



Synergy of Digital Competence and Customer Co-Creation: MSME Product Innovation Strategy

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Abstract

This study aims to analyze the effect of digital competence and customer co-creation on product innovation in culinary MSMEs in Cirebon City and its surrounding areas. The study uses a quantitative approach with an explanatory design and cross-sectional method. Data were collected through structured questionnaires from 312 culinary MSME actors determined using the Cochran formula. Data analysis was performed using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) method using SmartPLS 4.0 software. The results showed that digital competence and customer co-creation had a positive and significant effect on product innovation. Digital competence had a more dominant effect than customer co-creation. The coefficient of determination (R^2) value of 0.836 indicates that 83.6% of product innovation variation can be explained by these two variables. This finding indicates that strengthening digital competence is a major factor in driving MSME product innovation, while customer involvement plays a supporting role in strengthening the innovation process to better suit market needs.

INTRODUCTION

The development of digital technology has changed the global business landscape, forcing MSMEs to adapt or face the risk of falling behind (Singh, Kumar, Singh, Dwivedi, & Kumar, 2024). Similarly, in the city of Cirebon, MSMEs are forced to adapt to technology, including those engaged in the batik, handicraft, and culinary sectors, in order to face the challenges of increasingly digitized consumer behavior (Duong, Nga Ngo, Thu Nguyen, Tran, & Pham, 2024). MSME data shows that only about 46.83% of MSMEs in Indonesia are actually utilizing digital technology optimally, while the rest are still constrained by limited skills and access to the micro and small industry, 2024. This phenomenon highlights a digital divide that needs to be addressed through a contextual training approach. Digital competence has emerged as a crucial determining factor in the ability of MSMEs to survive and thrive in the digital era (Vuorikari, Kluzer, & Punie, 2022). This concept goes beyond simply being able to use technological devices; it includes a deep understanding of the digital ecosystem, data analysis skills, the capacity to adapt to rapid technological changes, and an innovative mindset that supports digital experimentation (Amalia, Aini, Paradita, & Mirza BR, 2025). Recent research shows that MSMEs with better digital competence have a much higher chance of surviving in times of crisis compared to businesses that still rely on conventional methods (Khurana, Dutta, & Singh Ghura, 2022). However, the reality on the ground shows a digital divide among business actors, including MSMEs in the city of Cirebon, where digital capabilities are still limited and technology adoption is uneven (Prihadini, Maulina, & Rahmawati, 2024). This divide is not just an obstacle; it also presents a huge opportunity. Many MSMEs in Cirebon

have quality products, creative potential, and good relationships with local communities, but are constrained by access to technology, training, and digital networks. They often wait for outside help, even though the available technology is quite affordable.

Nevertheless, when customer collaboration, or co-creation, is incorporated, the results can be very powerful in driving product innovation (Rahayu, Krishna Yuliawati, & Fakhrudin, 2020). Digitally literate MSME players can quickly hear customer feedback, adjust their products, and deliver them faster (Prakasa & Jumani, 2024). This is particularly important for creative SMEs in Cirebon, which must continuously innovate not only in terms of functionality but also cultural value and market trends. Studies indicate that each one-level increase in digital capability correlates directly with a significant rise in product innovation (Radicic & Petković, 2023). The purpose of this study is to understand how digital competence and co-creation influence product innovation in MSMEs in Cirebon, particularly in limited conditions and the local cultural context (Karia, 2022). This study also aims to assist SME actors who can work with digital capabilities that are in line with the characteristics of SME actors in Cirebon, so that the training provided is more targeted and can be applied in other regions (Prihadini, Sukoco, Hermanto, & Tresna, 2023).

Previous studies such as (Sugiharto, 2024) identified that the measurement of MSME digital competence tends to focus on technical aspects such as the use of social media and e-commerce platforms, without considering cultural adaptation. Meanwhile, research (Mohamad, Mohd Rizal, Kamarudin, & Sahimi, 2022) found that existing co-creation models are more suitable for companies with adequate digital infrastructure. Meanwhile, the study (Hadi, 2023) examined MSME product innovation separately from collaboration with customers, resulting in a partial understanding of the innovation process.

