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Editorial Comment

This is a maiden edition of the Journal published by College of Management and Social Sciences. This Journal titled Journal of Social Sciences, Management and Development has undergone peer review processes. The Editors were mindful of reflection of expertise and ensure compliance to ethical principles in scientific research and the constructs of American Psychology Association (APA) formats.

The Journal in earnest consists of one hundred and sixty eight pages with thirteen sole and joint authorship. The journal was designed for subscribing authors from Departments in the Faculty of Management Sciences as well as Faculty of Social Sciences. The Managing Editors were appointed strictly on merit to guarantee and sustain the ideal of peer review processes and scholarship.

The quality and quantity of the papers in this Journal is highly commendable. We can see some evidences of scholarly research outputs as expressed in each of the articles published in the Journal. To my amazement, the authors, who had contributed to this maiden edition of the journal cut across some disciplines in Management, Social Sciences and humanity. Besides, considering the multi-disciplinary nature of the Journal, most of the papers were co-authored by renowned scholars from within and outside Osun State University.

At this juncture, it is very important to note that the blind peer review process adopted for the Journal has added values to the structure and volumes of the published articles with plausible plagiarism checks. This suggests that the articles published in this Journal are original to subscribing authors and has proof of evidences for scholarly contribution to the existing body of knowledge.

I hereby warmly recommend this knowledge-driven Journal to all policy planners, employers of Labour, Entrepreneurs, researchers, local and international students for their patronage and usage. The quality of production of the Journal will definitely attest to its inherent fastidious scholarship.

Prof Dayo Idowu Akintayo

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EVALUATION OF SUPPLIERS EFFICIENCY IN A PROJECT MANAGEMENT ENVIRONMENT USING DATA ENVELOPMENT ANALYSIS (DEA)

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Abstract

Supplier performance evaluation and selection plays a vital role in the establishing an effective project delivery in an organization. More also, selecting the right supplier for an assignment, as well as evaluating this supplier's performance while the contract is being implemented, plays an important role in ensuring a good project outcome. The evaluation of a supplier is important for an enterprise to survive in a competitive market in a global project environment. One of the techniques that can be used for supplier performance evaluation and selection is data envelopment analysis (DEA). In this paper, the study examined the benefit of data envelopment analysis in evaluating the performance of decision making units (DMUs). DEA is a mathematical programming tool applied in performance measurement. The problem identified is establishing business support units, a case study is presented to exhibit the efficiency of the model for supplier selection problem in a project environment. The case study research design method was used in which quantitative data were collected and analysed to demonstrate that the model can measure effectiveness, efficiency and productivity in a project environment. It shows that the model decision makers to deal with economic, social and environmental factors when selecting suppliers for the project. The article concludes that in any project environment, there is need to establish methods used to assess supply chain performance so that companies can improve performance from all sides, such as product quality and company resources. So, it is expected that the supplier will get more profit and overall supplier's performance will increase as well.

Keywords: *Suppliers Performance Evaluation; Data Envelopment Analysis model; decision-making units; Setraco Nig. Ltd.; Abuja.*

Introduction

Supply chain management (SCM) is the planning, execution and control of operations and flows of products, finances, and information between and within companies, from primary sources to the final consumer (Cano & Ayala, (2019). SCM must therefore; to satisfy business unit integrate the final consumers demand, increasing competitiveness and all materials flows from raw materials to finished products (Amin-Tahmasbi & Alfi, 2018). It is of utmost importance to perform efficient sourcing and purchasing process for proper supply chain link integration.

There is rapid development in development of supply chain recent years. Since the economic performance sheer focus is to enhance the capital or cost return doesn't allow for supply chain sustainability performance (Hong et al., 2018; Araújo, Alencar, & Miranda-Mota, 2017), the idea of supply chain management and green supply chain management have to lay emphasis emerged on the extent to the importance of environmental and social concern with the factors of economics in the planning of supply chain (Bastas & Liyanage, 2018; Bendul, Rosca, & Pivovarova, 2017).

