Jurnal Teknologi, Kejuruan, dan Pengajarannya
Vol. 45, No. 1, Februari 2022: 32-41

Comparison of Decision Support Systems with DEMATEL-SAW and DEMATEL-TOPSIS in the Process of Journal Acceptance: Case study in The Postgraduate E-Journal of State University of Malang

Ahmad Khakim Amrullah, Syaad Patmanthara
Graduate School of Vocational Education, State University of Malang, East Java, Indonesia
E-mail: haqiemahmed92@gmail.com

Abstract. Concerns about scientific publications have been proliferating in Indonesia. Consequently, the number of published journals in e-journal has been rapidly increasing over the past few years. The growing trend of e-journal hence requires a decision support system in its application. The DSS will help the reviewers in determining the eligibility of an article in the journal's verification process. Several DSS methods such as DEMATEL, SAW, and TOPSIS, among others, are proposed to provide an effective means in the process. This research aims to present a solid comparison of two combined methods, DEMATEL-SAW and DEMATEL-TOPSIS, as they overcome each method's shortcomings, in determining the eligibility of an article. The eligibility criteria have been determined as a guide. The calculation results show that the DEMATEL-SAW has a relatively higher degree of accuracy compared to that of DEMATEL-TOPSIS when fewer criteria variables are included, whereas the DEMATEL-TOPSIS method has a higher degree of consistency when being utilized on a variable with more criteria.

Keywords: DSS, Comparison, MCDM, DEMATEL-SAW, DEMATEL-TOPSIS

INTRODUCTION

Concerns about scientific publications have been proliferating. For the past 50 years, the number of published science journals has been rapidly increasing as seen from numerous researches that utilized data from various literature database such as Science Citation Index (SCI) and Social Science Citation Index (SSCI). Simultaneously, academic publishing has been undergoing major changes as it steadily makes the transition from the print to the electronic format, and many academic journals, therefore, had been published on new channels such as the internet, conferences, and digital archives (Larsen, 2010). This has encouraged many universities, including the Graduate School of State University of Malang, to actively develop e-journal system.

The role of Decision Support System (DSS) is hence required in the ever-growing trend of e-journal. DSS will help the verification process of the reviewers and provide assistance in determining the eligibility of a journal. There have been numerous developments of DSS by applying MCDM (Multi-Criteria Decision Making) method like AHP (Analytical Hierarchy Process), SAW (Simple Additive Weighting), DEMATEL (Decision Making Trial and Evaluation Laboratory), TOPSIS (Technique for Order Preferences by Similarity to Ideal Solutions), Fuzzy, MAUT (Multi-Attribute Utility Theory), SMART (Simple Multi-Attribute Rating Technique). Among many others, DEMATEL, SAW, and TOPSIS are proven to be the most effective to be implemented in the journal recommendation submission system. DEMATEL is capable of analyzing the correlation between the components of each criterion (Aksakal, 2010), while SAW and TOPSIS are intuitive in the decision-making process with simple calculation (Velasquez, 2013).

The DEMATEL method is a methodology that can be employed to evaluate the factor effectiveness by narrowing down the criteria (Thor, 2013). The method describes the relation E as a direct-relation matrix (Chang, 2011) to visualize the causal relationships and the analysis of dominant criteria in a system; DEMATEL, however, requires another method like SAW and TOPSIS in order to stop receiving any recommendations from the journals (Tzeng, 2007).

The SAW method (Simple Additive Weighting), furthermore, is one of the most versatile and natural multi-criteria among other evaluation methods (Podvezko, 2011; Talebanpour, 2015). Huang et

al. studied Multi-Attribute Utility Theory (MAUT) in which a decision can be taken through a single attribute (Abdullah, 2014). This method integrates value and weighting criteria into an estimated value called method criteria. The evaluation score is calculated for each alternative by multiplying the value of the attribute scale by the weight of the relative importance (Talebanpour, 2015). The SAW method requires the process of normalizing the decision matrix (X) to a scale that is comparable to all existing alternative ratings (Josaputri, 2016). The advantage of the SAW method is that the linear proportional transformation of the raw data results in the relative order of magnitude of the standard score that remains the same (Afshari, 2010).