The main novelty of this study lies in combining variables that were previously studied separately. Previous studies tended to examine digital competence, customer co-creation, and product innovation as separate aspects, without looking at the synergistic relationship between the three. This approach is expected to produce an innovation model that is not only oriented towards technology and the adaptive capabilities of SME actors, thus contributing practically to the development of digital training and mentoring strategies in the Cirebon region.

The contribution of this research can be used as a basis for conducting training for MSME actors in Cirebon by utilizing digital technology. This digital technology can be used by MSME actors to evaluate digital training so that it is more suited to their needs. In addition, practical methods have been developed so that MSME players can interact with customers, enabling customers to provide suggestions to business players, thereby encouraging MSME innovation (Farida & Listyorini, 2021; Sudarti & Dewi, 2023).

The Relationship between Digital Competence (X1) and Product Innovation (Y)

Digital competence has evolved from basic literacy to a comprehensive framework that encompasses various important skills in the digital era. In the context of MSMEs, this includes the use of e-commerce platforms, strategic social media management, consumer pattern analysis, digital content creation, and operational technical problem solving (Vuorikari et al., 2022). A strong digital mindset, characterized by curiosity, adaptability, and openness to experimentation, is a key determinant of successful technology adoption in SMEs (Christodoulides et al., 2021). The relationship between digital competence and product innovation occurs through real-time access to and processing of market information, which

enables faster identification of trends and market gaps; the ability to create digital content that supports efficient product development and market simulation; and the use of digital collaboration tools to continuously integrate customer feedback into the product development cycle (Wang & Zhang, 2025). This relationship is particularly strong in creative and knowledge-based MSMEs, where speed to market and product adaptation are crucial. MSMEs with high scores in at least three of the five dimensions of digital competence are 3.2 times more likely to launch innovative products each year (Romero & Mammadov, 2025).

Digital competence has five indicators: Technical Skills (the ability of MSME actors to use digital applications on smartphones for business operations), data analytics (the ability to read and interpret data analysis on social media), digital marketing (MSME actors utilizing digital platforms for promotion and distribution), e-commerce operations (the ability of MSME actors to manage online transactions and digital customer delivery), and cybersecurity awareness (understanding risks and protecting digital assets). Collectively, these indicators support product innovation from the idea generation stage to market validation (Cunningham et al., 2023; Sagala & Öri, 2024).

H1: Digital competence has a positive and significant effect on innovation products in MSMEs in Cirebon City.

The Relationship between Customer Co-Creation (X2) and Product Innovation (Y)

Customer co-creation has become an important concept in modern innovation theory, marking a shift from consumers as passive recipients to active participants in the value creation process, as emphasized by (“Phil” Klaus et al., 2022). Key co-creation mechanisms such as co-design, co-production, and customer knowledge integration play an important role in driving product innovation through market insight gathering, innovation risk reduction, and product feature refinement (Sarkar et al., 2022). The main mechanisms that explain how customer co-creation drives product innovation include collaboration, risk reduction through early customer involvement, and the utilization of customer knowledge and ideas to strengthen the R&D capabilities of MSME players. Through the sharing of customer knowledge and personal insights, companies can gain a deeper understanding of market needs and direct the innovation process more accurately. The co-creation approach through social media shows that customers who actively participate in digital platforms generate more ideas that are more actionable than traditional feedback mechanisms (Sergio et al., 2023).

Customer co-creation in MSMEs can also be operationalized through four main indicators, namely co-design (MSME actors adjust product designs based on customer feedback), co-production (MSME actors adjust product functions based on customer experiences), co-marketing (MSME actors encourage customers to help spread information about products), and co-innovation (MSME actors adopt new ideas from customers). co-marketing (MSME actors encourage customers to help spread information about products), and co-innovation (MSME actors adopt new ideas that originate from customers). Each of these contributes differently to the type of innovation, such as co-design, which has an impact on aesthetic innovation, and co-production, which is more significant for functional innovation, as evidenced in studies of fashion SMEs in Cirebon (Farida & Listyorini, 2021; Kinkel et al., 2022).