Many ventures have today, considerably progressed dues to the application of sustainable supply chain (Ding et al., 2018), and the sustainable supply chain management (SSCM) is seen as the benchmark for success that is sustainable and firms competitive advantage establishment (Hong et al., 2018; Moktadir, Ali, Kusi-Sarpong, & Shaikh, 2018). Along with the business economic gains that the sustainable supply chain considers, the environmental and social consequences of the producers and activities of the supply chain over the material flow and services processes between customers and suppliers such as production and material purchase, sales of goods and distribution (Osiro, Lima-Junior, & Carpinetti, 2018; Liu & Papageorgiou, 2013; Kuo, Wang, & Tien, 2010).

Also, in order to form long term relationship with partners that are dependable to improve the performance of supply chain, companies have increasingly been interested in suppliers' reduction (Abdolshah, 2013; Kellner, Lienland, & Utz, 2019). As useful information is being provided to managers in the supply chains and purchasing process, reviewing the literatures in the current study becomes necessary so as to research opportunities, identify trends, uncertainty management, criteria selection and supplier method to support company's strategic plans (Alkahtani, Al-Ahmari, Kaid, & Sonboa, 2019).

This indicates the focus on each stage of supplier selection which include competitive strategy identification, criteria and indicators formulation, new selection method development, candidate supplier selection, selecting final supplier, supplier development program formulation, evaluation of performance etc (Chen, 2011; Zimmer, Fröhling, & Schultmann, 2016).

The aforementioned challenge could be can be overcome using DEA as it has proven to be an effective method. Supplier performance efficiency based on DEA was proposed by Narasimhan, Talluri, & Mendez, (2001). Ma, Yao, Jin, & Ren, (2014) evaluated supplier by considering the competition between the suppliers and choose cross game efficiency of DEA for supplier evaluation. Radfar and Salahi (2014) used fuzzy DEA and preference ranking organization method for supplier selection enrichment evaluation.

Literature Review

Supplier Evaluation and Selection

The system of supply chain continually varies as a technological and social outcome development (Zijm, Klumpp, Heragu, & Regattieri, 2019). Azevedo, (2013) stated the supply chain functioning efficiency is important to those companies as the attempted to increase the effectiveness of supply chain. Strategic sourcing and supplier advantage are as a result of supplier selections processes. The main aim of the process of evaluation is minimize the risk of purchasing and to provide purchaser maximum value (Olanrewaju et al., (2021).

Certain benefits are at times derived by some organizations when investing in their supplier is typical of that fact (Cheshmberah, 2020). Various forms of supplier development programs are deployable. Suppliers receive shared business information from their buyer's financial assistance provision and supplier involvement in developing new product (Oseghale et al., (2021).

The suppliers are therefore invested upon by the companies in order to ensure improved performance or capabilities and accumulate substantial benefits. The supplier debates are interestingly on the practices of supplier relationship management and greatly admired by practitioners and academicians (Karami, Shirouyehzad & Asadpour, 2021). Nevertheless, increased investment in the firm's supplier competencies and skills has been encouraged in order to achieve supply chain of a world class level (Alumbugu et. al., (2020).

Data Envelope Analysis (DEA) has been demonstrated a compelling technique to conquer the previously mentioned impediment. Narasimhan, Talluri, & Mendez, (2001) proposed a procedure for viable provider execution assessment dependent on DEA. Prasad, Subbaiah, Rao, & Rao, (2012) created provider execution - proficiency score network utilizing DEA for recognizing likely providers for an organization. Mama, Yao, Jin& Ren, (2014) thought about the opposition between the providers and received game cross-effectiveness of DEA to assess providers. Radfar and Salah (2014) utilized fluffy DEA for provider assessment and Preference Ranking organization Method for Enrichment Evaluation (PROMETHEE) model for provider determination.

Past investigations have proposed utilizing DEA for provider assessment and determination (e.g., Mahdiloo, Saen, & Lee, 2015), green provider choice (Kumar et al. 2014), flexibly chain hazard examination (Talluri, Kull, Yildiz, & Yoon, 2013), holder and provider advancement (Noorizadeh, Rashidi, & Peltokorpi, 2018), among others. Nonetheless, it appears to be that the development flexibly chain performed inadequately in embracing and adjusting productivity assessment strategies contrasted and fabricating SCM.

