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Development Model of the Batik Harmoni SMI Cluster in North Sumatera: Post-COVID-19 Strategies and Solutions

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Abstract

Objective: This study aims to develop a cluster development model for Batik Harmoni MSMEs in North Sumatra using the Analytic Network Process (ANP) to identify priority solutions and strategies in the post-COVID-19 era. **Theoretical Framework:** This study is based on the theory of MSME cluster development, performance-based competitiveness, and crisis resilience theory, considering the interdependence between internal capabilities and external environmental factors. **Literature Review:** Criteria and Performance of Micro, Small, and Medium Enterprises (MSME), The Relationship between MSME Clusters and Business Performance, The Source of Working Capital, The Relationship between HR and Business Performance, The Connection Between Marketing Mix and Business Performance. **Method:** A mixed qualitative-quantitative approach was used through focus group discussions, in-depth interviews, and paired comparison questionnaires involving seven expert participants, with data processed using Super Decisions software and analyzed through priority weighting and Kendall's concordance coefficient. **Results:** The findings indicate that internal solutions are the highest priority, led by performance, followed by human resources, marketing mix, and business size, with total sales and profit margin as key performance indicators, training as the top human resource solution, product as the dominant marketing mix element, and working capital as the main business size factor. Externally, the economic environment during COVID-19, working capital, and government support, particularly technological assistance, were the most influential factors. **Implications:** The results suggest that post-pandemic MSME cluster development should prioritize strengthening internal performance supported by technology-based policies and institutional support. **Novelty:** This study offers an integrated ANP-based development model that systematically links the internal and external determinants of the resilience and competitiveness of batik MSME clusters in developing countries.

Keywords: msme, cluster of batik, priority solutions and strategy, pandemic covid-19, anp.

INTRODUCTION

Batik is one of Indonesia's leading cultural products and has received international recognition since its incorporation by UNESCO as an Intangible Cultural Heritage of Humanity in 2009 [1][2]. This recognition is due to several distinctive characteristics of batik production, including the regeneration of traditional skills, careful selection of printing tools and methods, rich motifs, and sophisticated dyeing techniques that reflect profound cultural values [3][4][5]. Beyond its cultural significance, batik also plays a significant economic

role, particularly as a labor-intensive creative industry that contributes to regional economic development and the sustainability of small and medium enterprises (SMEs) [6][7].

Historically, the batik industry has demonstrated relatively strong resilience to global economic shocks. Previous studies have shown that batik SMEs are supported by stable market demand and strong cultural attachments among consumers, enabling them to survive times of economic turbulence [8][9][10]. Nevertheless, maintaining competitiveness in an increasingly open and globalized market requires continuous improvement in human resource capabilities, product quality, standardization, production facilities, and marketing strategies, including participation in exhibitions and the adoption of digital-based programs such as the e-Smart initiative [11][12][13]. Furthermore, access to sustainable financing remains a crucial prerequisite for the long-term development of batik MSMEs.

Despite its resilience, the Indonesian batik industry faces increasing competition, particularly from lower-priced batik products originating from China, which puts significant pressure on local producers [14][15]. In response, local governments and stakeholders have sought to strengthen competitiveness through cluster-based development approaches. In North Sumatra, the Batik Cluster Cooperation Agreement signed between the Deli Serdang Cooperatives, MSMEs Office, and Bank Indonesia marked a significant milestone in institutional support for batik MSMEs. Established in 2018, the North Sumatra Batik Cluster initially consisted of ten entrepreneurs and was designed to increase collective efficiency, innovation, and market access through collaboration between producers and supporting institutions [7][16].

However, the COVID-19 pandemic presented unprecedented challenges to the sustainability of batik SME clusters. The Harmoni Batik Cluster in North Sumatra experienced a significant decline in business performance during the pandemic, with sales dropping to only 25–30 percent of normal levels. This decline was accompanied by workforce reductions, decreased production volumes, and increased production costs. At the same time, structural weaknesses became more apparent, including limited employee skills, increased competition, and less strategic business locations [17][18]. These conditions underscore the vulnerability of creative industry clusters when facing a systemic crisis such as the global pandemic.

