The Key Success Factors for the Operation of SME Cluster Business Ecosystem

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Abstract: With the emphasis on cross-industry cooperation and the increasing complexity of the consumer market, an open and innovative business ecosystem has become a trend, and companies are no longer competing on their own, but rather between systems and systems. This study explores the development of SME cluster operations from a business ecosystem perspective. It summarizes the influencing dimensions and relevant factors of SME cluster ecosystem operation through literature research and expert interviews. We utilize the Fuzzy DEMATEL method and Interpretive Structural Model and classified by classification of matrix multiplication method. At the same time, this study figures out the factors’ correlation and characteristics and further develops their management implications to provide a reference for enterprises and subsequent research. The results reveal that robustness and niche creation with significant influence and low dependence are considered critical factors to influence other factors. Therefore, decision-makers should consider prioritizing control over factors in this category.

Keywords: SME; cluster; business ecosystem; key success factor

1. Introduction

During Taiwan’s economic development over the past few decades, small and medium-sized enterprises (SMEs) have been the keystone of industrial development. They are not only the satellite production and sales units of many large enterprises but also the main force of labor absorption and the economy’s most active and dynamic factor. As an important force and solid pillar of economic development, SMEs often face operational problems such as tight running capital, inaccessible resources, and difficulties in removing international trade barriers when the external environment changes drastically [1]. In response to this dilemma, Gereffi and Lee [2] indicated that the concept of the industrial cluster had been used to reduce the barriers to international trade and increase the productivity of firms or industries by shaping value chains.

As the industrial environment became increasingly volatile, the need for an eco-system that can adapt to changes and achieve sustainable development has become more acute. The industrial model has been extended from cluster to business eco-system development. Competitiveness is generated through trust, dependence, interaction, competition, and interaction with a network structure, cooperative patterns, and collective interests. Bell et al. [3] also pointed out that cluster network formation contributes to competitiveness. These studies mainly explained the cluster phenomenon as a significant knowledge-driven catalyst from the viewpoint of the regional economy and modern management theory. An industry cluster’s agglomeration effects could facilitate higher productivity for enterprises in the industry cluster. Zeng et al. [4] examined the agglomeration effects of industry clusters on a firm’s innovation performance. The study measured the technological cooperation network with textual analysis of the interfirm agreement among core enterprises. It was found that betweenness centrality and clustering coefficient had statistically significant and positive effects on an enterprise’s ability for technological innovation.
The business ecosystem provides a new perspective for contemporary companies. Moshabaki et al. [5] pointed out that attitudes toward organizations had changed over time. In the past, organizations were considered closed systems that did not interact with the environment. With the introduction of the system perspective, attitudes toward organizations have also changed. At the same time, organizations were considered open systems and were interacting with their environment. Considering that the business environment has changed dramatically, the boundaries between industries have blurred significantly. Chen et al. [6] used manufacturing and service SMEs in Taiwan as the sample population and utilized the Fuzzy Analytic Hierarchy Process and survey questionnaire methods to explore the factors that influence the analysis and comparison of the keystone business strategy between manufacturing and service industries and the reasons behind it.

Previous studies have not explored the business ecosystem from the SME perspective, and there is a lack of rigorous academic research on this subject. Suppose we can construct cluster operation dimensions and critical factors from this viewpoint. In that case, it will help SMEs build an open and innovative system, expand their economic scope, and create leverage for the comprehensive effect of resource integration, thus achieving the goal of sustainable business operation.

To sum up, in the face of the sweeping wave of technological and digital development, this study explores the development of SME cluster operations from a business ecosystem perspective. It summarizes the influencing dimensions and relevant factors of SME cluster ecosystem operation through literature research and expert interviews. The Fuzzy DEMATEL method combined with the Interpretive Structural Model (ISM) was used to analyze and screen out the core players, and then their management implications were further developed. Thus, this research could be a reference for enterprises and future studies.

2. Literatures

2.1. Industrial Cluster

Cluster drives the common growth of SMEs and the sharing of resources. According to Gereffi and Lee [2], SMEs of a small startup scale, when facing operational problems such as insufficient R&D capabilities, difficult access to resources, and fund shortage, often adopt the industry cluster concept to reduce international trade barriers.