In the development business, the adequacy of the DEA procedure has been exemplified in various investigations. For instance, DEA was utilized for security execution examination of development organizations (El-Mashaleh, Rababeh, & Hyari, 2010), execution assessment and change in proficiency outskirts after some time for development organizations working in Europe, Asia, and North America (Horta, Camanho, Johnes, & Johnes, 2013), execution estimation of 265 biggest development organizations in the United Kingdom (Deng and Smyth 2013), profitability change in Spanish and Portuguese development organizations (Kapelko, Horta, Camanho, & Lansink, 2015), and to assess the presentation of the development business in Australia (Hu and Liu 2016).

In any case, notwithstanding the ongoing utilizations of DEA for examining development organizations' exhibition, restricted examinations have researched utilizing DEA for provider assessment in the development SCM. Subsequently, we think that its important to examine the chance of utilizing the DEA model as a compelling device for managing complex dynamic which helps a leader in setting needs and settling on the best choice. Dependable and precise estimate are required for settling on steady choice by joining logical methodology with the end goal of accomplishing the ideal outcome in a venture in Nigeria.

Supplier Performance

For greater supply chain collation, companies are in turbulent and complex environment making concerted efforts (Zhang & Cao, 2018). Improving the procurement effectiveness of the supplier and getting collaboration fluency can be used through the buyer and supplier well managed partnership (Grudinski et al., 2014). (San Cristóbal, 2012) posited that suppliers have significant role in the overall performance of the project and (Araújo et al., 2017) one of the relevant procurement processes for a project to be successful is the selection of the most efficient supplier which integral for the supply chain effective management (Rao et al., 2017). In any organization, considerable efforts are required for the selection of supplier (Olanipekun, 2020).

In examining relationship–performance spirals, they found that the strength or weakness of the collaboration between the buyer and supplier affects supplier performance and that a long-term relationship can result in better project time and budget management. Gosling et al. (2015) investigated suppliers' key performance indicators (KPIs) to illustrate the impact of supplier development initiatives on KPIs. In another study, Gosling et al. (2019) shows that the long-term supplier-buyer partnership, supported by SD, can enhance a supplier's learning and performance for more desirable outcomes. Noorizadeh et al. (2019) also discussed the challenges of performance evaluation where a supplier's working environment changes from one construction project to another.

Nonetheless, after investigating supplier performance both in general and in the construction business in particular, we believe that there are important unexplored areas. As such, over time, analyses of supplier performance and their influence on the continuity or discontinuity of a relationship with a buying company can generate meaningful managerial insights. Consequently, we underline the need for promising methods that can connect supplier selection and evaluation to the overall supply chain performance in a project environment.

Model Development for Multi-Criteria Decision-Making

DEA is a linear mathematical process for a frontier investigation of inputs and outputs. DEA allocates a score of 1 to a DMU once comparison with other DMUs do not offer inefficiency evidence. It allocates a less than one score to inefficient units. A less than one score shows that a linear mixture of other DMUs can make the same outputs with smaller inputs. DEA considers that the inputs and outputs are truly defined. Typically, as the quantity of inputs and outputs upsurge, many DMUs tend to become efficient. Conversely, with few inputs and outputs, more DMUs tend to be similar. To solve this issue, we developed different models based on each perspective. Model inputs are lean supplier selection criteria and the outputs are supply variety and quality of distribution. The input is obtained as the linear weighted sum of all its inputs using equation (1).

$$\text{Virtual Input} = \sum_{i=1}^I u_i x_i \quad (1)$$

Where u_i is the weight assigned to input.

Similarly, the output is obtained as the linear weighted sum of all its outputs which is given in equation (2).

$$\text{Virtual output} = \sum_{j=1}^J v_j y_j \quad (2)$$

Where v_j is the weight assigned to output; $I, J > 0$.

