

# A knowledge-based System for Conveyor Equipment Selection Using the DEMATEL Method

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**Abstract:** Belt conveyors are in a straight line or with changes in height or direction and can be used to transport goods. Grain, Ore, Coal, and smooth slopes of aggregates such as sand or a tank belt conveyor for conveying in smooth curves is used. Conveyor system means production, shipping or packages, goods, materials, parts, and so on for transfer A method of moving equipment. Different types of conductors Systems include pneumatic, screw, belt, and roller. A conveyor belt is a material handler System, it takes time, energy, and cost savings efficient and effortless process Using products, materials, and components Designed to move. of conveyor belts, the design is equipped with two motors Consisting of pulleys, on which the conveyor material is looped. Conveyor belts are one or more fabrics materials or steel of different diameters Rubber or plastic combined with cables are prepared from the mixture. A conveyor the belt is made of polyvinyl chloride and polyester or such as styrene-butadiene rubber from fabric, polyester or nylon fabric can be made from multiple layers. In which test to conclude from analysis and Evaluation Laboratory (DEMATEL) of complex system components a cause-and-effect chain is considered correct One of the best to identify. It values relationships Interdependence between factors and identification through visual structural modeling Important to see. Alternative: Convenience, Maintainability, Safety, Risk, and Repeatability. Evaluation Preference: Convenience, Maintainability, Safety, Risk, Repeatability. The result it is seen that Safety is got the first rank where as is the Risk is having the lowest rank. The value of the dataset for Alkynes in Test and evaluate decision making the lab shows that it results in Safety and top ranking.

**Keywords:** Conveyor Equipment Evaluation, Maintainability, Convenience, Safety, repeatability.

## 1. INTRODUCTION

There are many factors in the selection of conveyor equipment inclusive, many of which are subjective. Meaning Analysis used for manipulation selection Approaches cost and use of equipment [1] Related to belt conveyor equipment Parameters are measured by sensors. to run as the parameters of the instruments fluctuate, a The parameters of method points are cumulative of devices Does not reflect operational status, therefore multi-time The parameters of the points are averaged. [2] A Sudden failure of at least one belt conveyor for long-term outages for the entire mining enterprise leads to So, all the conveyor Equipment is also evolving in time Its real to detect defects Controlled and evaluated at technical level to be done. The main belt that provides traction The conveyor unit is a gearbox. Unemployed time analysis, [3] Dust emissions from a conveyor belt and, Hence, the amount of dust emitted by its surface. Dust emission based on wind speed Analysis is done according to granulomere. PM10 and PM50 particles being analyzed [4] Manufactured in a metal cutting workshop with all kinds of metal swards to move, currently through a special screw conveyor The only type of handling equipment manufactured There are only New screw-type conveyor patented Received and all types of chips Easy to handle and highly print driven Can provide swards [5]. Most Dust control for conveyor transfers Settings are "active" and external power and equipment or suppressors are required. For example, many coal Handling plants control dust emissions Process water is used. [6] Industrial Conveyor-Belt Dryers Agricultural A lot of dryers for drying things A famous family. To distribute products, they are equipped with a conveyor-belt uniformly at the entrance to be dried. The dryer for air recirculation, through the fitted product Personal heating utility and fans, there are Streamlined heat exchangers Generally used to heat air. [7] Conveyor power estimation, Calculations of resistance and starting control are discussed. A component-based approach using the hybrid electro Modeling method of mechanical systems was introduced. of roller chain drive system Dynamic properties are studied. Unfortunately, for sending devices Dynamic modeling and simulation investigations are Not as intense as other products like automotive. [8] A considerable number of coal mines belt Drive conveyors and are full of Kasbahs Performance Indicators of the Coal Industry depending on their functional status. In the future, power consumption and belt conveyors as technological devices increase Expected, as well as rock mass Efficiency and length of transport, variable frequency Drivers are widely introduced. [9] Generally, all surplus electrical equipment is new and Can be reused for conveyors. However, whether the device is in good condition Ensure all cleaning, repair, and high Capacity

