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Information Technology: Its Impact on Product Competitiveness Mediated by Product Innovation in SMEs

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Abstract
One of the main challenges for SMEs players is the application of information technology to increase product innovation and competitiveness This study aims to examine a research model that is expected to provide insights into the impact of information technology on product innovation and its influence on product competitiveness. Data were collected from 100 respondents involved in SMEs through a distributed questionnaire. This research conducted three tests on the hypotheses based on indicator variables using SEM-PLS (Partial Least Squares) analysis with SmartPLS software. These tests include the outer model, the inner model, and hypothesis testing. The results of hypothesis testing show a significant positive direct impact of information technology on both product competitiveness and product innovation. Additionally, there is a significant positive direct impact of product innovation on product competitiveness.

Keywords: Information Technology, Product Innovation, Product Competitiveness

Abstrak
Salah satu tantangan utama pelaku UMKM adalah penerapan teknologi informasi dalam meningkatkan inovasi dan daya saing produk. Penelitian ini bertujuan untuk menguji model penelitian yang diharapkan memperoleh hasil dari pengaruh teknologi informasi terhadap inovasi produk serta dampaknya pada daya saing produk. Data responden yang diperoleh dari hasil sebaran kuesioner kepada pelaku UMKM sebanyak 100 responden. Pada penelitian ini dilakukan 3 pengujian terhadap hipotesis berdasarkan indikator variabel yang disusun dengan menggunakan analisis SEM PLS (partial least square) dengan metode SmartPLS. Pengujian ini terdiri dari outer model, inner model, dan pengujian hipotesis. Pengujian hipotesis menunjukan adanya pengaruh langsung secara positif dan signifikan antara teknologi informasi terhadap daya saing produk dan inovasi produk. Adanya pengaruh langsung secara positif dan signifikan antara inovasi produk terhadap daya saing produk.

Kata Kunci: Teknologi Informasi, InovasiProduk, Daya Saing Produk

JEL Classification: D2, H8, R11

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1. Introduction

Micro, small, and medium enterprises (MSMEs) play a crucial role in the national economy. With their large number and presence in every economic sector, MSMEs significantly contribute to job creation and gross domestic product (GDP) formation. This is due to their ability to utilize natural and human resources effectively, especially in sectors like trade, agriculture, aquaculture, and restaurants. Medium-sized enterprises similarly contribute by adding value in sectors such as finance, hospitality, and business services. Large enterprises contribute to industries like manufacturing, electricity, gas, transportation, communication, and mining. This demonstrates that MSMEs and large businesses are interdependent and complementary (Solikatun et al., 2014).

The main issue faced by many SMEs is their ability to implement information technology. The adoption of appropriate information technology can improve operational efficiency and competitiveness, yet many SMEs still struggle to access the necessary resources and training. Technological capabilities can help businesses become more flexible in designing their operations, allowing them to adapt more readily to rapidly changing business environments and develop strong business resilience(Yakubu & Lily, 2019). MSMEs need information technology to develop their products and to provide information to the public about their offerings.

In addition to leveraging information technology Lv et al., (2018), argue that business resilience is also influenced by innovation capabilities. Managing innovation can enhance an organization's capacity for resilience, which is characterized by sustained superior performance. The competitiveness of an MSME refers to its ability to maintain market position by supplying products promptly at competitive prices, responding quickly to changes in demand, and managing product differentiation effectively by building innovative capacity and efficient business systems. This concept of business competitiveness can also be applied at the national level, where productivity is defined as the output value generated by a worker (Pitoyo & Suhartono, 2018).

Competitiveness plays a crucial role in business. According to Syariah & Fauziyah, (2017), applying technology in every business area can enhance a company's competitiveness. Many conveniences can be achieved in various business aspects through technology. Information technology can meet the information needs of the business world. This capability allows companies to streamline operations, improve decision-making processes, and ultimately deliver better products and services to their customers. By leveraging advanced technologies such as artificial intelligence and data analytics, businesses can gain deeper insights into market trends and consumer behavior, further enhancing their competitive edge.

