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Technopreneurship Enhancing Student MSMEs Competitive Edge via Digital Marketing

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ABSTRACT

This research aims to analyze the role of technopreneurship in increasing the competitive advantage of student MSMEs in Semarang City through digital marketing capability. **This study** uses a quantitative approach. The sampling technique in this research is a quota random sampling technique. This technique is used because the grouping of MSMEs is united into one group, namely the student MSME group in Semarang City which is technology oriented. The number of samples in this research was 120 student MSME actors in Semarang City. **The analytical method** used in this research is Structural Equation Modeling (SEM) analysis with the help of the SmartPLS program. The research results show that digital marketing capability and innovation capability directly have a positive and significant influence on the competitive advantage of student MSMEs in Semarang City. **Technopreneurship has a significant effect** on competitive advantage. Indirectly, technopreneurship has a significant effect on competitive advantage through digital marketing capability. However, indirectly, innovation capability has no significant effect on competitive advantage through digital marketing capability. **The implication of this research** is that student MSMEs that are run by students tend to be more adaptive to technological developments, so that a technopreneurship approach will be very helpful in increasing the competitive advantage of student MSMEs.

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1. INTRODUCTION

Technopreneurship in MSMEs owned by students is an interesting phenomenon in the context of the current digital economy. Technopreneurship combines elements of technology with an entrepreneurial spirit to create added value and innovate in a competitive market. Students as technopreneurship practitioners often utilize the technical knowledge they gain during their studies to develop innovative technology-based

products or services. They also tend to be more open to risk, taking advantage of supportive environments such as startup incubators in universities or digital platforms to market their products [1]. This phenomenon is increasingly important as digital technology has drastically changed the business landscape, enabling easier access to global markets and accelerating product development cycles. Students involved in technopreneurship not only develop their technical skills but also learn to manage a business, market products, and interact with customers directly. This provides them with valuable experience that can improve their future career prospects, either as independent entrepreneurs or as professionals in the technology industry [2].

Technopreneurship in MSMEs owned by students, although promising, is also faced with a number of problems that need to be overcome. One of the main challenges is limited capital and resources [3]. Students who want to start a technopreneurship business often face obstacles in obtaining sufficient initial capital to develop their technology-based products or services. Lack of access to formal funding sources and investors' concerns about high business risks often make it difficult for students to develop their innovative ideas into sustainable businesses [4].

Technopreneurship can increase the competitive advantage of student MSMEs if supported by innovation and digital marketing capabilities. However, research on the influence of technopreneurship, innovation capabilities, and digital marketing on competitive advantage still produces varying findings [5, 6]. Although there have been several studies that reveal the relationship between these factors separately, there is still a lack of literature that comprehensively investigates the interactions and relationships between the three in the same context. Previous research tends to focus on each variable in isolation, without considering how the interaction between technopreneurship, innovation capabilities, and digital marketing capabilities can mutually reinforce each other in achieving competitive advantage [7, 8].

Furthermore, existing research has not fully explained the mechanisms or processes of how technopreneurship and innovation capabilities contribute to the development of effective digital marketing capabilities, and conversely, how digital marketing capabilities influence the adoption of innovative technologies and business development strategies. In addition, the context of industrial and geographic differences can also influence how the interaction between these variables affects specific competitive advantages [9, 10]. Therefore, there is a need for more in-depth and holistic research that not only identifies the influence of each factor but also explores the dynamic interaction between technopreneurship, innovation capability, and digital marketing capability in creating sustainable competitive advantages for companies. This research can provide valuable guidance for practitioners and decision-makers in developing appropriate strategies to face increasingly complex and dynamic market challenges in today's digital era [11].

The novelty of this study lies in its focus on integrating technopreneurship and digital marketing skills in improving the competitive advantage of student Micro, Small, and Medium Enterprises (MSMEs). Unlike previous studies that generally discuss technopreneurship separately from digital marketing strategies, this study highlights how the synergy between the two can provide stronger competitiveness for student MSMEs [12, 13]. In addition, this study adopts a case study-based approach and empirical analysis of student MSMEs, thus providing deeper insight into the factors that influence the success of technopreneurship in the digital-based business world. The main difference with previous studies can also be seen from the approach used. Many previous studies emphasize the technical aspects of technopreneurship, such as technology-based product development or innovation in business models, without delving deeply into the role of digital marketing as a major factor in creating competitive advantage. This research aims to analyze the role of technopreneurship in increasing the competitive advantage of student MSMEs in Semarang City through digital marketing capability.