On the other hand, Hwang and Yoon introduced TOPSIS in 1993 as a multi-criteria decision-making method that can rank a set of factors by identifying and weighing their interests, prioritizing them in a definite order (Khanjankhani, 2016). The method calculates the geometric distance between both alternatives and takes the result into account to get the most ideal alternative or the best result possible (Bulgurcu, 2012).

This research, therefore, presents a comparison between two combined approaches, DEMATEL-SAW and DEMATEL-TOPSIS, to provide a means in evaluating and determining the eligibility of a journal submitted in the e-journal of Postgraduate Study of State University of Malang.

METHODS

This section of the study presents the literature review related to the implementation of DEMATEL and SAW as well as the selection of the criteria that later will be used to evaluate the eligibility of the articles. The following is the criteria used as shown in Table 1.

Table 1. Eligibility Criteria for Articles Publication

Criteria	Description
Significance	How important is the work reported; does it involve or synthesize ideas, methods, approaches from multiple disciplines; does it have interesting implications for multiple disciplines
Originality	Is this a new issue; does the paper point out differences from related research
Quality	Is the paper technically sound; how are its claims backed up; Does it carefully evaluate the strengths and limitations of its contribution
Clarity	Is the paper clearly written, does it motivate the research; does it describe clearly the methods employed (e.g., experimental procedures, algorithms, analytical tools); Are the results, if any, described and evaluated thoroughly
Relevance	Is the paper closely related to the theme; is the content interesting enough to a broad audience;

From the abovementioned aspects, we have obtained the criteria required to get the weighting result. To collect the sample of data, the respondents were asked to complete a questionnaire, in which each criterion will determine the weight-taking of the data. The questionnaire can be seen in Table 2.

Table 2. Sample Data Return Questionnaire

Influencing criteria	Criteria influenced	Influences			
		0	1	2	3
Significance	Originality				
	Quality				
	Clarity				
	Relevance				
Originality	Significance				
	Quality				
	Clarity				
	Relevance				
Quality	Significance				

Influencing criteria	Criteria influenced	Influences			
		0	1	2	3
	Originality				
	Clarity				
	Relevance				
Clarity	Significance				
	Originality				
	Quality				
	Relevance				
Relevance	Significance				
	Originality				
	Quality				
	Clarity				

DEMATEL

DEMATEL (Decision Making Trial and Evaluation Laboratory) is one of MCDM methods that was developed between 1972 and 1979 at the Battelle Memorial Institute of Geneva for Science and Human Affairs Program (Sumrit, 2013). Dematel is used to analyze and establish causal relationships that occur between evaluation criteria (Sumrit, 2013). This method uses a diagram and matrix to describe the causal relationships that occur between the dominant criteria (Chang, 2011).

Here are the steps in the DEMATEL method:

1. First, calculate the initial average matrix by score. Subsequently, the respondents are asked to show the level of direct influence of each factor or element we give to each factor or element j, which is denoted by “aij”. We assume that scales 0, 1, 2, 3 and 4 represent ranges of "no effect" to "very high impact". Each respondent will produce a direct matrix, and the average matrix A is then derived through the mean of the same factor or element in the various direct matrix of the respondent. The average matrix A is represented in the following equation:

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\ \vdots & & \vdots & & \vdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & & \vdots & & \vdots \\ a_{n1} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

2. Second, calculate the normalized initial direct-influence matrix, $X\,(X=[x_{ij}]_{n\times n})$. It can be obtained through normalizing the average matrix A. Specifically, the matrix X can be obtained through the equation (2) and (3), in which all the main diagonal elements are equal to zero.

$$X = s \times A \quad (2)$$

$$s = \min\left[\frac{1}{\max_i \sum_{j=1}^{n} |a_{ij}|}, \frac{1}{\max_j \sum_{i=1}^{n} |a_{ij}|}\right] \quad (3)$$