The Efficiency is computed by using the equation (3).

$$\text{Efficiency} = \frac{\sum_{j=1}^J v_j y_j}{\sum_{i=1}^I u_i x_i} \quad (3)$$

The weights used in this model were calculated using Entropy method. The weights were calculated using equations (4), (5) and (6).

$$E_l = -\frac{1}{\ln(m)} \sum_{k=1}^m P_{kl} \ln(P_{kl}) \quad (4)$$

Where P_{kl} is normalized payoff matrix; E_l is the entropy of the set of alternatives for criterion k ; m is number of alternatives and k is number of criterion.

$$\text{Degree of diversification } D_l = 1 - E_l \quad (5)$$

$$\text{Weights } w_l = \frac{D_l}{\sum_{l=1}^L D_l} \quad (6)$$

For this study, the supplier selection model was created dependent on five suppliers (S1, S2, S3, S4 and S5) with five assessing factors, which incorporates three sources of input and two outputs namely, delivery (D) in days, capacity (Ca) in units, warranty (W) in number of days, cost (C) in naira and quality (Q) in level of acceptance respectively. The table 1 shows the information of suppliers and the corresponding inputs and outputs.

The fundamental productivity measure utilized in DEA is the proportion of all outputs to total inputs. The DEA model utilized in this research comprises of three inputs and two outputs. In DEA, various inputs and outputs are linearly aggregated using weights.

Evaluation of Suppliers

We used different perspectives in order to evaluate the performance of each supplier. The first perspective is related to cost (with C1-C5 indicators as input and supply variety and quality of distribution as outputs). The second perspective evaluated the suppliers' performance with regard to quality (with C6-C10 indicators as input and supply variety and quality of distribution as outputs). Third perspective focused on lead time (with C11-C15 indicators as input and supply variety and quality of distribution as outputs). Finally, last perspective evaluated suppliers based on service level (with C16-C20 indicators as input and supply variety and quality of distribution as outputs). Figure 3 shows a conceptual framework of suppliers' evaluation.

Case Study: Efficiency Evaluation of Suppliers with Setraco Nigeria Ltd

Project Description and Problem Considered

In construction, one of the most critical tasks is selecting the right supplier. It is a multi-criteria problem including both quantitative and qualitative factors. To choose the right supplier from many applicants available in today's market is a somewhat complicated problem for clients. Selecting of a proper supplier is crucially important to ensure the quality of the delivery in a project

environment when dealing with long-term assets. To achieve this aim, it will largely depend on the efficiency of the performance of the selected supplier.

In this study the best supplier was selected by using Data Envelopment Analysis (DEA). It is a “data oriented” approach for evaluating the performance of a set of peer entities called decision making units (DMUs) which convert multiple inputs into multiple outputs. DEA can handle the multiple inputs and multiple output models. At the same time. Figure 1 explains the frame work for the supplier selection. DEA was used to evaluate the performance construction firms. The study was conducted in the Federal Capital Territory of Abuja. The targeted population were professional suppliers in the construction industry particularly those who work with or have dealt with Setraco Nig. Ltd.

Table 1: Dataset of Inputs and Outputs from 5 DMUs

Suppliers	Inputs			Outputs	
	Delivery	Capacity	Warranty	Cost	Quality
S1	12	170	28	2439	0.87
S2	12	260	21	2567	0.90
S3	14	280	21	2711	0.92
S4	10	260	24	2800	0.96
S5	13	290	18	2302	0.89

The weights of the attributes are calculated by using entropy method

Table 2: Entropy Calculations

	Delivery	Capacity	Warranty	Cost	Quality
Entropy Value E_c	0.5997	0.9904	0.993	0.9985	0.9996
Degree of Diversification D_c	1.5997	0.0096	0.007	0.0015	0.0004
Weights of Criteria W_c	0.9886	0.0060	0.0043	0.0009	0.0002

First the entropy is determined using equation (4). From the entropy, the degree of diversification and the weights of the criteria are computed using equations (5) & (6). The weights are given in Table 2.

These weights are used to calculate the DEA efficiency for all the suppliers using equation (3). The DEA efficiency score for all the suppliers is tabulated in Table 3.

