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Evaluation of a Best Digital Supplier by Fuzzy SWARA-WASPAS Strategies

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Abstract: In this ruthless society, digital suppliers are noteworthy in building each organization to be productive and rich. Hence, choosing a reliable and well-grounded digital supplier becomes very necessary. The process of choosing digital suppliers is a multiple-criteria decision-making compliance. Digital suppliers are decided by considering some factors which improve the productivity of the suppliers. Digital suppliers'output is grounded on behalf of the digital suppliers' criteria. Extra precaution is required to confirm these criteria. This paper looks at digital retail shopping in Iran, which includes the selection of the best digital supplier on applying MCDM strategies called SWARA as well as WASPAS in fuzzy surroundings where SWARA strategy is applicable to establishing the weightage of the factors and WSM, WPM and WASPAS strategies are applicable to establish the best as well as worst supplier and also the gratings of the suppliers in a probabilistic surrounding made by linguistic concepts by triangular fuzzy numbers deciding through resource persons. By applying SWARA methodology in a fuzzy environment, the implications of the findings demonstrate that the factor named high-quality certification contains the maximum weight and the factor named accountability contains the lowest weight. Applying WSM, WPM, and WASPAS also demonstrates that digital supplier 2 is the best and digital supplier 3 is the worst.

Introduction

Most of the suppliers have become more digitally transformed, and the relationships and exchanges within the SCM system have become more complicated. These relationships are sensitive to the adoption of new technologies and frequently entail substantial expenses. In this way, the way SCs and networks build their business processes and operations is being influenced by new digital SCM methods. However, the utilization of strategic initiatives driven by focus firms plays a vital role in strengthening their supplier base since it becomes necessary for suppliers to acquire sophisticated digital capabilities in order to adapt and prosper in a digital business environment. The advantages of digitally transforming a SC seem obvious, but to gain a competitive edge in an increasingly digital business environment, suppliers need to build sophisticated digital (and analytical) capabilities that can facilitate the adoption of digital SCM practices. These practices will

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increase operational efficiency and foster a culture of data-driven decision-making.

Due to the fact that certain suppliers lack the necessary resources to assist the attainment of DSC targets, SDPs are now a crucial procedure for enhancing the (digital) capabilities and performance of new providers. Therefore, focus businesses need to use strategic activities to pressure suppliers to meet or surpass digital competitiveness standards. For every corporation, digital suppliers have the utmost ingredients for building them productive and rich. For that reason, proficient and versatile digital suppliers must be chosen. Furthermore, the well-grounded suppliers have been picked on behalf of the criteria of the digital suppliers in which accurate supervision is must. The paper depicts the SWARA strategy for nominating the weightage of the factors and the WASPAS strategy for nominating the ratings and grading by assisting the fuzzy concepts when considering the criteria of the digital providers.

The research question and the purpose of the study are to find out the best and worst digital suppliers on the basis of identified factors through fuzzy mathematical modeling in terms of linguistic variables by applying triangular fuzzy numbers in order to run the organizations efficiently. In this study, the weightage of the factors is chosen through the SWARA strategy and the best as well as worst suppliers and also the gratings of the suppliers are chosen through the WASPAS strategy in fuzzy surroundings, which uses linguistic expressions expressed by the tri-angular fuzzy numerals in a very simple manner. Digital supplier's selection criteria related to society, economy, business and eco-friendliness are decided through the beliefs of researchers on behalf of their past experiences and literature reviews. By examining the effectiveness of fuzzy techniques, we proposed a study of digital retail shopping in Iran.

Literature review

Literature on the MCDM approach and the evaluation of the digital supplier problem is given in this part, with particular attention to the SWARA and WASPAS methods. Researchers have created many decision-making models to address supplier selection issues in various industries. But issues with digital supplier selection and supply chains are still relatively new to these domains, and there is a clear lack of research regarding the decision-making processes, decision-making criteria, and policies that can be created to deal with these issues.