3. Third, derive the direct / non-direct matrix directly. The continuous derivation of the non direct effect along the line of X. For instance, $X^2, X^3, \ldots, X^k$ and $\lim_{k\to\infty} X^k = [0]_{n\times n}$, in which $X=[x_{ij}]_{n\times n}$, $0 \le x_{ij} < 1$ and/or $0 \le \sum_i x_{ij} \;\; \sum_j x_{ij} < 1$ with only one equal column or row. 1 total-influence matrix is registered as follows,

$$T = X + X^2 + \cdots + X^k$$
$$= X\left(I + X + X^2 + \cdots + X^{k-1}\right)(I - X)(I - X)^{-1}$$
$$= X(I - X^k)(I - X)^{-1},$$

then $T = X(I - X)^{-1}$ when

$$\lim_{k \to \infty} X^k = [0]_{n \times n} \qquad (4)$$

where $T = [t_j]_{n \times n}$, $i, j = 1, 2, \ldots, n$. Furthermore, this method presents the result of every sum and the number of columns of matrix T,

$$r = (r_i)_{n \times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n \times 1} \qquad (5)$$

$$c = (c_j)_{n \times 1} = (c_j)'_{1 \times n} = \left[\sum_{i=1}^{n} t_{ij}\right]'_{1 \times n} \qquad (6)$$

in which r_i shows the number of rows from the i row of matrix T and the direct and non-direct effect of the other i in other factors / elements.

Likewise, c_j shows the number of columns from the j column of matrix T as well as the non-direct effects of other factors / elements of other factors / criteria. In addition, when *i* is equal to *j* (or the sum of the columns and rows), $(r_i + c_i)$ gives an index of power given and accepted. $(r_i + c_i)$ indicates the key role of the factors. If $(r_i + c_i)$ is positive, *i* will influence other factors; however, if it is negative, *i* will be influenced by other factors (Tzeng, 2007).

4. Fourth, set the threshold values and get the IRM. Setting the threshold value A, filtering out the minor effects represented by the matrix factor T, is necessary in order to isolate the structure of factor relations. Based on the matrix T, each matrix factor tij informs about how i influences j. Practically, if all information from a T matrix converts to IRM, the map would be too complex to show the information required for the decision-making process. To reduce the complexity of IRM, decision makers have to set the threshold value for the level of influence: that only the factor whose value of influence on the T matrix is higher than the threshold value can be selected and converted to IRM. The threshold value can be decided through a brainstorming process of experts. IRM can be shown when the relative threshold and IRM values have been decided (Chou, 2016).

Simple Additive Weighting (SAW)

The SAW method, usually dubbed the simple weighting method, represents each criterion that is multiplied by a certain weight (Velasquez, 2013). The calculation integrates a particular criterion and weight value into a single unit, indicated by the method criteria (Sj). The result of Sj from the weighted normalization of each criterion is then calculated for j using the following equation (Podvezko, 2011):

$$S_j = \sum_{i=1}^{m} \omega_i \tilde{r}_{ij}$$

ω_i is the weigh of the *i* ($\sum_{i=1}^{m} \omega_i = 1$); r_{ij} is the result of normalization of *i* for *j*; *i*=1,…,*m*; *j*=1,…,*n*; *m* is the number of criteria used while *n* is the object being compared.

TOPSIS

TOPSIS (Technique for Order Preferences by Similarity to Ideal Solutions) is a method used to identify alternative solutions in order to approach positive ideal solutions and avoid negative ideal solutions (Thor, 2013). The positive ideal solution shows the maximum solutions that are determined from the combination of best values of the matrix calculations; meanwhile, a negative ideal solution shows a minimal solution gain, denoting the combined result of the worst value of the matrix calculation. The positive ideal solution is shown as $S_i{}^+$and the negative ideal solution is shown as $S_i{}^-$. The following is the calculations for finding both the positive and negative ideal solution (Thor, 2013):

$$S_i{}^* = \sqrt{\sum_{i=1}^{n} \left(v_i{}^+ - v_{ij}\right)^2}$$

$S_i{}^+$ = distance between the target alternative and the positive ideal solution
$v_i{}^+$ = positive ideal solution [i]
v_{ij} = weighted normalized matrix [i][j]

$$S_i{}^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_i{}^-\right)^2}$$

$S_i{}^-$ = distance between the target alternative and the negative ideal solution
$v_i{}^-$ = negative ideal solution [i]
v_{ij} = weighted normalized matrix [i][j]

RESULTS AND DISCUSSIONS

Data Processing with the Dematel Method

We use the DEMATEL method to find out the weight and interrelationship between the criteria. The data used are sourced from the questionnaire. The matrix questionnaire is shown in Table 3.