Table 3: DEA efficiency

Suppliers	Inputs			Outputs		Efficiency (%)
	Delivery	Capacity	Warranty	Cost	Quality	
S1	0.1967	0.1349	0.2500	0.1902	0.1916	94
S2	0.1967	0.2063	0.1875	0.2002	0.1982	93
S3	0.2295	0.2222	0.1875	0.2115	0.2026	91
S4	0.1639	0.2063	0.2143	0.2184	0.2115	99
S5	0.2131	0.2301	0.1607	0.1795	0.1960	83

Figure 2 depicts the DEA efficiency of the suppliers. From the table 3, the supplier with higher efficiency (ie. supplier 4) is selected as best supplier. For this case study supplier 4 is selected as best supplier.



Figure 2 DEA efficiency

Then sensitivity analysis has been carried out to observe whether the optimal setting is sensitive to the individual response weights. This is used to check the robustness of the model. For the change in any variable, the response of the model is observed. In this work, equal weights for the criteria were assumed and the DEA efficiency was calculated. It is observed that the ranking of the suppliers is not changed and hence the optimal setting is robust to the individual weights. The sensitivity of the DEA model is shown in Figure 3.

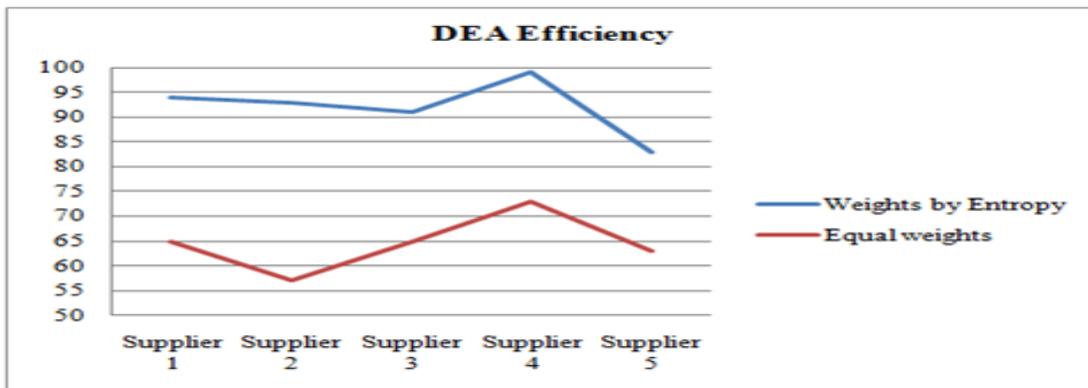


Figure 3: Ranking of the supplier using DEA model

Conclusion and Recommendations

Decisions of evaluation and selection of a supplier is an important part of chain management. In today's intense competition, producing high quality products with minimum cost without satisfactory suppliers is not possible. In this work a multi-criteria decision-making model based on DEA for selecting the best supplier was developed. This proposed model can be more flexible to accommodate the qualitative and quantitative criteria for supplier selection. DEA can help to evaluate and compare suppliers on different evaluation criteria which can offer a more robust tool to select and evaluate suppliers based on both qualitative and quantitative criteria. The input and output factors are fixed in this study and can be extended for additional input and output factors. Companies need to establish methods used to assess supply chain performance so that companies

can improve performance from all sides, such as product quality and company resources. So, it is expected that the company will get more profit and overall company performance will increase as well.