MSMEs need to leverage IT to enhance their competitiveness, especially in the era of globalization, where competition is highly competitive and global. Small and medium enterprises (SMEs) must compete effectively, requiring strategies to boost their competitiveness. With the capabilities of the web/internet to transmit various forms of data such as text, graphics, images, sound, animation, or even video, many businesses are utilizing this technology to create homepages for promoting their businesses (Bodendorf & Lang, 2009).

Research by Ihya I & Zulfikar (2017)shows the impact of information technology and innovation on competitiveness in the hat center of Marga Asih, Bandung. Hotmauli Silaen (2018), found that information technology influences competitive advantage by 20.9%, product innovation influences competitive advantage by 35.9%, and both information technology and product innovation together contribute 56.8% to competitive advantage, indicating a positive and significant result. Another study by Muhammad (2021) indicates that

technological capability has a positive and significant impact on business resilience, technological capability positively influences innovation capability, innovation capability positively impacts business resilience, and technological capability affects business resilience through innovation capability.

The aspect that has not been explored in previous research is the direct and indirect impact of information technology on product competitiveness. Further research is needed to identify the specific mechanisms that influence this relationship and how companies can leverage information technology to enhance their position in the market. Understanding these mechanisms will enable businesses to implement targeted strategies that not only improve their operational efficiency but also foster innovation and adaptability in an ever-evolving marketplace.

2. Literature Review and Hypothesis

Information Technology

According to the Information Technology Association of America (ITAA), information technology is the study, design, development, implementation, support, or management of computer-based information systems. The advent of information technology can enhance performance and enable various activities to be conducted quickly, accurately, and efficiently, thereby ultimately improving productivity. Haag and Keen(Kadir, 2005)define information technology as a set of tools that assist in working with information and performing tasks related to information processing.

According to Warsita (2008), information technology encompasses the hardware, software, user, systems, and methods used to acquire, transmit, process, interpret, store, organize, and meaningfully use data. SimilarlyDiat Prosojo & Riyanto (2011)describe information technology as a field of knowledge related to computer-based information systems, that has evolved rapidly. To compete in the ASEAN free market, SMEs need to enhance their competitiveness through various means, such as expanding markets, improving information and communication technology capabilities, and increasing promotion efforts. Therefore, support for empowering information technology, particularly in promoting and marketing products, is necessary. Additionally, utilizing e-commerce applications or online marketplaces for online buying and selling transactions can provide efficient services for SME customers (Suprihadi et al., 2016).

According to Khusnul (2006) in the context of small business operators, the role of information technology is crucial, as competitors are no longer limited to local or regional businesses but now include international players. The use of information technology by SMEs can provide flexibility in production, accepting offers, and supporting rapid paperless transactions. One key focus of empowering SMEs with information technology is enhancing competitiveness.

Factors influencing SMEs' use of information technology, as identified by Ghobakhloo et al (2011) include: 1) decisions made by SME top management, 2) availability of capital or budget for technology development, 3) human resources (HR) with expertise in information technology within SMEs, and 4) the availability of information technology applications that meet the needs and culture/characteristics of SMEs.

Product Innovation

Innovation is the result of a company or industry developing new things, whether they exist or novel. Product development is crucial for business sustainability, especially in building customer loyalty. Product innovation can stem from consumer desire for a product that meets

their needs (market pull) or through technology that creates or develops new products that are then introduced to the market (technology push).

According to Dooley et al., (2002)the best way to carry out product development is by using four generic dimensions to outline the strategy for implementing new product development, including project selection, goals, product strategy, and customer involvement. This involves controlling the execution of product innovation (including matrix control processes and documentation) and enhancing the human resources involved in product innovation.

The characteristics of innovation include: 1) Innovation Culture: Continuous innovation within a company is a fundamental requirement that, in turn, can create a competitive advantage. Thus, innovation is a crucial management function because it determines superior business performance. Innovation becomes increasingly important as a tool for survival, not only for growth but also in the face of intense competition and environmental uncertainty. 2) Technical Innovation: Technical innovation relates to products, services, and production process technologies. It involves fundamental work activities and can encompass products or processes. Technical or product innovation involves applying new technology to make it useful. 3) Administrative Innovation: Administrative innovation pertains to organizational structure and the administrative processes of an organization. Indicators in this research include innovation culture, technical innovation, and administrative innovation (Wahyono, 2002).