Previous studies on SMEs and cluster development provide important insights but also reveal limitations. Research by Yahaya and G. Nadarajah (2023) identified key dimensions shaping SME productivity, including the organizational environment, capabilities, investment, innovation, external knowledge, and commercialization [19]. Prasanna et al. (2019) highlighted the crucial role of institutional quality and financial development in determining SME survival [20], while Audretsch (2021) emphasized the effectiveness of digital advertising in restoring brand awareness during a crisis [21]. Other studies highlight internal constraints such as financial viability, marketing innovation, digital readiness, and human resource quality, as well as external challenges related to inflation, declining purchasing power, and the adequacy of government support and training programs [22][23].

From a cluster perspective, Temouri et al. (2020), Wilson (2022), and Vernay (2018) argue that cluster growth is influenced by the presence of supporting industries, competitive business strategies, and the role of the government, along with demand conditions and broader economic factors [24][25][26][27]. However, most existing studies focus on SMEs in general or on cluster performance under normal economic conditions. Empirical research specifically examining post-pandemic development models for culture-based SME clusters, particularly batik clusters at the regional level, is still limited. There is a lack of integrative studies that combine internal and external challenges with a strategic and solution-oriented framework tailored to post-COVID-19 recovery.Based on these considerations, this study aims to fill this research gap by proposing a development model for the Harmoni Batik SME Cluster in North Sumatra in the post-industrial era.

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LITERATURE REVIEW

Criteria and Performance of Micro, Small, and Medium Enterprises (MSME)

Government Regulation No. 7, 2021, relating to the Ease, Protection, and Empowerment of Cooperatives and MSMEs, has amended several provisions of Law No. 20, 2008 concerning MSMEs and their criteria. Articles 35-36 explain that the grouping of MSMEs is based on business capital or sales results per year. Micro business capital criteria: maximum Rp1 billion. Small businesses: Rp1 billion to Rp5 billion. More than Rp5–Rp10 billion in medium-sized businesses. Everything does not include land and buildings for business premises. The criteria for annual sales results consist of: maximum IDR 2 billion for a microbusiness; small business: more than IDR 2-15 billion. More than IDR 15 billion to IDR 50 billion for a medium enterprise.The nominal amount of these criteria can change according to economic developments (Article 35 paragraph (7), government regulation on MSMEs, explaining that performance includes growth, profitability, returns, productivity, efficiency, and competitiveness [28][29]. Performance measurement in this study consists of sales growth and profit.

The Relationship between MSME Clusters and Business Performance

The empowerment of MSME's through the "cluster" approach is a model for strengthening, developing, and growing SMEs through grouping based on the type of business. Center for SMEs, namely grouping similar types of businesses (at least 20 SMEs) in one particular area [16][30]. Show that demand is a variable that needs to be considered in cluster development. On the other hand, the more active the government's role, will have a better impact on cluster development in an area [31]. Jiang et al. (2024) asserted that the cost structure affects profitability [32].

The Source of Working Capital

According to Prasanna (2019), there are two types of capital: 1. Capital itself is the wealth of the company's owners or is sourced from within the company; and 2. Foreign capital comes from parties outside the company, namely in the form of long-term loans with a term of more than one year, known as "long-term credit," such as bonds, mortgages, and so on, or short-term loans with a term of no more than one year. Sources of loan funds can come from formal financial institutions and loans from informal institutions [20]. Defilania (2025), showing a positive relationship between project quality and labor productivity, also found that SMEs that applied for bank loans but were rejected had lower levels of labor productivity than SMEs that received financing [33].

The Connection Between Marketing Mix and Business Performance

Nopsuwan (2025) A marketing mix is a combination of products, price, promotion, and distribution that is designed to elicit the desired response from the target market [34]. Amrin (2025) found that the main internal problems in the development of SMEs in Muslim entrepreneurs in Medan-Indonesia is a marketing problem, which consists of its main elements, namely the problem of product innovation and digital marketing [35]. Rizal Agus (2025) found a strong positive relationship between Nigerian SME marketing practices and indications of organizational performance [36]. There was a significant positive relationship between product, price, and promotion on the performance of SMEs, while the relationship between location and the performance of SMEs was found to be significantly negative.

