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Key Success Factors of Sustainable Organization for Traditional Manufacturing Industries: A Case Study in Taiwan

Shih-Hsien Tseng [1,*], Hsiu-Chuan Chen [1] and Tien Son Nguyen [2]

1 Department of Industrial Management, National Taiwan University of Science and Technology, 43 Sec. 4 Keelung Road, Daan District, Taipei 106, Taiwan
2 Institute of Industrial Management, National Central University, 300 Zhongda Road, Zhongli District, Taoyuan City 32001, Taiwan
* Correspondence: shtseng@mail.ntust.edu.tw

Abstract: Even sustainable organizations have received overwhelming attention, but there is a lack of studies to explore the key success factors for sustainable traditional manufacturing based on expert opinions. The purpose of this study was to explore the key success factors for sustainable development in traditional industries through expert knowledge. In this study, the Delphi method was applied to construct the research framework with the most appropriate criteria. Moreover, we proposed an effective solution based on the Decision-Making Trial and Evaluation Laboratory (DEMATEL)-based Analytic Network Process (ANP) to determine the correlation and causality of these factors based on the decision laboratory method for multi-criteria decision-making. We also integrated the importance–performance analysis to illustrate the attributes improvement priorities. Our results show that managers and policy-makers should concentrate more on knowledge management to enhance the sustainability of organizations. Moreover, managers should keep teamwork and employee engagement at a high level to achieve the goal of organizations. Additionally, the theoretical and practical implications provide five priority indicators for the success of a sustainable organization.

Keywords: knowledge management; decision making; traditional manufacturing; organizational science

MSC: 90B50; 90B90

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1. Introduction

Sustainable organization is an emerging research topic recently that has been considered a fundamental aspect of many organizations nowadays [1]. To achieve sustainability, organizations should effectively integrate economic, social, and environmental from internal to external in the long run [2]. While team members are often stated as an organization's greatest asset, we focus more on the human factors rather than the larger aspect of the sustainability organization in this study. Although traditional manufacturing industries represent an essential aspect of many countries' spirits, there is a lack of recent practical research that explore the critical factors for the sustainability and success of traditional manufacturing firms, especially in the post-COVID-19 era. As the COVID-19 pandemic is gradually brought under control, demand for supplies will likely rebound in 2022. For example, a high-technology enterprise as TSMC's output accounts for more than 4% of Taiwan's GDP in 2018 and is recognized as the "protector of the nation" and its economy; however, it employs only 43,000 people [3]. In contrast, traditional industries have brought many job opportunities, social stability, and local economic prosperity to the economy, but these industries are facing a shortage of workers. Specifically, the traditional manufacturing industries are facing an aging workforce as employees who consider retirement while a decline in young people is coming forward to take their places. In a recent report from the General Accounting Office [4] in Taiwan, young people are no longer interested in pursuing careers in traditional industries and are primarily engaged in service industries and high-tech enterprises.

Over the past decade, knowledge sharing has been regarded as the most important asset of an organization, which is also reinforced by the knowledge-based view of the company, where the company will protect these intangible resources as high-value intellectual capital [5]. Prior studies have also confirmed that knowledge management plays a key role in the performance of SMEs and overall economic growth [6]. In addition, the combination of intelligent systems and sustainable management can help organizations mitigate the negative effects of the pandemic [7]. Based on the recent changing environment, we aimed to address key factors to increase the sustainability of traditional manufacturing organizations. In this study, we investigated practical methods based on expert opinions with a combination of practical management and floor supervisors' experience. Thus, the objectives of this study were as follows: (1) investigate and identify the framework with critical factors for the sustainability of traditional manufacturing industries based on expert's opinions; (2) construct the importance and the correlation of criteria; and (3) analyze the importance and performance relationship among the criteria for sustainability development. This paper is organized as follows: Section 2 represents the related studies while the methodology and experiment design are constructed in Section 3. In addition, we showed the results and analysis of critical factors in Section 4. The discussion and conclusions of this study are represented in Sections 5 and 6, respectively.

2. Literature Review

In the era of sustainable development, managing and attracting talent play a vital role in the success of the organization [8]. Managers should be able to recognize, promote, and reward their employees properly to boost their performance and satisfaction. Boudreaux [9] argued that new ventures could reduce their failure rates with an effective compensation and benefits strategy. In addition, researchers and practitioners have pointed out that an organization can motivate its workers through various forms of incentive systems to improve and contribute to the organization's performance. Moreover, incentive systems can be used as a strategy to retain employees [10] or as a recruitment tool [11]. Additionally, organization systems should review and evaluate their employees' performance and productivity fairly and accurately [12,13]. In order to foster and improve employees' skills, the training program was applied as an essential role at any level in many organizations. Therefore, employees will be able to contribute better to the organization's development and perform their jobs more efficiently [14]. Organizational culture encompasses the assumptions, values, and behavioral norms commonly agreed upon by its members [15]. Moreover, it is a system of meaning shared by the members that distinguish the organization from others [16]. As stated by Lee and Chung [17], cultural values are at the core of an organization, which creates the work ethic of employees. Organizational leaders can attempt to improve the performance of their members and achieve the goals set out in the organizational plan for sustainable development of the organization through the enterprise's culture [18]. Moreover, managers can encourage their team members to innovate and take risks [19,20]. In order to achieve a high level of sustainability, an effective distribution must be implemented between the values declared by the organization and the values that guide employees' behavior and attitude, which helps the organization to have a positive impact on the social environment [21].

Since the mid-1980s, knowledge management has emerged as a fundamental factor of all enterprises' success [22,23]. With appropriate knowledge management systems, organizations can improve their ability to acquire and retain expert knowledge [24]. At present, knowledge assets seem more important to enhance the effectiveness, outcomes, or inheritance skills of employees [20]. Specifically, technical knowledge inheritance has long been considered the key success of many technology organizations [25]. In addition, knowledge sharing and mentoring can help new employees adapt to their job quickly. Moreover, managers should create an effective training and learning process for all members to contribute their knowledge, ideas, and thoughts [26]. The effectiveness of these activities is intertwined with the organization's success. A psychological contract is a mutual obligation that is constructed between a person's belief and another party or employee and the employer [27]. Therefore, managers usually use the psychological contract as a tool to help them understand, manage, and improve employee relations [28]. The satisfaction or dissatisfaction with this social contract can directly affect workplace outcomes [29]. Commitment and engagement can motivate an individual to promote and achieve the goals of the organization [30]. Similar to previous studies, Brown et al. [31] argued that employee trust is an important factor in employment relationships and workplace performance.