Porter [7] defined industrial clusters as “geographic concentrations of interconnected firms with both competitive and cooperative relationships, consisting of interrelated firms, specialized suppliers, service providers, relevant industry players, and related institutions (e.g., universities, trade organizations)”. The formation principle and value of industrial cluster theory were discussed in terms of organizational change, value chains, and competitive edges created by economic benefits. Further, the competitive characteristics of industrial clusters among different countries and regions were analyzed to compare national competitive advantages. Herliana [8] examined the factors that promote the development of SME clusters and how regional innovation can facilitate SME growth. The scholar defined clusters as geographically concentrated, related, or complementary firms and institutions. In addition to government and business, clusters provide support services, including training, education, information, research, and technical support. Moreover, clusters encourage competitive behavior among enterprises. Behfar et al. [9] explored how SME cluster relationships can effectively extend the transmission of innovation. They illustrated clusters as a way of bringing enterprises together, allowing them to learn various perspectives. It encompasses knowledge sharing, management, and transaction costs and achieves the benefits of exploring and developing ideas. The study further developed the concept of innovation clusters. It is a collection of enterprises and institutions seeking to innovate through agreements, transactions, and formal or informal meetings.

According to the principles of industrial cluster theory, this study finds industrial cluster development to be a complex process. Moreover, since it is difficult to propose development factors unilaterally, we should comprehensively view and analyze them.
Gordon and McCann [10] classified industrial clusters into four types of models based on different growth dynamics and theoretical connotations: (1) Pure Agglomeration Model (PAM) refers to a region where firms and industries tend to be concentrated in a specific locational space, and where artificial industry support policies may be one of the contributing factors to the emergence and continuous self-reinforcement of local industry clusters. (2) The Industrial complex model focuses on the relationship between production and industrial spatial organization and explores the most appropriate location, transportation costs, and regional production factors for manufacturers. It is characterized by transaction costs of limited space and geographic distance, and the input and output of related enterprises are considered for location analysis and decision making. (3) The social network model holds that in addition to cost factors, many non-cost factors need to be taken into accounts such as social networks of non-transactional dependencies, customs and practices, mutual trust, values, and other social capital, which can help the stability of cooperation and production networks, promote knowledge innovation, and shape the process of innovative learning. (4) Domain innovation model evolved under the cluster effect, which is a combination of industrial cluster, social culture, and innovation. This model regards the environment as a basis for development that induces innovative institutions to interact with each other.

According to Furman et al. [11], industrial clusters benefit industrial innovation. Based on the geographical proximity of enterprises in clusters, the more obvious competitive pressure and market opportunities they perceive, the better the industrial knowledge spillover effect is when the information and human resources flow relatively fast. This can strengthen the advantages of industrial innovation. Porter [12] argued that industry clusters are composed of industries or firms that are closely linked together and that their interests are mutually met through vertical (buyers or suppliers) and horizontal (typical customers, technologies, channels) linkages.

Sellitto et al. [13] studied how green innovation helped gain competitive advantages in a furniture industrial cluster. The furniture industrial cluster encompassed 245 companies located in Southern Brazil. The research findings suggest the following: First, green innovation focused on operation and process did not positively influence competitive enablers, but competitive advantages. Second, green innovation focused on product and customers, and eco-efficiency positively affected competitive enablers. Third, competitive enablers based only on product and customers and eco-efficiency positively affected competitive advantage.

The creation of industrial clusters is one of Russia’s current trends of economic transition. Therefore, Babkin et al. [14] proposed research objectives based on investigating the nature of industrial clusters and the concept and evaluation of their innovative potential. Further research directions were suggested in the study and recognition of the organizational and economic mechanisms regulating the innovation potential of clusters in different industries. Lysenko et al. [15] discussed the development of a conceptual framework to transform the functions of education and industrial clusters into a forward-looking form of vocational training for secondary vocational education. The study described the stages of development of education and industrial clusters, providing some learning outcomes. Han et al. [16] believed that industrial cluster theories were valuable for regional industrial development and the advantages of industrial clusters, while inter-firm cooperation was the cornerstone of industrial clusters.

Enright [17] argued that industrial clusters are different from business networks or regional clusters in that industrial clusters are formed by a group of related manufacturers. A combination of shared technology, vendors, and labor supply sources is established through the interaction of existing manufacturers and suppliers. Although there are interactions and exchanges between manufacturers in a network of companies, the manufacturers are not necessarily related or identical, nor are they necessarily geographically related. On the other hand, a regional cluster is an industrial agglomeration. Although there is regional concentration among manufacturers, the elastic trans-regional network of suppliers and finished product manufacturers belonging to different value chain stages is formed with
decentralized production. Thus, an active cluster effect is formed. The Italian fashion trend best represents this regional cluster, and its regional cluster effect creates Milan’s position as the fashion capital.

Based on the literature mentioned above, an industry cluster can be considered a group of enterprises and other relevant organizations that enjoy competitive and cooperative relationships and are geographically concentrated in a specific region. Through clusters, enterprises can share their professional knowledge and increase the market competitiveness of industries.