H2: Customer co-creation has a positive and significant effect on product innovation in MSMEs in Cirebon.

The relationship between Digital Competence (X1) and Customer Collaboration (X2) with Product Innovation (Y)

The collaboration between digital competence and customer co-creation creates customer engagement that has a positive impact on the innovation capabilities of MSMEs. Digital competence acts as a driver that enables customer co-creation to be carried out extensively, efficiently, and effectively. Without adequate digital competence, MSMEs may have the intention to engage in co-creation but lack the ability to implement it effectively (Saputra et al., 2024). Research on digital transformation in MSMEs reveals that high digital capabilities, when combined with external collaboration and customer participation, can drive innovation and competitiveness in MSMEs (Romero & Mammadov, 2025). These two factors work synergistically in a digital collaboration ecosystem, where digital platforms serve as a means of maintaining customer engagement throughout the product development stage. Adequate digital capabilities also enable MSMEs to utilize various forms of collaboration, such as the use of e-commerce, online communities for market testing, and AI-based recommendation systems.

Key indicators of digital competency collaboration and customer co-creation include digital platform maturity (which measures how mature MSMEs are in adopting digital tools such as e-commerce and AI), customer engagement via integrated feedback, innovation efficiency (how customers not only buy but also contribute through feedback that is immediately processed), a collaborative strategic mindset (viewing customers as partners), and the overall impact of increased production of superior innovations. Studies of customer-based service innovation show that co-creation consistently contributes to the quality and speed of innovation, especially when conducted through mature digital platforms (Bonaque-Rodríguez et al., 2024)

H3: Digital competence and customer co-creation collaboration simultaneously have a positive and significant impact on product innovation in MSMEs in Cirebon City.

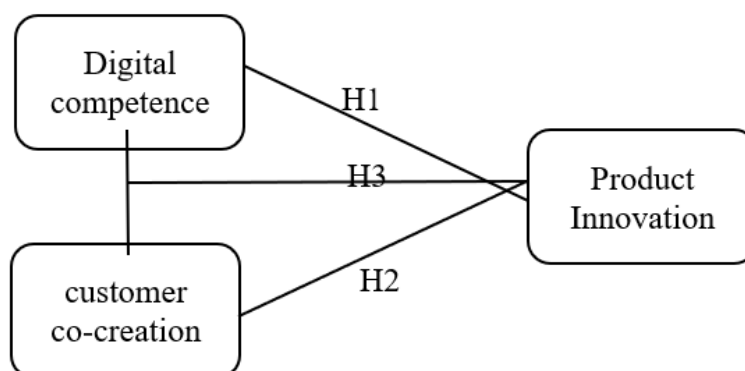


Figure 1: Conceptual framework

METHOD

This study adopts a quantitative approach with an explanatory cross-sectional design to examine the causal relationship between digital competence, customer co-creation, and product innovation in MSMEs in Cirebon and its surrounding areas. The quantitative method was chosen because it allows for objective measurement of research constructs, statistical testing of

hypotheses, and generalization of findings to a broader SME population (Saputra et al., 2024). The cross-sectional research design was used to obtain a snapshot of how the phenomenon of culinary product innovation occurs in MSMEs in Cirebon, identifying patterns and relationships between variables without waiting for long-term developments. The sample size was determined using the Cochran formula. Based on data from the Cirebon City Cooperative, Small and Medium Enterprises, Trade and Industry Agency (DKUKMPP) in 2024, it is known that the research population includes 1,631 culinary sector MSME actors in Cirebon City. With a margin of error of 5%, the sample size obtained is 312 MSME actors.