Multi-criteria decision-making has been studied for many decades to solve very complex problems in different application areas [32]. The Delphi method is usually applied as a forecasting technique for obtaining consistent and reliable opinions from a panel of experts [33,34]. As decisions are made, internal dependencies among the evaluation criteria often influence the judgment of the decision-makers. As decisions are made, internal dependencies among the evaluation criteria often influence the judgment of the decision-makers. The Decision-Making Trial and Evaluation Laboratory (DEMATEL) algorithm was proposed to explore the degree of mutual influence among criteria and obtain the causal relationship among all the criteria through a matrix and mathematical calculation [35,36]. Hybrid methods for multi-criteria decision-making have been used effectively to explore sustainability in industries and organizations [37]. Many variants and combinations of the DEMATEL method have been developed to solve complex problems, such as DEMATEL-based ANP (DANP) [38–41], hierarchical DEMATEL [42], and fuzzy DEMATEL [43]. In this study, the DANP multi-criteria approach was adopted mainly to explore the effects of critical factors, making it easy to determine the feedback relationship and dependence between the components and the criteria. The Analytic Network Process (ANP) is a modified version of the Analysis Hierarchy Process (AHP) that includes feedback that is incorporated into a non-linear, network-based framework for solving decision-making problems using several criteria [38]. The DEMATEL-based ANP is a hybrid multi-criteria decision-making approach that combines the DEMATEL and ANP methods [44,45].

3. Methodology and Experimental Design

In this study, interviews and the Delphi Method, DEMATEL, and ANP were used to reach a consensus among the community of experts. We also provided multiple anonymous questionnaires and conducted brainstorming sessions. The scale of this questionnaire was 0–100; 0 as absolutely unnecessary, 50 as somewhat necessary, and 100 as absolutely necessary. Responses were tallied in order to assess the experts' opinions. Experts with practical management experience and experienced floor worker supervisors were selected to help explore the key factors of technical knowledge transmission in traditional industries. Eight experts with many experiences in the range from 12 to 42 years in their field as chairman, general manager, plant manager, senior engineer, or vice president were interviewed in this study.

Firstly, we conducted the Delphi technique to aggregate opinions from experts for selecting appropriate criteria. After three rounds of questionnaires, a formal research framework was established based on 5 components and 20 criteria with an agreement of experts on the factors and criteria. Then, the DEMATEL was conducted to prioritize the selection criteria and evaluate the weight of the criteria by ANP. Unlike DEMATEL with AHP, we combined DEMATEL with ANP for better priority and more accurate calculations in multi-criteria decision-making. ANP is usually applied to explore multi-criteria decision-making problems that cannot be expressed in a hierarchical structure to decrease the limitations of AHP, such as project selection, strategic decision-making, product planning, etc.

3.1. Determination of Causality and the Critical Factors between Criteria

We compiled the structure and criterion framework based on previous studies, then invited experts to rate the influence of the questionnaire on the structure and criterion framework as 0–2, with 0 indicating "no influence at all", 1 designating "somewhat influential", and 2 indicating "definitely influential". The next step was to add and average the responses to establish an average initial matrix. Following this, we removed all units of factors through normalization. We then obtained the total influence matrix by repeated convergence, from which the degree of direct or indirect influence of each component and criterion was calculated. We then set the threshold values for expert decision-making, removed the components and criteria with lesser influence, and finally produced a concise influence relationship diagram showing the steps of the DANP method as follows:

Step (1): Establish the direct relationship to the matrix (A): after calculating the degree of influence among the criteria via the questionnaire survey, we were able to establish the direct influence of matrix A, where a_{ij} represents the degree of influence of criterion i on criterion j, and sets its corresponding diagonal effect to 0.

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

Step (2): Formulate the normalized direct relationship to matrix (X): by normalizing the direct relationship to a matrix A obtained in Step (1) using Equations (2) and (3), we attained the normalized direct relationship matrix X.

$$S = \min\left[\frac{1}{\max\limits_{1\le i\le n}\sum_{j=1}^{n}|a_{ij}|}, \frac{1}{\max\limits_{1\le j\le n}\sum_{i=1}^{n}|a_{ij}|}\right] \text{ where } i,\ j \in \{1,\ 2, 3,\ \ldots,\ n\} \tag{2}$$

$$X = S \times \mathrm{A} \tag{3}$$

Step (3): Establish the total influence of matrix (T): by using the normalized direct relationship matrix (X), we calculated the total relationship matrix T via Equation (4).

$$T = X + X^2 + \ldots\ldots + X^k = \sum_{i=1}^{\infty} X^i = X(I - X)^{-1} \tag{4}$$

where I is an $n \times n$ identity matrix. By adding the values of each column and row in matrix T, shown in Equations (5) and (6), we found the r and d values, which represent the degrees of direct and indirect influence, with the r-value representing the degree of direct or indirect influence of the structure on the other factors, and the d value representing the degree of direct or indirect influence of the factor by other elements.