Fuzzy theory originated with Zadeh (1996). Zavadskas et al. (2014) created a WASPAS strategy through interval-valued intuitionistic fuzzy numerals to predict uncertainty. Ghorabaee et al. (2016) tackled the green supplier evaluation with the application of an improved WASPAS approach under interval type-2 fuzzy theory. The WASPAS model was created by Baušys and Juodagalvienė (2017) to answer the garage position evaluation problem for residential sites.

In order to solve an issue related to the evaluation of digital suppliers, Büyüközkan and Göçer (2017a) combined the AHP as well as ARAS approaches through fuzzy set. The F-ARAS approach was used to assess providers in an airport organization, and AHP model was created to estimate the importance of the factors. The MOORA approach was created byBüyüközkan and Göçer (2017b) to solve a digital supplier selection problem for Turkish airport operating firms. Mavi et al. (2017) developed F-SWARA to estimate the weights of the proven attributes and F-MOORA to determine the ratings of the options in order to address a 3rdparty logistic contributor assessment issue in a plastic-making organization.

Büyüközkan and Göçer (2018) provided a thorough analysis of the literature about digital supply chains, including their advantages, disadvantages, restrictions, and potential for growth. Furthermore, this research offers significant insights into digital technologies and how businesses may use them in their supply chain processes to improve efficiency across several domains. Using the F-SWARA and F-CRITIC techniques for calculating the weights of the attributes and the EDAS strategy for calculating the ratings of choices, Ghorabaee et al. (2018a) analyzed sustainable components in a manufacturing Iranian corporation.

In order to calculate the consequence of cognitive funds in a business corporation, Keshavarz-Ghorabaee et al. (2018b) developed F-SWARA strategy for computing the weights of the attributes. In the 3rd-party reverse logistic contributor assessment of a locomotive-making corporation with risk features, Zarbakhshnia et al. (2018) created F-SWARA and F-COPRAS. For the evaluation of finance suppliers, Büyüközkan and Göçer (2019) established a F-BWM as well as F-ARAS.

An expanded version of the WASPAS approach under linguistic neutrosophic numbers was developed by Pamučar et al. (2019) for adviser evaluation in the hazardous transport sector.

In order to pick a location for electrical vehicle charging in China, Cavallaro (2019) used a hybrid and integrated MCDM strategy that included F-SWARA and F-WASPAS as well as a reluctant fuzzy set expressed by language variables. Ighravwe and Oke (2019) used

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models F-SWARA and COPRAS and F-SWARA and PROMETHEE to address a problem concerning hiring a technician in the cement production industry.

Two MCDM techniques, F-SWARA and F-AD, were used by Perçin (2019) to choose an outsourcing substance contributor for Turkish alchemical-making companies. Sadeghi and Kazemi (2019) used strategies such as F-SWARA and F-COPRAS to overcome the issues with online banking help in Iran. In order to solve the issue of choosing the best vendor for a Turkish fabric industry, Ulutas (2020) first applied two hybrid integrated approaches, dubbed F-SWARA and F-ARAS. Then, they implemented SWARA and WASPAS approaches to rank website performance ratings in Turkey.

The language set of f-AHP and F-ARAS techniques was presented by Büyüközkan and Güler (2020) to analyze the digital maturity of four banking companies. Chen et al. (2020) developed a model for the selection of suppliers in the electric vehicle industry by applying the DEMATEL and TOPSIS approaches under fuzzy rough set.Özek and Yildiz (2020) applied F-TOPSIS algorithm for the selection of digital suppliers in a study that was similar to this one for the apparel industry. The suggested decision-making tool aims to help a clothing firm choose the best Industry 4.0 supplier.

Singh and Modgil (2020) developed the SWARA and WASPAS approaches to answer the problem of the evaluation of the supplier in the cement sector of India. The weight of supplier factors was determined in this study using SWARA, and the alternatives were then assessed using the WASPAS approach in relation to those factors. Agarwal et al. (2022) analyzed a study on benchmarking the interactions among green and sustainable vendor selection attributes. Agarwal et al. (2023) developed a strategy for the selection of the best sustainable as well as resilient supplier through F-EDAS strategy. Again, Agarwal et al. (2023) study a strategy for selecting the best sustainable solution through the ARAS strategy.