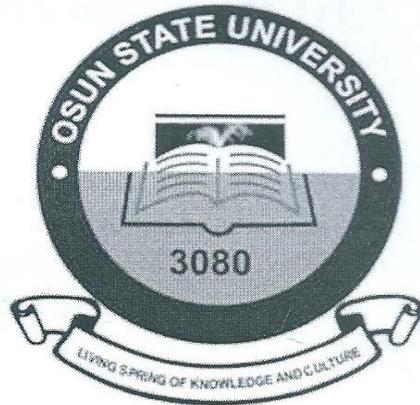
References

- Abdolshah, M. (2013). 'A Review of Quality Criteria Supporting Supplier Selection,' *Journal of Quality and Reliability Engineering*, 2013, 1–9.
- Alkahtani, M., & Kaid, H. (2018) 'Supplier selection in supply chain management: a review study,' *International Journal of Business Performance and Supply Chain Modelling*, 10(2), 107.
- Alkahtani, M., Al-Ahmari, A., Kaid, H., & Sonboa, M. (2019). Comparison and evaluation of multi-criteria supplier selection approaches: A case study. *Advances in Mechanical Engineering*, 11(2).
- Alumbugu, P., Shakantu, W. & Tsado, A., (2020). Assessment of transportation efficiency for the delivery of construction material in North-Central Nigeria. *Acta Structilia*, 27(2), 30-56.
- Amin-Tahmasbi, H., & Alfi, S. (2018) 'A fuzzy multi-criteria decision model for integrated suppliers selection and optimal order allocation in the green supply chain,' *Decision Science Letters*, 7(1), 549–566.
- Araújo, M. C. B., Alencar, L. H., & Miranda Mota, C. M. (2017). Project procurement management: a structured literature review. *International Journal of Project Management*, 35(3), 353-377.
- Azevedo, A. (2013). *Advances in Sustainable and Competitive Manufacturing Systems*. Springer Science & Business Media.
- Banaeian, N., Mobli, H., Fahimnia, B., Nielsen, I. E., & Omid, M. (2018). Green supplier selection using fuzzy group decision making methods: A case study from the agri-food industry. *Computers & Operations Research*, 89, 337-347.
- Bastas, A., & Liyanage, K. (2018). Sustainable supply chain quality management: A systematic review. *Journal of cleaner production*, 181, 726-744.
- Bendul, J. C., Rosca, E., & Pivovarov, D. (2017). Sustainable supply chain models for base of the pyramid. *Journal of Cleaner Production*, 162, S107-S120.
- Bhattacharya, A., Geraghty, J., & Young, P. (2010). Supplier selection paradigm: An integrated hierarchical QFD methodology under multiple-criteria environment. *Applied Soft Computing*, 10(4), 1013-1027.
- Cano, J. A., & Ayala, C. J. (2019). Research opportunities for supplier selection: An analysis from literature reviews. *IBIMA Business Review*, 2019, 828922.
- Cano, J.A., & Baena, J. J. (2015a) 'Impact of Information and Communication Technologies in International Negotiation Performance,' *Review of Business Management*, 17(54), 751–768.
- Chen, Y. J. (2011). Structured methodology for supplier selection and evaluation in a supply chain. *Information Sciences*, 181(9), 1651-1670.
- Cheshmberah, M., (2020). Measures Developing an Integrated Framework for Supplier Evaluation based on Relevant Attributes and Performance. *Logistics & Sustainable Transport II* (1) 101-113 doi: 10.2478/jlst-2020-0007
- Cilly, K., Spekman, R. & Kamauff, J. (1999). Technological uncertainty, buyer performance and supplier assurances: an examination of Pacific Rim purchasing arrangements. *Journal of International Business Studies* 30(2), 297-316.