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

$$d = (d_i)_{n\times 1} = \left[\sum_{i=1}^{n} t_{ij}\right]_{1\times n} \tag{6}$$

Step (4): Establish the threshold values and plot the DEMATEL causal diagram: according to Equation (7), we set the threshold α (expert decision) to the total influence matrix T derived in Step 3, which filters out values in the T matrix that are less than α and retains the ones that are higher. Eliminating the factors that are too small results in a more compact causal map [46], as shown in Equation (7) below, where the values of α that are lower than the default are replaced by 0.

$$T = \begin{array}{c} \\ C1 \\ C2 \\ C3 \end{array} \begin{array}{c} \begin{array}{ccc} C1 & C2 & C3 \end{array} \\ \begin{bmatrix} t_{11} & t_{12} & t_{13} \\ t_{21} & t_{22} & t_{23} \\ t_{31} & t_{32} & t_{33} \end{bmatrix} \end{array} \Rightarrow T = \begin{array}{c} \\ C1 \\ C2 \\ C3 \end{array} \begin{array}{c} \begin{array}{ccc} C1 & C2 & C3 \end{array} \\ \begin{bmatrix} 0 & t_{12} & t_{13} \\ 0 & t_{22} & t_{23} \\ t_{31} & 0 & 0 \end{bmatrix} \end{array} \tag{7}$$

Step (5): Create an unweighted super matrix (W): we normalized and converted the DEMATEL checked total influence relation matrix T into an unweighted super matrix using the equation as follows:

$$W = \begin{array}{cc} & \begin{array}{cccc} C_1 & C_2 & & C_n \\ e_{11}...e_{1_{m1}} & e_{21}...e_{2_{m2}} & \cdots\cdots & e_{n1}...e_{nm_n} \end{array} \\ \begin{array}{c} C1 \begin{array}{c} e_{11} \\ e_{12} \\ \vdots \\ e1_{m1} \end{array} \\ C2 \begin{array}{c} e_{21} \\ e_{22} \\ \vdots \\ e2_{m2} \end{array} \\ \vdots \quad \vdots \\ Cn \begin{array}{c} e_{n1} \\ e_{n2} \\ \vdots \\ e_{nm_n} \end{array} \end{array} & \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1n} \\ W_{12} & W_{22} & \cdots & W_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ W_{n1} & W_{n2} & \cdots & W_{nn} \end{bmatrix} \end{array} \tag{8}$$

Step (6): Establish the weighted super matrix (Ww): we utilized Equations (9)–(11), shown below, to calculate the weighted super matrix.

$$T_a = \begin{bmatrix} t_{11}^{\alpha} & \cdots & t_{1j}^{\alpha} & \cdots & t_{1n}^{\alpha} \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{\alpha} & \cdots & t_{ij}^{\alpha} & \cdots & t_{in}^{\alpha} \\ \vdots & & \vdots & & \vdots \\ t_{n1}^{\alpha} & \cdots & t_{nj}^{\alpha} & \cdots & t_{nn}^{\alpha} \end{bmatrix} \rightarrow d_1 = \sum_{j=1}^{n} t_{1_j}^{\alpha} \tag{9}$$

$$T_s = \begin{bmatrix} t_{11}^{\alpha}/d_1 & \cdots & t_{1j}^{\alpha}/d_1 & \cdots & t_{1n}^{\alpha}/d_1 \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{\alpha}/d_i & \cdots & t_{ij}^{\alpha}/d_i & \cdots & t_{in}^{\alpha}/d_i \\ \vdots & & \vdots & & \vdots \\ t_{n1}^{\alpha}/d_n & \cdots & t_{nj}^{\alpha}/d_n & \cdots & t_{nn}^{\alpha}/d_n \end{bmatrix} = \begin{bmatrix} t_{11}^{s} & \cdots & t_{1j}^{s} & \cdots & t_{1n}^{s} \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{s} & \cdots & t_{ij}^{s} & \cdots & t_{in}^{s} \\ \vdots & & \vdots & & \vdots \\ t_{n1}^{s} & \cdots & t_{nj}^{s} & \cdots & t_{nn}^{s} \end{bmatrix} \tag{10}$$

$$W_w = \begin{bmatrix} t^s_{11} \times W_{11} & t^s_{21} \times W_{12} & \cdots & \cdots & t^s_{n1} \times W_{1n} \\ t^s_{12} \times W_{21} & t^s_{22} \times W_{22} & \vdots & & \vdots \\ \vdots & \cdots & t^s_{ji} \times W_{ij} & \cdots & t^s_{ni} \times W_{in} \\ \vdots & & \vdots & & \vdots \\ t^s_{1n} \times W_{n1} & t^s_{2n} \times W_{n2} & \cdots & \cdots & t^s_{nn} \times W_{nn} \end{bmatrix} \tag{11}$$

Step (7): Establish a limited super matrix: we converted the weighted super matrix into a limited one by multiple convergences, as seen in Equation (12). We then ranked the components and criteria based on importance, which encompassed all the results from the DEMATEL and the ANP method.

$$\lim_{it \to \infty} W^t \tag{12}$$

Step (8): By following the above DANP steps, we compiled a simple diagram, as shown in Figure 1.