Research Methodology

The present research study introduces an extended fuzzy version of the MCDM technique, F-SWARA and F-WASPAS, for addressing digital supplier selection problems. Fuzzy logic applies a harsh mathematical structure; it investigates the indefinite conceptual situation, which can be carefully studied. Furthermore, many researchers have applied the fuzzy set theory and its extension to decision-making problems and have obtained superior results. It is also considered a modeling language, well suited for conditions in a fuzzy environment. Moreover, it allows the company's managers to optimize and design a given organization.

The set $A = < x, \mu_A(x) >$, defined over the non-empty universal set U, is a fuzzy set where $\mu_A(x): U \rightarrow [0,1]$ is called the grade of membership of x in A. The fuzzy set $B = < b_1, b_2, b_3 >$ on R is referred to as a TFN, whose membership function can be expressed as shown below in figure 1:

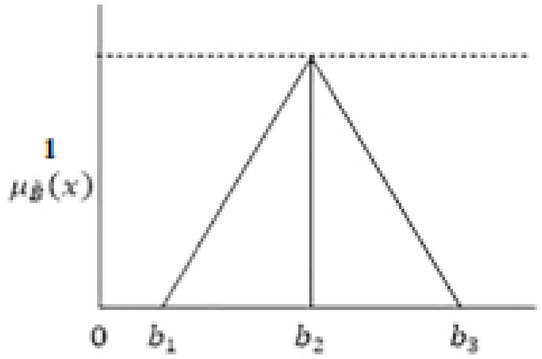

Figure 1. Membership function in fuzzy set.

This paper looks at digital retail shopping in Iran, which includes the selection of the best digital supplier on applying MCDM strategies called SWARA as well as WASPAS in fuzzy surroundings where SWARA strategy is applicable to establishing the weightage of the factors and WSM, WPM and WASPAS strategies are applicable to establish the best as well as worst supplier and also the gratings of the suppliers in a probabilistic surrounding made by linguistic concepts by triangular fuzzy numbers deciding through resource persons.

Fuzzy step-wise weight assessment ratio (F-SWARA) method

The traditional SWARA method for crisp numerals was initially put forth by Kersˇuliene et al. (2010). It finds the rank of the factors according to their weights, allowing the best option to be chosen. It also serves to assess the weights of the criterion. Using precise numerical data, purchasing managers express their preferences for certain criteria in this manner. However, this approach is not suitable for handling unclear environments. A revised version of the fuzzy SWARA approach is offered as a solution to this problem. The decision managers in the F-SWARA approach validate the fuzzy preference values of the criterion based on linguistic phrases through TrFNs. In contrast to FAHP, the FSWARA approach does not use a pair-wise relationship among the factors.

The primary advantages of the F-SWARA approach are its capability to maintain the highest level of consistency, its short computation time, and its lack of sophisticated or simple processes (Wen et al., 2019). A

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team of experts from academia and business contributes significantly to determining the weights of each discovered criterion in this procedure. Experts also determine and evaluate the significance and order of the factors based on their own comprehension, expertise, facts, and experiences while considering the organizations' rules. This technique designates the most prominent factor as the rank that comes in first and the least prominent factor as the rank that comes in last. The main component of this strategy is the assessment of the significance ratio of the criterion in the weight estimation (Mardani et al. 2017).

Mathematical formulation of F- SWARA method

Step 1 Remembrance of factors–At first, factors are remembered on the basis of their increasing or decreasing grading on behalf of their significance through the facts of the resource persons.

Step 2 Validation of linguistic concepts (l_j) - Originating through 2^{nd} factor, $(j-1)^{th}$ the factor is differentiated by j^{th} factor through linguistic concepts by TrFNsthrough the experiences of the resource persons coined comparative importance of mean numerals.

