasing power (i.e. Walmart) and/or collaboration (i.e. Toyota) (16). Both modes of interaction have been successful in the past for achieving more rapid and often inimitable process or product-based improvements. In previous research most research pressure on derivation of environmental responsibilities between customer, suppliers and organization. However, only small number of study focusing on the roles supply chain or procument context.

In this study, TQM, LM and Green supply chain management practices are integrated in a framework in order to establish Quality Green Energy Supply Chain Management Practices which breakdown into four components; i) Green Distribution ii) Green Manufacturing iii) Reverse Logistics iv) reduce energy cost. This research will not only explore the existence and application of such requirements but to explore the influence of specific exchange conditions on their uptake and effectiveness. The proposed of this study is to establish a Quality Green Energy Supply Chain framework by implementing the integration of TQM, LM, EMS and EnMS supply chain practices.

Methodology

The questionnaire was developed based on four award and seven system from Japan (Deming Piece), America (Malcolm Baldrige National Quality Award), European Countries (European Quality Foundation Award) and Malaysia (Malaysian Prime Minister award Model) while the system are ISO/TS16949 for TQM, LM (America SAEJ4001), Japan (Toyota Production System) and Malaysia (MAJAICO-Lean System). The questionnaire are distributed to 30 highly performing companies from MAJAICO Improvement and Vendors Improvement Program in Selangor as well as recommendation by Proton and Perodua Vendor Club .The data collected and analyze by using SPSS Software.

Result and Discussions

a) Customer-supplier interaction and environmental performance in Malaysian Automotive Companies

The study result show that the most practices system is the LM implement by 68% followed by EMS and TQM with 60% and 55%. There are an increase in percentage implementation in automotive companies compare to the previous study (18). The improvement in implementation was due to the customer requirement and market request. An academic research generates the theory about customer-supplier or supplier-supplier relationship to generate range positive environmental outcomes said Klassen and Vahon, 2003(19)(20)(21). The environmental performance through the supply relationship with waste reduction, environmentally sound innovation, cost effective and environmentally beneficial solution to production problems and more rapid development and uptake of environmental technologies.

b)Integrated TQM, LM, EMS and EnMS in Malaysian Automotive companies

By using the SPSS software, the mean of data was analyzed which resulted to the implementation percentage of the system. The implementation is divided into 4 categories. Foundation level between 90.5%-96.5%, level I,II and III is in between 85-89.9%, 80-84.9% and 70-79% respectively. The data in the table below are documented based on the data collected from the survey.

Table 1: Supply Chain Management Practices of integrated TQM, LM, EMS and EnMS for foundation framework

QGELM Supply Chain Practices	**Mean**	**% Implementation Level**
QGELM-SCM(1) Suppliers and customers participate at the earliest stage of product/process/project	5.13	86%(High Implementation)
QGELM-SCM(2) Suppliers and customers are appropriately represented on the organization's product/process/project team.	5.14	86%(High Implementation)

Notes: Mean Value Scale: 5.1 – 6 (High Implementation), 4.8 – 5.1 (Moderate Implementation), 4.2 - 4.8 (Low Implementation) and 0 – 4.2 (Very Low).
Percentage Scale: 85 – 100: High Implementation, 80-84: Moderate Implementation, 70-79: Low Implementation, 0 – 69: Very Low Implementation

Table 2: Supply Chain management practices of integrated TQM, LM, EMS and EnMS for Level 1 Framework

QGELM Supply Chain Practices	Mean	% Implementation Level
QGELM-SCM(3) Suppliers and customers participate in the regular reviews of product/process/project progress	4.87	81% (Moderate)
QGELM-SCM(4) Financial incentives/benefits for supplier, organization and customers are in place that reward performance improvements in quality improvements or cost reduction	4.88	82%(Moderate)
QGELM-SCM(5) Long term agreements for financial benefits are in place.	4.87	81% (Moderate)
QGELM-SCM(6) Up-to-date and customer requirements are available through surveys, interviews and etc	4.88	82%(Moderate)
QGELM-SCM(7) Customers' requirements including the service requirements are communicated to all employee	4.87	81% (Moderate)
QGELM-LSHIP(8) Follow-up activities with customers are conducted to determine satisfaction.	4.88	82%(Moderate)

Notes: Mean Value Scale: 5.1 – 6 (High Implementation), 4.8 – 5.1 (Moderate Implementation), 4.2 - 4.8 (Low Implementation) and 0 – 4.2 (Very Low).
Percentage Scale: 85 – 100: High Implementation, 80-84: Moderate