Table 3. Dematel's Average Decision Matrix Questionnaire

	Significance	Originality	Quality	Clarity	Relevance
Significance	0.00	2.06	2.38	2.25	2.44
Originality	2.19	0.00	2.25	2.06	2.13
Quality	2.13	2.19	0.00	2.50	2.31
Clarity	1.88	2.06	2.13	0.00	1.88
Relevance	2.31	1.88	2.31	1.94	0.00

The next step is to find out the relationship matrix directly by normalizing the questionnaire matrix of the DEMATEL method. The direct link matrix is shown in Table 4.

Table 4. Dematel's Direct-Influence Matrix

	Significance	Originality	Quality	Clarity	Relevance	D	Weighting
Significance	0.00	0.52	0.59	0.56	0.61	2.28	0.21
Originality	0.55	0.00	0.56	0.52	0.53	2.16	0.20
Quality	0.53	0.55	0.00	0.63	0.58	2.28	0.21
Clarity	0.47	0.52	0.53	0.00	0.47	1.98	0.18
Relevance	0.58	0.47	0.58	0.48	0.00	2.11	0.20
R	2.13	2.05	2.27	2.19	2.19		

R is the sum of the columns, whereas D is the total of the direct-relationship matrix rows. The values of D and R will be used in determining the relationship between variables, grouping them into

two groups: dispatcher and receiver. The dispatcher are the criteria that become the cause of other criteria, whereas the receiver becomes the result of other variables. The dispatcher and receiver groups are shown in Table 5.

Table 5. Dispather and Receiver

Criteria	D	R	D+R	D-R	Group
Significance	2.28	2.13	4.41	0.15	dispatcher
Originality	2.16	2.05	4.21	0.11	dispatcher
Quality	2.28	2.27	4.55	0.01	dispatcher
Clarity	1.98	2.19	4.17	-0.21	receiver
Relevance	2.11	2.19	4.30	-0.08	receiver

The significance, originality, and quality of an article belong to the dispatchers—these are the main criteria that will influence other criteria. On the other hand, the clarity and relevance are included in the receiver group, which in turns is influenced by those who belong to the dispatchers. Therefore, in reviewing journals, it is suggested that one prioritizes the significance, originality and quality as the main criteria

Data Processing with the Dematel Method

The data processing with the SAW method is used to accommodate the result of weights calculation of that of DEMATEL and proceed to the actual calculation, which is the recommendation of the journal's acceptance. The result of the DEMATEL data processing is shown in Table 6.

Table 6. Data Processing with The SAW Method

Journal	V (SAW Result)	Experts' result	Rank	Standard Error
Journal 1	2.6	3	7	11.90%
Journal 2	2.6	3	9	12.88%
Journal 3	2.5	3	14	17.97%
Journal 4	2.5	3	12	16.73%
Journal 5	2.8	2.5	3	9.24%
Journal 6	2.6	3	8	12.22%
Journal 7	2.5	3	13	17.13%
Journal 8	2.4	3	16	21.30%
Journal 9	2.0	2.5	17	21.89%
Journal 10	1.8	2	18	7.55%
Journal 11	2.5	2.5	11	0.03%
Journal 12	2.7	2.5	4	7.98%
Journal 13	2.7	3	5	9.59%
Journal 14	2.9	3	2	4.59%
Journal 15	2.4	2	15	18.11%
Journal 16	2.9	3	1	1.99%
Journal 17	2.7	3	6	11.41%
Journal 18	2.6	3	10	12.95%
Total				11.97%

The data processing using SAW method will result in values and ranks that will be used to recommend which journals are accepted (in this research, the value ranges from 1 to 3). Subsequently, it will be compared with the results of the experts in order to find the standard error and its accuracy. The standard error of the method is 11,97% and the accuracy is 88,03%.