- Deng, F. & Smyth, H. (2013). "Nature of firm execution in development." *J. Constr. Eng. oversee.* 140 (2): 1–14.
- Ding, K., Li, Y., Wang, L., Zheng, W., Peng, Z., & Guo, S. (2018). An optimizing model for solving outsourcing supplier selecting problem based on particle swarm algorithm. *Journal of Industrial and Production Engineering*, 35(8), 526-534.
- El-Mashaleh, M. S., Rababeh, S. M. & Hyari, K. H. (2010). "Using information envelopment examination to benchmark security execution of development contractual workers." *International. J. Undertaking Manage.* 28 (1): 61–67.
- Gosling, J., Abouarghoub, W., Naim, M., Moone, B., 2019. Constructing supplier learning curves to evaluate relational gain in engineering projects. *Comput. Ind. Eng.* 131, 502–514.
- Gosling, J., Naim, M., Towill, D., Abouarghoub, W., Moone, B., (2015). Supplier development initiatives and their impact on the consistency of project performance. *Construction Management Economy.* 33 (5–6), 390–403.
- Grudinschi, D., Sintonen, S., & Hallikas, J. (2014). Relationship risk perception and determinants of the collaboration fluency of buyer-supplier relationships in public service procurement. *Journal of Purchasing and Supply Management*, 20(2), 82-91. <http://dx.doi.org/10.1016/j.pursup.2014.03.004>.
- Horta, I. M.; Camanho, A. S.; Johnes, J. & Johnes. G. (2013). "Execution patterns in the development business around the world: A review of the turn of the century." *J. Nudge. Butt-centric.* 39 (1): 89–99.
- Hashemi, S. H., Karimi, A., & Tavana, M. (2015). An integrated green supplier selection approach with analytic network process and improved Grey relational analysis. *International Journal of Production Economics*, 159, 178-191.
- Hong, J., Zhang, Y., & Ding, M. (2017). Sustainable supply chain management practices, supply chain dynamic capabilities, and enterprise performance. *Journal of Cleaner Production.* 172.
- Hu, X., & Liu, C. (2016). "Productivity execution appraisal in the Australian development industry: A worldwide social two-stage DEA strategy." *Constr. oversee. Econ.* 34 (3): 147–159.
- Igarashi, M., De Boer, L., & Fet, A. M. (2013) 'What is required for greener supplier selection? A literature review and conceptual model development,' *Journal of Purchasing and Supply Management*, 19(4), 247–263.
- Igarashi, M., de Boer, L., & Michelsen, O. (2015). Investigating the anatomy of supplier selection in green public procurement. *Journal of Cleaner Production*, 108, 442-450.
- Kapelko, M., Horta, I. M., Camanho, A. S. & Lansink, A. O. (2015). "Estimation of info explicit efficiency development with an application to the development business in Spain and Portugal." *Int. J. Nudge. Econ.* 166: 64–71.
- Karami, A., Shirouyehzad, H., & Asadpour, M., (2021). A DEA-Based Decision Support Framework for Organizations' Performance Evaluation considering TQM and Knowledge Management. *Hindawi Journal of Healthcare Engineering* Volume 2021, Article ID 6654600, 13 pages <https://doi.org/10.1155/2021/6654600>
- Kellner, F., Lienland, B., & Utz, S. (2018) 'An a posteriori decision support methodology for solving the multi-criteria supplier selection problem,' *European Journal of Operational Research*, 0, 1–18.
- Kellner, F., Lienland, B., & Utz, S. (2019). An a posteriori decision support methodology for solving the multi-criteria supplier selection problem. *European Journal of Operational Research*, 272(2), 505-522.

- Keshavarz G., M., Amiri, M., Zavadskas, E. K., & Antucheviciene, J. (2017). Supplier evaluation and selection in fuzzy environments: a review of MADM approaches. *Economic research*, 30(1), 1073-1118.
- Kumar A., Jain V., & Kumar S. (2014), A comprehensive environment friendly approach for supplier selection, "Omega", 42, (1), 109–123.
- Kuo, R. J., Wang, Y. C., & Tien, F. C. (2010). Integration of artificial neural network and MADA methods for green supplier selection. *Journal of cleaner production*, 18(12), 1161-1170.
- Liu, S., & Papageorgiou, L. G. (2013). Multiobjective optimisation of production, distribution and capacity planning of global supply chains in the process industry. *Omega*, 41(2), 369-382.
- Luthra, S., Garg, D. & Haleem, A. (2015). Critical success factors of green supply chain management for achieving sustainability in Indian automobile industry. *Production Planning and Control* 26(5):339-362.
- Luthra, S., Qadri, M. A., Garg, D. & Haleem, A. (2014). Identification of critical success factors to achieve high green supply chain management performances in Indian automobile industry. *International Journal of Logistics Systems and Management* 18(2):170-199.
- Ma, R., Yao, L., Jin, M., & Ren, P. (2014). The DEA game cross-efficiency model for supplier selection problem under competition. *Applied Mathematics & Information Sciences*, 8(2), 811-818.
- Mahdiloo, M., Saen, R. F. & Lee, K. H. (2015). "Specialized, ecological and eco-proficiency estimation for provider choice: An augmentation and utilization of information envelopment examination." *Int. J. Goad. Econ.* 168: 279–289.
- Mama, R., Yao, L., Jin, M., & Ren, P. (2014). The DEA game cross-productivity model for provider choice issue under rivalry. *Applied Mathematics and Information Sciences*, 8(2), 811-818.
- Moktadir, M. A., Ali, S. M., Kusi-Sarpong, S., & Shaikh, M. A. A. (2018). Assessing challenges for implementing Industry 4.0: Implications for process safety and environmental protection. *Process Safety and Environmental Protection*, 117, 730-741.
- Narasimhan, R., Talluri, S., & Mendez, D. (2001). Supplier evaluation and rationalization via data envelopment analysis: an empirical examination. *Journal of Supply Chain Management*, 37(2), 28-37.
- Noorizadeh, A., Peltokorpi, A., Avkiran, N.K., (2019). Supplier performance evaluation in construction projects: challenges and possible solutions. *J. Construct. Eng. Manag.* 145 (4), 1–13.
- Noorizadeh, A., Rashidi, K., Peltokorpi, A., (2018). Categorizing suppliers for development investments in construction: application of DEA and RFM concept. *Construct. Manag. Econ.* 36 (9), 487–506.
- Olanipekun, A.O., (2020). Relationship between the Economy, Construction Sector and Imports in Nigeria. DOI: 10.1080/15623599.2020.1863173, <https://www.researchgate.net/publication/347951456>
- Olanrewaju, S.B.O., Olatunya, D.A., & Okedare, D.K.O., (2021). Appraisal of the Factors that Affect the Material Management Strategies of Construction Works in Ekiti State Nigeria. *IOSR Journal of Humanities and Social Science (IOSR-JHSS) Volume 26, Issue 9, Series 7 (September. 2021) 21-29 e-ISSN: 2279-0837, p-ISSN: 2279-0845. www.iosrjournals.org*
- Oseghale, G.E., Adetooto, J.D., & Oseghale, B., (2021). *Evaluation of Material Management Methods in Selected Building Construction Sites in Abuja and Lagos State, Nigeria.*

