A Possibility Degree Method for Ranking A Selected Supplier

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Abstract

In the last years, the problem of selecting suppliers with an environmental aspect has been the focus of many researchers. Today's companies have realized that a good choice of suppliers according to well-defined criteria constitutes a substantial advantage. To be competitive and respond to quickly changing markets, more flexibility is required. Selecting suppliers is a multi-step process that involves finding, evaluating, and ultimately contracting with potential vendors. The final decision will be based on a variety of aspects, including price, quality, dependability, and customer service. There are several criteria to consider when selecting a supplier, including both qualitative and quantitative ones. This problem can never be solved without the application of an MCDM approach. In this research work, a detailed analysis on the choice and selection criteria of sustainable suppliers is presented, highlighting the methodology of Possibility degree of green and sustainable supplier selection. A matrice-based system is used to rank all the options, and the best is chosen. Finally, the proposed method is tested on a case study in the automotive industry based in Morocco to determine its feasibility and applicability. This research will also allow us to refine existing practices and get insight into the future.

Keywords
Supplier selection, green supplier selection, green supply chain management, green and sustainable supplier.

1. Introduction
Due to environmental challenges such as climate change, environmental degradation, ocean acidification and other factors, it has become crucial for a company to pay strict attention to its sustainable development. In order to improve product quality, packaging, shipping, and supplier selection criteria, as well as to reduce energy consumption and improve the image of an ecologically responsible organization, experts have recently been interested in sustainable supplier management.

Environmental and social problems have acquired considerable focus during the last two decades as part of the sustainable development effort. As a result, companies have increasingly relied on sustainability (Chiarini2012; Govindan 2016). Organizations' main business goal is to strike a balance between economic, environmental, and social performance in order to achieve sustainable development (Lee et al. 2009; Kannan et al. 2009). This is due to increasing environmental laws and regulations, as well as pressures from internal and external stakeholders.

Supply chain management has grown into a distinct and expanding subject because of the incorporation of environmental issues. Nevertheless, in order to enhance environmental relations, firms must apply methods to decrease the environmental effects of the whole supply chain throughout manufacturing, consumption, customer service, and product disposal (Sarkis 2001; Kannan et al. 2009)

Supplier selection is one of the most determining challenges confronting mass production businesses. In such sectors, the prices of goods accounts for a significant proportion of the ultimate cost of the product, and operating system vendors highly decreases buying prices Ghodsypour et al. (1998). On the basis of Tseng et al. (2009)'s investigations, the selection of an appropriate supplier is a challenging task since it involves a number of criteria and decision-making approaches that are characterized by their uncertainty and unreliability. Identifying the appropriate criteria and implementing an appropriate result for assessment and comparing performance are often cited in the literature as being most important challenges. As a part of the sustainable supplier selection process, suppliers are encouraged to get certifications or follow green practices to enhance environmental performance. Furthermore, several organizations green their supply chains by choosing suppliers that are already recognized as environmentally friendly. Suppliers' raw materials may include toxic materials that have the potential to make a huge negative impact on the environment.

Overall, there are multiple options to choose a supplier. Singular sourcing allows buyers to choose only one supplier to achieve all of their requirements, minimizing the need for customers to make several alternatives. Multiple sourcing is a typical form of sourcing in which more than one supplier must be picked since no one supplier is capable of fulfilling all of the buyer's demands.

As a result, organizations must determine as well the best eco responsible suppliers and the appropriate amount of quantity to be distributed among them in order to maintain a consistent context of competitiveness.

An intuitionistic fuzzy number (IFN), a component of an IFS, is frequently used to describe the degree of satisfiability and non-satisfiability of each alternative with consideration to a set of criteria in fuzzy multiple criteria decision making (MCDM)(Xu 2007).The evaluation of IFNs to many other options is conceptually similar to the comparison of alternatives.

IFNs may be compared using a ranking method developed by Chen and Tan (1994). Using the score function and accuracy function, Hong and Choi (2007) identified the flaws and provided a fix. Improved scoring functions were established by Li and Liu (2001) eventually. The assessment methods include both the classification method and the precision function. We can determine the IFNs' relative importance by utilizing these assessment tools. The comparison of IFNs may also represent the uncertainty of rating objectively because of their uncertainties.