This study aligns closely with several Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 9 (Industry, Innovation, and Infrastructure). The relevance to SDG 4 is reflected in how technopreneurship and digital marketing capabilities enhance students' technological literacy, creativity, and entrepreneurial competencies. The connection to SDG 8 appears through the role of student MSMEs in generating new business opportunities, stimulating local economic growth, and strengthening the competitiveness of young entrepreneurs. Meanwhile, SDG 9 is embodied in the use of technology, innovation capability, and digital marketing as essential foundations for building sustainable competitive advantage. By integrating technopreneurship, innovation capability, and digital marketing skills, this research demonstrates how student entrepreneurs can act as drivers of innovation and digital transformation, while simultaneously supporting the development of a modern, adaptive, and competitive business ecosystem.

2. LITERATURE REVIEW

2.1. Resource-Based View Theory

The contribution of the company's resource-based perspective to date is the theory of competitive advantage. The logical basis begins with the assumption that the primary goal of managerial efforts in a company is to achieve sustainable competitive advantage. The focus is on how companies can identify, develop, and use key resources to maximize profits, as well as finding ways to achieve and maintain these advantages. A resource-based approach places strategic responsibility on company management, burdening them with these critical tasks.

The importance of resources in creating competitive advantage is immeasurable, as resources form the core foundation upon which organizations build their strategic capabilities and differentiate themselves from competitors in dynamic market environments. The Resource-Based View (RBV) argues that a firm's success is fundamentally rooted in its ability to acquire, develop, and deploy internal resources that are not only valuable but also rare, difficult to imitate, and non-substitutable. These resources may include employee expertise, technological assets, knowledge capital, organizational culture, strong brand reputation, innovative capabilities, and efficient managerial systems each of which contributes uniquely to a firm's operational effectiveness and strategic resilience. According to RBV, such internal strengths determine how effectively a company can innovate, respond to market changes, and sustain long-term performance outcomes. This internal orientation represents a clear departure from traditional strategic approaches that prioritize external environmental analysis such as industry competition, market structure, or macroeconomic trends as the primary basis for gaining advantage [14]. By shifting the analytical focus inward, RBV emphasizes that true and enduring competitive advantage stems from cultivating organizational capabilities that competitors cannot easily replicate, thereby enabling firms to continuously generate superior value, maintain strategic distinctiveness, and thrive even amid external uncertainty and technological disruption.

According to the RBV, resources that are Rare, Valuable, Inimitable and Non-substitutable (RVIN resources) can be a source of sustainable competitive advantage for companies. Rare resources make a company unique in the market, while the value of these resources can increase operational efficiency or effectiveness. The non-imitable and non-substitutable nature of resources ensures that these advantages are not easily imitated by competitors or replaced by other alternatives.

2.2. Competitive Advantage

Competitive advantage refers to a relatively better position in the market, encouraging a company to overcome its competitors. Any company can achieve competitive advantage through two main approaches: cost, by operating its business at lower costs than competitors for comparable products; and differentiation, which involves developing "non-price" attributes that differentiate a company as superior to others suggests that companies maintain sustainable competitive advantage by implementing unique value creation strategies that cannot be imitated by current or potential competitors. In general, the literature on competitive advantage emphasizes that companies can choose between a cost leadership strategy to achieve low costs or a differentiation strategy to offer unique added value.

According to [5], differentiation strategy involves developing products with additional benefits that are considered unique or different, as well as offering more value to customers. This strategy is closely related to innovation activities. Meanwhile, a cost leadership strategy achieves lower costs than competitors without sacrificing quality, service, or other relevant attributes, by converting internal efficiencies into lower costs or lower prices for customers. Haseeb highlighted that the main factors in cost drivers include economies of scale, capacity utilization and process management. Companies can also differentiate themselves by providing superior service, offering innovative features, developing a strong brand, or implementing effective promotions [15].