tests or insulation resistance tests to be done. being used again. The age of the equipment, which can now be tested acceptably, [10] rigidly and efficiently developed to Indentation rolling resistance of conveyor belts Simulate and solve. In this method, the solution is Fourier Expands into a collection of series, which To relate the Fourier coefficients The Maxwell model used is called viscoelastic properties of the belt cover material, [11] A class Path and frequency and magnitude of movement, In some factors like shape and amount of load Due to the differences in, another of the class A class distinct from a member A piece of equipment that performs a function indicates. This means conveyors and trucks are used for exchange, but under different conditions. [12] Conveyor selection decision for FMCs The process is complex and time-consuming It's qualitative and quantitative because it takes Includes criteria. Of FMC/FMS layout Because of its significant impact on outcomes Consideration of selection in the design phase is Important. [13] Most from the list of conveyor types A to identify suitable conveyor The prototype expert system was created, Based on applicable scores, they are Using a weighted rating system were calculated. Various MHEs and Conveyor A between the various aspects of the genre Aggregate material to find the effective fit, Movement, and method attributes were considered. [15]

## 2. MATERIALS AND METHODS

Management of Expressway Construction Project Factors that have a major impact on performance To identify, the project of construction of expressway Provides a basis for improving governance To develop and improve coding The algorithm was used by Demoted. [1] Strategies based on the importance of factors can be created; Causal, affected, and independent Factors. Important factors in this are identity Their relationships are observed using the DEMATEL method are analyzed using [2] The DEMATEL method is a system failure companion Analyzing the degree of interaction of systems Used to calculate Failures are frequent Active supplement to identify the site Identify settings and center size can be used. [3] In addition to improving DEMATEL, Existing research is traditional DEMATEL Subjective range given as in method By means of a between two factors Distinguish whether there is an influential relationship determines. This processing method is not suitable and the spread between and within the data Ignores the relationship. [4] DEMATEL is used to determine the criteria of effect and cause, and containing a triangular fuzzy numbers Model based on linguistic parameters to receive. The proposed method is triangulated Each using fuzzy numbers and the spread between and within the data Explains relationships between criteria and by estimating values for DEMATEL Analyzes the importance of criteria. [5] DEMATEL tool, type of relations and their Based on a critique of implications between criteria and priorities Expresses relationship. ISM their bias and Through driving force creates relationships, but Not so specify significance and does not consider the relationship between AHP criteria. [6] Combination of DEMATEL method and network To construct a Bayesian network architecture Lays a solid foundation. This is the method In the traditional way of Bayesian network construction Avoids the subjective biases that occur and various Reasoning of internal logical relationships of attributes and Improves scientific character. [7] Although there is a large literature using DEMATEL, this useful structural modeling tool is still underutilized. Used for health performance management. Basically, health performance measurement can be considered a complex system for the large number of indicators that influence each other. [8] The main advantages of the DEMATEL method are a system Structure and relationships among factors As one of the useful procedures for assessment considered. This method types of relationships and Based on the severity of their impacts Criteria can be prioritized. each other. [9] A fuzzy method initially requires Information on the relative distance of evaluation criteria. Each of these imports is considered by assigning weights to the criterion as well as expressed. of each criterion Weighting with the help of the Fuzzy DEMATEL method is calculated. [10] With the help of the DEMATEL method. Green in production Barriers to adopting lean practices was identified through a literature review. Often in past research studies Used green lean and There can be a long list of restrictions on restrictions. [11] It is proposed to use the DEMATEL About influence relationships between factors In Deliberative Approach and Medical Tourism Obtaining the importance of factors. Contribution Even if it does to the field of medical tourism, the validity of the methodology used is questionable. [12] A The primary advantage of this method is one reason and an implicit relationship involving the outcome model Addition. DEMATEL is an organization Structure and relationships between elements It is a useful method of research. [13] Assuming that the criterion If the weights are equal the results can be skewed. DEMATEL, fuzzy scaling to overcome these problems and fuzzy integration are used. To create correlations between criteria [14] by Causal relationships using the DEMATEL method Analyzing, each criteria sub Severity and effectiveness of codes Determined, and supplier evaluation Naturally imprecise data is encountered Therefore, Fuzzy Inference System by MATLAB was used. [15]

**2.1. Convenience:** The next innovation is finding the comparative convenience that The internet provides. of our convenience rating Basically, a similar sequence again can be collected. Many factors influence this sequence of Readers that we expect should be observed. On the one hand, bigger, more expensive, and The most engaging materials on the Internet are Very convenient to buy; On the other hand, touch and there may be products that require sensitivity cumbersome.