The data analysis technique used is Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software. PLS-SEM was chosen because it is suitable for explanatory research with complex models and moderate sample sizes, and does not require strict normal distribution assumptions (Hair Jr et al., 2021). The analysis will include: (1) evaluation of the measurement model to test the validity and reliability of the construct through factor loadings, Average Variance Extracted (AVE), Cronbach's Alpha, and Composite Reliability; (2) evaluation of the structural model to test the significance of the influence of digital competence and customer co-creation on MSME product innovation using the bootstrapping procedure in SmartPLS 4.0.

RESULTS AND DISCUSSION

A total of 312 questionnaires from MSME actors in the culinary sector in Cirebon City and its surroundings were declared valid and used in this research analysis. The questionnaires were obtained after a data selection and screening process (data cleaning) that included checking the completeness of the answers and the suitability of the respondents with the research criteria. The characteristics of the respondents analyzed are presented to provide an overview of the demographic profile of MSME players, including gender, age, and type of culinary business. Details of the respondents' demographics are presented in Table 1.

Table 1. Respondent Demographics

Category	Possible Answer	F	%
Gender	Male	130	41,7%
	Female	182	58,3%
Your current age	< 20 years old	19	6,1%
	21-30 years old	107	34,3%
	31-40 years old	93	29,8%
	41-50 years old	46	14,7%
	>50 years old	47	15,1%
Types of culinary businesses	Heavy meals (rice, side dishes, catering)	101	32,4%
	Light meals (snacks, cakes, street food)	113	36,2%
	Beverages (coffee, juice, trendy drinks)	98	31,4%

Source: Data collected from 312 culinary MSME actors in Cirebon City and its surrounding areas using structured questionnaires

Based on the data presented in Table 1, the respondents in this study were predominantly female MSME entrepreneurs. In terms of age, most respondents were in the 21–30 age range. Meanwhile, based on the type of business, snack businesses were the most common type of

business run by respondents. These findings indicate that culinary entrepreneurs are predominantly from the productive age group, who are relatively active and adaptive in running their businesses, especially in the culinary sector, which has a fairly high market demand.

Out-of-model analysis was conducted to ensure that the measurement model applied in this study was appropriate. The suitability assessment was carried out through reliability and validity testing. Several analytical tests, such as external loadings, average extracted variance (AVE), Cronbach's alpha, and construct reliability, were performed to ensure that the research data obtained was valid and reliable. Each of these testing methods aimed to assess the extent to which the indicators used were able to reflect the measured construct, as well as to ensure the internal consistency of each variable in the research model.

Table 2 shows that the external loading values for each item met the criteria with a score above 0.7, and the average extracted variance (AVE) value also exceeded 0.5. This indicates that all indicators used in this study are valid. In addition, the reliability test results show that the Cronbach's alpha and composite reliability values also meet the specified criteria. Thus, it can be concluded

Model analysis aims to evaluate the structural model used in predicting the cause-and-effect relationship between latent variables, which are variables that cannot be measured directly. This assessment is carried out using indicators such as R-squared (R^2), F-squared (F), and adjusted R-squared (adjusted R^2) as shown in Table 2.

Table 2. Model Measurement Test

Variabel	Indicator	Outer Loading	AVE	Cronbach's Alpha	Composite Reliability
Digital Competence	X1.1	0,809	0,681	0,948	0,955
	X1.10	0,841			
	X1.2	0,826			
	X1.3	0,822			
	X1.4	0,822			
	X1.5	0,825			
	X1.6	0,828			
	X1.7	0,791			
	X1.8	0,892			
	X1.9	0,854			
Customer Co-Creation	X2.1	0,784	0,676	0,931	0,943
	X2.2	0,840			
	X2.3	0,832			
	X2.4	0,820			
	X2.5	0,828			
	X2.6	0,826			
	X2.7	0,841			
	X2.8	0,804			
Product Innovation	Y1	0,842	0,710	0,942	0,951
	Y2	0,854			
	Y3	0,848			
	Y4	0,846			
	Y5	0,850			