Step 3 Computation of fuzzy coefficient numeral (f_{cn}) - It is computed as:

$$f_{cn} = \begin{cases} 1, & \text{if } j \text{ is same as } 1 \\ l_j + 1, & \text{if } j \text{ is greater than one} \end{cases} \quad (1)$$

Step 4 Computation of fuzzy recalculated weights (fr_w)–These are computed by:

$$fr_w = \begin{cases} 1, & \text{if } j \text{ is same as } 1 \\ \frac{fr_{w-1}}{f_{cn}}, & \text{if } j \text{ is greater than } 1 \end{cases} \quad (2)$$

Step 5 Evaluation of f-weights of factors (w_f)– These are computed as:

$$w_f = \frac{fr_w}{\sum fr_w} \quad (3)$$

Where $fr_w = (fr_w^a, fr_w^b, fr_w^c)$

Step 6 Transformation of ending fuzzy weights into crisp weights(w_f) – These are computed as:

$$w_f = \frac{1}{3}(w_f^a + w_f^b + w_f^c) \quad (4)$$

F-WASPAS method

WASPAS was initially put forth by Zavadskas et al. (2012) by combining the weighted-sum-method (WSM) with weighted-product-method (WPM). The weighted sum of all the criteria is used by the WSM technique to estimate the final result of the options. The WPM technique was developed to stop decisions with low criterion values. Zavadskasalso used the multiplicative exponential weighting algorithm. In comparison to the WSM and WPM, the precision of the WASPAS technique was superior (Zavadskas et al., 2015a, 2015b).

Mathematical formulation of F-WASPAS method

Step 1 - Establishing a team of judges, digital suppliers, and selection criteria

The first step is to establish a team of judges, digital suppliers, and selection criteria for digital suppliers. Next, the judges must verify the digital suppliers and determine the limited factors used for digital suppliers.

Step 2-Establishing linguistic terms to determine the factors' weights and supplier performance gratings

The decision makers' opinions and judgments are used to express linguistic terms by TrFNs, which represent the significant weights of the factors and fuzzy gratings applied to find the performance of the digital suppliers.

Step 3-Building of the decision matrix:

In this stage, specialists build the decision matrix using fuzzy triangles to represent linguistic concepts.

Step 4–Normalized-decision-matrix (N_{ij}) construction: It is constructed as follows:

In beneficial factors, $N_{ij} = \frac{n_{ij}}{max n_{ij}}$ (6)

Innon-beneficial factors,

$$N_{ij} = \frac{min n_{ij}}{n_{ij}} \quad (7)$$

Where n_{ij} be decision matrix

Step 5-Establishing weighted-sum-decision-matrix (WS_i) –It is determined as:

$$WS_i = \sum N_{ij} * w_j \quad (8)$$

Step 6-Establishing weighted product decision matrix (WP_i) –It is determined as:

$$WP_i = \prod (N_{ij})^{w_j} \quad (9)$$

Step 7– Finding the best choice (C_i) - Grading of choices is computed as:

$$C_i = \max(0.5 * WS_i + 0.5 * WP_i) \quad (10)$$

Numerical analysis

This part examines a real-world study on the selection of digital supplier issues facing Iranian online retailers. Retailers of digital goods include those that process food grow vegetables, make textiles, make gadgets, make auto parts, etc. Ever since its founding, the online retail store has collaborated with a range of suppliers and partners to produce the materials needed to meet customer demands. We asked one of the company's judges to help us acquire the information needed for this work. As a result, in order to establish the best decision, we first identified the most prominent selection criteria for digital suppliers. These criteria are helpful in identifying both the best and worst digital suppliers as well as how the digital suppliers are ranked.