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The Relationship between the Government's Role and the MSME cluster during the COVID-19 pandemic

In facing the crisis of protecting against the impact of the COVID-19 pandemic, the government plays a very important role [37]. Demirkan (2021) shows that SMEs that receive government support for innovation are more likely to innovate than firms that are not supported. Companies that innovate have grown significantly faster [38]. Danh Vinh (2023) shows that SME innovation contributes positively to the possibility of exports. In addition, the government network has a significant and positive relationship with the possibility of exports, although it is weaker than the relationship between the industrial network and the possibility of exports [39]. Ganlin et al. (2021) show that SMEs that engage in innovation strategies are highly dependent on the acquisition of external knowledge sources, and their innovation patterns show clear differences from traditional R&D-based product innovation strategies [40]. Najib (202) finds that lessons on SME constraints related to governance are important for developing supportive policies [41]. Internal financing sources have a significant and positive effect on performance, whereas external financing sources have a positive but not significant effect on performance [42]. Otache et al. (2021) showed that COVID-19 hurt business continuity. The longer the pandemic lasts, the more it will have an impact on the sustainability of MSME businesses [43]. On the other hand, the use of tax incentives has a positive effect on business continuity. The use of the MSME PPh tax borne by the government, which was extended in December 2020, had a major impact on the business continuity of the Jepara-Indonesia Troso Weaving MSMEs.

Business Connections

Review of the Small Business Act (SBA) for Europe (2011), which designates clusters and networks as a new form of cooperation between companies that can trigger synergies and contribute to strengthening competitiveness and innovation [44], Holubčík et al. (2023) show that formal business networks are significantly positively correlated with net assets and value-added growth [45]. Luongo (2023) confirms that radical innovation initiates a positive drive for innovation through direct cooperative relationships [46]. Zhang shows that digital companies that maintain temporary and prolonged relationships with outside employees are more likely to introduce product innovations frequently [47]. In addition, cognitive proximity and the use of external knowledge providers increase the likelihood of frequent product innovations.

METHODOLOGY

This study employed a mixed qualitative-quantitative approach using the Analytic Network Process (ANP) to develop and prioritize a post-pandemic development model for the Batik Harmoni SME cluster in North Sumatra [48][49]. The research was conducted in three main stages. First, model construction was conducted through problem decomposition based on an extensive literature review, in-depth interviews, questionnaires, and Focus Group Discussions (FGDs). This process aimed to identify key internal and external factors influencing cluster performance and to structure them into an interrelated analytical model. The FGDs involved seven experts and practitioners representing government agencies, business development associations, and members of the batik SME cluster. To ensure conceptual robustness, the initial model was validated by experts to confirm the relevance and accuracy of the relationships between elements. Second, model quantification was conducted by translating the validated model into a pairwise comparison questionnaire using Super Decisions software. Respondents rated the relative importance of each element using a scale of 1 to 9. Third, the results were synthesized by entering the completed questionnaires into software to calculate priority weights, average respondent scores, and Kendall's concordance coefficient to measure the level of agreement among experts, followed by interpretation of the results [50].

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Data collection was conducted through in-depth interviews, questionnaires, and focus group discussions (FGDs), guided by a structured instrument. Seven expert participants were selected using purposive sampling based on their expertise and direct involvement in batik SME development, in line with qualitative research principles that emphasize information richness over population size [51]. Participants included one official from the North Sumatra Cooperatives and SMEs Office, two representatives from the North Sumatra Business Development Services Association (ABDSI), and four members of the Harmoni Batik SME cluster. Data validity was ensured through source triangulation, member checking, and expert confirmation, particularly with the Head of the Batik Harmoni Cluster, to verify the accuracy and consistency of the findings. Pairwise comparisons of ANPs used Saaty's fundamental scale, ranging from 1 (equally important) to 9 (much more important), with intermediate values to capture more nuanced assessments. This methodological design enabled the identification of comprehensive and reliable priority strategies and solutions to strengthen the resilience and competitiveness of the Batik Harmoni SME cluster in the post-COVID-19 era.

Table 1. Research Method Used in This Study

Aspect	Description
Type of Research	Mixed-method approach (qualitative–quantitative) using the Analytic Network Process (ANP)
Approach	Descriptive qualitative approach
Research Objective	To develop and prioritize a post-pandemic development model for the Batik Harmoni SME cluster in North Sumatra
Rationale for Approach	The mixed-method ANP approach enables the integration of expert judgment and empirical assessment to capture complex interdependencies among internal and external factors affecting SME cluster development.
Key Figures Analyzed	Seven experts and practitioners, consisting of government officials, business development service representatives, and Batik Harmoni SME cluster members
Main Data Sources	literature review, in-depth interviews, structured questionnaires, and Focus Group Discussions (FGDs)
Method of Analysis	Analytic Network Process (ANP) using pairwise comparisons, priority weighting, synthesis of results, and Kendall's coefficient of concordance (W) with the aid of Super Decisions software
Theoretical Framework	Cluster development theory, SME resilience and competitiveness theory, and decision-making theory based on ANP
Focus of Analysis	Identification and prioritization of internal and external factors influencing the resilience and competitiveness of the Batik Harmoni SME cluster in the post-COVID-19 era
Expected Outcome	A validated and prioritized strategic development model to strengthen the sustainability, resilience, and competitiveness of the Batik Harmoni SME cluster