**2.2 Maintainability:** Although of the system in an easily understandable measure Be clear in determining the maintainability of the source code We see the application, to achieve the desired effect Difficulty using maintenance code. An important reason is the specific calculation of MI value, and what maintenance behavior is for that value What contributed to or improved this value Does not provide clues to action.

**2.3 Safety:** As information on the safety and efficacy of combination therapy in patients with chronic kidney disease is very limited, the NKF recommends avoiding the use of a fib rate with a statin, at least for the safety of this combination

in patients with reduced GFRs. Fen fib rate may need to be used cautiously with other drugs such as met form in, which may be contraindicated if creatinine levels are significant.

**2.4 Risk:** Emphasis on the development of probability theory Given, the beginning of quantitative risk analysis Discusses antecedents. About probability Contemporary risk analysis from mathematical concepts Difficult to separate, impossible. Probability, however quantitatively expressed is relatively Our review is the latest idea indicates.

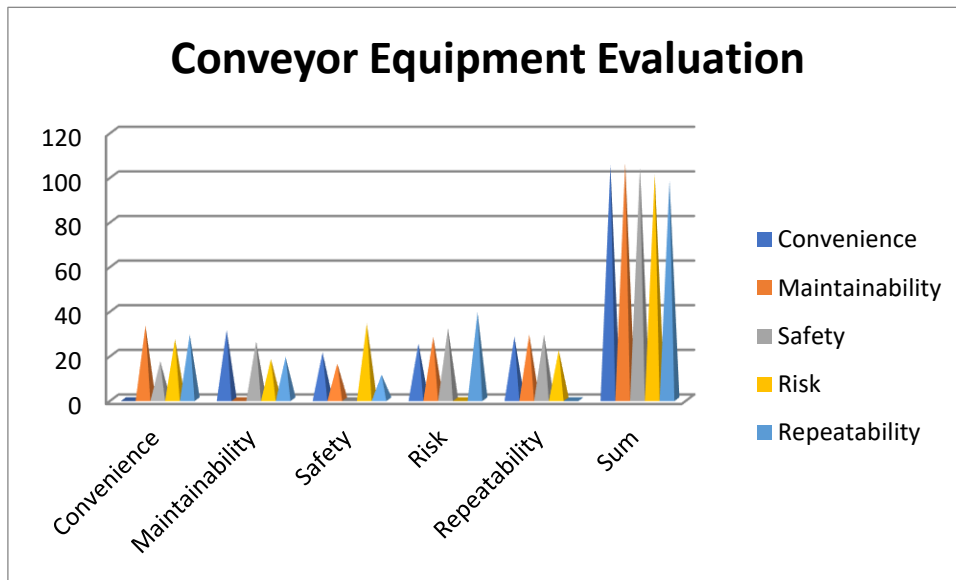
**2.5 Repeatability:** In short repeatability After defining the uncertainty Describe methods of scaling and Gaussian Iterate Gaussian data for non-Gaussian Data Assess feasibility. Two oft-neglected issues related to repeatability are (1) Confused when calculating repeatedly How to control factors and (2) Calculating extrapolated repeatability and how to explain it with heredity.

### 3. ANALYSIS AND DISSUASION

**TABLE 1.** Conveyor Equipment Evaluation

	Convenience	Maintainability	Safety	Risk	Repeatability	Sum
Convenience	0	31	21	25	28	105
Maintainability	33	0	16	28	29	106
Safety	17	26	0	32	29	104
Risk	27	18	34	0	22	101
Repeatability	29	19	11	39	0	98

TABLE 1. Conveyor Equipment Evaluation shows the Convenience it is seen that Maintainability the highest value for Safety is showing the lowest value. Maintainability it is seen that Convenience is showing the highest value for Risk is showing the lowest value. Safety it is seen that Risk is showing the highest value for Repeatability is showing the lowest value. Risk it is seen that the Repeatability is showing the highest value for Convenience is showing the lowest value. Repeatability it is seen that the Maintainability & Safety is showing the highest value for Risk is showing the lowest value. Table 1 shows that DEMATEL Decision making trail and evaluation laboratory in Alternative: Convenience, Maintainability, Safety, Risk, and Repeatability. Evaluation Preference: Convenience, Maintainability, Safety, Risk, Repeatability.



**FIGURE 1.** Conveyor Equipment Evaluation

Figure 1 shows the Alternative: Convenience, Maintainability, Safety, Risk, and Repeatability. Evaluation Preference: Convenience, Maintainability, Safety, Risk, Repeatability.