The result of the implementation level system for this study in the participated companies for high level is interpreted in the table 1 and table 2. Table 1 shows the highest percentage with high implementation between 85-100%. The manufacturers believe in the importance of the participation the

supplier and customer in earlier stage of product/process/project in (QGELM-SCM1). And the supplier also believes that the appropriately represented on the organization's product/process/project team(QGELM-SCM2) Implementation, 70-79: Low Implementation, 0 – 69: Very Low Implementation

Table 3: Supply Chain management practices of integrated TQM, LM, EMS and EnMS for level 2 framework

QGELM Supply Chain Practices	**Mean**	**Implementation Level**
QGELM-SCM(9) All the support services like financing, purchasing, human resource and manufacturing/engineering are geared towards meeting the quality requirements of the company followed with the evaluation of the effectiveness in order to continuously improve.	4.27	71%(Low Implementation)
QGELM-SCM(10) Customer complaint/feedback is handled promptly, effectively, analyzed and documented	4.57	76%(Low Implementation)
QGELM-SCM(11) All supplied materials and services from suppliers are assured and the qualities are continuously improved	4.57	76%(Low Implementation)

Notes: Mean Value Scale: 5.1 – 6 (High Implementation), 4.8 – 5.1 (Moderate Implementation), 4.2 - 4.8 (Low Implementation) and 0 – 4.2 (Very Low). Percentage Scale: 85 – 100: High Implementation, 80-84 : Moderate Implementation, 70-79: Low Implementation, 0 – 69: Very Low Implementation

Based on the result gained from the survey questionnaire, the supplier and customers participate in the regular reviews of product/process/project progress (QGELM-SCM3). The implementation of the integrated impact the financial incentives or benefits for supplier, organization and customers are in

place that reward performance improvements n quality improvement or cost reduction (QGELM-SCM4) and long-term agreements for financial benefits are in place (QGELM-SCM5). Due to practice in the companies, there also need to up to date the customer requirements are available through surveys, interviews and etc and in customer requirement including the service requirements are communicated to all employee. (QGELM-SCM6) (GELM-SCM7). The activity for follow up with customers are conducted to determine satisfaction. (QGELM-SCM8). In this level, the percentage is between 80 to 85% which indicate moderate and low implementation practices in automotive companies. In this level 1the supply chain management is starting to catch up with other section in these planning practices. The internal integration focuses on the integration of processes and transactions inside organization in order to develop its competitiveness. External integration encompasses both customer and supplier integration. Customer integration is the process of acquiring and assimilating information about customer requirements and related knowledge. Supplier integration is the process of acquiring and sharing operational, technical, and financial information and related knowledge with the supplier.

The data in table 3 shows the level 2 implementation percentage between 70 to 79%. In this level, all the support services like financing, purchasing, human resources and manufacturing/engineering are geared towards meeting the quality requirements of the companies follow the evolution of the effectiveness in order to continuously improve. (QGELM-SCM9). In supply chain also, the customer complaint or feedback is handled promptly, effectively, analyzed and documented (QGELM-SCM10) and all supplied and services from suppliers are assured and the qualities are continuously improved. (QGELM-SCM10)

Level 3 are the least practiced initiatives for Quality, Green, Energy Leadership with percentage between 30% to 79%. The activity on this level more on energy-green standard where the supplier improvements are done by the partnership, training, incentives and improved supplier selection. (QGELM-SCM12) Due to energy standard, the organization need to inform the supplier that purchasing is partly evaluated on the basis of energy efficiency and their ability to meet the company requirements. (QGELM-SCM13) (GELM-SCM14). The quality record with approved supplier like financing, purchasing, human resources and manufacturing toward meeting the quality requirements of the company followed by the evolution of the effectiveness in order to continuously improve(QGELM-SCM15)(QGELM-SCM16) . This study shows that most companies are doing less monitoring and reviews on energy as EnMS are not required by their customers as compared to LM, TQM and EMS. Thus, EnMS are less prioritized by the participated companies. The value of scale we calculated based on mean average of the questionnaire result from 30 companies that participate. The high implementation for 5.1-6.0 (85-100%) is average of the highest and most practices in the company, then 4.2-4.8(80-84%) is the moderate

implementation practices and the lowest and the very lowest implementation is score 0-4.2 which the company did not implement any activities such as the new management standard which Energy Management System.