RESULTS AND DISCUSSION

Decomposition

Study literature and in-depth interviews has been conducted to obtain the network model of the development model of Batik Harmoni Cluster after Pandemic Covid-19. Decomposition of the ANP model generates some sub-solutions. Developing Batik Harmoni Cluster after Pandemic Covid-19 model can be seen through the following figure:

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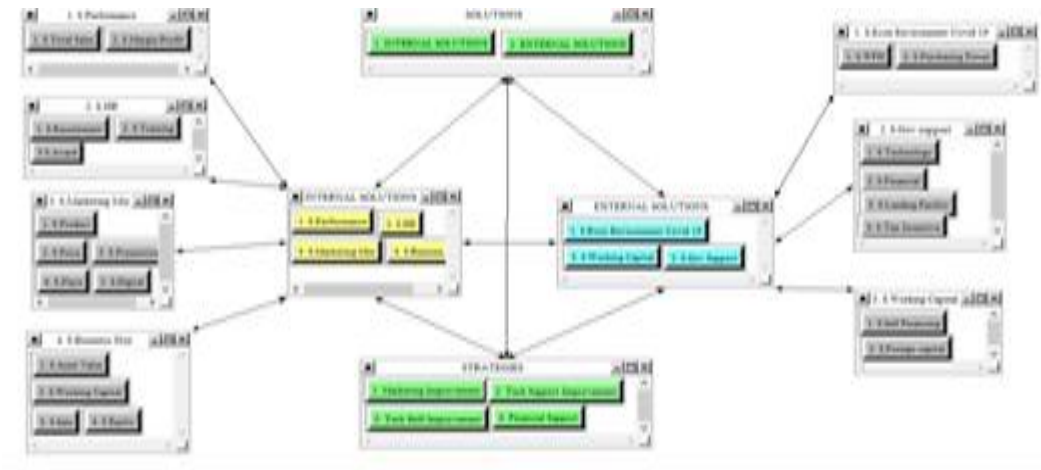

Figure 1. ANP Network Model

Synthesis Solution Results

There are seven (7) informants used in this study to obtain the number of priorities. R1 shows the first respondent, R2 indicates the second respondent, and R7 indicates the seventh respondent, while the geometric mean shows the overall value of all respondents. The consensus result shows that internal solutions are the highest priority. The last priority was the external solution (32.9%). The result of a rater agreement for this cluster shows that W = 100%, which means that the informant's agreement with the priority level of this cluster is perfect. Perfect agreement can be achieved once all the respondents come up with the same answer for all the priorities in the cluster. For more details, the consensus of the sub-cluster from internal and external factors can be discussed through the following sub-discussion:

Synthesis Internal and External Solution Results

Figure 2. Consensus Synthesis Internal Solution Results Related to Harmoni Batik Cluster Development Model

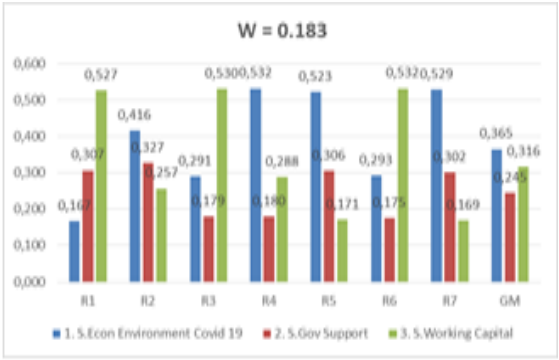

Figure 3. Consensus Synthesis External Solution Results Related to Harmoni Batik Cluster Development Model

Figure 2: Consensus Synthesis Internal Solution Results Related to Harmoni Batik Cluster Development Model Figure 3: Consensus Synthesis External Solution Results Related to Harmoni Batik Cluster Development Model

Figure 2 shows the consensus result that performance is the highest priority internal solution of the Harmoni cluster development model (0.352), followed by human resources (0.308), mixed marketing (0.170), and the last priority is business size (0.126). The result of a rater agreement for this cluster shows that W = 65.7%, which means that the informant's agreement with the priority level of this cluster is relatively high, above 50%. From the graph above, it can be seen that out of all 7 respondents, only 3 respondents have different answers

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to the top priority of the cluster. More details on the consensus of the sub-cluster from internal factors can be discussed afterwards.