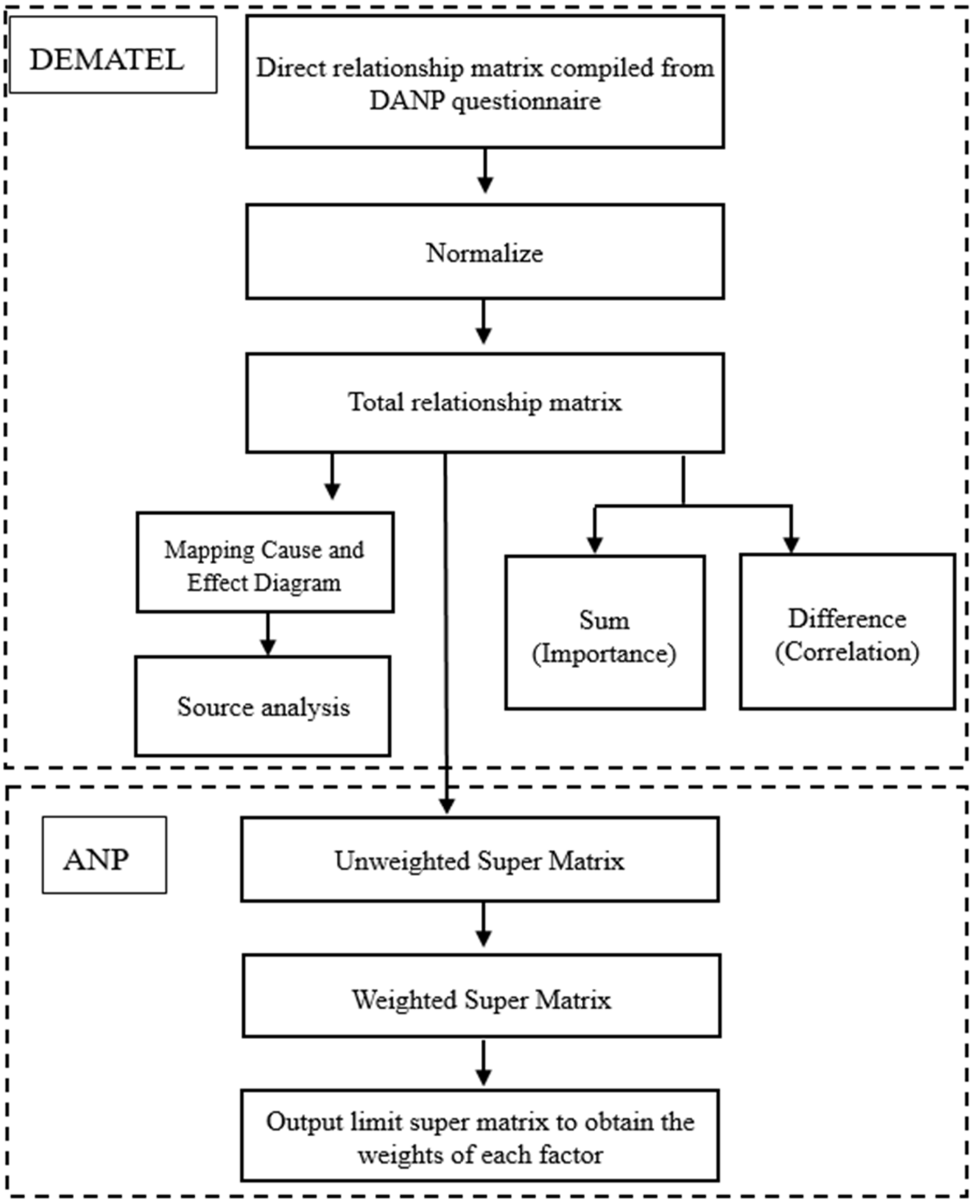

Figure 1. DANP operational steps.

The importance–performance analysis (IPA) [47] was used to calculate the average value of experts' ratings to obtain the performance level of the key criteria. Specifically, it has been commonly used to assess the difference between customers' perceived importance of products and their actual performance by rating them on a scale from 0 to 100.

3.2. Formal Research Framework

Based on previous studies and augmented by expert interviews, we established 5 components and 20 criteria in our research framework. Eight experts were invited to evaluate and calculate the weight they assigned to each criterion. Table 1 shows the evaluation criteria and previous studies.

Table 1. Formal research framework components and criteria.

Component/Criteria		Studies
Organizational System	Promotion System (A1)	[8,48,49]
	Compensation and Benefits (A2)	[9,50,51]
	Incentive system (A3)	[10,11,52]
	Performance Appraisal (A4)	[12,13]
	Education Training (A5)	[14,18]
Organizational Culture	Innovation and risk-taking (B1)	[15,18–20]
	Precision requirements (B2)	[15,18]
	Results-oriented (B3)	[18,53]
	Motivation (B4)	[18,26,54]
Mentoring/Knowledge Management	Technical knowledge Imitation and learning (C1)	[20,26,55,56]
	Technical knowledge sharing (C2)	[26,56–58]
	Technical knowledge inheritance (C3)	[25,56,59]
	Work ethic inheritance (C4)	[56,60,61]
Psychological Contract	Job satisfaction (D1)	[10,29,62,63]
	Employee engagement (D2)	[30,64–66]
	Organizational commitment (D3)	[17,18,30,63,65]
	Self-growth (D4)	[18,67,68]
Employment Relationship	Trust relationship (E1)	[28,31,69,70]
	Teamwork (E2)	[70–73]
	Work environment (E3)	[74–76]

In this study, the Delphi Method questionnaire was employed according to the structure and criteria of the formal research framework. We then carefully compiled and analyzed the ideas and opinions of the experts as well as conducted several discussions with them (A~H). This resulted in a consensus in the third questionnaire, which generally reached the target CDI value < 0.05 (after rounding). In addition, although the CDI value for education training (0.064) was >0.05, it was approved as it is a necessary element with a CDI value of <0.1, which is close to the standard. In addition, the mean scores of all criteria were higher than 70, which proved that the necessity of the various components and the criteria of this study framework were all agreed upon by the eight experts. The results of the third Delphi questionnaire are shown in Table A1.

4. Results and Analysis

In this section, the result of factors essential for the success of traditional manufacturing industries is presented through the analysis of expert knowledge. In order to achieve this goal, eight senior executives in this industry were invited to fill out a questionnaire on their degree of interaction. The total relationship matrix (T) is shown in Table A2. In this study, the numbers in each column of the total influence matrix (T) were added to obtain the column total (d), and each row was added to obtain the row total (r), using the "$d + r$" and "$d - r$" equation to reflect the prominence and the influence level of each attribute, respectively. The row sum represents the "importance", while the row difference represents the "correlation", as shown in Table 2. The larger number of the factor was, the more important it represented, and vice versa. If the correlation is a positive value, the factor belongs to the category of "cause" because it served as the "cause" of effect on other factors. The larger the value was, the more likely this factor would affect others, and priority for improvement should be considered for such a criterion.

Table 2. Importance and the correlation of criteria.