Variabel	Indicator	Outer Loading	AVE	Cronbach's Alpa	Composite Reability
	Y6	0,798			
	Y7	0,862			
	Y8	0,839			

Source: Data analysis results from Partial Least Squares-Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0 software

Table 3. Output R Square and Adjusted R Square

Model	R Square	Adjusted R Square
X1 and X2 to Y	0,836	0,835

Source: Results from the PLS-SEM analysis indicating the explanatory power of digital competence and customer co-creation on product innovation

There are three categories in the interpretation of the coefficient of determination (R^2) value, where the R^2 value is categorized as strong if it exceeds 0.75, categorized as moderate if it is in the range of 0.50 to 0.74, and categorized as weak if it is in the range of 0.25 to 0.49 (25). Table 3 shows that the R Square (0.836) and Adjusted R Square (0.835) values in the model of the influence of X1 and X2 on Y exceed 0.75, indicating that the independent variables have a very strong ability to explain the variation in the dependent variable. Additionally, to assess the magnitude of the influence of each independent variable, the f-square effect size was used with criteria of 0.02 (small), 0.15 (medium), and 0.35 (large) (28). In this study, the f-square values can be seen in Table 4.

Tabel 4. Output F Square

Variable	Purchase intention
Digital Competence	0,408
Customer Co-Creation	0,122

Source: Data from the hypothesis testing for effect sizes of digital competence and customer co-creation on product innovation

Table 4 shows that the effect size or f-squared value for the research variables indicates that the digital competence variable has a strong influence on purchase decisions, while the co-creation variable has a weak influence on purchase intention. The results of the path analysis can be seen in Figure 3.

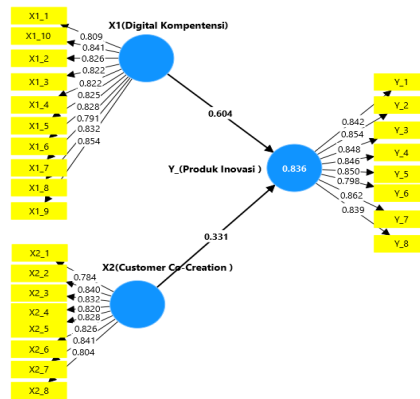


Figure 3. Diagram Model PLS-SEM

Table 5 shows information about direct and indirect hypothesis testing in this study.

Tabel 5. Summary of Hypothesis Testing

Hypothesis	Variable independent	Path Analysis	t value	p value
H1	Digital Competence → Innovative Products	0,604	8,336	0,000
H2	Customer Co-Creation → Innovative Products	0,331	4,498	0,000
H3	Digital Competence × Customer Co-Creation → Product Innovation	0,836	-	-

Source: Results from hypothesis testing in the study, showing direct effects of digital competence and customer co-creation on product innovation

The results in Table 5 show that the Digital Competence variable has a direct effect on Product Innovation of 0.604, while the Customer Co-Creation variable has a direct effect on Product Innovation of 0.331. As a result, it can be concluded that the variable that has the greatest direct effect on Product Innovation is Digital Competence. Meanwhile, the overall path coefficient value for Product Innovation (Y) is 0.836, which means that both independent variables (Digital Competence and Customer Co-Creation) together have a direct effect on Product Innovation. The t-values for all variable relationships are greater than the t-table (with t-values of 8.336 for H1 and 4.498 for H2, and p-values of 0.000 for both), so it can be concluded that all research hypotheses show that all dependent variables can be directly influenced by independent variables.

The results of this study indicate that the factors of Digital Competence and Customer Co-Creation significantly influence Product Innovation. However, the Digital Competence factor has a much stronger influence, with a path coefficient of 0.604, compared to the Customer Co-Creation factor, which only recorded a coefficient of 0.331. This is supported by an R² value of 0.836 (or an adjusted R-square of 0.835). Which shows that the model explains 83.6% (or 83.5% for adjusted R-square) of the variance in Innovation Products.