A possibility degree technique for ranking IFNs is presented in this study by extending the interval-valued number possibility degree approach to intuitionistic fuzzy sets. According to the possibility degree technique, the ranking result of IFSs may represent the uncertainty of the IFSs, and such give more information to decision makers.

The paper is structured as follows. Section 2 provides a literature review of green supplier selection problem. In Section 3, we present the problem's model formulation and Section 4 discusses the application of the methodology on case study and the last Section Concludes the work and gives some perspectives.

2. Literature Review of GSSSP

2.1 Green and sustainable supplier selection problem

Sustainable and Green Supply Chain Management (SGSCM) is also one of the most critical problems in the review of recent supply chain management. The strategy is to boost the ecological quality of products and servicesKannan et al. (2014).A different researchers agree that the strategic sourcing in association with environmental concepts is critical to a company's ability to develop a competitive advantage. Government agencies are still facilitating producers in the application of sustainable solutions in a variety of contexts, including allocating consumers and producers, that also provides best opportunities for the future of green materials, as well as industrial production and recycle decision making. Moreover, several organizations had already highlighted the need of integrating protection measures into their operational processes.

The progress of environmental aspects is the primary goal of green supply chain management. According to the literature review, SGSCM can accelerate an all solutions in terms of environmental efficiency and business advantages.Google scholar's database was examined to identify the 8 most significant literary papers in this subject using the keywords "green supply chain," "green supply chain management," "sustainable supplier selection," and "green supplier selection. Table 1 is a summary of the most relevant and most significant GSSSP publications.

Table 1. Review of the most relevant GSSSP publications

Year	Author	Tittle	Investigations
2016	Liou, J. J. H	New hybrid COPRAS-G MADM Model for improving and selecting suppliers in green supply chain management.	It is suggested in this paper that a new hybrid model be established using Decision Experiment and Assessment Lab (DEMATEL) advanced technologies to facilitate collaboration between the criteria, typically results in the building projects of an influential network analysis model (INRM) that discusses a multitude of standards and stakeholders have intuitionistic configurations between information.
2016	Formentini, M.	Corporate sustainability approaches and governance mechanisms in sustainable supply chain management.	This review looks at seven published studies through the optics of theoretical framework, business strategy, and the information perspective of organizations to see how they worked.
2017	Dubey, R	Sustainable supply chain management: framework and further research directions.	Total Interpretive Structural Modeling (TISM) is presented in this article as a purpose of making it to sustainability management. It is proposed in this study that a significant contribution be used to solve challenges associated with the sustainable supply chain management driver.
2018	ZP Tian, HY Zhang, JQ Wang, TL Wang	Green Supplier Selection Using Improved TOPSIS and Best-Worst Method Under Intuitionistic Fuzzy Environment	It is proposed in this paper to use an enhanced TOPSIS coupled with the Best-Worst Method (BWM) to tackle MCGDM issues using intuitionistic fuzzy information in the context of green supplier selection.
2019	Agnieszka Konys	Green Supplier Selection Criteria: From a Literature Review to a Comprehensive Knowledge Base	The current research provides a conceptual and practical framework for collecting and managing information regarding green supplier selection criteria, as well as examples of such knowledge.

2020	F Ecer	Multi-criteria decision making for green supplier selection using interval type-2 fuzzy AHP: a case study of a home appliance manufacturer	This work extends the analytical hierarchy process (AHP) to an interval type-2 fuzzy environment (IT2FAHP) model in order to improve interact with ambiguity and vagueness in order to solve a supplier selection issue that incorporates green ideas. Additionally, a practical application at a manufacturer company is used to illustrate the productivity and reliability of the IT2FAHP model in this study.
2021	N. Foroozesh, F. Jolai, S. M. Mousavi & B. Karimi	A new fuzzy-stochastic compromise ratio approach for green supplier selection problem with interval-valued possibilistic statistical information	This article presents a strong group decision-making approach for solving GSSPs using Monte Carlo simulations in interval-valued fuzzy and stochastic settings. The suggested compromise ratio approach is divided into many phases: weights and rating, aggregation, simulation, and ranking.
2022	B Masoomi, IG Sahebi, M Fathi, F Yıldırım	An Integrated Approach by Using Various Approaches for a Green Supplier Selection Problem	The purpose of this study is to assess a hybrid algorithm for determining the relevance of selected criteria and displaying green providers.