Data Processing with the TOPSIS Method

The TOPSIS method is used to execute the weighting values that have been calculated using the DEMATEL method. The result of the TOPSIS data processing is shown in Table 7.

Table 7. Data Processing with The TOPSIS Method

Journal	V (TOPSIS result)	Experts' result	Rank	Standard Error
Journal 1	2.1	3	6	31.66%
Journal 2	2.0	3	8	32.69%
Journal 3	1.7	3	14	44.55%
Journal 4	1.8	3	11	41.41%
Journal 5	2.3	2.5	4	6.82%
Journal 6	1.9	3	10	36.55%
Journal 7	1.7	3	12	42.47%
Journal 8	1.5	3	16	50.28%
Journal 9	0.5	2.5	17	78.75%
Journal 10	0.3	2	18	87.12%
Journal 11	1.7	2.5	13	30.69%
Journal 12	2.3	2.5	3	8.09%
Journal 13	2.2	3	5	27.68%
Journal 14	2.6	3	2	13.71%
Journal 15	1.6	2	15	20.21%
Journal 16	2.7	3	1	10.20%
Journal 17	2.1	3	7	30.84%
Journal 18	2.0	3	9	32.97%
Total				34.82%

Comparison between Dematel-SAW and Dematel-TOPSIS Method

The calculation result of the DEMATEL-SAW and the DEMATEL-TOPSIS will be compared to see which method is the most effective in the decision-making process in the journal's acceptance. The result of the comparison is shown in table 8.

The calculation using the TOPSIS method will result in the values and ranks that contribute in the journal's acceptance. In determining the accuracy and the standard error, it is suggested that the result is compared to that of the experts. The standard error of the TOPSIS method is 34,82% and the accuracy is 65,13%.

Table 8. Data Processing with The TOPSIS Method

Method	***Standart Error***	***Accuration***
Dematel-SAW	11,97%	88,03%
Dematel-Topsis	34,82%	65,13%

The result of the calculation shows that the accuracy level of the DEMATEL-SAW is relatively higher compared to that of the DEMATEL-TOPSIS, whereas the result of the DEMATEL-TOPSIS method shows a more consistent accuracy when being implemented on variables with numerous criteria. Hence, it is concluded that DEMATEL-SAW is slightly better as it has a lower rate of standard error.

CONCLUSION

The result of the DEMATEL method in the process of e-journal selection suggests that the reviewer should be more concerned with several main criteria such as significance, originality and quality, for they affect other criteria like clarity and relevance. In this research, the result also shows that the DEMATEL-SAW method befits the data processing if it includes fewer criteria as its high accuracy but inconsistent when the criteria used are many.

The DEMATEL-TOPSIS method, however, is more suitable for data processing that involves many criteria, thanks to the consistency of the value accuracy. In making the decision-making support system recommendation of journal acceptance that is comprised of five items of criteria, thus, it is suggested that the decision makers use DEMATEL-SAW method because it has a high degree of accuracy.

REFERENCES

Abdullah, L. and C. W. R. Adawiyah. (2014). Simple Additive Weighting Methods of Multi criteria Decision Making and Applications: A Decade Review. *International Journal of Information Processing and Management*, *5*(1), 39-49. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjO-rHSuZD_AhXz-DgGHfLEDpYQFnoECA0QAQ&url=https%3A%2F%2Fwww.semanticscholar.org%2Fpaper%2FSimple-Additive-Weighting-Methods-of-Multi-criteria-Abdullah-Adawiyah%2F05a0d6d88b7a86fd783f736532af68e0e297e299&usg=AOvVaw3jY-BN4W89VQjB51PmEI2i

Afshari, A., et al. (2010). Simple additive weighting approach to personnel selection problem. *International Journal of Innovation, Management and Technology*, *1*(5), 511-515. Retrieved from https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bec304ffd086871cdc9dd84cbee6e610da5030d8

Aksakal, M., et al. (2010). An integrated approach for personnel selection with DEMATEL and ANP methods. *Journal of the Faculty of Engineering and Architecture of Gazi University*, *25*(4), 905-913. Retrieved from https://avesis.atauni.edu.tr/yayin/93e71560-c10d-46de-bd85-650aaa0f7fc5/an-integrated-approach-for-personel-selection-with-dematel-and-anp-methods