Criteria	Column Sum (d)	Row Sum (r)	Column and Row Sum ($d + r$)	Column and Row Difference ($d - r$)	Ranking
A1	9.754	9.756	19.510	−0.002	8
A2	9.684	10.021	19.705	−0.337	4
A3	9.680	9.832	19.513	−0.152	7
A4	9.479	10.162	19.641	−0.683	5
A5	8.814	8.444	17.259	0.370	19
B1	7.881	8.104	15.985	−0.222	20
B2	9.120	9.221	18.341	−0.101	16
B3	9.476	9.259	18.735	0.217	12
B4	9.751	9.843	19.594	−0.092	6
C1	10.162	9.675	19.837	0.487	3
C2	9.038	9.582	18.620	−0.545	13
C3	9.236	9.875	19.111	−0.639	10
C4	9.753	9.434	19.187	0.319	9
D1	8.510	9.043	17.553	−0.532	18
D2	9.940	10.165	20.104	−0.225	2
D3	9.399	9.086	18.484	0.313	15
D4	9.819	8.978	18.797	0.841	11
E1	9.527	9.009	18.536	0.517	14
E2	10.244	10.404	20.649	−0.160	1
E3	9.132	8.506	17.638	0.625	17

Overall, the result in Table 2 indicated that the experts agreed that the eleven criteria (E2, D2, A2, A4, B4, C1, A3, C3, A1, C4, and C2) were all crucial in varying degrees in the traditional manufacturing industry. It must be noted that the importance of D1, A5, and B1, was relatively low. Teamwork, employee engagement, and imitation and learning are ranked among the top three in important and correlation of criteria analysis. In addition, the classification of a factor as a "cause" or "effect" depended on whether it had a positive or negative value with regard to the row and column difference; if the difference between the rows and columns was positive, this indicated that the criterion "tends to influence the other criteria" and would be classified as a "cause"; if the row and column difference was negative, this indicates that the criterion "tends to be influenced by other criteria", so it would be classified as an "effect" as shown in Table 3.

Table 3. Cause–effect characteristics of criteria.

Characteristic	Criteria
Cause	A5, B3, C1, C4, D3, D4, E1, E3.
Effect	A1, A2, A3, A4, B1, B2, B4, C2, C3, D1, D2, E2.

The matrix was converted to a stable state through the process of convergence described in the previous chapter. The limit of the criterion, the super matrix, is shown in Table A3. In this study, the DEMATEL row and column ranking and the D-ANP weight ranking were aggregated (a low score indicates a higher level of importance, and a high score indicates lower) to obtain the overall ranking, as shown in Table 4.

Table 4. Summary of the weighting of criteria.

Criteria	DEMATEL Column and Row Sum Ranking	DANP Weighting Ranking	Ranking Sum	Total Rank
A1	8	8	16	9
A2	4	4	8	3
A3	7	7	14	7
A4	5	3	8	3
A5	19	19	38	19
B1	20	20	40	20
B2	16	13	29	14
B3	12	12	24	12
B4	6	6	12	5
C1	3	9	12	5
C2	13	10	23	11
C3	10	5	15	8
C4	9	11	20	10
D1	18	15	33	17
D2	2	2	4	2
D3	15	14	29	14
D4	11	17	28	13
E1	14	16	30	16
E2	1	1	2	1
E3	17	18	35	18

Table 4 shows that E2, D2, A2, A4, B4, C1, A3, C3, A1, C4, and C2, were found to be the key criteria that affect the sustainable development in traditional manufacturing industries. In addition, they made up a high percentage of the organizational system and knowledge management components. The key-criteria-based cause-and-effect diagrams were taken from the key criteria determined by the matrix of the total influence in Table 3, as shown in Figure 2.

According to Figure 2, C1 and E2 were found to be interconnected. With regard to the ranking difference analysis in the matrix of total influence, C1 had a positive value and was classified as a "cause" and can be considered a driving criterion for improvement; the negative value of teamwork was determined to be a factor that is influenced by other criteria. Technical knowledge Imitation and learning were found to be the most critical criterion that affects incentive systems, performance appraisal, technical knowledge sharing, technical knowledge inheritance, and teamwork. Teamwork was the key criterion affecting the promotion system, compensation and benefits, incentive system, performance appraisal, motivation, technical knowledge imitation and learning, technical knowledge sharing, work ethic inheritance, and employee engagement.

The positive value of technical knowledge imitation and learning tended to have an influence over teamwork; however, all the criteria that were influenced by it were also indirectly influenced by technical knowledge imitation and learning. Therefore, if we take the latter as the starting point, we will be able to improve the performance of other key criteria. Therefore, we must pay special attention to the interaction of these criteria with others to effectively configure resource priority. In the following, we conducted a two-dimensional IPA to illustrate the evaluation of the importance and performance of each attribute. After a discussion with the group of experts, 81.25 was set as the critical value (horizontal axis) to determine the performance of the 20 criteria factors. In addition, the final importance of all attributes in Table 4 is shown as the vertical axis. By combining importance with performance, the result of IPA is shown in Figure 3.

According to the result from Figure 3, managers should focus on the E2, D2, A2, C1, A3, and A1 criteria to achieve the goal of technical knowledge inheritance. Criteria that may be over-emphasized as B2, B3, and D1, must be disregarded if there are too many resources prioritized for technical knowledge inheritance. Moreover, the criteria of A4, B4, C3, C2, and

C4 should be strengthened and improved effectively to sustain organizations. Otherwise, the effectiveness of traditional manufacturing technical knowledge inheritance may be weakened. D3, D4, E1, E3, A5, and B1 were found to be secondary factors for improvement.