Product Competitiveness

According to Porter (Asrienda, 2020), competitiveness is a company's ability to face various environments within its industry. Competitiveness is a concept referring to the commitment to market competition in the case of companies or industries and to international competition in the case of countries. The competitiveness of MSMEs (micro, small, and medium enterprises) is the extent to which a company can meet market demand, both domestic and international, in producing goods and services while maintaining or improving the company's and its employees' income. Enhancing the competitiveness of MSMEs is done to ensure their survival in a changing environment and strong business competition (Rostek, 2012).

Factors influencing product competitiveness include: 1) Product Uniqueness: This refers to the unique features of the products produced by the company, distinguishing them from competitors' products or common market products. It represents a breakthrough by the company in implementing ideas or innovations to create something different or unique, thus attracting customers. 2) Product Quality: This is the quality of the products successfully created by the company. A sustainable competitive advantage. Resources and capabilities are difficult for competitors to replicate when theyitors. 3) Competitive Pricing: This refers to the company's ability to produce products at prices that can compete in the market. With the creation of unique and high-quality products, the company must adjust its prices to align with customers' purchasing power (affordable), meaning not burdening the customers (Abdul Fatah, 2013).

Hypothesis

The Influence of Information Technology on Product Competitiveness

Information technology has become crucial for enhancing product competitiveness, enabling businesses to streamline operations, improve customer engagement, and innovate more effectively (Syahchari et al., 2020). The implementation of this technology also enhances efficiency in product development (Yan & Li, 2015). This aligns with the findings of Jiang (2016), which concluded that the development of applications affects product competitiveness.

H1: Information technology has a significant effect on Product Competitiveness

The Influence of Information Technology on Product Innovation

The impact of information technology on product innovation is significant, as it facilitates faster communication, enhances collaboration among teams, and provides access to vast amounts of data for informed decision-making. Information technology also allows companies to identify market trends more quickly, enabling them to respond to customer needs and create more relevant and competitive products (Mauerhoefer et al., 2017). Product innovation driven by information technology not only improves operational efficiency but also fosters the development of creative solutions that can meet the ever-evolving market demand (Kalinina et al., 2020). Previous research by Ihya & Zulfikar (2017) shows that information technology has an influence on product innovation. This finding is consistent with the research by Mauerhoefer et al. (2017), which concluded that the overall capability of information technology is an important predictor of new product development performance.

H2: Information technology has a significant effect on product innovation

The Influence of Product Innovation on Product Competitiveness

Product innovation plays a key role in enhancing competitiveness, as it allows companies to meet the ever-changing needs of consumers and create added value that differentiates them from competitors (Poplavska et al., 2018). Sustainable innovation enables companies to remain relevant and responsive to market trends, while also driving the development of creative solutions that can better meet consumer expectations. This is consistent with the research by DOĞAN (2016), which shows that two key factors of innovation, namely knowledge and creative technology, positively influence competitiveness

H3: Product Innovation has a significant effect on Product Competitiveness

Conceptual Framework

In this study, there are three variables analyzed: information technology, product innovation, and product competitiveness. As shown in Figure 1, it is hypothesized that information technology has an effect on both product competitiveness and product innovation. Additionally, product innovation is hypothesized to have an effect on product competitiveness.