After reviewing the literature, we came up with a total of ten criteria for choosing digital suppliers, and they are as follows: High-quality certification (D^{C1}); economic cost (D^{C2}); timely service (D^{C3}); precise delivery (D^{C4}); digital collaboration (D^{C5}); eco-friendliness (D^{C6}); financial capacity (D^{C7}); Research ability (D^{C8}); Communication skills (D^{C9}); Accountability (D^{C10}). Following the acceptance criteria, we asked the judges to identify the online retailer's digital suppliers, referred to as DS1–DS6. Tables 1 and 2, respectively, display the linguistic expressions of the factors and gratings of the providers through the expert group's assessments expressed as triangular fuzzy numbers.

through linguistic phrases indicated by triangular fuzzy numbers.

The group of experts constructed an average fuzzy decision matrix using linguistic phrases defined by triangular fuzzy numbers displayed in Table 6.

Using equations (6) for advantageous criteria and (7) for non-beneficial criteria, a normalized average fuzzy decision matrix is now constructed displayed in Table 7.

Now, constructing a (WSM) matrix by using the equation (8) and is shown in Table 9.

Now, constructing a WPM matrix by using the equation (9) shown in Table 10.

Table 1. Linguistic concept of factors.

Linguistic Concepts	Tri-angular Fuzzy numerals
Exceedingly low (EL)	(0.0, 0.0, 0.1)
Very Low (VL)	(0.0, 0.1, 0.3)
Low (L)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
High (H)	(0.5, 0.7, 0.9)
Very High (VH)	(0.7, 0.9, 1.0)
Exceedingly high (EH)	(0.9, 1.0, 1.0)

Table 2. Linguistic concepts of performance gratings of suppliers.

Linguistic Concepts	Fuzzy Numerals
Very Low	1,1,3
Low	1,3,5
Average	3,5,7
High	5,7,9
Very High	7,9,9

Calculating f_{cn} and fr_w through the equations (1) and (2) resp which depicts Table 3.

Table 3. Computing f_{cn} and fr_w.

Factors	(l_j)	(f_{cn})	(fr_w)
High-Quality certification system		(1, 1, 1)	(1, 1, 1)
Economic cost	(0.9, 1, 1)	(1.9, 2, 2)	(0.53, 0.5, 0.5)
Timely service	(0.9, 1, 1)	(1.9, 2, 2)	(0.27, 0.25, 0.25)
Precise delivery	(0.7, 0.9, 1)	(1.7, 1.9, 2)	(0.15,0.13,0.12)
Digital collaboration	(0.5, 0.7, 0.9)	(1.5, 1.7, 1.9)	(0.10,0.07,0.06)
Eco-friendliness	(0.5, 0.7, 0.9)	(1.5, 1.7, 1.9)	(0.06, 0.04,0.03)
Financial capacity	(0.7, 0.9, 1)	(1.7, 1.9, 2)	(0.03,0.02,0.01)
Research ability	(0.3, 0.5, 0.7)	(1.3, 1.5, 1.7)	(0.02,0.01,0.005)
Communication skills	(0.1, 0.3, 0.5)	(1.1, 1.3, 1.5)	(0.018,0.007,0.003)
Accountability	(0.1, 0.3, 0.5)	(1.1, 1.3, 1.5)	(0.016,0.005,0.015)

Calculating fuzzy and crisp weights through the eqs. (1) and (2) resp. which depicts Table 4.

The group of experts constructed a fuzzy decision matrix, which is displayed in Table 6 and is expressed

Using equation (10) in a fuzzy environment, rank all the identified digital providers according to all the criteria by WSM, WPM, and WASPAS. The results are displayed in Table 10.

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Table 4. Calculating fuzzy and crisp weights.

Factors	Fuzzy weights	Crisp weights
High-Quality certification	(0.45,0.49,0.5)	0.48
Economic cost	(0.24,0.25,0.26)	0.25
Timely service	(0.12,0.12,0.13)	0.12
Precise delivery	(0.06,0.07,0.07)	0.06
Digital collaboration	(0.05,0.04,0.04)	0.04
Eco-friendliness	(0.027,0.03,0.02)	0.019
Financial capacity	(0.013,0.008,0.005)	0.009
Research ability	(0.009,0.004,0.002)	0.005
Communication skills	(0.008,0.003,0.003)	0.004
Accountability	(0.007,0.002,0.007)	0.005

Table 5. Fuzzy decision matrix.