2.3. Technopreneurship

Technopreneurship is a combination of two words, namely "Technology" and "Entrepreneurship", which means the process of forming a new business by involving technology to create the right strategy and innovation, becoming one of the factors in developing the national economy. Technopreneurship is the process of commercializing technology products that were initially of little value into high-value products that attract consumer interest, and is considered a derivative concept of "Entrepreneurship" with the main principle of seeking profit, but focuses more on businesses that apply certain technologies [16]. The initiators of ideas and product creators in the technology sector are called technopreneurs because they combine their knowledge with product creation and entrepreneurial skills through selling products on the market. The ability of business actors

to utilize technology can increase their ability to market their products, thereby increasing their competitiveness in domestic and international markets [17].

In the context of digital marketing, technopreneurship enables companies to leverage advanced technologies such as data analytics, artificial intelligence, automation systems, and social media platformsn to optimize and refine their marketing strategies in a highly competitive digital environment. Innovative technopreneurs are often capable of developing new digital tools, applications, and analytical models that enhance the understanding of consumer behavior, support more accurate market segmentation, and enable deeper levels of content personalization [15]. These innovations not only increase the overall efficiency and precision of digital marketing campaigns but also expand market reach, strengthen brand awareness, and foster higher levels of customer engagement across various digital touchpoints. Moreover, the ability to continuously innovate and deliver market-relevant solutions allows companies to become more adaptive and responsive to rapidly evolving trends and shifting consumer preferences, ultimately reinforcing their competitive position. Technopreneurship also provides broader strategic value by opening pathways to new markets, facilitating collaboration with digital partners, and encouraging the formation of strategic alliances that can accelerate growth. These opportunities contribute to increased market share, enhanced business resilience, and potentially higher company revenue over time [18].

- H1a: Technopreneurship has a positive and significant effect on digital marketing capability.
- H1b: Technopreneurship has a positive and significant effect on competitive advantage.

2.4. Innovation Capability

An organization's innovation capability is able to respond to the environment more effectively than its competitors. Innovation is defined as a method in which knowledge is obtained, shared and transformed into new knowledge to develop and improve products and services [19]. Innovation is divided into two parts; the first is a series of innovations that include existing rules, structures, managerial procedures, products and services. Another part is the depth of innovation and creativity, which is the main focus of this paper, which includes employee inspiration and the results of the products and services produced. Human Resources (HR) practices are a collection of activities used by an organization to manage organizational capabilities; for example, in creating public relations, collecting and managing knowledge to achieve competitive advantage. Success in managing organizational innovation has become an important strategy for survival.

Innovation capabilities enable companies to continuously generate and implement new ideas, redesign and enhance existing products and services, and develop more efficient and customer-oriented methods to reach and satisfy their target markets. These capabilities reflect an organization's ability to transform knowledge, creativity, and technological insight into meaningful improvements that strengthen its competitive position. In the context of digital marketing, innovation capabilities play an even more critical role, as they allow companies to adopt and maximize the use of emerging technologies and cutting-edge marketing strategies such as predictive data analytics, artificial intelligence driven personalization, machine-learning-based recommendation engines, and marketing automation systems to improve the precision and effectiveness of their promotional activities. By leveraging these innovative tools, companies can design highly personalized, dynamic, and context-specific marketing messages that resonate more strongly with individual consumers. This leads to deeper interaction, higher engagement levels, and stronger customer relationships across various digital channels. Ultimately, innovation capabilities enable firms to remain agile in responding to rapid technological changes, anticipate shifts in consumer preferences, and deliver superior digital experiences that enhance brand loyalty and long-term competitiveness.

- H2a: Innovation Capability has a positive and significant effect on digital marketing capability.
- H2b: Innovation Capability has a positive and significant effect on competitive advantage.

2.5. Digital Marketing Capabilities

Digital marketing capabilities enable companies to reach a wider and more diverse audience through various digital channels such as social media, email marketing, and search engines. By using engaging content digital marketing tools and techniques, companies can increase brand visibility and attract more potential customers [20]. The use of digital analytics also helps companies to measure the effectiveness of their marketing campaigns and make necessary adjustments quickly, thereby increasing the efficiency and (ROI) Return On

Investment of marketing efforts. The ability to interact and communicate directly with customers via digital platforms also provides a competitive advantage. Companies can respond quickly to customer feedback, resolve complaints, and build closer relationships with their customers. This not only increases customer satisfaction but also strengthens the company's brand image and reputation in the market [21].