2.2 Sustainable criteria for supplier selection problem

This section describes the criteria that should be consider when choosing green suppliers. After conducting a review of the published studies, research revealed many typical criteria. In a literature study of supplier selection approaches, many researchers found that cost, quality, delivery, management, technology, and green performance are the most prominent economic factors.

Authors such as (Lee et al. 2009) and (Sarkis2001) are increasingly considering environmental aspects when selecting suppliers. In order to examine the significant tasks, Yang et al. (2019) utilized the Delphi approach and created a model of sustainability management and green solutions in order to prove the value of each criterion.

The purpose of this research is to provide a thorough framework for selecting green suppliers that considers both economically and environmentally attributes, and to collect all standard and sustainable results indicators. An overview of the most relevant criteria found in published studies can be found in Figure 1.

A. Cost: When it refers to supplier selection, cost is considered the most crucial elements to consider. Choosing the right suppliers may help consumers conserve money and then get a higher understanding of business. Costs includes product price, manufacturing & logistics costs and finally cost of trash removal.
B. Quality: The quality of a product is the most important factor in how well a company conducts business in the industry. In each company, it is always necessary to check and supervise the quality of the product/process at the arrival and before delivery of the product. This is important in order to keep a credibility towards the customer. Certifications are also very important. Quality includes reliability of the products, ratio of qualified products, quality product, quality process, quality management, quality certifications and quality of the products rejected by customers.
C. Delivery: In order to achieve the brand image, businesses must collaborate with the appropriate supplier, who deliver their needs at the appropriate time, at the precise place, under the proper situations, and with the optimum price. Delivery includes delivery time delay, delivery reliability and supplier lead time
D. Service: Customers expect high-quality products at competitive prices, and businesses must provide them while maintaining a high level of service. Businesses must also operate at a high level of service while maintaining good inventory management and design capabilities in order to achieve customer satisfaction. Services includes guarantee, coordination, inventory management, technological and ecological skills
E. Technique capability: Innovative industry 4.0 will help the company in obtaining a status of notoriety in its sector. Technique capability includes manufacturing capacity, innovation, technical compliance.
F. Green product: Generally, the term "green measure" refers to a supplier's degree of environmental influence or their level of environmental responsibility. There is still a higher emphasis placed on green ability from customers and suppliers, which has strategic value and is beneficial to the company's brand image. Green product includes sustainable packaging, reusing, reprocessing and recycling materials.

G. Pollution Control: Pollution not only affects the ecosystem either through the emission of organic toxic sludge, but it also results in excessive energy use. In the supply chain, pollution control is a significant key indicator. It is necessary to reduce the waste and to set up control points in each stage of the process.

H. Environmental management: Ecological management systems' aims include ensuring firms' commitment to reducing environmental impacts as well as encouraging purchasers to become more conscious of environmental issues. Environment management includes zero emission carbon, environment certifications, green and sustainable process.

