

Sustainable supplier selection in the logistics industry: A comparison of
alternative approaches

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Akademisk Avhandling

för avläggande av ekonomie doktorsexamen i företagsekonomi som med tillstånd av
Handelshögskolans fakultetsstyrelse vid Göteborgs universitet framlägges för
offentlig granskning tisdagen den 10 december 2019, klockan 10:00 i sal C24,
Handelshögskolan, Vasagatan 1, Göteborg.

Avhandlingen baseras på följande delarbeten:

1. Rashidi, K., & Cullinane, K.P.B. (2019), "Evaluating the sustainability of national logistics performance using Data Envelopment Analysis", *Transport Policy*, 74, 35-46.
2. Rashidi, K., & Cullinane, K.P.B. (Under review), "Techniques Applied for the Selection of Sustainable Suppliers: A Systematic Review of the Literature", *Submitted to International Journal of Information Technology and Management*.
3. Rashidi, K., Noorizadeh, A., and Cullinane, K.P.B. (Under review), "Applying the Triple Bottom Line in Supplier Selection: A Meta-Review of the State of the Art", *Revised and Re-submitted to International journal of Cleaner Production*.
4. Rashidi, K., and Cullinane, K.P.B. (2019), "A comparison of fuzzy DEA and fuzzy TOPSIS in sustainable supplier selection: Implications for sourcing strategy", *Expert Systems with Applications*, Vol. 121, 266-281.
5. Rashidi, K. "AHP versus DEA for the gradual improvement of unsustainable suppliers: A comparative analysis". *Presented at the eighth annual Swedish transportation research conference (Linköping, 22-23 October 2019)*.



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Language: English
229 pages
ISBN: 978-91-88623-16-4
Doctoral thesis 2019

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Supplier selection has become one of the most crucial tasks in supply chain management, especially in the procurement function. In recent years, the importance of selecting the best possible suppliers has been enhanced due to the emergence of sustainability issues. Manufacturers have been obliged and/or encouraged by various stakeholders to embed environmental and social concerns into their supply chain activities. As a consequence of this evolution, procurement managers have started to not only evaluate the suppliers' economic abilities, but also their competencies in environmental and social aspects. In addition to traditional economic criteria, therefore, environmental criteria (e.g. energy consumption, greenhouse gas emissions) and social criteria (e.g. labour health and work safety, diverse education programs for employees) have been added to the process of evaluating suppliers. One group of suppliers with a crucial role in any chain is the group of logistics service providers that need to be evaluated and selected based on all three lines of sustainability, i.e. economic, environmental, and social competencies.

Researchers have continuously proposed a number of diverse methods for handling the problem of sustainable supplier selection efficiently. Three of the most widely applied methods in the literature in this field are the Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS), Data Envelopment Analysis (DEA) and the Analytical Hierarchy Process (AHP). Each method is applied to evaluate a set of suppliers, given a set of variables/criteria, to provide a ranking of the suppliers. As discussed in the literature, many strategic decisions can be made based on the outcomes of these methods, e.g. sourcing and benchmarking strategies. This study aims at comparing the outcomes of these three methods based on a common data set. The comparisons are illustrated with an empirical application for measuring the sustainability of a set of logistics service providers. In other words, this study sheds light on the aspect regarding the extent to which the outcomes of these methods are reliable for making strategic decisions in a supplier management system.

The results reveal that each method produces a unique ranking of the logistics service providers under evaluation. Despite positive correlation coefficients between the rankings yielded, it is not possible to find only one supplier as the best or worst in the list. More specifically, the supplier rankings are influenced by the nature of the algorithm underpinning the evaluation methods and/or type of data used (e.g. fuzzy or non-fuzzy data). Therefore, due to this inconsistency between the outcomes of AHP, DEA, and TOPSIS, it is challenging to make decisions regarding sourcing and benchmarking strategies. It is not possible to find the best supplier(s) for either single- or multiple-sourcing strategies. Of course, considering the outcomes of only one method is not reliable, but the buying company can create a network of top suppliers based on the outcomes of each method and then further analyse their performance for the final decision. Furthermore, the comparison between AHP and DEA shows that each method provides a different benchmarking strategy for suppliers that need to improve their performance.

Keywords: Sustainable supplier evaluation; Logistics industry; Sourcing; Benchmarking; Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS); Data Envelopment Analysis (DEA); and Analytical Hierarchy Process (AHP).

Printed in Sweden
By GU Interstryckeri, 2019

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