Digital marketing capabilities mediate the influence of technopreneurship and innovation capabilities on competitive advantage by increasing the efficiency, precision, and effectiveness of marketing communications, strengthening customer engagement, and ultimately driving business growth and long-term organizational success [22]. Through the use of digital tools, analytics, and interactive platforms, businesses are able to translate technological and innovative strengths into measurable market outcomes, such as improved brand visibility, stronger customer loyalty, and more accurate targeting of consumer segments. These capabilities also enable firms to respond rapidly to market changes, personalize marketing content, and optimize promotional strategies in real time. Without strong digital marketing capabilities, however, the full benefits of technopreneurship and innovation may not be maximized, limiting a firm's ability to transform technological potential into strategic market advantages and thereby reducing the overall impact of these factors on the company's competitive advantage.

- H3: Digital Marketing Capability has a positive and significant effect on Competitive Advantage.
- H4: Digital Marketing Capability can mediate the influence of technopreneurship on Competitive Advantage.
- H5: Digital Marketing Capability can mediate the influence of innovation capability on Competitive Advantage.

3. RESEARCH METHOD

This study uses a quantitative approach. There are two data used in this research, namely primary and secondary data. Primary data in this research was directly collected by the researcher from the first source. Primary data was collected using a questionnaire addressed directly to the research sample. The sampling technique in this research is a quota random sampling technique. This technique is used because the grouping of MSMEs is united into one group, namely the Student MSME group in Semarang City which runs its business by utilizing technology. This means that sampling for MSMEs does not have levels (stratification) in it, so that sampling is carried out randomly and proportionally at each university in Semarang City. The number of samples in this research was 120 student MSME actors in Semarang City, Central Java Province, Indonesia. The number of samples has met the requirements of SEM-PLS analysis which is a minimum of 100 samples. The sample in this study were students who have digital-based businesses and are related to the use of technology.

The questionnaire used in this research is a Structured Equation Modeling (SEM)–based instrument consisting of several carefully designed questions intended to capture comprehensive information related to Technopreneurship, Digital Marketing Capability, Innovation Capability, and Competitive Advantage among Student MSMEs in Semarang City. Each construct is measured through multiple indicators that reflect the behavioral, strategic, and technological dimensions relevant to student-led business activities. To ensure consistency and comparability of responses, the questionnaire adopts a five-point Likert scale ranging from 1 to 5, where respondents indicate their level of agreement or preference for each statement. This scale allows researchers to quantify attitudes, perceptions, and capabilities in a structured manner, making it possible to conduct further statistical and SEM-PLS analyses accurately. The use of this standardized measurement approach also enhances the reliability of the data, enabling a deeper understanding of how technopreneurial behavior and digital competencies contribute to the competitive performance of student MSMEs.

The analysis technique used in this research is SEM with the help of the SmartPLS program. SEM is a powerful multivariate statistical technique that integrates multiple regression analysis and factor analysis, allowing researchers to examine complex relationships between observed and latent variables. This method is particularly useful for testing theoretical models that involve multiple interdependent relationships simultaneously. SEM enables a deeper understanding of how different constructs influence one another, making it ideal for research involving behavioral, social, and business sciences. By utilizing Partial Least Squares (PLS) in this study, the researchers ensure flexibility in handling non-normally distributed data and small sample sizes while maximizing the explained variance of the dependent constructs. The application of SmartPLS software

streamlines the process by providing graphical modeling tools and statistical validation, ensuring the robustness of the findings. This approach allows for a more comprehensive evaluation of hypotheses, making it an essential method for analyzing technopreneurship, digital marketing capability, and competitive advantage in student MSMEs.

Table 1. Variables, Indicators and Factor Loadings

Variable	Indicator	Loading Factor	Source
Technopreneurship	Mastery of Technology and Information	0.880	[13]
	Access to Technology Resources	0.820	
	Adaptive to technological developments	0.796	
	Speed of product launch to market	0.816	
Innovation Capability	Product characteristics are diverse	0.897	[23]
	Ability to change product prices	0.870	
	Product innovation capabilities	0.854	
	Administrative innovation	0.798	
	Ability to develop products	0.790	
	Ability to display different products	0.850	
Digital Marketing Capabilities	Use of digital marketing technology	0.786	[24]
	Utilization of social media	0.785	
	Utilization of digital advertising	0.871	
	Use of data to inform and optimize marketing strategies	0.864	
	The level of customer interaction through various digital channels	0.842	
Competitive Advantage	Product price	0.794	[25]
	Product uniqueness	0.877	
	Human resources responsibilities	0.910	
	Company sensitivity	0.914	
	Product quality	0.876	
	Speed of product development	0.810	

Source: Processed Primary Data, 2024.