Table 4: Supply Chain management practices of integrated TQM, LM, EMS and EnMS for level 3 framework

QGELM Supply Chain Practices	Mean	% Implementation Level
QGELM-SCM(12) Suppliers' improvements are done by partnership, training, incentives and improved supplier selection.	4.17	69%(Very Low)
QGELM-SCM(13) The organization inform suppliers that purchasing is partly evaluated on the basis of energy efficiency	2.13	35%(Very Low)
QGELM-SCM(14) The suppliers evaluated and selected on the basis of their ability to meet with your company requirement	4.17	69% (Very Low)
QGELM-SCM(15) The quality records of approved suppliers establish and maintained	4.13	68% (Very Low)
QGELM-SCM(16) The support services like financing, purchasing, human resource and manufacturing/engineering are geared towards meeting the quality requirements of the company followed with the evaluation of the effectiveness to continuously improve.	4.00	66% (Very Low)

Notes: Mean Value Scale: 5.1 – 6 (High Implementation), 4.8 – 5.1 (Moderate Implementation), 4.2 - 4.8 (Low Implementation) and 0 – 4.2 (Very Low). Percentage Scale: 85 – 100: High Implementation, 80-84 : Moderate Implementation, 70-79: Low Implementation, 0 – 69: Very Low Implementation.

c) Reliability Test

The questionnaire of this study is follow and based guide from Likert questions. The score scale of 6 indicate in Likert scale that the respondent strongly agreed with the point while the point 1 is the lowest scale indicated vice versa. The collected data are analyzed using Minitab software to measure the consistency of the reliability of the scale. In the Minitab software, the analyze of result show the mean and standard deviation of data, Cronbach's alpha score. The Cronbach's alpha is a measure of internal consistency. In this study only 16 questionnaires are built to measure the construct, supplier, and customer. Th scale had a high level of internal consistency and determined 0.9103 Cronbach's alpha.

Conclusion

There are only few companies have knowledge and capability to actually assess the connection between their industrial practices and the value their customers perceive. The problem currently facing by manufacturer is the company perceived that it is difficult to link their supply chain practices and align them with the requirements of the final customer. In the previous research mentioned that the customer value is performed under six terms which are Time, Quality, Cost, Respect environment, customization and know how. Based on the literature studies, we can conclude that with the exception of internal environmental initiatives, the practices affect companies market performance and customer satisfaction levels but are not significant to energy-environmental performance. The partner for relationship and trust, are moderate between SCM practices and environmental performance but are not applicable to relationships between SCM practices and performance such as energy efficiency, financial outcomes and customer satisfaction. For the external activities, still at the very low level, but however still can be improved. The findings from this study contribute to the body of knowledge regarding green supply chain management, as environmentally friendly operations and processes become more important in today's world. Specifically, this study contributes to a greater understanding of the dimensions of such critical issues as the factors that influence firms to think and act more green-energy. The companies' may improve their productivity, managing the quality, the environment management and energy efficiency through effective SCM methods. This model is applicable to be used to assess and gauge the status of SCM management practices in companies as well as be extended to another industry.

Acknowledgement

This contribution was developed from Research Study funded by funded by Ministry of Education Malaysia and Universiti Teknologi MARA, Malaysia-FRGS Fund 600-RMI/FRGS 5/3 (143/2014). Special thanks to all participated vendors and Dean of Faculty of Mechanical Engineering UiTM Shah Alam Malaysia.

References

[1] Aref A. Hervani, Marilyn M. Helms, Joseph Sarkis, (2005) "Performance measurement for green supply chain management", Benchmarking: An International Journal, Vol. 12 Issue: 4, pp.330-353, doi: 10.1108/14635770510609015

[2] Agus, A. & Hassan, Z. 2011 Enhancing production performance and customer performance through Total Quality Management (TQM): Strategies for competitive advantage Procedia - Social and Behavioral Sciences. Vol. 24, p. 1650-1662 13 p

[3] Davis, Mark M; Heineke, Janelle N.Davis, Mark M. Fundamentals of operations management Operations management : integrating manufacturing and services

[4] LAMBERT, D.M., COOPER, M.C. & PAGH, J.D. Supply Chain Management: Implementation Issues and Research Opportunities. The International Journal of Logistics Management, Vol. 9, n.2, p.1-19, 1998.