Further, clusters are classified into eight categories, namely: (1) organizational complex clusters, (2) service innovation clusters, (3) technology niche clusters, (4) local innovation clusters, (5) mature network clusters, (6) value network clusters, (7) emerging technology clusters, and (8) innovation network clusters. Each category has its definition and characteristics. For example, the characteristics of complex organizational clusters are geographic concentration, mature clusters, and high-tech drive.

2.2. Business Ecosystem

The business ecosystem, first proposed by Moore [18], is defined as a cross-industry group of organizations that compete and cooperate in production, customer service, and innovation to achieve and co-evolve to help organizations adapt to their environment. Basole et al. [19] defined the business ecosystem as a heterogeneous and continuously evolving group of individuals and enterprises connected and interacting through a complex network of global relationships. In addition, scholars emphasized that a single market cannot provide all products or services to the end-consumer, but rather, through a system of enterprises from various markets, each offering a unique value proposition.

Kim [20] proposed that a business ecosystem is a platform that includes the creation of a bilateral marketplace in which multiple groups (including suppliers and consumers) can exchange resources and conduct fair transactions. The participants in the system develop into a coexisting ecosystem by linking and interacting with each other through the platform, providing value, and creating benefits for all participants. According to Rinkinen and Harmaakorpi [21], a business ecosystem is open to all possible contributors and participants. It can be regarded as an interdependent network of stakeholders that co-evolve and share the same future or as a network of established values with fixed interconnections. To summarize the above definitions of business ecosystem proposed by various scholars, this study defined a business ecosystem as a group of interconnected, value-creating, and value-sharing participants who compete and cooperate and share a common future in a dynamic business environment.

From the above definition, it is clear that no enterprise can be considered independent in a networked environment. A company’s performance is not created solely by its capabilities or positioning relative to its competitors, customers, business partners, and suppliers but by its continuous interaction with the entire ecosystem. For a business ecosystem to function properly, Caraganciu et al. [22] proposed the three critical dimensions of business ecosystem performance measurement, which are: (1) productivity, (2) robustness, and (3) niche creation. These are also a business ecosystem’s three critical success factors [23]. Aquilani et al. [24] illustrated that the value of ecosystems is embodied in the interaction of platforms, where participants engage in the co-creation process, which translates value into reality. The study further suggested that the conditions for the sustainability of enterprises in ecosystems are based on the co-creation of value and innovation, which can be extended to include the four core elements of inclusiveness, generativity, connectivity, and evaluability.

The business ecosystem is based on the ecosystem in biology applied to the field of business management. Many scholars in the economic and management domains have already used biological analogies to explore economic activities or management phenomena [5,21,25]. For example, evolutionary economics and organizational ecology have been widely used to study economic and organizational changes by applying the
concepts of evolutionary biology and community ecology, respectively. Evolutionary economics studies the process of economic development from the biological evolutionary process. Organizational ecology is mainly analogous to community ecology in biology, where the unit of analysis is the organizational community, and the subject of study is the phenomena of the organizational community as a whole, such as generation rate, mortality rate, and the factors affecting these phenomena.

Ecosystem value creation and capture have recently attracted much attention in the academic literature on business and management. Khademi [25] pointed out that collaboration, co-creation, and competition was essential strategies for success for today’s modern businesses. Compared with former ways of doing business in isolation, ecosystems nowadays have created ample opportunities for generating significantly more value. However, there were also potential threats in the pathway towards success in ecosystems. Hakanen and Rajala [26] discussed how the Internet of Things (IoT) deployment allowed businesses to benefit from the speed and diversity of information associated with things and provided guidance for future research to explore ways of value creation through IoT-enabled business models. Rong et al. [27] presented a guide encouraging organizations to identify new opportunities and solutions for implementing a circular economy. The study identified new opportunities to improve an organization’s performance in the circular economy and provided a systematic view of the business ecosystem, integrating stakeholders into the decision-making process.

SMEs usually lack resources and technical capabilities. Clusters are considered a typical development pattern to promote resource sharing and information exchange among SMEs. Riquelme-Medina et al. [28] aimed to elucidate the mechanisms that enable firms to manage the paradoxical logic of competition and cooperation in business ecosystems to achieve better performance. The study examined the relationship between cooperative competition and performance through the indirect effects of absorptive capacity and supply chain agility. The results did not support a positive relationship between cooperative competition and firm performance. Instead, firms in business ecosystems acquire critical knowledge through collaboration. This, in turn, positively impacted absorptive capacity, which was associated with improved supply chain agility and firm performance.