**TABLE 2.** Normalisation of direct relation matrix

Normalisation of direct relation matrix					
	Convenience	Maintainability	Safety	Risk	Repeatability
Convenience	0	2.818181818	1.90909091	2.272727273	2.545454545
Maintainability	3	0	1.45454545	2.545454545	2.636363636
Safety	1.545454545	2.363636364	0	2.909090909	2.636363636
Risk	2.454545455	1.636363636	3.09090909	0	2
Repeatability	2.636363636	1.727272727	1	3.545454545	0

Table 2 shows that the Normalizing of direct relation matrix in Convenience, Maintainability, Safety, Risk, and Repeatability. The diagonal value of all the data set is zero.

**TABLE 3.** Calculate the total relation matrix

Calculate the total relation matrix					
	Convenience	Maintainability	Safety	Risk	Repeatability
Convenience	0	2.818181818	1.909090909	2.272727273	2.54545455
Maintainability	3	0	1.454545455	2.545454545	2.63636364
Safety	1.545454545	2.363636364	0	2.909090909	2.63636364
Risk	2.454545455	1.636363636	3.090909091	0	2
Repeatability	2.636363636	1.727272727	1	3.545454545	0

Table 3 Shows the Calculate the total relation matrix in Convenience, Maintainability, Safety, Risk, and Repeatability.

**TABLE 4. I**

I				
1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

Table 4 Shows the  $T = Y(I - Y)^{-1}$ , I= Identity matrix in Convenience, Maintainability, Safety, Risk, and Repeatability. Is the common Value.

**TABLE 5. Y**

Y				
0	2.818182	1.909091	2.272727	2.545455
3	0	1.454545	2.545455	2.636364
1.545455	2.363636	0	2.909091	2.636364
2.454545	1.636364	3.090909	0	2
2.636364	1.727273	1	3.545455	0

Table 5 Shows the Y Value in Convenience, Maintainability, Safety, Risk, and Repeatability. Is the Calculate the total relation matrix Value and Y Value is the same value.

**TABLE 6. I-Y**

I-Y				
1	-2.81818	-1.90909	-2.27273	-2.54545
-3	1	-1.45455	-2.54545	-2.63636
-1.54545	-2.36364	1	-2.90909	-2.63636
-2.45455	-1.63636	-3.09091	1	-2
-2.63636	-1.72727	-1	-3.54545	1

Table 6 Shows the I-Y Value Convenience, Maintainability, Safety, Risk, and Repeatability. table 4  $T = Y(I - Y)^{-1}$ , I= Identity matrix and table 5 Y Value Subtraction Value.

**TABLE 7. (I-Y)-1**

(I-Y)-1				
0.221748	-0.01613	-0.11755	-0.14329	-0.07454
-0.01851	0.243724	-0.15489	-0.12987	-0.07265
-0.17455	-0.08098	0.272354	-0.06617	-0.07211
-0.11996	-0.11557	0.050948	0.181457	-0.1128
-0.04723	-0.11225	-0.12445	-0.0249	0.205955

Table 7 shows the (I-Y)-1 Value Convenience, Maintainability, Safety, Risk, and Repeatability. Table 6 shown the Inverse Value.

**TABLE 8. Total Relation matrix (T)**

Total Relation matrix (T)				
-0.77825161	-0.01613	-0.11755	-0.14329	-0.07454
-0.018510932	-0.75628	-0.15489	-0.12987	-0.07265
-0.17454544	-0.08098	-0.72765	-0.06617	-0.07211