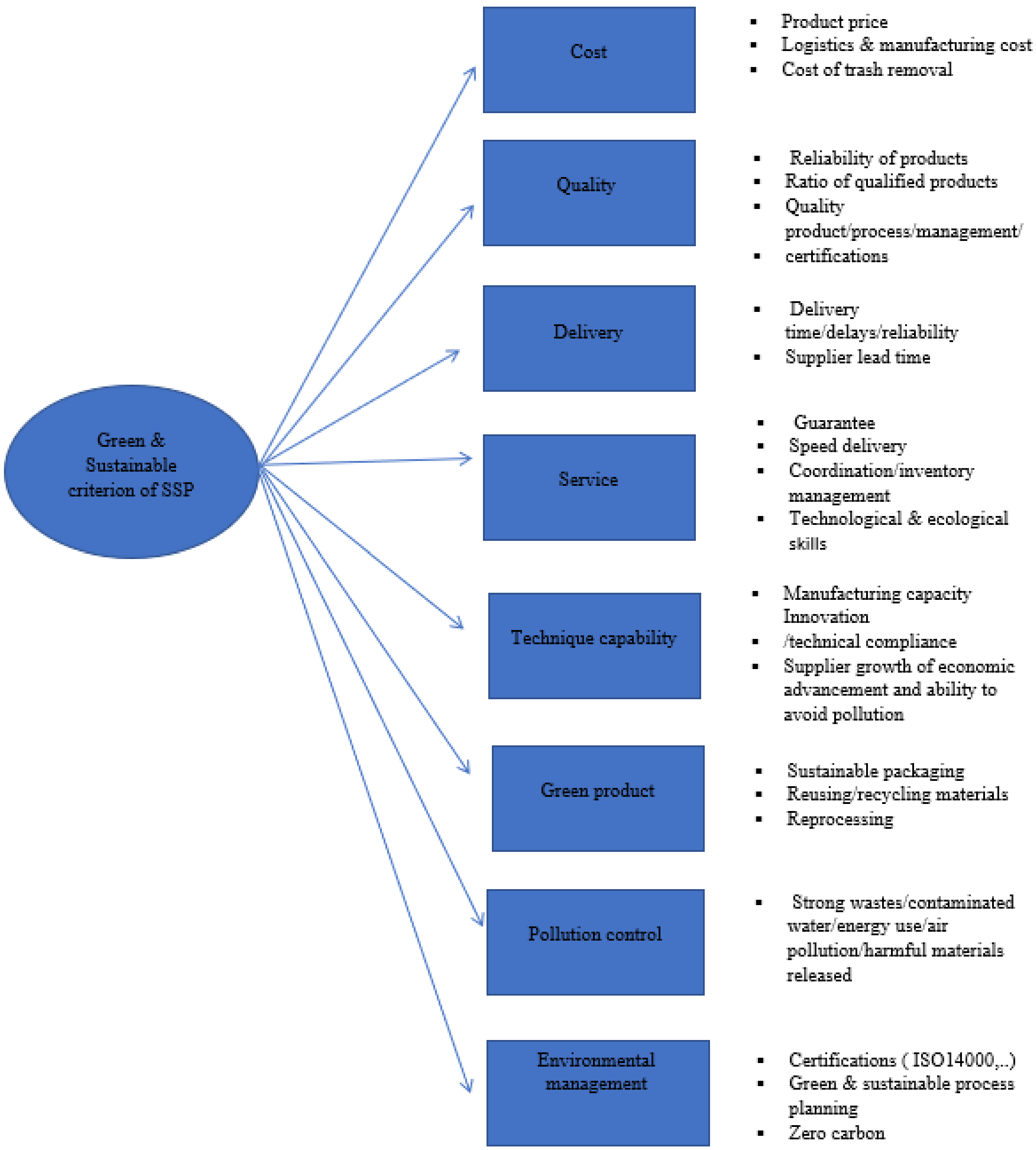

Figure 1. Green & sustainable criterion of SSP

Because of the emerging consideration of global sustainability and its long-term impact on business and marketing effectiveness, green supplier selection has become an attractive study issue.

2.3 Multi criteria methods for sustainable supplier selection problem

Multiple criterion decision making (MCDM) is the key to making selections when presented with various number of criteria, several of which are in contradiction. When faced with a decision issue, decision makers consider selected possibilities based on predetermined criteria. In order to get theappropriate ranking of options, a decision maker might proactively select attribute weights. The literature search on supplier selection methodologies is presented as follows in Table 2:

Table 2. Methods of SSP

Model types	Methods	Utilization
Linear weighting model	AHP (Analytic Hierarchy Process)	In this approach, the weight of each criterion is determined by the combination of binaries from each level of the hierarchical hierarchy relative to those from the higher levels.
	FST (Fuzzy Sets Theory)	The uncertainty and imprecision in the weight values assigned to criteria may be modelled using the flous ensemble theory.
Mathematical programming	integer linear/non-linear programming	The goal is to reduce the total amount of storage and order costs while also reducing shipping costs and non-quality costs.
	linear/non-linear programming	The goal is to reduce the total cost of acquiring, manufacturing, and creating partnerships with suppliers to the lowest possible level. The restrictions taken into account in the model relate to the demand from the DO and the production capacity of the suppliers.
	MOP(Multi-Objectives Programming)	Allows for the simultaneous pursuit of various (qualitative and/or quantitative) and sometimes conflicting goals while taking into account the prioritizations defined beforehand.
	DEA(DataEnvelopmentAnalysis)	It's a deterministic strategy that doesn't rely on parameters. A linear envelope that connects the criteria against which it is feasible to calculate the efficiency of suppliers may be created.
Total cost method	ABC (Activity Based Costing)	Suppliers are chosen by rating purchases made from them in three categories in decreasing order: 20% of suppliers (class A) represent 80% of purchases, 30% (class B) correspond to 15% of purchases, and 50% (class C) share the remaining 5% of purchases.
	TCO(Total Cost of Ownership)	It is the advanced cost-ratio approach, which necessitates the calculation of the whole cost of purchasing a product, which includes the purchase price as well as the underlying operating expenses such as quality control, inspection, and delivery.
Statistics method	Payoff MATRIX	In order to establish different possibilities of future supplier behavior, we must use the model we just developed. A likely score is assigned to each of the criteria in each scenario. When selecting a provider, look for the one that has a score that may be graded according to many circumstances.
	VPA(Vendor profile analysis)	According to the model, for each criterion, each supplier is assigned a probability distribution. One way to predict the behavior of suppliers is to use simulation.
	MNL(multi nominal Logit)	MNL is a regression model that depicts the likelihood that

		a given option will be selected from a set of all available alternatives. The alternative is defined by the emphasis given to the various criteria.
	UT(Utility theory)	Min (1994) proposed the use of this tool to evaluate suppliers in the case of international supply chain procurement.
	FA (factor analysis)	Analysis of the relationship between supplier selection criteria, their contribution to product performance improvement, customer satisfaction (competitiveness in price quality of product variety and delivery service) and the company's overall performance may be done using this tool.
	ISM(Interpretive Structural Modelling)	It is an analytical method that allows you to determine the relationships between criteria and their levels of relevance in order to categorize them into different sectors.
	CA (cluster analysis)	Statistically, it is possible to arrange suppliers by the scores they received for the criteria used in the analysis into a number of clusters (groupes).
Categorization method	Categorization method	They provide good management of the supplier network by categorizing suppliers according to their strategic positioning and product criticism.
Artificial intelligence	Artificial intelligence	Contrary to previous quantitative approaches, artificial intelligence tools aim to include qualitative factors and human skills into the supplier selection process.

3. A possibility degree approach for sustainable supplier selection problem

A decision matrix such as the one in (Bräysy, O.,2005) is used in Table 3 to describe the key components of the strategy given in the research.

Table 3. Decision matrix

	S_1	s_2	…	S_n
A_1	x_{11}	x_{12}	…	x_{1n}
A_2	x_{21}	x_{22}	…	x_{2n}
A_m	x_{m1}	x_{m2}	…	x_{mn}

An aggregation function may be used to integrate the performance values of the alternatives to create a score, and then the alternatives can be ranked according to this score.

To summarize, The weighted analytical method is a fundamental aggregation function, in which the decision maker gives a set of weights to be used in the aggregate W={w1,w2,…,wn}, then the score of an alternate Ai is determined as follows: ∑mj=1wj×xij with ∑mj=1wj=1. In this case, ci will be more crucial for the responsible of the decisions, then wi≥wj.

Consider the following scenario: we have just three criteria and the preference order are c2, c1, c3. After that, we will define w2≥w1≥w3 and w1+w2+w3=1. In fact, as the viewer will observe, there are an unlimited number of potential values for wi that may be used to verify both conditions, and every such combination of values will result in a different score for the alternative condition.

As a result, rather of providing a single score value to an alternative, the suggested technique generates a range of possible scores that the alternative may achieve. The important stages are listed below:

3.1 Decision Matrix Normalization

Normalization is required before using an aggregation function so that the decision matrix is invertible and that all its elements are similar. There are a variety of normalizing approaches, but the respective one is used below: In terms of the benefit criterion:

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} i = 1, \ldots, m, j = 1, \ldots, n(1)$$

For cost criteria:

$$\text{nij} = 1 - \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \qquad i = 1, \ldots, m, j = 1, \ldots, n \ (2)$$

3.2 Intervals Calculations

Consider that the DM presents his or her preferences in terms of an ordinal relationship among criteria given by the symbol c1≥pc2≥p…≥pcn.