In summary, the above literature shows that the current ecosystem assessment framework needs to be evaluated through a more comprehensive and multi-faceted approach to the change in the general environment. For the current ecosystem assessment framework and factors, this study conducted further literature inventory and compilation in the subsequent chapters.

2.3. Key Success Factors

Key success factors (KSFs) are one of the information system planning methods often used to combine special capabilities with important requirements of the environment to achieve good performance when exploring industry characteristics and corporate strategy relationships [7]. Critical success factors are unique as assets, resources, technologies, activities, and competencies that managers should demonstrate.

Aaker and Moorman [29] argued that critical success factors are beneficial for companies to focus on existing strengths that contribute to success, including basic resources, patents, technological advantages, access. Hill et al. [30] stated that corporate strategy choices are based on critical success factor analysis, and the distinction between a company’s resources and potential capabilities can help a company generate unique competitive advantages.

Previous studies have adopted different research methods to investigate critical success factors. For this study, we used the Fuzzy DEMATEL combined with ISM. The Fuzzy DEMATEL has been widely applied in many fields and can be utilized to clarify the mutual causality between factors. Many scholars have used it to identify the critical success factors that managers consider when making decisions [31–33]. Wu [33] used this approach to identify the critical factors for successfully implementing knowledge management to enhance the competitive edge of enterprises.
ISM can be used to find the weighting relationships between various factors. This method has been extensively applied in management research and strategic analysis. A study by Thakkar, Kanda, and Deshmukh [32] used ISM to explore the issues related to the adoption and implementation of information technology (IT) in improving the supply chain capabilities of SMEs in the Indian manufacturing sector. Additionally, Jia, Diabat, and Mathiyazhagan [31] used the ISM model to assist the mining industry in integrating sustainability with traditional supply chain management, identifying key implementation elements through expert advice, and improving the environmental development process to promote sustainability.

2.4. Factors Influencing the Operation of SME Cluster Ecosystem

Key success factors are essential to the operation of a business in any industry. They enable enterprises to leverage their strengths to remain competitive in the industry. This study examined the literature on the factors influencing the operation of SME cluster ecosystems.

The experts’ assessment of productivity in the past emphasized innovation as a cost advantage and represents the effectiveness of new products and functions [34]. With the evolution of the space-time background, productivity assessment has further explored whether the interaction among system members through cooperation, competition, and complementarity can achieve synergy and enhance the overall system productivity.

The sustainability of the ecosystem structure can be evaluated, and members or technologies can be reduced to a limited extent to maintain the ecosystem’s robustness [35]. In terms of robustness, it is essential to establish long-term trusting, collaborative relationships in the ecosystem. The financial capacity of members should be considered to assess the survivability of members in the system and the number of members participating in other ecosystems. In addition, the closeness of relationships among members should be analyzed for risk prediction, allocation, and management.

Koskela-Huotari et al. [36] illustrated that the core elements of an ecosystem are value creation and innovation. Noticeably, the process of innovation is driven by the integration, exchange, and application of resources by multiple members, through the integration of resources and service delivery that includes knowledge, skills, and experience to promote market innovation and stimulate competition and learning among participants. It follows that a robust ecosystem should be able to innovate and create opportunities for system members. The niche creation dimension is a dimension that evaluates the use of knowledge, technology, and resources by system members to enhance internal capabilities and external competitiveness to meet market demands.

Finally, a sound ecosystem is characterized by how the distribution and availability of resources are affected by the degree of sharing and integration of resources in the co-creation process among system members. At the same time, system members also generate new resources through co-creation to solve the problem of insufficient resources in the ecosystem. Therefore, the co-creation dimension means that new knowledge, partners, and values are created by sharing and integrating resources based on common goals and cooperation among evaluating enterprises.

The advantages of cluster development create a cluster effect of technology, capital, talent, and market. By integrating resources and industrial links for SMEs with relatively scarce resources and insufficient capital, the cluster can enhance collective efficiency and pool resources to give full play to the combined effect and enhance competitiveness. Venugopal et al. [37] studied the determinants and variables of sustainable development of SME clusters based on past SME clusters and cluster strategies. The study illustrated that building trust, maintaining constructive dialogue among cluster members, and sharing common strategic goals are important factors for developing an efficient cluster and have a significant role in achieving inter-firm cooperation.

Andreano et al. [38] explored the contextual factors that affected the viability of SME clusters during economic crises and explained the existence of spatial dependence and spatial heterogeneity of clusters with bankruptcy model analysis. The study pointed out
that business clusters emphasize geographical relationships and interconnected networks, including vertical (buyers, suppliers) and horizontal (general customers, technology, and distribution channels) relationships. The complex dynamics of each other’s operations will affect the survival conditions of enterprises.