Bastos, T. R., Longaray, A. A., dos Santos Machado, C. M., Ensslin, L., Ensslin, S. R., & Dutra, A. (2023). Fuzzy-MACBETH Hybrid Method: Mathematical Treatment of a Qualitative Scale Using the Fuzzy Theory. *International Journal of Computational Intelligence Systems*, *16*(1), 21. Doi: doi.org/10.1007/s44196-023-00195-9

Bulgurcu, B. (2012). Application of TOPSIS Technique for Financial Performance Evaluation of Technology Firms in Istanbul Stock Exchange Market. *Procedia - Social and Behavioral Sciences*, *62*(2012), 1033-1040. Doi: 10.1016/j.sbspro.2012.09.176

Chang, B., et al. (2011). Fuzzy Dematel method for developing supplier selection criteria. *Expert Systems with Applications*, *38*(3), 1850-1858. Doi: 10.1016/j.eswa.2010.07.114

Chen, L., Li, Z., & Deng, X. (2020). Emergency alternative evaluation under group decision makers: a new method based on entropy weight and DEMATEL. *International journal of systems science*, *51*(3), 570-583. Doi: 10.1080/00207721.2020.1723731

Chou, S. Y., et al. (2016). A Novel Hybrid MCDM Procedure for Achieving Aspired Earned Value Project Performance. *Mathematical Problems in Engineering*, 2016, 7-9. Doi: 10.1155/2016/9721726

Chu-Hua, L., Sun-Weng, H., Mei-Ting, H., Chiao-Bing, L., & Gwo-Hshiung, T. (2023). Improving the Poverty-Alleviating Effects of Bed and Breakfast Tourism Using Z-DEMATEL. *International Journal of Fuzzy Systems*, 1-15. Doi: 10.1007/s40815-023-01481-6

Ghosh, S., Mandal, M. C., & Ray, A. (2022). Green supply chain management framework for supplier selection: An integrated multi-criteria decision-making approach. *International Journal of Management Science and Engineering Management*, *17*(3), 205-219. Doi: 10.1080/17509653.2021.1997661

Gunaydin, G., Duvan, G., & Ozceylan, E. (2022). An Integrated Approach of Multi-Criteria Decision Making to Determine the Most Habitable Planet. *HighTech and Innovation Journal*, *3*(2), 151-161. Doi: 10.28991/HIJ-2022-03-02-04

Jain, V., & Ajmera, P. (2021). DEMATEL method for evaluating FMS variables in the Indian manufacturing industry. *International Journal of Process Management and Benchmarking*, *11*(6), 822-838. Doi: doi.org/10.1504/IJPMB.2021.118321

Josaputri, et al. (2016). Decision Support Systems for The Determination of Cattle with Superior Seeds using AHP and SAW Method. *Scientific Journal of Informatics*, *3*(2), 21-30. Doi: 10.15294/sji.v3i2.7908

Kaya, N. (2021). A review on manufacturing applications of the VIKOR approach. *Business & Management Studies: An International Journal*, *9*(4), 1673-1695. Doi: 10.15295/bmij.v9i4.1896

Khanjankhani, K., et al. (2016). Evaluation and Prioritization of Service Quality Dimensions Using Dematel and Topsis (A Case Study in Iran). *Bali Medical Journal*, *5*(2), 298-302. Doi: 10.15562/bmj.v5i2.233

Larsen, O. and M. von Ins. (2010). The rate of growth in scientific publication and the decline in coverage provided by science citation index. *Scientometrics*, *84*(3), 575-603. Doi: 10.1007/s11192-010-0202-z

Liew, K. F., Lam, W. S., & Lam, W. H. (2022). Financial Network Analysis on the Performance of Companies Using Integrated Entropy–DEMATEL–TOPSIS Model. *Entropy*, *24*(8), 1056. Doi: 10.3390/e24081056