The mark ≥p should be interpreted as "at the very recommended to." This indicates that the weights are arranged in the following order: w1≥w2≥w3…≥wm.El Raoui & al. (2021).

All of the possible scores that an alternate Ai may achieve are contained in the interval shown by the symbol Ii=[Li,Ui]. Li,Ui are the two simple linear programming problems that generated the lowest and highest scores, respectively.

$$L_i = MIN \sum_{j=1}^{m} wj \times x_{ij} \ (3)$$

$$U_i = MAX \sum_{j=1}^{m} wj \times x_{ij} (4)$$

For both issues, s.t.

$$w1 \geq w2 \geq w3 \geq \ldots \geq wm \ (5)$$

$$\sum_{j=1}^{m} \boldsymbol{wj} = \mathbf{1} \quad (6)$$

$$\boldsymbol{w_i} \in [\mathbf{0}, \mathbf{1}] \ (\mathbf{7})$$

3.3 Reference Interval and Interval's Comparison

At this phase, each possibility Ai is assigned with a specific interval =[Li,Ui].

Following that, an alternate reference and the interval that corresponds to$I^* = [L^*, U^*]$are recognized. An example of such an option isA^* which has the biggest lower limit ∀i,$L^* \geq Li$.As a result, there is no solution that consistently performs better than A^*.

Each option Ai is then evaluated in relation toA^*taking into account the probabilities of one option being stronger than another based on the appropriate intervals of that alternative.

Let $[X = x_{l,} x_r]$, Y=$[y_{l,} y_r]$ consider two non-negative interval integers having the samexl,xr,yl,yr∈R_0^+ . The probability of X obtaining more than Y to a certain degree, precisely P(X≥Y).

a. if X∩Y=∅

$$P(X \geq Y) = \begin{cases} 0 \ x_r \leq y_l \\ 1 x_l \geq y_r \end{cases} (8)$$

b.if X∩Y≠∅

$$P(X \geq Y) = \frac{\int_{y_t}^{x_r} f(p)\,dp}{\int_{y_t}^{x_r} f(p)\,dp + \int_{x_t}^{y_r} f(p)\,dp}$$

The specified disposition equation is obtained by f(z). Because f(z)=c, we may suppose that the person making the choice is unattached to the outcome. According to this formula for expressing the appropriate probability degree,the possibly is as follows:

$$P(X \geq Y) = \frac{x_r - y_t}{x_r - x_l + y_r - y_t} \quad (9)$$

3.4 Ranking of Alternatives

Now, for every alternative Ai the value $P\ (Ai \geq A^{*})$ is calculated. The possibilities are then ranked based on the probability degree values that were determined.

4. Application in a Moroccan Case

In order to demonstrate the many solutions that have been used to resolve the supplier selection issue, we offer a numerical example in this section.

For a Moroccan automotive component manufacturer, we will show how this strategy was used to identify green suppliers. It is necessary for the case firm to be responsible for the sales of goods and the ecological effects that it has on the environment in order to promote sustainable growth. In this example, the corporation recognizes that delivering greener component products not only better serves the requirements of customers, but also expresses the social value of the organization in general. Identifying reputable green suppliers is crucial for the company's supply chain management to improve. The corporate responsibility manager at the case firm is looking for a strategy to identify and choose suppliers who will support the case company's adoption of sustainable and environmentally friendly supplier selecting processes.

To simplify the analysis, we take into account in this application case only 6 selection criteria (C1: Cost, C2: Quality, C3:Delivery, C4:Service,C5:Green Product,C6: Environmental management)and 10 suppliers(S1, S2,S3,S4,S5,S6,S7,S8,S9,S10).

A typical Multi Criteria Decision Making Problem (MCDMP) is fully described using an initial decision matrix M. The rows of this matrix represent alternatives to be ranked. And columns represent criteria. Furthermore, the Decision Maker may assign a weight for each used criterion. The matrix M below gives the evaluation, based on historical data, of set of 10 suppliers for the Moroccan company. The final objective will be the ranking of these suppliers based on the six conflicting criteria.