The Table 1 above presents the variables, indicators, and factor loadings used in this study. The variables include Technopreneurship, Innovation Capability, Digital Marketing Capabilities, and Competitive Advantage. Each variable consists of multiple indicators that represent measurable aspects of the construct. The factor loadings indicate the strength of the relationship between each indicator and its respective variable, where higher values suggest stronger associations.

The results demonstrate that all indicators exhibit significant factor loadings, confirming their validity in representing the respective constructs. Technopreneurship encompasses aspects such as mastery of technology, access to resources, adaptability, and product launch speed. Innovation Capability covers diverse product characteristics, pricing flexibility, and administrative innovation. Digital Marketing Capabilities measure the effectiveness of using digital tools, advertising, and customer interaction. Competitive Advantage reflects key business performance attributes, including pricing, product uniqueness, and responsiveness.

These findings support the reliability of the measurement model, reinforcing that each construct is adequately captured by its respective indicators. The strong factor loadings suggest that the selected indicators effectively represent the key dimensions of technopreneurship, innovation, digital marketing, and competitive advantage within student MSMEs.

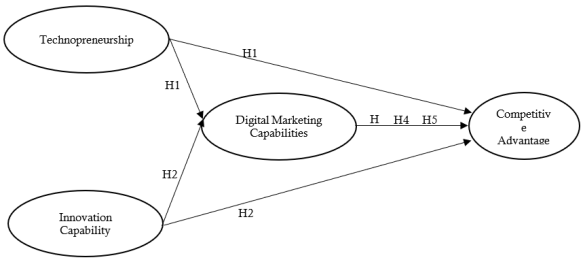

Figure 1. Research Framework

Figure 1 illustrates the research framework, depicting the relationships between Technopreneurship, Innovation Capability, Digital Marketing Capability, and Competitive Advantage. The model is designed based on the SEM approach, utilizing SmartPLS to analyze the interdependencies between these variables.

In the framework, Technopreneurship and Innovation Capability serve as independent variables, influencing both Digital Marketing Capability and Competitive Advantage. Digital Marketing Capability acts as a mediating factor, facilitating the effect of Technopreneurship and Innovation Capability on Competitive Advantage. The directional arrows indicate the hypothesized relationships among these constructs, reflecting the theoretical assumptions tested in this study.

The research aims to determine whether Technopreneurship and Innovation Capability have a direct impact on Competitive Advantage or whether Digital Marketing Capability plays a significant mediating role. This conceptual model provides a structured approach to understanding the factors that contribute to the success of student MSMEs in a competitive business environment.

4. RESULTS AND DISCUSSION

4.1. Cronbach's Alpha Reliability Test

The results of the Cronbach's Alpha reliability test in this research model are as follows:

Table 2. Results of Cronbach's Alpha Reliability Test

Construct	Cronbach's Alpha	Information
Technopreneurship	0.910	Reliable
Innovation Capability	0.890	Reliable
Digital Marketing Capabilities	0.879	Reliable
Competitive Advantage	0.925	Reliable

Source: Processed Primary Data Output, 2024.

Based on Table 2, it is evident that all constructs in the research model demonstrate strong internal consistency, as reflected by Cronbach's Alpha values that exceed the commonly accepted threshold of 0.70. The Technopreneurship construct shows a reliability coefficient of 0.910, indicating excellent internal consistency and suggesting that the indicators used to measure this construct are highly cohesive and stable. Similarly, Innovation Capability records an alpha value of 0.890, reinforcing that the associated indicators accurately represent the underlying conceptual domain. Digital Marketing Capabilities, with a reliability score of 0.879, also demonstrates a high degree of measurement consistency, confirming that respondents' answers to the related items are reliable and align well with the construct being measured. Competitive Advantage shows the highest reliability at 0.925, further validating that the indicators used effectively capture the dimensions of competitive strength within student MSMEs. Overall, these results confirm that all constructs in the model possess strong reliability, ensuring that the instrument used in this study is robust and capable of producing consistent and dependable measurements across respondents. This high level of reliability also strengthens the validity of subsequent structural analyses, as it ensures that the relationships tested within the SEM-PLS model are based on constructs measured with precision and stability.