	D^{C1}	D^{C2}	D^{C3}	D^{C4}	D^{C5}	D^{C6}	D^{C7}	D^{C8}	D^{C9}	D^{C10}
D_{S1}	5,7,9	3,5,7	1,3,5	7,9,9	1,3,5	5,7,9	3,5,7	5,7,9	1,3,5	3,5,7
D_{S2}	3,5,7	7,9,9	3,5,7	5,7,9	3,5,7	1,3,5	5,7,9	3,5,7	7,9,9	5,7,9
D_{S3}	3,5,7	5,7,9	1,3,5	5,7,9	1,3,5	7,9,9	3,5,7	3,5,7	5,7,9	5,7,9
D_{S4}	1,3,5	5,7,9	7,9,9	3,5,7	1,3,5	5,7,9	7,9,9	1,3,5	5,7,9	3,5,7
D_{S5}	7,9,9	3,5,7	5,7,9	3,5,7	7,9,9	1,3,5	5,7,9	5,7,9	7,9,9	5,7,9
D_{S6}	3,5,7	5,7,9	7,9,9	5,7,9	3,5,7	7,9,9	1,3,5	1,3,5	5,7,9	3,5,7

Table 6. Average fuzzy decision matrix.

	D^{C1}	D^{C2}	D^{C3}	D^{C4}	D^{C5}	D^{C6}	D^{C7}	D^{C8}	D^{C9}	D^{C10}
D_{S1}	7	5	3	8.3	3	7	5	7	3	5
D_{S2}	5	8.3	5	7	5	3	7	5	8.3	7
D_{S3}	5	7	3	7	3	7	5	5	7	7
D_{S4}	9	7	8.3	5	3	7	8.3	3	7	5
D_{S5}	8.3	5	7	5	8.3	3	7	7	8.3	7
D_{S6}	5	7	8.3	7	5	8.3	3	3	7	5

Table 7. Normalizedaverage fuzzy decision matrix.

	D^{C1}	D^{C2}	D^{C3}	D^{C4}	D^{C5}	D^{C6}	D^{C7}	D^{C8}	D^{C9}	D^{C10}
D_{S1}	0.84	1	0.37	1	0.37	0.84	0.60	0.84	0.37	0.60
D_{S2}	0.60	0.60	0.60	0.84	0.60	0.37	0.84	0.60	1	0.84
D_{S3}	0.60	0.71	0.37	0.84	0.37	0.84	0.60	0.60	0.84	0.84
D_{S4}	1.08	0.71	1	0.60	0.37	0.84	1	0.37	0.84	0.60
D_{S5}	1	1	0.84	0.60	1	0.37	0.84	0.84	1	0.84
D_{S6}	0.60	0.71	1	0.84	0.60	1	0.37	0.37	0.84	0.60

Table 8. WSM matrix.

	D^{C1}	D^{C2}	D^{C3}	D^{C4}	D^{C5}	D^{C6}	D^{C7}	D^{C8}	D^{C9}	D^{C10}	WS_i
D_{S1}	0.40	0.25	0.04	0.06	0.11	0.015	0.005	0.005	0.001	0.003	0.885
D_{S2}	0.28	0.15	0.07	0.05	0.01	0.007	0.007	0.003	0.004	0.004	0.981
D_{S3}	0.28	0.17	0.04	0.05	0.11	0.015	0.005	0.003	0.003	0.004	0.656
D_{S4}	0.51	0.17	0.12	0.03	0.11	0.015	0.009	0.001	0.003	0.003	0.968
D_{S5}	0.48	0.25	0.10	0.03	0.03	0.007	0.007	0.004	0.004	0.004	0.912
D_{S6}	0.28	0.17	0.12	0.05	0.01	0.019	0.003	0.001	0.003	0.003	0.676

Table 9. WPM matrix.