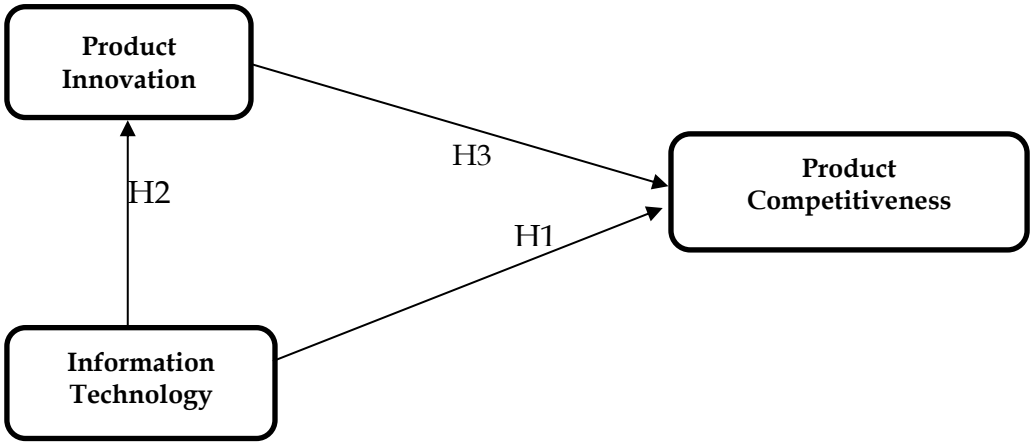

Figure 1. Conceptual Framework

3. Data and Method

Population and sample

This study used a survey as its research method. The population used in this study consists of all MSMEs (micro, small, and medium enterprises) in Yogyakarta City. A sample is a subset of the population that possesses similar characteristics, which is used as the actual data source. Typically, the sample is highly dependent on the population (Sugiyono, 2015). This research used a sample of 100 respondents. According to (Hair Jr et al., 2010). The sample size for the research can use a minimum of 5-10 times the number of parameters or indicators in the study. In this research, there are 9 research indicators, so the minimum sample size needed is 90. data collection technique using a questionnaire, measurement scale using Likert.

Data analysis

Data analysis technique using Partial Least Square (PLS) with the help of Smart PLS 3.0 software. According to Imam & Latan, (2015)the stages of PLS testing are as follows: Outer Model Test/Measurement Model Test. The indicator test, also known as the outer model or measurement model, examines the relationship between the indicators and their respective constructs. The results of this indicator test provide outputs for the validity and reliability of the model, which are measured using the criteria of convergent validity, discriminant validity, and reliability. Convergent Validity. Convergent validity is measured by the correlation between the indicator scores and their respective constructs. An indicator is considered valid if the loading factor value is above 0.70 for confirmatory research and between 0.60 and 0.70 for exploratory research Another way to measure convergent validity is through the Average Variance Extracted (AVE). The AVE value should be 0.5 or higher. An AVE value of 0.5 or above means that the construction can explain 50% or more of the variance of its. Discriminant Validity. Discriminant validity is measured by the cross-loading between the indicators and their constructs. To test discriminant validity, one examines the cross-loading values for each variable. An indicator is considered valid if the cross-loading value for each variable is greater than 0.70, and the relationship between the indicator and its construct is stronger than its relationship with other constructs(Hair et al., 2011).

To evaluate the model with R-Squares value that represents the amount of variance of the construct that can be explained by the model. The R-Squares criteria consist of three classifications, namely a value of 0.67 (strong), 0.33 (moderate), and 0.19. (weak). Analysis of the Inner model using the bootstrap method. The inner model, or structural model, is essentially a hypothesis test that illustrates the relationships and effects between latent variables using the bootstrap method. The significance values used are a two-tailed t-value of 1.65 for a 10% significance level and a t-value of 1.96 for a 5% significance level (Hair et al., 2011).

4. Results

Convergent Validity

Based on the PLS output in Figure 1, an evaluation can be conducted to assess the convergent validity of each observed indicator value. The results of the convergent validity evaluation show that all loading factor values are greater than 0.70, indicating that all indicators are valid.