4.2. Combined Reliability Test (Composite Reliability)

Composite reliability testing is carried out to show the internal consistency of an indicator in a latent variable. Usually, the composite reliability value is greater than the Cronbach's Alpha value. Indicators are

considered reliable if the composite reliability value is greater than 0.70. The composite reliability test results are presented in Table 3 as follows:

Table 3. Combined Reliability Test Results (Composite Reliability)

Construct	Cronbach's Alpha	Information
Technopreneurship	0.876	Reliable
Innovation Capability	0.917	Reliable
Digital Marketing Capabilities	0.910	Reliable
Competitive Advantage	0.894	Reliable

Source: Processed Primary Data Output, 2024.

Based on Table 3, it can be seen that all constructs in the model have composite reliability values greater than 0.70, so it can be concluded that all indicators in the variables are reliable.

4.3. Structural Model Evaluation (Inner Model)

Evaluation of the structural model in SEM with PLS was carried out by conducting the R-squared (R^2), Goodness of Fit (GoF) test, and significance test via path coefficient estimation.

4.3.1. R-Square Test (R^2)

The R-Square (R^2) values with scores of 0.67, 0.33, and 0.19 indicate that the model is strong, moderate, and weak. The R-Square (R^2) value in this study is presented in Table 4 as follows:

Table 4. R-Square Test Results (R^2)

Construct	R-Square	R-Square Adjusted
Digital Marketing Capabilities	0.614	0.598
Competitive Advantage	0.717	0.699

Source: Processed Primary Data Output, 2024.

Based on Table 4, it can be seen that the R-Square value for the competitive advantage variable shows a value of 0.717. This value indicates that the variables technopreneurship, ability to innovate, and ability to market with social media influence competitive advantage by 71.7%. This value suggests that the model in this study falls into the strong criteria category because the value of 0.717 is within the range of 0.67.

4.3.2. Goodness of Fit (GoF)

The GoF value in this research model can be seen in Table 5 as follows:

Table 5. Goodness of Fit (GoF) Test Results

Construct	R-Square	Communality
Technopreneurship	-	0.620
Innovation Capability	-	0.597
Digital Marketing Capabilities	0.614	0.774
Competitive Advantage	0.717	0.786
Mean	0.665	0.694

Source: Processed Primary Data Output, 2024.

Based on Table 5, the GoF value can be calculated using the square root of the average communality index and average R-squares as follows:

$$GoF = \sqrt{(0.665 \times 0.694)}$$

$$GoF = 0.679$$

Based on the calculations above, a GoF value of 0.679 can be obtained, so it can be concluded that the model in this research is included in the GoF Large criteria. The fit model in this study has been explained in the GoF analysis with a value of 0.679, which means that the model is very good.

4.4. Significance Test (Bootstrapping)

Hypothesis testing using the SEM PLS method is carried out by carrying out a bootstrapping process with the help of SmartPLS 4.0 software so that the relationship between the influence of exogenous variables on endogenous variables is obtained as follows:

Table 6. Results of Bootstrapping Calculation of Research Data

Hypothesis	Construct	Original Sample Estimate	Sample Mean	Standard Deviation	t-Statistics	P-Values	Information
H1a	Tech → DMC	1.026	0.793	0.086	4.653	0.000	Significant
H1b	Tech → C.A	0.527	0.216	0.078	1.651	0.122	Not significant
H2a	I.C → DMC	0.628	0.577	0.064	1.773	0.080	Not significant
H2b	I.C → C.A	0.488	0.437	0.167	2.128	0.020	Significant
H3	DMC → C.A	0.514	0.411	0.248	2.526	0.007	Significant
H4	Tech → DMC → C.A	0.786	0.674	0.097	3.254	0.001	Significant
H5	I.C → DMC → C.A	0.174	0.084	0.172	0.972	0.572	Not significant

Source: Processed Primary Data Output, 2024.

