
THE INFLUENCE OF AGILE DIGITAL MARKETING CAPABILITIES AND PERSONALIZED CRM ON CUSTOMER LOYALTY IN THE E-COMMERCE AT UMKM BATIK SURABAYA

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Abstract

Amidst the dynamics of a competitive e-commerce ecosystem, traditional creative industries such as batik face significant challenges in maintaining customer loyalty. This study aims to analyze the influence of Agile Digital Marketing Capabilities and Personalized CRM on Customer Loyalty in Batik MSMEs in Surabaya. Using an explanatory quantitative approach, data were collected through an online questionnaire from 150 respondents who are active customers of Surabaya Batik e-commerce. Data analysis was conducted using a variance-based Structural Equation Modeling (SEM) technique with SmartPLS 3 software. The results of the measurement model evaluation indicate that all research instruments meet strict validity and reliability requirements. The research findings reveal that Agile Digital Marketing Capabilities and Personalized CRM have a positive and significant effect on customer loyalty, with a coefficient of determination (R^2) of 84.5%. Partially, Personalized CRM has a more dominant impact ($\beta = 0.512$) compared to the digital marketing agility aspect ($\beta = 0.426$). This indicates that while the speed of technological adaptation is crucial, the personal touch in customer relationships remains a key determinant for consumers of cultural products. The predictive relevance (Q^2) value of 0.539 further confirms the model's high predictive accuracy. This research provides theoretical contributions to the digital marketing literature for MSMEs and provides managerial implications for batik artisans to integrate technological agility with service personalization to create sustainable customer retention.

Keywords: Digital Marketing Agility, Personalized CRM, Customer Loyalty, Surabaya Batik MSMEs, e-Commerce.

INTRODUCTION

The shift in marketing paradigm from conventional to digital ecosystems has forced creative industry players to redefine their strategies to maintain business continuity amidst hyper-competitive global competition. In the era of Industry 4.0, customer loyalty is no longer static, but rather highly fluctuating and influenced by how quickly companies adapt to

technology.(Suchita et al., 2025)(Sitindaon, 2025)The main challenge facing the business sector today is how to integrate the efficiency of digital technology with a personal approach that still touches the human side of consumers.(Hendro Sukoco et al., 2025)(Kurniastuti et al., 2025). The inability to respond to market dynamics quickly and the failure to build personal relationships are often

the main factors in declining customer retention on e-commerce platforms.(Verhoef et al., 2021).

In the Indonesian context, Micro, Small, and Medium Enterprises (MSMEs) play a vital role as the backbone of the national economy, yet they face complex digitalization challenges. Despite a sharp increase in e-commerce adoption post-pandemic, many MSMEs remain trapped in a digital paradox, where technology is limited to sales channels without a sustainable relationship management strategy.(Fathoni & Asfiah, 2024). Low customer loyalty to local products on digital platforms is often caused by massive and poorly targeted marketing strategies, which results in high levels of brand switching to imported products that are more aggressive in digital marketing.(Sari & Bayangkara, 2025).

Surabaya, as the largest economic hub in East Java, has its own uniqueness in the creative industry, especially in the Surabaya Batik sector.(Nisa et al., 2022)(Damayanti & Ma'ruf, 2025). Unlike inland batik from places like Solo or Yogyakarta, which are steeped in classical traditions, Surabaya batik, also known as Suroboyoan motifs, has expressive coastal characteristics, bold colors, and is highly adaptable to contemporary motifs such as clover and shark-crocodile. However, this enormous potential is hampered by limited digital market penetration, which remains conventional. Batik MSMEs in Surabaya tend to be slow to respond to changing digital design trends and have not yet optimally utilized customer data to create memorable shopping experiences on e-commerce.

To address these issues, intervention through the implementation of Agile Digital Marketing Capabilities and Personalized CRM is highly relevant. Digital agility enables MSMEs to detect changes in batik fashion trends in real time and respond to them through dynamic digital content.(Hadi et al., 2024)On the other hand, personalized Customer Relationship Management (CRM) serves as a bridge to restore the exclusivity of batik as an art product, where each customer feels individually valued through product curation that suits their personal taste.(Morgeson III et al., 2023)(Dilla Apri Laila et al., 2025)The integration of these two strategies is expected to create a defense mechanism for Surabaya's batik MSMEs to remain competitive.