In light of this, based on common goals, SMEs can establish mutual trust through complementary links, which will enhance the overall innovation and competitiveness.

In this study, the critical factors related to the operation of the SME cluster ecosystem are categorized into five primary dimensions: productivity, robustness, niche creation, co-creation, and cluster cohesion (as described in Table 1).

Table 1. Literature Review on Key Success Factors for SME Cluster Ecosystem Operation.

| Dimension       | Standard                                      | Reference                                                                 |
|-----------------|-----------------------------------------------|---------------------------------------------------------------------------|
|                 | Elemental Productivity                        | Hill, Jones and Schilling [30], Iansiti and Levien [39]                   |
|                 | The ability to pass on innovation             | Hill, Jones and Schilling [30], Iansiti and Levien [39]                   |
| Productivity    | Financial Productivity                        | Aaker and Moorman [29], Ferreira, Coelho and Moutinho [34]               |
|                 | Value Productivity                            | Aaker and Moorman [29], Ferreira, Coelho and Moutinho [34]               |
|                 | The simplicity of interaction among members   | Koskela-Huotari, Edvardsson, Jonas, Sörhammar and Witell [36]             |
| Robustness      | Member Survival Rate                          | Hakanen and Rajala [26], Koskela-Huotari, Edvardsson, Jonas, Sörhammar and Witell [36], Iansiti and Levien [39] |
|                 | Sustainability                                | Ferreira, Coelho and Moutinho [34], Iansiti and Levien [39]              |
|                 | Predictability                                | Koskela-Huotari, Edvardsson, Jonas, Sörhammar and Witell [36], Iansiti and Levien [39] |
|                 | Limited elimination                           | Hill, Jones and Schilling [30], Iansiti and Levien [39]                  |
|                 | Network Stability                             | Khademi [25], Riquelme-Medina, Stevenson, Barrales-Molina and Llorens-Montes [28] |
| Niche creation  | Visionary Leadership                          | Chen, Wu, Chen and Huang [6], Iansiti and Levien [39]                    |
|                 | Group effort                                  | Chen, Wu, Chen and Huang [6], Moutinho [34]                               |
|                 | Active corporate participation                | Hill, Jones and Schilling [30], Iansiti and Levien [39]                  |
|                 | Product/Service Diversity                     | Chen, Wu, Chen and Huang [6], Iansiti and Levien [39]                    |
|                 | Intangible Resources                          | Khademi [25], Viholainen, Kylkilathi, Autio, Pöyhönen and Toppinen [35]  |
|                 | Knowledge and Experience                      | Khademi [25], Riquelme-Medina, Stevenson, Barrales-Molina and Llorens-Montes [28] |
|                 | Partnerships with Third Parties               | Hill, Jones and Schilling [30],                                                                                     |
| Co-creation     | Resource Enrichment                           | Hakanen and Rajala [26], Viholainen, Kylkilathi, Autio, Pöyhönen and Toppinen [35]                                  |
|                 | Knowledge Spillover                           | Khademi [25], Viholainen, Kylkilathi, Autio, Pöyhönen and Toppinen [35]                                          |
|                 | Direct externality                            | Viholainen, Kylkilathi, Autio, Pöyhönen and Toppinen [35], Venugopal et al. [37]                                  |
Table 1. Cont.

| Dimension                  | Standard                                                                 | Reference                                                                 |
|----------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Indirect externality       | Viholainen, Kykilathi, Autio, Pöyhönen and Toppinen [35], Venugopal et al. [37] | Hakanen and Rajala [26], Viholainen,                                     |
| Resource Derivation        | Kylkilathi, Autio, Pöyhönen and Toppinen [35]                            | Venugopal et al. [37]                                                     |
| Platform Openness          | Khademi [25], Viholainen, Kykilathi, Autio, Pöyhönen and Toppinen [35]  |                                                                          |
| Alignment of goals and values |                                                            | Khademi [25], Venugopal et al. [37]                                       |
| Network Relationship       | Andreano, Benedetti, Mazzitelli, Piersimoni and Di Fatta [38]            |                                                                          |
| Counselling Unit           | Andreano, Benedetti, Mazzitelli, Piersimoni and Di Fatta [38]            |                                                                          |
| Connectedness              | Venugopal, Malhotra and Annamalai [37]                                   |                                                                          |
| cluster Cohesion           |                                                                          |                                                                          |
| Trust Relationship         | Hill, Jones and Schilling [30], Venugopal, Malhotra and Annamalai [37]  |                                                                          |
| Co-induction               | Venugopal, Malhotra and Annamalai [37]                                   |                                                                          |
| Business Leader            | Khademi [25], Riquelme-Medina, Stevenson, Barrales-Molina and Llorens-Montes [28] |                                                                 |
| Integration Capability     | Riquelme-Medina, Stevenson, Barrales-Molina and Llorens-Montes [28]      |                                                                          |

3. Methods

This study integrates the concept of the business ecosystem and the characteristics of SME clusters to compile the dimensions and factors that affect the critical success factors of SME cluster ecosystem operation. We conducted the pre-testing by interviewing experts to evaluate the validity of each dimension, identify the interviewed experts, and organize and revise each dimension and factor. Finally, this study’s research methodology and implementation steps were the step-by-step process of Fuzzy DEMATEL combined with ISM analysis.