The Consensus Synthesis Performance Solution Results show that total sales is the highest priority performance solution cluster of the Harmoni cluster development model (0.614), and the last priority is margin/profit (0.353). The result of a rater agreement for this cluster shows that W = 51%, which means that the informant's agreement with the priority level of this cluster is slightly above 50%. From the graph above, it can be seen that out of all 7 respondents, only 1 respondent had a different answer to the priority of the cluster.

The Consensus Synthesis of Human Resource Solution Results shows that training is the highest priority human resource solution cluster of the Harmoni Cluster Development Model (0.358), followed by awards (0.299) and recruitment (0.238). The result of a rater agreement for this cluster shows that W = 8.1%, which means that the informant's agreement with the priority level of this cluster is extremely low. The informants' differing responses to the priority question result in low levels of agreement among them.

The Consensus Synthesis of Marketing Mix Solution Results shows that product is the highest priority Mix Marketing solution cluster of Harmoni cluster development model (0.295), followed by price and promotion (0.199), digital (0.115), and the last priority is place (0.086). The result of a rater agreement for this cluster shows that W = 46.1%, which means that the informant's agreement with the priority level of this cluster is slightly higher, almost reach 50% consensus. The informants' differing responses to the priority question result in low levels of agreement among them.

The Consensus Synthesis of business-size Solution Results shows that working capital is the highest priority business size solution cluster of the Harmoni cluster development model (0.307) and is followed by asset value (0.236), equity (0.227), and the last priority is sales (0.127). The result of a rater agreement for this cluster shows that W = 36.3%, which means that the informant's agreement with the priority level of this cluster is relatively low. The informants' differing responses to the priority question result in low levels of agreement among them.

Synthesis of External Solution Results shows consensus assessment results from the priority external solution of the Batik Harmoni cluster development model. The consensus result shows that the economic environment in the Covid19 situation is the highest priority external solution (0.365), and is followed by working capital (0.316), and the last priority is government support (0.245). The result of a rater agreement for this cluster shows that W = 18.3%, which means that the informant's agreement with the priority level of this cluster is low. The informants' differing responses to the priority question result in low levels of agreement among them. More details on the consensus of the sub-cluster from external factors can be discussed afterwards.

The Consensus Synthesis Covid-19 situation Solution Results show that working from home is the highest priority of the Covid-19 situation solution cluster of the Harmoni cluster development model (0.483), and the second priority is purchasing power (0.438). The result of a rater agreement for this cluster shows that W = 2%, which means that the informant's agreement with the priority level of this cluster is extremely low. The informants' differing responses to the priority question result in low levels of agreement among them.

The Government Consensus Synthesis Solution Results show that technology is the highest priority government support solution cluster of the Harmoni cluster development model (0.321), and the second priority is financial (0.221), third is lending facility (0.195), while the last priority is tax incentive (0.140). The result of a rater agreement for this cluster shows that W = 25%, which means that the informant's agreement with the priority level of this cluster is low. The informants' differing responses to the priority question result in low levels of agreement among them.

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The Consensus Synthesis Working Capital Solution Results Related to the Harmoni Batik Cluster Development Mode. The consensus result shows that self-financing is the highest priority working capital solution cluster of the Harmoni cluster development model (0.684), while the last priority is foreign capital (0.310). The result of a rater agreement for this cluster shows that W = 100%, which means that the informant's agreement with the priority level of this cluster is perfect. Perfect agreement can be achieved once all the respondents come up with the same answer for all the priorities in the cluster.

The results of the Synthesis Strategy consensus assessments show that marketing improvement is the highest priority strategy of the Harmoni cluster development model (27.4%), followed by technology support improvement (0.272), technology skill improvement (0.223), and the last priority was financial support (14%). The result of a rater agreement for this cluster shows that W = 25%, which means that the informant's agreement with the priority level of this cluster is low. The informants' differing responses to the priority question result in low levels of agreement among them.