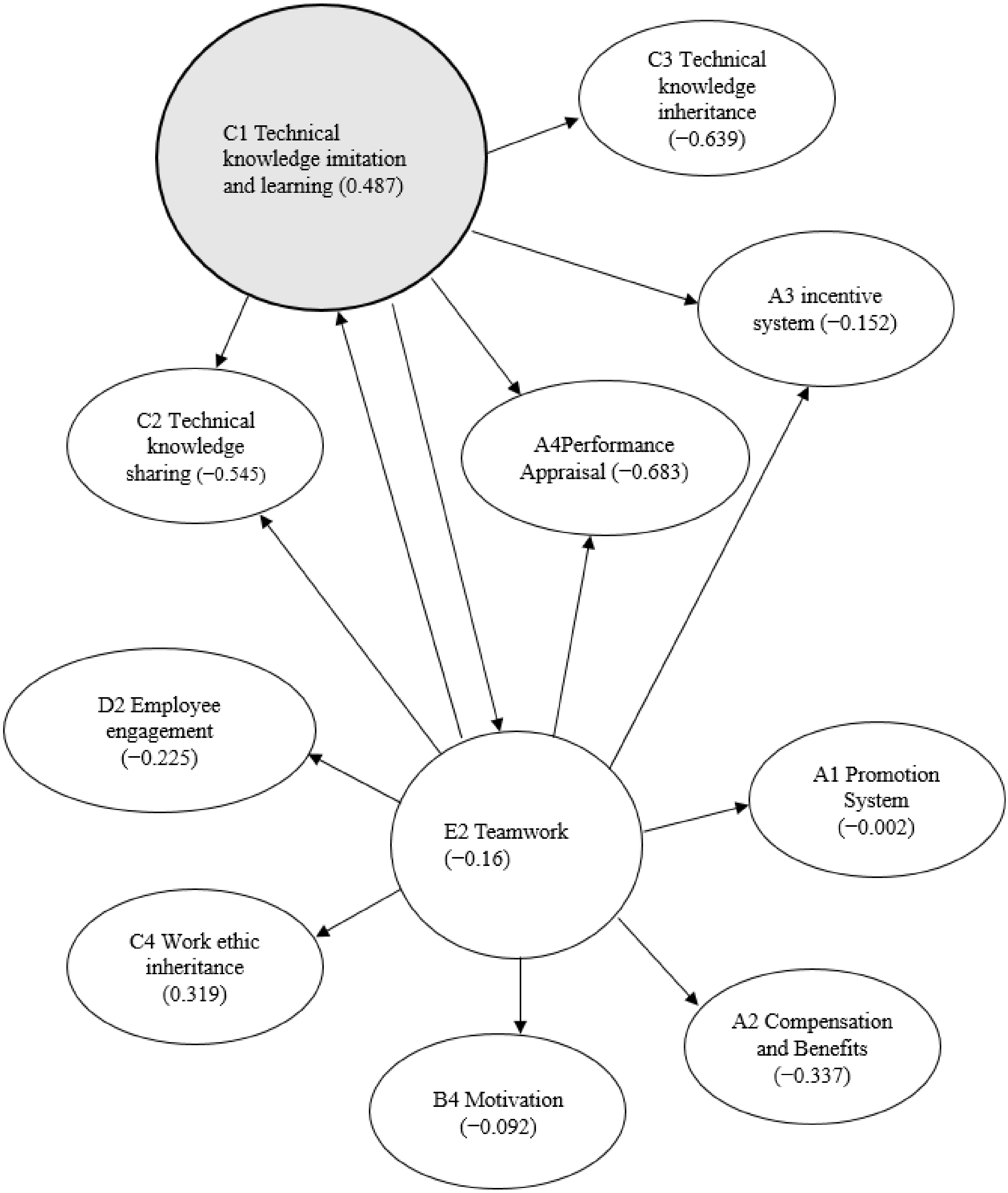

Figure 2. Key criteria of cause and effect.

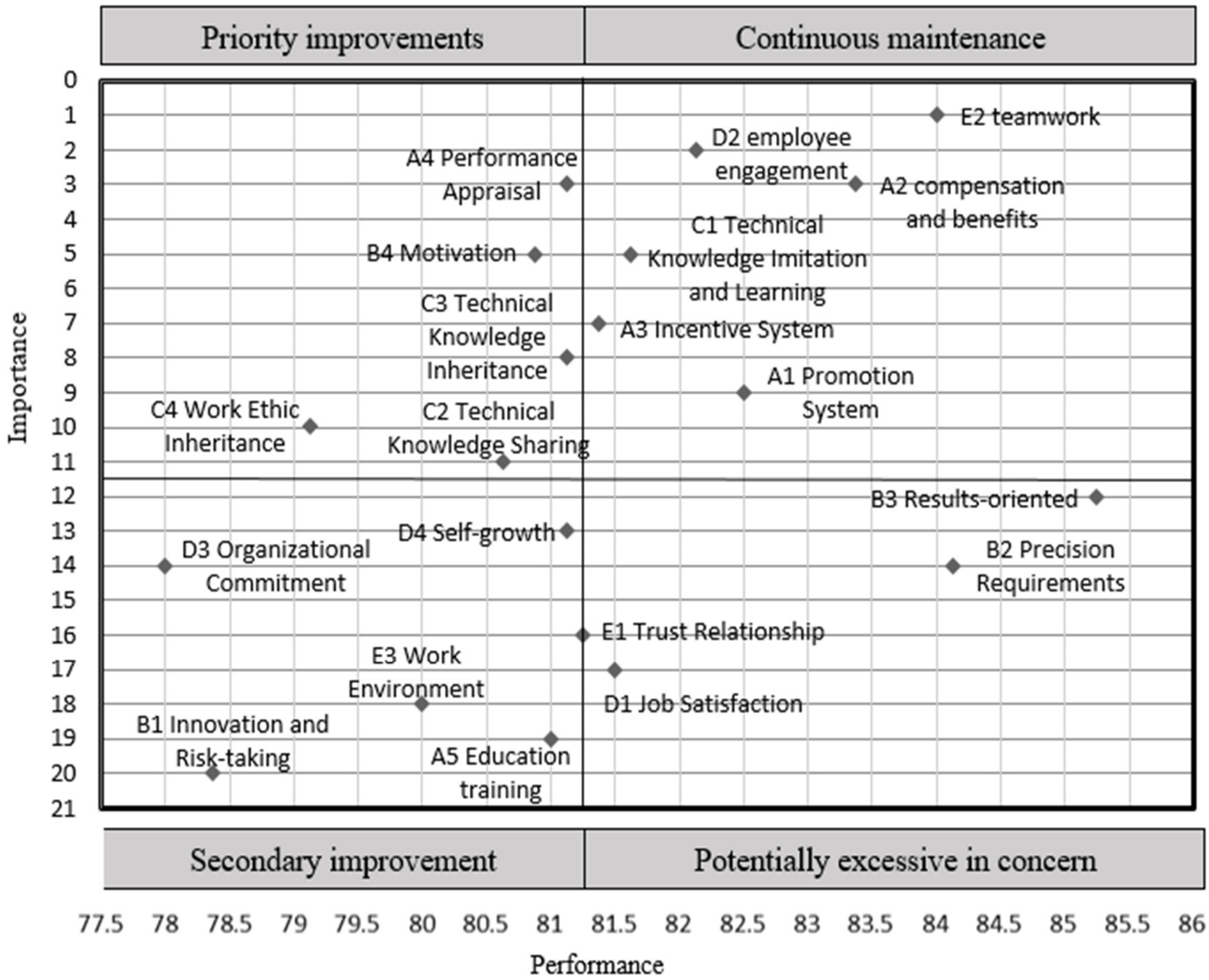

Figure 3. The relationship between importance and performance.