The ISM method can be used to find the weight relationship between factors. However, the method cannot consider the strength of factor relationships and the lack of correlation between weights and attributes. By combining it with Fuzzy DEMATEL, its shortcomings can be improved. The Fuzzy DEMATEL combined with the ISM method can clarify the interactions and strengths of different factors, the state of the distribution of the structure and factors, and the mutual causality between them.

With the rapid development of technology, SME clusters have been further extended from the value chain to the concept of an ecosystem. Therefore, by collecting literature and compiling relevant data, this study proposes a prototype framework of the critical success factors for the operation of the SME cluster ecosystem. The five major dimensions, which have a total of 30 factors, are as follows: (1) productivity, (2) robustness, (3) niche creation, (4) co-creation, and (5) cluster cohesion.

Scholars defined productivity as the effectiveness of transforming value or enhancing the productivity of products through innovation. However, as ecosystems become more diverse and complex, the interaction among system members must also be considered when measuring productivity. This study, therefore, further incorporated factors such as “value productivity” and “simplicity of interaction among system members”.

Moreover, the ecosystem’s robustness plays an important role in resisting external disturbance. Through literature collection, it was found that experts emphasized the discussion of the relationship between the structure and ecosystem members as the core concept of robustness. As for niche creation, a sound ecosystem must have the ability to innovate and create opportunities for system members continuously. This study defines niche creation as the diversity of business ecosystems that allow members to apply various knowledge,
technologies, and resources to enhance internal capabilities and external competitiveness to create or meet market demand. When SMEs engage in clusters, they expect to stimulate and accelerate innovation through the interfirm exchange, learning, and imitation. Another indicator of a healthy ecosystem is the process of co-creation among system members, where the distribution and availability of resources are influenced by the degree of sharing and integration of resources. At the same time, system members generate new resources through co-creation to solve the problem of insufficient resources in the ecosystem.

Finally, this study defines cluster cohesion as an industry cluster linked by common interests, needs, or goals. The mutual trust and benefit relationship established by cluster cohesion facilitates the smooth operation of economic and production activities and enhances the innovation and competitiveness of the cluster. By integrating resources and industry segments, the ecosystem concept can enhance collective efficiency and pool resources with each other to enhance competitiveness.

To summarize the above, this study used five major dimensions, namely productivity, robustness, niche creation, co-creation, and cluster cohesion, to construct factors of SME cluster ecosystem operation (as described in Table 2). This study interviewed three experts in related fields and used the pre-test questionnaire to seek expert opinions as a reference for the study. Further, expert interviews were used to provide a practical basis for the study and to ensure the necessity of the dimension and factors. Then, the factor profiles compiled through Section 2 were revised and screened.

**Table 2. Key Success Factors for SME Cluster Ecosystem Operation.**

| Dimension        | Standard                                                                 |
|------------------|--------------------------------------------------------------------------|
| Productivity     | Elemental Productivity                                                   |
|                  | The ability to pass on innovation                                        |
|                  | Financial Productivity                                                   |
|                  | Value Productivity                                                       |
|                  | The simplicity of interaction among system members                        |
| Robustness       | Member Survival Rate                                                     |
|                  | Sustainability                                                           |
|                  | Predictability                                                           |
|                  | Limited elimination                                                      |
|                  | Network Stability                                                        |
| Niche Creation   | Visionary Leadership                                                     |
|                  | Group effort                                                             |
|                  | Active corporate participation                                            |
|                  | Product/Service Diversity                                                |
|                  | Intangible Resources                                                      |
|                  | Knowledge and Experience                                                  |
|                  | Partnerships with Third Parties                                          |
| Co-creation      | Resource Enrichment                                                      |
|                  | Knowledge Spillover                                                       |
|                  | Product and Service Optimization                                          |
|                  | New Resource Creation                                                    |
|                  | Openness                                                                  |
|                  | Alignment of goals and values                                             |
| Cluster Cohesion | Network Relationship                                                      |
|                  | Counselling Unit Connectedness                                            |
|                  | Trust Relationship                                                        |
|                  | Co-induction                                                              |
|                  | Integration Capability                                                    |

Source: Compiled by this research.