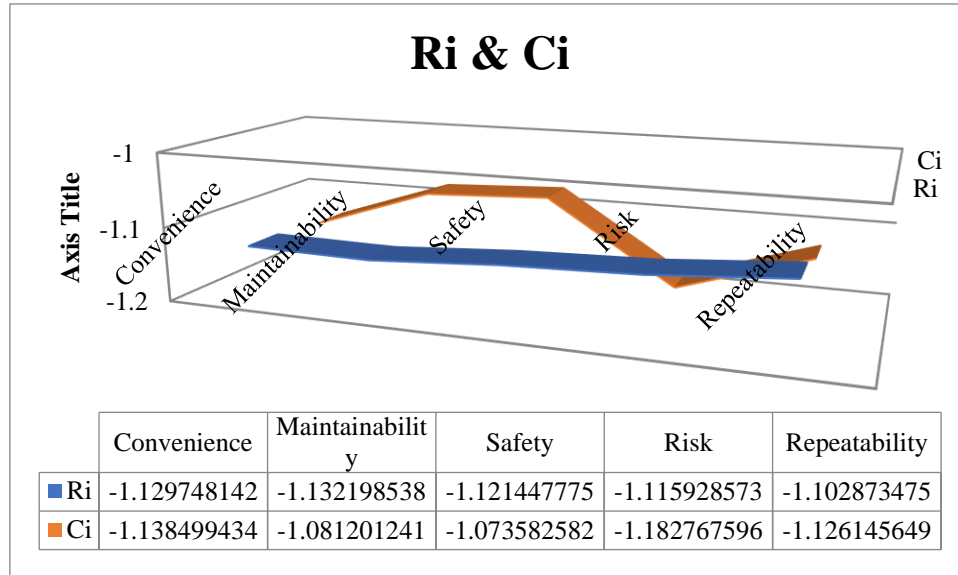
-0.119962035	-0.11557	0.050948	-0.81854	-0.1128
-0.047229418	-0.11225	-0.12445	-0.0249	-0.79405

Table 8 shows that the total relation matrix the direct relation matrix is multiplied with the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

**TABLE 9. Ri & Ci**

	Ri	Ci
Convenience	-1.12975	-1.1385
Maintainability	-1.1322	-1.0812
Safety	-1.12145	-1.07358
Risk	-1.11593	-1.18277
Repeatability	-1.10287	-1.12615

Table 9 shows the Ri, Ci Value in Convenience, Maintainability, Safety, Risk, and Repeatability.



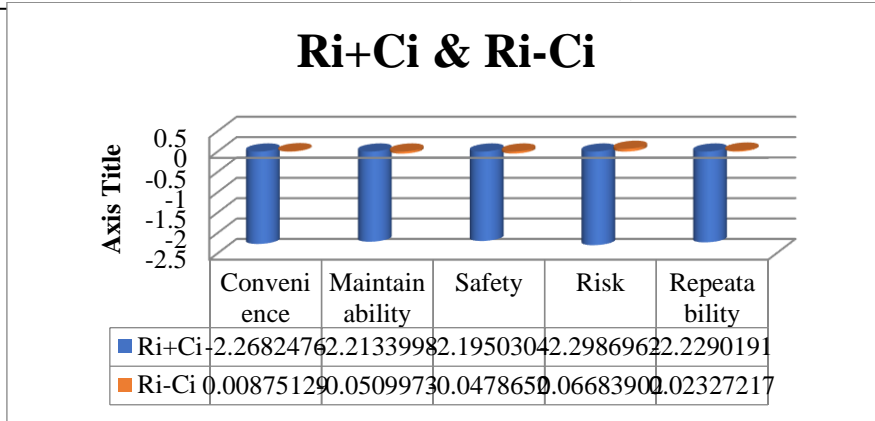
**FIGURE 2. Ri & Ci**

Figure 2 shows the Ri, Ci Value in Convenience, Maintainability, Safety, Risk, and Repeatability.

**TABLE 10. Ri+Ci & Ri-Ci**

	Ri+Ci	Ri-Ci
Convenience	-2.26825	0.008751
Maintainability	-2.2134	-0.051
Safety	-2.19503	-0.04787
Risk	-2.2987	0.066839
Repeatability	-2.22902	0.023272

Table 10 shows the Calculation of Ri+Ci and Ri-Ci to get the value RI+Ci highest value Risk, Lowest value Safety. Ri-Ci highest value Risk, Lowest value Convenience.