5. Discussion

In this section, the five priority indicators for sustainability organizations are discussed and summarized as follows:

- Performance appraisal: In addition to the performance appraisal score, an individual's performance review should be in the form of an interview with their supervisor in the annual work plan, whether the employee has made any positive contributions to be rewarded or mistakes or unethical behavior to be reprimanded and establish the employee's improvement and training plan. It is also necessary to see performance appraisal from employee feedback to clarify an individual performance;
- Encourage motivation: an excellent manager makes quality decisions and always delivers desired results. In order to maintain this smooth operation, the management philosophy must be reviewed and updated from time to time to encourage their team members always be motivated. Therefore, a "positive and motivated" work culture needs to be developed from the top down to create a more encouraging work environment within the organization;
- Technical knowledge sharing: Similar to previous studies, managers should encourage the sharing of employees' skills and knowledge to strengthen the organization and employee/supervisor relationships. In order to overcome hesitancy, the imparting of knowledge must be intelligent and platform-oriented. By using information software,

knowledge sharing can integrate knowledge management with each operational process to shorten it and enhance learning;

- Promote technical knowledge inheritance: In a knowledge-driven environment, organizational leaders must continuously train and cultivate various types of professionals or knowledge workers through the passing on of skills and information accumulated and created through core activities in order to contribute to the goal of sustainable business operation. Through this process, organization leaders can identify the location, importance, and value of each type of knowledge and then utilize the core technical knowledge as a critical target for inheritance, monitoring, and enhancing implementation effectiveness;
- Foster Work Ethic Inheritance: In the workplace, education can be seen as an essential requirement and a threshold. However, we believe that "work ethic" is more important than education in the workplace. Every employee must be able to meet the requirements of the job, which is supported by a good work ethic. However, these are two very different factors in that good work ethic is a matter of choice and is under the employee's control.

6. Theoretical and Practical Implications

Based on our results, we argued that the imitation and learning of technical knowledge significantly influence the success of an organization. Imitation also plays a vital role in mentorship and knowledge inheritance, as it helps new employees begin to refer to and adopt various strategies, attitudes, values, and behaviors and learn from them. Furthermore, performance appraisal is shown as one of the critical issues in attracting and retaining talent in traditional Taiwanese industries. Moreover, it is essential to encourage members of the organization to express and present their knowledge, ideas, and experiences to other members to enhance productivity and achieve long-term performance. We also demonstrated that organizations should keep the knowledge inheritance at a high level in any period to capitalize on knowledge gained from time to time.

Practical managers should create a friendly and humble image, be effective communicators, and be good listeners between managers and their team members to make them more inclined to be proactive and innovative in the workplace. Moreover, supervisors can actively encourage employees to show a good work ethic through culture, education, training, and incentive systems, which contribute to the organization's development. Leaders can use information software as a tool to integrate knowledge management with each operational process to shorten and enhance learning. The immediate supervisor should give the employee an opportunity to conduct a written self-assessment and respond to comments in the review. They should also consider any rewards or reprimands as well as attendance records. In order to build a culture where knowledge management and sharing are accessible to all and to encourage all members to participate in and actively promote related activities, supervisors are encouraged to hold competitions and exchange activities between teams or departments within the company.

7. Conclusions

In this study, we applied DEMATEL-ANP to analyze cause–effect relationships among the key factors for sustainable development in traditional manufacturing industries through experts' opinions. The data in this study were organized and analyzed from questionnaires answered by an expert group. The key success factors of sustainable organizations in the traditional manufacturing industry were identified. Based on our results, technical knowledge transfer is considered one of the major factors in the success of organizations, but sadly, labor shortages are resulting in the loss of advantages of knowledge inheritance and critical skills. In addition, it was theoretically and practically reasonable to use imitation and learning as the source of key influencing factors. In order to achieve sustainable development, supervisors should encourage new employees to learn informally from senior workers through observation and interpersonal interaction rather than relying solely on training programs. This will facilitate the transmission and continuation of the organization's core tacit knowledge. This study is limited by mainly focusing on the human-to-human method of technical knowledge transmission. However, people are not easily controlled variables; after all, if we can further study how to promote the externalization of implicit knowledge and combine it with intelligent inheritance in future research will greatly contribute to the industry's stability. In the future, other techniques (e.g., fuzzy DEMATEL) should be conducted for comparison with the proposed model. Additional industries also need to study to show more viewpoints of key success factors for sustainable organization. Moreover, further study of the "externalization of tacit knowledge" and "smart inheritance of knowledge" also needs to explore to bring advanced and long-term contributions to the sustainability of the traditional manufacturing industry.

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Appendix A

Table A1. Results of the third Delphi questionnaire administration.

Criteria	A	B	C	D	E	F	G	H	AVG	SD	CDI
Promotion System	80	88	80	80	80	75	86	90	82.375	4.742	0.050
Compensation and Benefits	85	90	92	90	82	92	90	90	88.875	3.295	0.035
Incentive system	85	86	83	90	80	83	86	90	85.375	3.238	0.034
Performance Appraisal	80	84	75	90	80	80	85	85	82.375	4.270	0.045
Education Training	80	90	75	90	80	92	90	90	85.875	6.051	0.064
Innovation and Risk-taking	80	75	85	70	70	70	73	75	74.750	5.044	0.053
Precision Requirements	85	90	95	95	82	95	90	90	90.250	4.521	0.048
Results-oriented	75	70	85	70	72	70	73	70	73.125	4.807	0.051
Motivation	80	83	85	70	75	80	80	80	79.125	4.371	0.046
Technical knowledge imitation and learning	90	92	92	90	83	87	92	90	89.500	2.915	0.031
Technical knowledge sharing	90	95	95	100	90	95	95	95	94.375	2.997	0.032
Technical knowledge inheritance	90	94	95	100	90	95	94	95	94.125	2.976	0.032
Work ethic inheritance	90	90	90	100	88	94	91	95	92.250	3.631	0.038
Job satisfaction	85	85	92	90	82	82	86	90	86.500	3.536	0.037
Employee engagement	85	85	85	90	82	85	86	90	86.000	2.550	0.027
Organizational commitment	85	85	85	90	82	84	85	90	85.750	2.634	0.028
Self-growth	80	85	90	80	80	86	85	85	83.875	3.370	0.036
Trust relationship	85	85	85	90	80	82	85	90	85.250	3.231	0.034
Teamwork	85	90	90	100	85	90	90	90	90.000	4.330	0.046
Work environment	80	83	82	90	80	90	83	80	83.500	3.937	0.042

Table A2. Criteria total relationship matrix.