Scholars have combined the fuzzy theory and DEMATEL into Fuzzy DEMATEL to solve uncertain problems. In this way, the results could better reflect the actual conditions and enable managers to make better decisions in a fuzzy environment. Keskin [40]
illustrated that DEMATEL could solve socially complex problems and causal structures. Combining the fuzzy theory and DEMATEL could help objectively analyze the mutual relationships between factors and solve multi-criteria decision-making problems. In addition, many experts and scholars have used Fuzzy DEMATEL to identify the critical success factors managers should consider in decision-making [40–42].

This study aimed to investigate the factors that require special attention in the operation of SME cluster ecosystems on different dimensions. It also explored the correlations between and characteristics of the elements. Therefore, drawing on previous studies, this study used Fuzzy DEMATEL as the research method to obtain critical success factors. The findings of this study will enable firms to leverage their strengths to ensure that they maintain competitive advantages in their industries. This study adopts the fuzzy DEMATEL research method. According to fuzzy theory literature, between 5 and 15 experts in a group is considered an appropriate size [43]. Therefore, this study invited 12 experts to respond to the questionnaires. These participants are experts with the knowledge or relevant experiences in operating ecosystems and SME industrial clusters, as shown in Table 3.

| Expertise        | Specialist Background | Number of Specialists |
|------------------|-----------------------|-----------------------|
| Practical Experience (years) | 1–10                  | 4                     |
|                  | 11–20                 | 4                     |
|                  | 21–30                 | 4                     |

| Field             | Academia              | 2                     |
|                  | Manufacturing industry | 5                     |
|                  | Information technology industry | 5               |

The purpose is to use their understanding of SME clusters and business ecosystems to evaluate the crucial dimensions and factors and construct the operations of SME cluster ecosystems, thus informing practical strategies in ecosystem construction.

The questionnaire items mainly cover the critical success factors in the operations of SME cluster ecosystems. The framework contains five dimensions, (1) productivity, (2) robustness, (3) niche creation, (4) co-creation, (5) cluster cohesion, and 27 factors.

4. Results and Analysis

Since ambiguity and uncertainty are unavoidable when experts fill out the questionnaires, this study used Fuzzy DEMATEL combined with ISM to understand the strength of influence relationships and mutual causality among the constructs and factors. However, the combination of the above two methods still cannot clearly show the degree of interaction between the factors, so the classification of matrix multiplication method was used to understand the interaction between the factors. Through these methods, the critical success factors can be derived. Finally, their management implications can be presented. Next, using the data obtained from the experts’ questionnaire, Microsoft Excel software and MATLAB commercial mathematical software were employed to calculate the matrix to obtain D-value and R-value. It was then divided into four clusters of factors, as shown in Figure 1.

Based on this research method, Figure 1 presents the analysis of the interactions between factors. The first group includes autonomous factors, productivity (A) and cluster cohesion (E), with low dependence and influence. Because these factors are close to the origin, their correlations with other factors are weak. These factors have a low or zero impact on the overall system. It is difficult to control these factors effectively in the short term.
The factor in the second group is co-creation (D), a dependent factor, characterized by the low influence and high dependence. Factors in this group are easily affected by autonomous factors and are the outcomes of the comprehensive effects of multiple factors, serving as indicators of the system’s performance. The analysis results in this study contain no factors in the third group, that is, linkage factors. They have high influence and high dependence and affect other factors. They are influenced by other factors and are relatively unstable.

The fourth group includes independent factors, robustness (B) and niche creation (C), with high influence and low dependence. They are liable to influence other factors and are considered critical factors. Therefore, decision-makers should consider prioritizing control over factors in this category.

Based on the results, the core dimension SMEs need to prioritize is the robustness dimension. Member survival rate and network stability were the most influential key factors in this dimension. This result echoes Moore’s vision of the business ecosystem, which was first proposed in the Harvard Business Review in 1993. It emphasizes that although members are interdependent and interlocked through competition and cooperation, forming a complex business network is essential. Enterprises should not focus too much on the competitive field but should view themselves as a part of the ecosystem from a holistic perspective. They can cross various industrial fields and continuously cooperate with system members in technology or product innovation to share benefits and grow together. Through collaboration and co-existence, members in the system can achieve a competitive advantage that a single enterprise cannot obtain. This means that the members in a cluster have a high degree of mutual connection. An individual’s survival is affected by individual performance and the ecosystem as a whole. As a result, the emphasis is on combining the wisdom and strategies of system members to adapt to rapid changes in the environment and survive. Since the core of value co-creation is interaction, forming a close and diversified collaborative relationship among members plays a significant role in defending the system against external interference and promoting the system’s stability.