Initial matrix M= mij (Table 4)

Table 4. Initial matrix

	C1 (Cost)	C2 (Quality)	C3 (Delivery)	C4 (Service)	C5 (Green Product)	C6 (Environmental Management)
Weights	0,85	0,57	0,72	0,6	0,7	0,9
S1	435	643	851	1059	1267	640
S2	456	876	1296	1716	2136	950
S3	547	654	761	868	975	1033
S4	546	765	984	1203	1422	4265
S5	567	654	741	828	915	320
S6	616,4	691,7	767	842,3	917,6	1233
S7	651,8	682,8	713,8	744,8	775,8	1486

S8	687,2	673,9	660,6	647,3	634	654
S9	722,6	665	607,4	549,8	492,2	828
S10	758	656,1	554,2	452,3	350,4	647,3

Step 1: Compute normalization coefficient
The first step is to compute the normalization coefficient given by the two equation (1) and (2) (Table 5). This step is needed to work with numbers drawn from the interval [0, 1].

Table 5.Normalization Coefficient

Nj	44430,77211	54192,84101	61178,50645	65329,9478	66245,85246	70672,3957

Step 2: Compute normalized matrix N=n_ij
Using the normalization coefficient, a new matrix called "Normalized matrix" is computed. Each element of this matrix is computed by dividing elements of the initial matrix M by the normalization coefficient (Table 6).

Table 6.Normalized matrix

0,009790512	0,011865036	0,986089886	0,983789976	0,980874274	0,99094413
0,010263157	0,016164497	0,97881609	0,973733333	0,967756472	0,986557694
0,012311287	0,012068015	0,987560991	0,986713597	0,985282097	0,98538326
0,01228878	0,014116256	0,98391592	0,98158578	0,978534505	0,939651119
0,012761426	0,012068015	0,987887903	0,987325874	0,986187815	0,995472065
0,013873268	0,012763679	0,987462917	0,987106985	0,986148567	0,982553301
0,014670013	0,01259945	0,988332504	0,988599409	0,988289078	0,978973403
0,015466758	0,012435222	0,98920209	0,990091834	0,99042959	0,990746033
0,016263503	0,012270994	0,990071677	0,991584258	0,992570101	0,988283969
0,017060248	0,012106765	0,990941263	0,993076682	0,994710612	0,990840837

Step 3: Compute Li & Ui
The normalized matrix is used as an input to the linear models described by the formulas (3)-(7) to compute lower and upper bounds of interval [Li, Ui] (Table 7).

Table 7.Compute Li & Ui

Li	Ui
0,00932725	0,99094413
0,0127071	0,98655769
0,00948681	0,98756099
0,01109696	0,98391592
0,00948681	0,99547207
0,01003368	0,98746292
0,00990458	0,98859941
0,00977548	0,99074603
0,00964637	0,9925701
0,00951727	0,99471061

Step 4: Reference Interval

In this step, a reference interval is determined. Such interval has the biggest lower bound (Table 8).

Table 8. Reference Interval

Test	0,0127071
1	0,50093412
1	0,5006791
1	0,50010896
1	0,49958587
1	0,50212954
1	0,50022415
1	0,50048232
1	0,5009985
1	0,50143119
1	0,50194358
Determined interval	0,98391592

Step 5: Compute Pi

The final ranking of suppliers is obtained by computing the possibility degree of each interval with regard to the reference interval using the equation (8) and (9) (Table 9).

Table 9.Compute Pi

Alpha	Value	Supplier	Final Ranking
1	0,500713051	S1	9
1	0,5	S2	10
1	0,501282861	S3	7
1	0,500885777	S4	8
1	0,501391404	S5	6
1	0,501526911	S6	5
1	0,501750143	S7	4
1	0,501973116	S8	3
1	0,502195831	S9	2
1	0,502418287	S10	1

6. Conclusion

Since the 1960s, the challenges surrounding green supplier selection have captivated the attention of academics, and the number of research papers in this field has expanded. Investigation was performed to find out what factors were utilized to choose a sustainable provider. Most supplier selection criteria are often in conflict with each other.

It's important to implement a good green supplier selection strategy in a dynamic competitive and regulatory environment since it helps mitigate environmental and legal concerns while also improving efficiency and productivity.This paper suggests a possibility degree approaches to choose & rank the criteria for determining green suppliers and to measure operational efficiency.

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