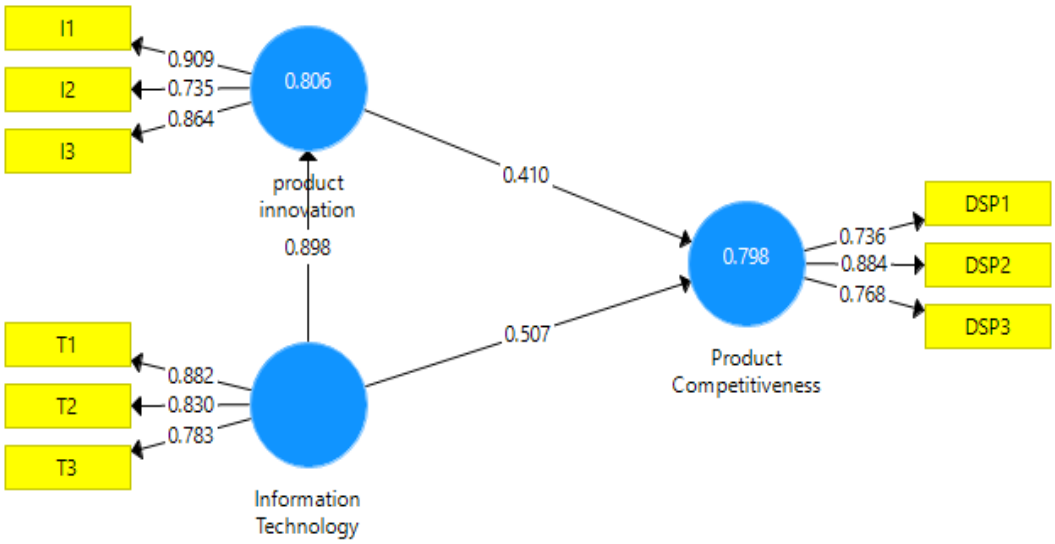

Figure 2. SmartPLS Outer Model

Convergent Validity

To find out the validity of the convergent, a test is carried out to find out the loading factor is a number that shows the correlation between the score of a question item and the score of a construct indicator. If the loading factor value is greater than 0.70 it is said to be valid.

Table 1. Loading Factor

Construct	Indicator	Convergent Validity	Results
Information Technology	T1	0.882	Valid
	T2	0.830	Valid
	T3	0.783	Valid
Product Innovation	I1	0.909	Valid
	I2	0.735	Valid
	I3	0.864	Valid
Product Competitiveness	DSP1	0.736	Valid
	DSP2	0.884	Valid
	DSP3	0.768	Valid

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

The AVE values in Table 2 indicate that all indicators in the model are valid, as all AVE values are greater than 0.5. To ensure there are no issues related to the measurement of the structural model, the next step taken was to test the unidimensionality of the model using the composite reliability and Cronbach's alpha indicators. A construct is considered reliable if the Composite Reliability and Cronbach's Alpha values are greater than 0.70. Table 1 shows that all indicators have Composite Reliability and Cronbach's Alpha values above 0.7, so it can be concluded that the research model is reliable in measuring the construct.

Table 2. AVE, Composite Reliability and Cronbach's Alpha values

Construct	AVE	*Composite Reliability*	*Cronbachs Alpha*
Information Technology	0,693	0,871	0,793
Product Innovation	0,705	0,877	0,705
Product Competitiveness	0,638	0,840	0,738

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

Discriminant Validity

Discriminant Validity to find out the value of cross loading. In this research model, in general, the cross loading value of one indicator variable must have a value that is greater than all the cross loading values of other indicator variables on other constructs as well

Table 3. Cross Loading

Indicator	Information Technology	Product Innovation	Product Competitiveness
T1	**0.882**	0.802	0.866
T2	**0.830**	0.641	0.631
T3	**0.783**	0.724	0.717
I1	0.782	**0.909**	0.768
I2	0.716	**0.735**	0.783
I3	0.759	**0.864**	0.692
DSP1	0.522	0.509	**0.736**
DSP2	0.823	0.886	**0.884**
DSP3	0.703	0.608	**0.768**

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

Hypotesis test

The structural model, or inner model, is tested to examine the effects of the relationships between variables using t-statistics. The following are the results of the testing using the bootstrapping method with SmartPLS. The calculation results for direct, indirect, and total effects can be seen in the following table.

Table 4. Direct Effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Information Technology ->Product Competitiveness	0.507	0.505	0.168	3.016	0.003
Information Technology ->Product Innovation	0.898	0.901	0.021	41.964	0.000
Product Innovation ->Product Competitiveness	0.410	0.417	0.159	2.574	0.010

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

The information technology variable has a significant effect on product competitiveness, obtained by a value of p = 0.003 which is smaller than 0.05. The information technology variable has a significant effect on product innovation obtained by a value of p = 0.000 which is smaller than 0.05. The product innovation variable has a significant effect on product competitiveness, obtained by a value of p = 0.010 which is smaller than 0.05.