The results of this study indicate that Digital Competence and Customer Co-Creation have a positive and significant effect on MSME Product Innovation, with Digital Competence having a more dominant influence. These findings indicate that in the context of culinary MSMEs, digital capabilities are a major factor driving product innovation, while customer involvement acts as a supporting factor that strengthens the innovation process. The dominance

of Digital Competence in this study shows that the ability of SME actors to utilize digital technology, manage information, and adapt to digital-based business processes is the main foundation for creating innovative products. This finding is in line with recent research confirming that digital capabilities and maturity play an important role in shaping dynamic capabilities that directly improve innovation performance in small and medium-sized enterprises (Jie, Gooi, & Lou, 2025). In the context of culinary SMEs, mastery of digital technology enables business actors to respond more quickly to market changes, develop relevant product ideas, and improve efficiency in the product development and refinement process.

The results of this study also support the findings (Christodoulides, Athwal, Boukis, & Semaan, 2021) which confirm that digital competence not only plays a role as an operational tool, but also as a strategic enabler in value creation and innovation. MSME actors with high levels of digital competence tend to be better able to integrate technology into their daily business activities, resulting in relevant learning experiences and insights that form the basis for product innovation decision-making (Cunningham, Damij, Modic, & Olan, 2023; Vuorikari et al., 2022).

On the other hand, although Customer Co-Creation has a smaller influence than Digital Competence, its role remains significant in driving product innovation. These findings indicate that customer involvement in the value creation process, such as providing ideas, input, and product evaluation, remains an important element in producing innovations that are relevant to market needs. This is in line with the research by Sarkar et al. (2022) and Sergio et al. (2023), which states that collaboration between businesses and customers can enrich the innovation process through the direct exchange of knowledge and ideas (Maksum, Sri Rahayu, & Kusumawardhani, 2020)

Collaborative interactions between MSMEs and customers also create an atmosphere of trust and openness, so that business actors are more confident in developing or refining their products. These findings support the view of “Phil” Klaus et al. (2022), who emphasize that positive and emotional interaction experiences can improve the quality of innovation decisions. Thus, Customer Co-Creation not only serves as a source of ideas but also as a strategic mechanism that strengthens the confidence of SME entrepreneurs in pursuing sustainable innovation (Annamalah, Aravindan, Raman, & Paraman, 2022).

Interestingly, the results of this study indicate that Digital Competence plays a more dominant role than Customer Co-Creation, suggesting that without a strong foundation in digital capabilities, customer contributions to the innovation process cannot be fully leveraged. This finding expands on previous research that often places co-creation as the main factor in innovation, showing that in the context of MSMEs, internal digital-based capabilities are an important prerequisite for the collaboration process with customers to produce effective innovation (Anatan & Nur, 2023).

Overall, the findings of this study confirm that the synergy between Digital Competence and Customer Co-Creation is the key to driving MSME product innovation, where Digital Competence acts as the main driver, while Customer Co-Creation serves to strengthen the innovation process. These results enrich the literature on SME innovation by emphasizing the importance of strengthening internal digital capabilities before and during customer involvement in the value creation process (Romero & Mammadov, 2025; Saputra et al., 2024).

CONCLUSION

This study concludes that digital competence and customer co-creation have a significant effect in driving product innovation in culinary MSMEs in Cirebon. Digital competence has proven to be the main foundation that enables MSME players to utilize technology effectively, gain market insights, and develop products that are more adaptive to consumer needs. Meanwhile, customer co-creation acts as a collaborative mechanism that strengthens the innovation process through active customer involvement in value creation. The synergy between internal digital capabilities and collaboration with customers is a key factor in creating sustainable product innovation.

Based on these findings, SME actors are advised to continuously improve their digital competencies and manage customer co-creation practices in a more structured manner to optimize product innovation. This effort can be done through the use of digital technology, strengthening communication with customers, and integrating customer input into the product development process. In addition, further research is recommended to use a more diverse methodological approach and expand the object of study to different MSME sectors or regions in order to increase the generalization and depth of understanding of MSME product innovation.

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