Table 6 presents the results of the bootstrapping calculation from the research data, including the original sample estimate, sample mean, standard deviation, t-statistics, p-values, and significance information for each tested hypothesis. The analysis shows that hypotheses H1a (Tech → DMC), H3 (DMC → C.A), H4 (Tech → DMC → C.A), and H2b (I.C → C.A) have p-values less than 0.05, indicating that these relationships are statistically significant. On the other hand, hypotheses H1b (Tech → C.A), H2a (I.C → DMC), and H5 (I.C → DMC → C.A) have p-values greater than 0.05, suggesting that these relationships are not significant.

4.5. Discussion

Technopreneurship and innovation capabilities play an important role in enhancing digital marketing capabilities in the modern era. Technopreneurship, which is a combination of technology and entrepreneurship, encourages companies to create innovative solutions that can meet changing market needs. By utilizing cutting-edge technology, such as artificial intelligence, big data analysis, and the Internet of Things (IoT), technopreneurs can develop products and services that are more sophisticated and relevant to consumer desires. This not only increases the company's competitiveness, but also opens up new opportunities in digital marketing through more measurable and efficient strategies [26].

Innovation capability on the other hand is a company's capacity to develop new ideas and implement them in their business processes. This innovation can cover various aspects, from new product development, process improvements, to more effective marketing strategies. In the context of digital marketing, innovation capabilities enable companies to explore and implement the latest marketing tools, such as data-based marketing, marketing automation, and content personalization [27]. Companies that have a high level of innovation capability tend to be more responsive to changing market trends and can quickly adapt to new technologies, which in turn increases the effectiveness of their digital marketing campaigns.

The interaction between technopreneurship and innovation capabilities creates a dynamic ecosystem where creative ideas and advanced technology complement each other. Technopreneurship provides a platform for the development of new technologies, while innovation capabilities ensure that these technologies are effectively integrated into digital marketing strategies [28].

Technopreneurship, innovation capabilities and digital marketing capabilities are key factors that have a significant influence on a company's competitive advantage in the digital era. Technopreneurship, which combines technology and entrepreneurship, encourages the creation of innovative solutions that not only meet evolving market needs but also open up new opportunities that were previously unimaginable [29].

Innovation capability, which refers to a company's capacity to create and implement new ideas, plays an important role in maintaining relevance and competitiveness in dynamic markets. Innovation allows companies to continuously update and improve their products, services and business processes, thereby offering better value to customers [30]. Digital marketing capabilities, which involve the use of digital technology to promote products and services, are also an important factor in creating competitive advantage. By utilizing digital tools such as social media, email marketing, SEO, and data analysis, companies can reach wider and more specific audiences, as well as measure and optimize the effectiveness of their marketing campaigns in real-time [31].

Strong digital marketing capabilities enable companies to build closer relationships with customers, better understand their needs and preferences, and provide more personalized and relevant experiences. This not only increases customer satisfaction and loyalty but also gives companies an edge in terms of marketing efficiency and effectiveness [32].

The synergy between technopreneurship, innovation capabilities and digital marketing capabilities creates an ecosystem that allows companies to operate more effectively and efficiently. Technopreneurship provides the technological foundation necessary for innovation, while innovation capabilities ensure that the technology is used to create real added value. Digital marketing capabilities enable companies to communicate and distribute this added value to customers in the most effective way [25].

The results of this study have significant implications for student MSMEs, especially in increasing competitiveness through the use of technopreneurship and digital marketing skills. By understanding the strategic role of technopreneurship, student entrepreneurs can optimize technology in their business operations, from service automation to implementing data-based digital marketing strategies. The practical implication is that student MSMEs can be more adaptive to market changes and increase their marketing efficiency with digital strategies such as SEO, social media, and e-commerce. In addition, this study also encourages educational institutions to develop more applicable curricula in the fields of technopreneurship and digital marketing to equip students with skills that are relevant to current industry needs. More broadly, the results of this study also have an impact on the development of the digital entrepreneurship ecosystem among MSMEs in general. In the era of digital transformation, the integration of technopreneurship with digital marketing is not only a competitive advantage but also a necessity for MSMEs in facing global competition. Therefore, the government and other stakeholders can use these findings as a basis for designing policies and mentoring programs for digital-based MSMEs, such as digital marketing training and access to innovative technology.