Table 5. Indirect Effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Information Technology ->Product Innovation->Product Competitiveness	0.368	0.736	0.146	2.528	0.012

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

Information technology has an indirect effect on product competitiveness through product innovation. Referring to Table 5, the p-value is 0.012, which is less than 0.05, indicating that it is accepted. This means that the information technology variable has a positive and significant indirect effect on the product competitiveness variable through product innovation.

Table 6. Total Effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Information Technology ->Product Competitiveness	0.875	0.881	0.031	28.147	0.000

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

The total effect of the information technology on product competitiveness is 0.876. Referring to Table 6, the p-value is 0.000, which is less than 0.05, indicating that it is accepted. This means that the information technology has a significant total effect on the product competitiveness through product innovation.

Table 7. ***Goodness of Fit***

Construct	R^2	Adjusted R^2
Product Innovation	0.806	0.804
Product Competitiveness	0.798	0.793

Source: Data SmartPLS 3.2.9 processed by researchers (2024)

The R-squared value for product innovation is 0.806, which indicates a strong relationship between information technology and product innovation. The R-squared value for the product competitiveness construct is 0.798, showing a strong relationship between information technology, product innovation, and product competitiveness.

5. Discussion

The Influence of Information Technology on Product Competitiveness

The results of this study indicate that information technology has a significant direct impact on product competitiveness. Information technology has changed the way work is done, such as accelerating numerical computations, storing large amounts of information, and facilitating access to information. By optimizing the use of information technology, companies can improve operational efficiency, accelerate innovation, and offer products with better quality and more competitive prices. Therefore, information technology is not just a supportive tool, but an essential element that can enhance product competitiveness in an increasingly competitive global market.

This aligns with the findings of Jiang (2016), which concluded that the development of applications affects product competitiveness. This aligns with the findings of Jiang (2016), which concluded that the development of applications affects product competitiveness. Research by Ihya & Zulfikar, (2017) shows that there is an influence between information technology and product competitiveness.

The Influence of Information Technology on Product Innovation

The results of this study indicate that information technology has a significant direct impact on product innovation. Information technology plays a crucial role in achieving a company's competitive advantage. With the advancement of information technology, companies can easily access the necessary information to improve product quality (Hartanto &Manggalarini,

2018). Information technology opens up opportunities for innovation that is more data-based and oriented to real market needs.

This finding is consistent with the research by Mauerhoefer et al. (2017), which concluded that the overall capability of information technology is an important predictor of new product development performance. Research by Ihya & Zulfikar, (2017) shows that there is an influence between information technology and product innovation.

The Influence of Product Innovation on Product Competitiveness

The results of this study show that product innovation has a significant direct impact on product competitiveness. Product innovation is a crucial factor in determining a product's competitiveness in the market. The innovation created by a company is the key to competitive advantage, determining the success of an organization. The uniqueness of a product will temporarily enhance its competitiveness, as innovation increases the added value of a product and differentiates it from competitors' products (Lestari et al., 2020). Innovation is a key factor in creating product competitiveness. Innovation allows companies to create unique products that are different from competitors. The products become more attractive to consumers. Innovation will adapt to the ever-changing market demands. Innovation can open new markets by creating products that meet the needs of market segments that were previously underserved.

This is consistent with the research by DOĞAN (2016), Liu (2016) which shows that two key factors of innovation, namely knowledge and creative technology, positively influence competitiveness.

6. Conclusion

Based on the hypothesis testing, overall, the hypothesis is accepted. Information technology has a direct positive and significant effect on product innovation and product competitiveness. Product innovation has a direct positive and significant effect on product competitiveness. Product innovation mediates the relationship between information technology and product competitiveness.

The managerial implications are the importance of investing in information technology: management needs to focus on investing in and implementing the right information technology to drive product innovation. Advanced technology can improve operational efficiency, accelerate decision-making, and help companies identify relevant market trends. Companies should view product innovation as an integral part of their competitive strategy. By creating more innovative products that meet market needs, companies can more easily differentiate themselves from competitors and enhance their market position. Companies must ensure that their information technology infrastructure supports product innovation. By applying these implications, companies can maximize the potential of information technology to enhance product competitiveness through sustainable innovation.

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