The next consideration for SMEs is niche creation. Key factors include visionary leadership, group effort, enterprises’ active participation, and multiply cooperative relationships in niche creation. This shows that cooperation and active participation among enterprises can effectively stimulate diversity. Regarding co-creation, the optimization of products
and services and openness are its main factors. Thus, sharing resources and opening the platform will help the system stimulate new values.

According to the study results, SMEs may deem productivity and cluster cohesion as the final dimensions to be considered. The factors of productivity include value productivity and the simplicity of member interactions and processes. This indicates that the system members can effectively improve overall performance by simplifying the red tape in cooperation, complementarity, and competition. In addition, these interactions create financial profits and add meaningful value, thereby increasing the benefits of sustainable business development. Finally, the network relationship and integration capability are the priority factors in cluster cohesion, which indicates that the system members can effectively enhance the system’s competitiveness through integrating resources and establishing a close relationship.

Comparing results with existing literature, Kong et al. [40] pointed out that innovative industrial clusters were regarded as regional innovation centers and have become an essential foundation for national innovation strategies. However, problems such as unbalanced growth and inefficient development also existed in the actual development process of innovative industrial clusters. The findings of this study also agreed with Kong, Wang and Wu [40] that the dimension of cluster cohesion was often easily overlooked. The relationships within the network and integration capability should be the prime factors to be considered. This suggested that system members could only effectively enhance the system’s competitiveness by establishing close relationships. This study’s results were also consistent with Han, Chen, and Poh [16], suggesting that industrial clusters should emphasize strengthening external innovation partnerships, enhancing credit network externalities, and avoiding related risks. The results of Zeng, Liu, and Yi [4] implied that government should allow leading enterprises to establish professional technology cooperation platforms and provide additional support to promote cooperation among firms. The results of this study agreed with [4]. Both argued that with close interactions, the benefits of disseminating new knowledge and technology among participants in the system could be enhanced, thus, stimulating innovation.

5. Conclusions

This study aimed to investigate the factors that require special attention in the operation of SME cluster ecosystems on different dimensions. Given the importance of cross-industry collaboration and the consumer market’s growing complexity, SMEs seek to open up and innovate for the future by entering an ecosystem that fits their needs and building collaborative relationships with the system members. Therefore, this study aims to investigate the critical success factors of the ecosystem operation of SME clusters and uses the literature to inspect the prototype of the framework of the constructing factors. Additionally, an expert with experience in ecosystem operation and SME clusters was invited for pre-testing and interviews. A total of five significant dimensions and 27 related factors were compiled to revise the ecosystem operation structure for the SME cluster. Finally, the Fuzzy DEMATEL and the ISM analysis were conducted to understand the causal relationships among the factors. Next, the matrix multiplication method was used to classify the factors into four clusters. According to the influence dependency diagram, the influence and dependency of the factors were clarified, and different management methods were determined based on the location of the factors.

The influence–interdependence chart of the dimension of SME cluster ecosystem operation can be illustrated based on Figure 1. In Figure 1, items on the upper left, such as robustness (B) and niche creation (C) (1, 2), have relatively significant influence and low dependence. These factors are prone to exert significant influence on other factors. By controlling variables in this group, the developmental direction of the system can be influenced. Decision-makers should consider prioritizing control over these factors.

Conversely, the item on the bottom right, such as co-creation (D) (3, 1), has low influence and high dependence. The factor is the outcome of the comprehensive effects of
multiple factors. Therefore, it can serve as an indicator of the system’s performance and is liable to be influenced by independent factors.

Finally, the items on the bottom left, such as productivity (A) and cluster cohesion (E) (1, 1), have relatively low dependence and influence. These factors are located near the origin point and are known as non-linkage factors. Because they have weak linkage with other factors and low or zero influence on the overall system, it is challenging to control these factors effectively in the short term.

In summary, the SME cluster operation constructed by the business ecosystem concept can enhance innovation efficiency and value for the industry clusters that used to develop linearly. By creating physical or virtual platforms, we can provide members with more niche creation tools or technologies to enhance individual or overall operational performance and evolve together through interdependence in a cooperative and competitive relationship. Taiwan’s SMEs face the unknown and challenges brought by the fastest-changing environment by entering the business ecosystem. Enterprises interacting with system members and shared values in their respective professions, will enable the ecosystem to resist and withstand external impacts. SMEs could use cross-border communication and integration of each other’s resources to create expected benefits and achieve the goal of a co-prosperous ecosystem.

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