Criteria	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	E1	E2	E3
A1	0.459	0.522	0.513	0.536	0.437	0.421	0.481	0.483	0.521	0.499	0.501	0.515	0.491	0.466	0.522	0.478	0.466	0.461	0.540	0.444
A2	0.503	0.468	0.510	0.532	0.430	0.422	0.474	0.480	0.511	0.499	0.484	0.508	0.484	0.470	0.525	0.479	0.459	0.464	0.543	0.438
A3	0.506	0.519	0.459	0.532	0.430	0.426	0.474	0.479	0.514	0.492	0.487	0.501	0.488	0.466	0.528	0.475	0.463	0.464	0.540	0.437
A4	0.500	0.512	0.500	0.465	0.412	0.407	0.469	0.470	0.504	0.489	0.481	0.502	0.482	0.454	0.515	0.463	0.451	0.449	0.526	0.426
A5	0.458	0.469	0.458	0.476	0.360	0.374	0.429	0.434	0.451	0.469	0.465	0.471	0.445	0.424	0.476	0.430	0.425	0.420	0.486	0.395
B1	0.418	0.428	0.428	0.427	0.357	0.308	0.383	0.389	0.414	0.401	0.404	0.412	0.392	0.377	0.427	0.372	0.385	0.372	0.432	0.356
B2	0.476	0.491	0.483	0.494	0.415	0.386	0.406	0.451	0.470	0.473	0.462	0.488	0.466	0.445	0.491	0.440	0.435	0.430	0.508	0.411
B3	0.497	0.512	0.504	0.512	0.422	0.404	0.465	0.423	0.497	0.493	0.485	0.495	0.475	0.461	0.515	0.459	0.454	0.452	0.530	0.422
B4	0.513	0.525	0.520	0.536	0.437	0.428	0.467	0.476	0.463	0.502	0.494	0.511	0.494	0.476	0.525	0.475	0.466	0.467	0.540	0.437
C1	0.525	0.542	0.536	0.556	0.471	0.437	0.502	0.504	0.529	0.474	0.524	0.542	0.503	0.483	0.549	0.486	0.487	0.489	0.564	0.460
C2	0.469	0.480	0.472	0.480	0.426	0.386	0.439	0.437	0.466	0.469	0.418	0.485	0.458	0.434	0.490	0.429	0.431	0.444	0.511	0.415
C3	0.478	0.490	0.485	0.503	0.427	0.390	0.451	0.456	0.475	0.482	0.474	0.440	0.457	0.443	0.503	0.445	0.443	0.455	0.514	0.423
C4	0.506	0.522	0.503	0.525	0.451	0.418	0.491	0.483	0.520	0.502	0.498	0.508	0.444	0.466	0.522	0.461	0.473	0.474	0.540	0.447
D1	0.437	0.448	0.444	0.457	0.376	0.366	0.415	0.417	0.451	0.434	0.433	0.449	0.431	0.371	0.468	0.420	0.416	0.414	0.474	0.390
D2	0.515	0.531	0.518	0.538	0.438	0.429	0.493	0.491	0.519	0.514	0.510	0.524	0.506	0.484	0.487	0.486	0.477	0.479	0.546	0.455
D3	0.489	0.505	0.486	0.504	0.416	0.414	0.468	0.467	0.497	0.485	0.481	0.495	0.468	0.450	0.508	0.412	0.447	0.452	0.519	0.436
D4	0.513	0.525	0.513	0.535	0.440	0.431	0.484	0.489	0.517	0.505	0.501	0.515	0.490	0.472	0.535	0.481	0.425	0.470	0.536	0.443
E1	0.492	0.501	0.492	0.511	0.429	0.416	0.471	0.472	0.503	0.499	0.494	0.504	0.488	0.456	0.514	0.457	0.453	0.414	0.532	0.431
E2	0.532	0.546	0.536	0.556	0.457	0.440	0.503	0.504	0.540	0.528	0.524	0.538	0.520	0.501	0.560	0.493	0.487	0.496	0.514	0.467
E3	0.470	0.485	0.473	0.488	0.412	0.401	0.457	0.455	0.480	0.466	0.462	0.472	0.452	0.446	0.505	0.447	0.435	0.444	0.509	0.375

Table A3. Criteria limit super matrix.

Criteria	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	E1	E2	E3
A1	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.0518	0.052	0.052	0.052	0.052	0.052
A2	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.0532	0.053	0.053	0.053	0.053	0.053
A3	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.0522	0.052	0.052	0.052	0.052	0.052
A4	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.0539	0.054	0.054	0.054	0.054	0.054
A5	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.0448	0.045	0.045	0.045	0.045	0.045
B1	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
B2	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.0489	0.049	0.049	0.049	0.049	0.049
B3	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.0491	0.049	0.049	0.049	0.049	0.049
B4	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.0522	0.052	0.052	0.052	0.052	0.052
C1	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.0514	0.051	0.051	0.051	0.051	0.051
C2	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.0508	0.051	0.051	0.051	0.051	0.051
C3	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.0524	0.052	0.052	0.052	0.052	0.052
C4	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
D1	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048
D2	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.0539	0.054	0.054	0.054	0.054	0.054
D3	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.0482	0.048	0.048	0.048	0.048	0.048
D4	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.0477	0.048	0.048	0.048	0.048	0.048
E1	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.0478	0.048	0.048	0.048	0.048	0.048
E2	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.0552	0.055	0.055	0.055	0.055	0.055
E3	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.0452	0.045	0.045	0.045	0.045	0.045

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