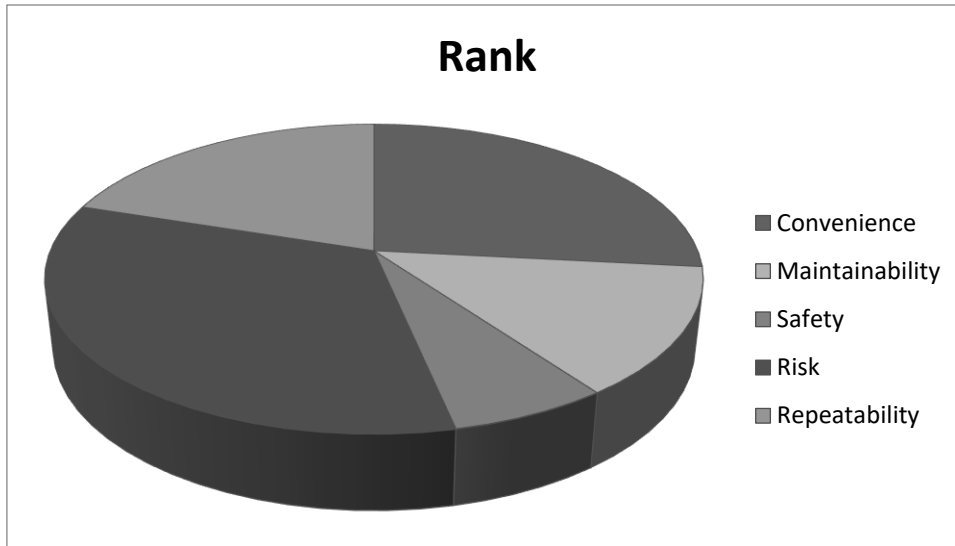
**FIGURE 3.** RI+Ci & Ri-Ci

Figure 3 shows the Calculation of Ri+Ci and Ri-Ci to get the value RI+Ci highest value Risk, Lowest value Safety. Ri-Ci highest value Risk, Lowest value Convenience.

**TABLE 11.** Rank & Identity

	Rank	Identity
Convenience	4	cause
Maintainability	2	cause
Safety	1	effect
Risk	5	effect
Repeatability	3	effect

Table 11 shows the final result of this paper the Convenience is in 4<sup>th</sup> rank cause, Maintainability is in 2<sup>nd</sup> rank because Safety is in 1<sup>st</sup> rank effect, Risk is in 5<sup>th</sup> rank effect and Repeatability is in 3<sup>rd</sup> rank effect. The final result is done by using the DEMATEL method.



**FIGURE 4.** Rank

Figure 4 shows the final result of this paper the Convenience is in 4<sup>th</sup> rank cause, Maintainability is in 2<sup>nd</sup> rank cause, Safety is in 1<sup>st</sup> rank effect, Risk is in 5<sup>th</sup> rank effect and Repeatability is in 3<sup>rd</sup> rank effect. The final result is done by using the DEMATEL method.

**TABLE 12.** T matrix

T matrix				
-0.77825	-0.01613	-0.11755	-0.14329	-0.07454

-0.01851	-0.75628	-0.15489	-0.12987	-0.07265
-0.17455	-0.08098	-0.72765	-0.06617	-0.07211
-0.11996	-0.11557	0.050948	-0.81854	-0.1128
-0.04723	-0.11225	-0.12445	-0.0249	-0.79405

Table 12 shows the T Matrix Value calculate the average of the matrix and its threshold value ( $\alpha$ ) = Alpha - 0.22408786014985 If the T matrix value is greater than threshold value then bolds it.

#### 4. CONCLUSION

The result it is seen that Safety is got the first rank where as is the Risk is having the lowest rank. Conveyor power estimation, Calculations of resistance and starting control are discussed. A component-based approach using the hybrid electro modeling method of mechanical systems was introduced. Of roller chain drive system Dynamic properties are studied. Unfortunately, for sending devices Dynamic modeling and simulation investigations are not as intense as other products like automotive. A considerable number of coal mines belt Drive conveyors and are full of Kusbas Performance Indicators of the Coal Industry depending on their functional status. In the future, power consumption and belt conveyors as technological devices increase Expected, as well as rock mass Efficiency and length of transport, variable frequency Drivers are widely introduced. The DEMATEL method is a system failure companion Analyzing the degree of interaction of systems Used to calculate Failures are frequent Active supplement to identify the site Identify settings and center size can be used. In addition to improving DEMATEL, Existing research is traditional DEMATEL Subjective range given as in method by means of a between two factors Distinguish whether there is an influential relationship determines. This processing method is not suitable and the spread between and within the data Ignores the relationship. DEMATEL is used to determine the criteria of effect and cause, and containing a triangular fuzzy numbers Model based on linguistic parameters to receive. The proposed method is triangulated Each using fuzzy numbers and the spread between and within the data Explains relationships between criteria and by estimating values for DEMATEL Analyzes the importance of criteria.

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