5. MANAGERIAL IMPLICATIONS

5.1. Enhancing Digital Marketing Strategies

To remain competitive, student MSMEs must effectively utilize digital marketing strategies. Managers should focus on implementing data-driven marketing strategies by leveraging AI and analytics, utilizing social media platforms to engage with target audiences, and optimizing search engine marketing (SEM) and search engine optimization (SEO) to increase online visibility. A well-structured digital marketing approach will enable student MSMEs to strengthen their brand presence and attract a larger customer base.

5.2. Strengthening Technopreneurship Mindset

Entrepreneurs in student MSMEs should develop a strong technopreneurial mindset that fosters innovation and adaptability. Encouraging continuous learning and the adoption of emerging technologies is crucial for business sustainability. Managers must invest in training programs and skill development initiatives to enhance digital competencies. Establishing networks with technology incubators and startup ecosystems will also provide valuable resources and mentorship to support the growth of student MSMEs.

5.3. Leveraging Innovation for Competitive Advantage

Innovation plays a critical role in securing long-term competitive advantages for student MSMEs. Business managers should actively develop new product features based on market needs and trends. The ability to adapt business models in response to technological advancements can lead to increased market relevance and customer satisfaction. Monitoring and analyzing customer feedback will allow businesses to continuously refine their offerings and maintain a strong position in the competitive landscape.

5.4. Policy and Educational Support

Educational institutions and policymakers have a significant role in supporting the growth of student MSMEs. Universities should integrate technopreneurship and digital marketing courses into their curricula to equip students with the necessary skills for modern business environments. Providing funding opportunities and mentorship programs will further enhance the sustainability of student-led startups. Collaboration with industry leaders and technology hubs will bridge the gap between academia and practical business applications, ensuring that student MSMEs are well-prepared for the challenges of the digital economy.

By adopting these managerial strategies, student MSMEs can effectively utilize technopreneurship and digital marketing to strengthen their competitive advantage and thrive in an increasingly dynamic business environment.

6. CONCLUSION

Based on the results and discussion, it can be concluded that technopreneurship directly has a significant effect on digital marketing capability, but does not have a significant effect on competitive advantage. Innovation capability has no significant effect on digital marketing capability. Innovation capability and digital marketing capabilities directly have a positive and significant influence on the competitive advantage of student MSMEs in Semarang City. Indirectly, technopreneurship has a significant effect on competitive advantage through digital marketing capabilities. However, indirectly, innovation capability has no significant effect on competitive advantage through digital marketing capabilities. This research has a variety of significant practical implications for companies and business managers. This research highlights the importance of integrating technology and entrepreneurship in creating innovative solutions that can increase a company's competitiveness. Business practitioners are advised to develop strategies that combine investment in advanced technology and the development of entrepreneurial skills within the organization. Innovation capability is identified as a key factor in adaptation and rapid response to market changes. This research also makes an important contribution to theory development in the fields of management, marketing and innovation. This research expands the literature on technopreneurship by showing how the combination of technology and entrepreneurship can create competitive advantage through sustainable innovation. This research confirms the important role of innovation capabilities in competitive advantage theory, by adding empirical evidence about how innovation can increase a company's responsiveness to market changes and technological trends.

This study has several limitations that need to be considered. One limitation is the limited sample coverage of student MSMEs, so the results of this study may not be fully generalizable to larger MSMEs or those managed by business actors outside the academic environment. In addition, this study focuses more on analyzing the role of technopreneurship and digital marketing capabilities in increasing competitive advantage, without delving deeper into external factors such as government policies, digital infrastructure, or changes in market trends that can also affect the success of student MSMEs. The research methods used, such as case studies or surveys, also have limitations in capturing the long-term dynamics of the application of technopreneurship in student businesses. For further research, it is recommended that the scope of the study be expanded by involving MSMEs from various backgrounds and different business scales so that the research findings are more universal.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: YI; Methodology: SD; Software: CB; Validation: YI and SD; Formal Analysis: EH and EB; Investigation: YI; Resources: SD; Data Curation: SD; Writing Original Draft Preparation: CB and EH; Writing Review and Editing: CB and EH; Visualization: SD. All authors, YI, SD, CB, EH, EB, IK and MN have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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