Ortiz-Barrios, M., Gul, M., Yucesan, M., Alfaro-Sarmiento, I., Navarro-Jiménez, E., & Jiménez-Delgado, G. (2022). A fuzzy hybrid decision-making framework for increasing the hospital disaster preparedness: The colombian case. *International journal of disaster risk reduction*, *72*, 102831. Doi: 10.1016/j.ijdrr.2022.102831

Podvezko, V. (2011). The Comparative Analysis of MCDA Methods SAW and COPRAS. *Inzinerine Ekonomika-Engineering Economics*, *22*(2), 134-146. Doi: 10.5755/j01.ee.22.2.310

Pourjavad, E., & Shahin, A. (2020). Green supplier development programmes selection: a hybrid fuzzy multi-criteria decision-making approach. *International Journal of Sustainable Engineering*, *13*(6), 463-472. Doi: 10.1080/19397038.2020.1773569

Raut, R. D., Gardas, B. B., Narkhede, B. E., & Narwane, V. S. (2019). To investigate the determinants of cloud computing adoption in the manufacturing micro, small and medium enterprises: A DEMATEL-based approach. *Benchmarking: An International Journal*, *26*(3), 990-1019. Doi: 10.1108/BIJ-03-2018-0060

Rong, Y., Liu, Y., & Pei, Z. (2022). A novel multiple attribute decision-making approach for evaluation of emergency management schemes under picture fuzzy environment. *International Journal of Machine Learning and Cybernetics*, *13*, 633-661. Doi: 10.1007/s13042-021-01280-1

Shanker, S., & Barve, A. (2021). Analysing sustainable concerns in diamond supply chain: a fuzzy ISM-MICMAC and DEMATEL approach. *International Journal of Sustainable Engineering*, *14*(5), 1269-1285. Doi: 10.1080/19397038.2020.1862351

Sumrit, D. and P. Anuntavoranich. (2013). Using DEMATEL Method to Analyze the Causal Relations on Technological Innovation Capability Evaluation Factors in Thai Technology-Based Firms. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, *4*(2), 81-103. Retrieved from https://www.academia.edu/download/80984163/081-103.pdf

Talebanpour, R. and M. Javadi. (2015). Decision-making for flexible manufacturing systems using DEMATEL and SAW. *Decision Science Letters*, *4*(3), 363-372. Doi: 10.5267/j.dsl.2015.4.002

Thor, J., et al (2013). Comparison of Multi Criteria Decision Making Methods from The Maintenance Alternative Selection Perspective. *The International Journal of Engineering and Science (IJES)*, *2*(6), 18-25. Retrieved from https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=6bb2e8b7de5a934f1df05397f107b7c9c69475e0

Tzeng, C. W., et al. (2007). Evaluating intertwined effect in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert Systems with Applications*, *32*(4), 1028-1044. Doi: 10.1016/j.eswa.2006.02.004

Velasquez, M. and P. T. Hester. (2013). An Analysis of Multi-Criteria Decision Making Methods. *International Journal of Operations Research*, *10*(2), 56-66. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiv4feNu5D_AhVsamwGHdh0D98QFnoECBIQAQ&url=http%3A%2F%2Fwww.orstw.org.tw%2Fijor%2Fvol10no2%2Fijor_vol10_no2_p56_p66.pdf&usg=AOvVaw2p8pctzkYByYhwyi-1ZuAx

Yadav, R. N., Kumar, D., Sharma, A. K., & Virmani, N. (2022). Analysing human and system related barriers of TQM in automobile industries using fuzzy DEMATEL approach. *International Journal of Productivity and Quality Management*, *35*(2), 193-219. Doi: 10.1504/IJPQM.2022.121302

Yazdani, M. (2014). An integrated MCDM approach to green supplier selection. *International Journal of Industrial Engineering Computations*, *5*(3), 443-458. Doi: 10.5267/j.ijiec.2014.3.003

Yeganeh, R., Mohammadfam, I., Soltanian, A., & Mirzaei Aliabadi, M. (2022). An integrative fuzzy Delphi decision-making trial and evaluation laboratory (DEMATEL) study on the risk perception-influencing factors. *International Journal of Occupational Safety and Ergonomics*, 1-12. Doi: 10.1080/10803548.2022.2112446.