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- Osiro, L., Lima-Junior, F. R., & Carpinetti, L. C. R. (2018). A group decision model based on quality function deployment and hesitant fuzzy for selecting supply chain sustainability metrics. *Journal of Cleaner Production*, 183, 964-978.
- Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, 23(3-4), 371-388.
- Prasad, K. G. D., Subbaiah, K.V., Rao, C. V. G., & Rao, K.N. (2012). Provider assessment through information envelopment examination. *Diary of Supply Chain Management Systems*, 1(2), 1-11.
- Radfar, R., & Salahi, F. (2014). Evaluation and ranking of suppliers with fuzzy DEA and PROMETHEE approach. *International Journal of Industrial Mathematics*, 6(3), 189-197.
- Rao, C., Xiao, X., Goh, M., Zheng, J., & Wen, J. (2017). Compound mechanism design of supplier selection based on multi-attribute auction and risk management of supply chain. *Computers & Industrial Engineering*, 105, 63-75.
- San-Cristóbal, J. R. (2012). Contractor selection using multicriteria decision-making methods. *Journal of Construction Engineering and Management*, 138(6), 751-758.
- Sarkis, J., & Dhavale, D. G. (2015). Supplier selection for sustainable operations: A triple-bottom-line approach using a Bayesian framework. *International Journal of Production Economics*, 166, 177-191.
- Talluri, S., Kull, T. Yildiz, H. & Yoon, J. (2013). "Assessing the efficiency of risk mitigation strategies in supply chains." *J. Bus. Logistics* 34 (4): 253-269.
- Zhang, Q., & Cao, M. (2018). Exploring antecedents of supply chain collaboration: effects of culture and interorganizational system appropriation. *International Journal of Production Economics*, 195, 146-157.
- Zijm, H., Klumpp, M., Heragu, S., & Regattieri, A. (2019). Operations, Logistics and Supply Chain Management: Definitions and Objectives. In H. Zijm, M. Klumpp, A. Regattieri, & S. Heragu (Eds.), *Operations, Logistics and Supply Chain Management* (27-42. Cham: Springer International Publishing. <https://doi.org/10.1007/978-3-319-92447-2>
- Zimmer, K., Fröhling, M., & Schultmann, F. (2016) 'Sustainable supplier management - A review of models supporting sustainable supplier selection, monitoring and development,' *International Journal of Production Research*, 54(5), 1412- 1442.



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