Analysis

The analysis of the Batik Harmoni SME cluster development model reveals that post-pandemic recovery is primarily driven by internal organizational capacity rather than external intervention alone. The prioritization results generated through the Analytic Network Process (ANP) demonstrate that internal solutions outweigh external factors in determining the resilience and competitiveness of the cluster. This finding highlights the importance of strengthening firm-level capabilities as a foundation for sustainable recovery in creative industry clusters affected by systemic crises.

Performance emerges as the most critical internal dimension, indicating that sales recovery and profitability are central concerns for SMEs following the COVID-19 disruption. The emphasis on total sales as the primary performance indicator reflects the immediate need for market reactivation and demand restoration. Profit margins, while still important, are treated as a secondary objective, suggesting that SMEs prioritize survival and cash flow stabilization before pursuing efficiency optimization. This pattern illustrates a pragmatic response to crisis conditions, where maintaining operational continuity takes precedence over long-term financial refinement. Human resources represent the second most important internal factor, with training identified as the top priority. This outcome indicates that skill enhancement and capacity building are viewed as essential mechanisms for adapting to post-pandemic market conditions, including digital transformation and changing consumer behavior. However, the low level of consensus among experts regarding human resource priorities suggests differing perspectives on how workforce development should be implemented. This divergence may reflect variations in firm size, resource availability, and managerial experience within the cluster.

The marketing mix occupies the third internal priority, with product development ranking highest among its elements. This result underscores the centrality of product quality, design, and innovation in maintaining competitiveness within the batik industry. While digital marketing and promotional strategies are recognized as important, they are perceived as supporting tools rather than primary drivers of recovery. This finding indicates that market access efforts are most effective when they are anchored in strong product differentiation and cultural authenticity. Business size, measured through indicators such as working capital, asset value, and equity, ranks as the fourth internal priority. The prominence of working capital within this cluster highlights the liquidity challenges faced by SMEs in the post-pandemic period. Access to sufficient internal financing is essential for sustaining production, managing costs, and responding to market opportunities, especially when external financing is perceived as risky or inaccessible.

From an external perspective, the economic environment during the COVID-19 period is identified as the most influential factor. Changes in working arrangements and declining

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purchasing power significantly affected production processes and consumer demand. The preference for self-financing over external capital reflects a cautious financial strategy adopted by SMEs under uncertainty. Government support, particularly in the form of technological assistance, is viewed as beneficial but not decisive unless it complements internal capability development. Overall, the analysis demonstrates that effective post-pandemic recovery for batik SME clusters depends on the strategic alignment of internal performance strengthening with selective external support, emphasizing adaptability, skill development, and market-oriented innovation as key drivers of resilience.

CONCLUSION

From this research, it can be concluded that the internal solution is the highest priority solution model, followed by external solutions. Performance is the highest priority internal solution, with the main elements, namely, total sales, followed by profit margin. The second priority cluster is human resources, with the main elements of training being the highest priority human resource solution, followed by awards and recruitment. The third priority cluster is the marketing mix, with its main elements. Product is the highest priority of the Marketing Mix solution cluster, followed by price and promotion, digital, and place. The fourth priority cluster is business size, with the main element of Working capital being the highest priority business size solution, followed by asset value, equity, and sale. The economic environment in the COVID-19 situation is the highest priority external solution, with the main element of working from home being the highest priority of the COVID-19 situation, followed by purchasing power. The second priority in the external solution is working capital, with the main element being self-financing, which is the highest priority working capital solution cluster, followed by foreign capital. The third priority in external solutions is government support. With technology as the main element, technology is the highest priority government support solution, followed by financial, lending facilities, and tax incentives. Marketing improvement is the highest priority of the strategy, followed by technology support improvement, technology skill improvement, and financial support.

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Author's Contributions

The author solely conceived the study, designed the research framework, conducted data collection and analysis, and interpreted the findings. The author also drafted, revised, and finalized the manuscript independently, approved the final version for publication, and takes full responsibility for the accuracy, integrity, originality, and scholarly quality of the work in accordance with ethical academic standards.

Conflicts of Interest

The author declares no conflicts of interest related to this study. There are no financial, institutional, or personal relationships that could influence the research process, analysis, or interpretation of results. The study was conducted independently, and all conclusions and arguments presented reflect the author's own academic judgment without external pressure or competing interests.

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