	D^{C1}	D^{C2}	D^{C3}	D^{C4}	D^{C5}	D^{C6}	D^{C7}	D^{C8}	D^{C9}	D^{C10}	WP_i
D_{S1}	0.91	1	0.88	1	0.97	0.99	0.99	0.999	0.996	0.997	0.755
D_{S2}	0.78	0.88	0.94	0.98	0.98	0.98	0.99	0.997	1	0.999	1.870
D_{S3}	0.78	0.91	0.88	0.98	0.97	0.99	0.99	0.997	0.999	0.999	0.579
D_{S4}	1.03	0.91	1	0.96	0.97	0.99	1	0.995	0.999	0.997	0.856
D_{S5}	1	1	0.97	0.96	1	0.98	0.99	0.999	1	0.999	0.901
D_{S6}	0.78	0.91	1	0.98	0.98	1	0.99	0.995	0.999	0.997	0.668

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Table 10. Ranking of digital suppliers.

WSM	Ranking by WSM	WPM	Ranking by WPM	F-WASPAS	Ranking by F-WASPAS
0.885	4	0.755	4	0.5*0.88 + 0.5*0.75 = 0.815	4
0.981	1	1.870	1	0.5*0.58 + 0.5*1.87 = 1.220	1
0.656	6	0.579	6	0.5*0.67 + 0.5*0.57 = 0.620	6
0.968	2	0.856	3	0.5*0.96 + 0.5*0.85 = 0.904	3
0.912	3	0.901	2	0.5*0.91 + 0.5*0.90 = 0.905	2
0.676	5	0.668	5	0.5*0.65 + 0.5*0.66 = 0.655	5

Conclusion, limitations of the study and future scope

Selecting and evaluating the best and most appropriate digital and sustainable supplier is difficult for any kind of business. Maintaining strong relationships with digital and sustainable suppliers throughout the supply chain processes is essential to guarantee their active participation. Therefore, organizations recommend working with a restricted number of suppliers or considering just one supplier to develop and retain excellent supply chain operations. A lot of research is being done to solve the MCDM challenge since the suppliers' evaluation process is strategically important. This study used an enhanced, updated fuzzy version of the SWARA-WASPAS technique to handle the challenge of evaluating and selecting sustainable and digital suppliers while considering sustainable and digital supplier selection criteria. Selecting the best digital provider is the main goal of this study report. The main benefit of using MCDM approaches is that they are readily accessible to all users. However, the main limitation of MCDM techniques that the users must be professionals, scholars and outstanding investigators. This technique uses fuzzy theory to address the problem of vagueness, uncertainties, obscurities, ambiguities, etc. in DM problems. However, the primary limitation of fuzzy theory is that it can only be applied in fuzzy environments. The recommended technique requires less processing time than earlier MCDM techniques. Because of this, DM finds this method to be very beneficial and applies it effectively in supply chain operations.

Since the supplier selection process is an MCDM strategy, the MCDM technique is used to answer it. A few factors are used to choose suppliers. As a result, it is crucial to choose the criteria based on their weights and significance. You should also use MCDM techniques to rank the criteria. The F-SWARA approach is used in this chapter to estimate the weights and rankings of all the digital supplier selection criteria, making it easier to select the ideal provider. Along with estimating the rating of every digital supplier based on WSM, WPM, and WASPAS, this article also identifies the best and worst digital suppliers. This paper's conclusion demonstrates how the F-SWARA approach assigned the first rank to the criterion with the highest weight and the last rank to the criterion with the lowest weight. Applying WSM, WPM and WASPAS methodologies in a fuzzy environment demonstrates that digital supplier 2 is the best and digital supplier 3 is the worst. In future cases, the fuzzy WASPAS and fuzzy SWARA approaches can be simply applied to any other evaluation problem in a variety of practical domains, especially in manufacturing and service organizations.

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Conflict of Interest

The authors declare no conflict of interest.

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