[5] Holt, D., Ghobadian, A. (2009). An empirical study of green supply chain management practices UK manufacturers, Vol. 20 Issue 7.

[6] Lee, S.Y. (2008). Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. Supply Chain Management: An International Journal, Vol. 13 No. 3, pp. 185-198.

[7] Lee, S.M., Kim, S.T. and Choi, D. (2012). Green supply chain management and organizational performance. Industrial Management & Data Systems, Vol. 112 No. 8, pp. 1148-1180

[8] Whicker, L., Bernon, M., Templar, S., Mena, C. Understanding the relationships between time and cost to improve supply chain performance. International Journal of Production Economics, 2009, 121(2), 641-650.

[9] CHAN, R. Y. K., HE, H.; CHAN, H. K., WANG, W. Y. C. (2012): Environmental orientation and corporate performance: The mediation

mechanism of green supply chain management and moderating effect of competitive intensity. Industrial Marketing Management 41 (4), 621-630. http://dx.doi.org/10.1016/j.indmarman.2012.04.009

[10] STEVELS, A. (2002): Green Supply Chain Management Much More than Questionnaires and IS0 14001 in IEEE International Symposium on Electronics and the Environment, 6-9 May 2002, San Francisco, USA, 96-100. San Francisco: Institute of Elecrical and Electronics Engineers Inc. http://dx.doi.org/10.1109/ISEE.2002.1003247

[11] ZHU, Q., SARKIS, J., LAI, K (2012): Examining the effects of green supply chain management practices and their mediations on performance improvements. International Journal of Production Research 5 (50), 1377-1394

[12] Cooper, Martha C., Dougls M. Lmbert and Janis D Pagh, "Supply Chain Management: More Than New Name for Logistics.;The international Jooourna of Logistics Management, Vol 8, No1 (1997),pp.1-13

[13] Clemens, B., and Douglas, T.J. (2006). Does coercion drive firms to adopt 'voluntary' green initiatives? Relationships among coercion, superior firm resources, and voluntary green natives. Journal of Business Research, Vol. 59 No. 4, pp. 483-91

[14] Eltayeb, T., Zailani, S. and Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: investigating the outcomes, Resources, Conservation and Recycling, Vol. 55, pp. 495-506

[15] Green, K., Zelbst, P., Meacham, J. and Bhadauria, V. (2012). Green supply chain management practices: impact on performance, Supply Chain Management. An International Journal, Vol. 17 No. 3, pp. 1-44

[16] Putri, N. T. and Yusof S. M. 2008. Critical Success Factors For Implementing Quality Engineering Tools And Techniques In Malaysian's And Indonesian's Automotive Industries: An Exploratory Study. Proceedings of the International Multiconference of Engineers and Computer Scientists. 2: 18 – 20

[17] Jusoh, R., Ibrahim, D. N. and Zainuddin, Y. 2008. The Performance Consequence Of Multiple Performance Measures Usage: Evidence From The Malaysian Manufacturers. International Journal of Productivity and Performance Management. 57 : 119-136

[18] M.S. Noor Azlina, K. Salmiah, J. Ahmed. "Green Lean TQM Practices in Malaysian Automotive Companies," "International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering", Vol. 6, No. 10, (2012).

[19] Siti Norhafizan Hibadullah*, Nurul Fadly Habidin, F.I.M.Z, N.M.F and Auni,2013, Lean Manufacturing Practices and Environmental Performance in Malaysian Automotive Industry, Asian Journal of finance 7 Accounting, ISSN 1946-052X, Vol. 5, No. 1 ;462-471

[20] Siti Norhafizan Hibadullah*, Nurul Fadly Habidin, F.I.M.Z, N.M.F and Auni,2013, Lean Manufacturing Practices and Environmental Performance in Malaysian Automotive Industry, Asian Journal of finance 7 Accounting, ISSN 1946-052X, Vol. 5, No. 1 ;462-471

[21] Zakuan N.M, Yusof S.M, Shamsudin S and T.L,2008, Reflective Review of Relationship between Total Quality Management and Organizational Performance, Proceedings of International Conference on Mechanical & manufacturing Engineering (ICM2008), 21-23 May 2008, ISBN : 97-98-2963-59-2, Faculty of Mechanical & Manufacturing engineering, UTHM,

[22] Rebelo, M.F. (2011) Contribution to the Structuring of a Model of Integrated Management System QES. Master Thesis, Polytechnic Institute of Cávado and Ave, Barcelos