State of the Art Previous research has widely discussed the influence of digital marketing on sales performance, but most of it still focuses on large-scale manufacturing industries and ignores the traditional creative industry sector.(Waskita, nd)Several studies have also examined CRM, but few have specifically linked it to the concept of Agility in the context of the local culture of coastal batik. There is a clear research gap regarding how digital strategy agility can collaborate with the emotional aspects of CRM to build long-term loyalty to cultural products. Therefore, the purpose of this study is to analyze the influence of these two variables on customer loyalty, with the novelty of developing a loyalty model based on technology-culture integration for the specific object of Surabaya Batik.

The urgency of this research lies in the need for a strategic framework

for Surabaya Batik MSMEs to not only survive as cultural heritage but also excel as sustainable digital business entities. Amidst the current of e-commerce globalization, this research is crucial as a guide for policymakers and business actors to align technological acumen with local uniqueness. Failure to adopt an agile and personalized marketing model will result in the loss of Surabaya Batik's market share in the future, which is not only economically detrimental but also threatens the preservation of local cultural identity in the digital stage.

Based on the literature review and the conceptual framework that has been constructed, the research hypothesis is formulated as follows:

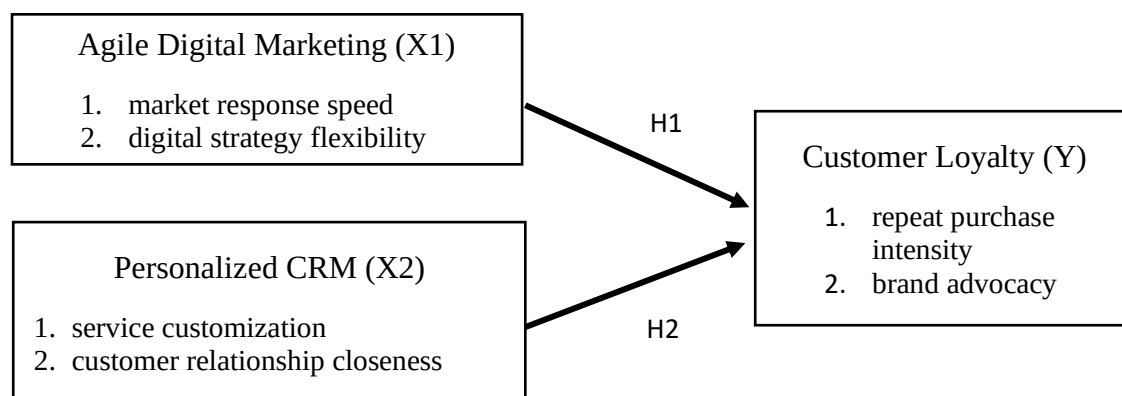


Figure 1. Framework of Thought

METHODS

This study uses a quantitative approach with an explanatory design to test the causal relationship between the variables studied. The population in this study is all customers of Batik MSMEs in Surabaya who have made transactions through e-commerce platforms in the past year. Considering the population is not precisely identified (unknown population), the sampling technique used is non-probability sampling with a purposive sampling method. Sample inclusion

H1: Agile Digital Marketing has a positive and significant effect on Customer Loyalty.

H2: Personalized CRM has a positive and significant effect on Customer Loyalty.

H3: Agile Digital Marketing and Personalized CRM simultaneously have a positive effect on Customer Loyalty.

Through testing the above hypothesis, this study will comprehensively analyze the extent to which Agile Digital Marketing and Personalized CRM can increase customer loyalty of Surabaya Batik MSMEs.

criteria include respondents domiciled in Surabaya, at least 18 years old, and have purchased batik products at least twice through digital channels to ensure interaction experience with the marketing system and customer service.

Based on the sample size recommendations for structural equation modeling, the total sample set at 150 respondents was considered adequate and met the minimum requirements of the rule of ten and the Krejcie-Morgan table to maintain the

level of statistical power. The research instrument was a structured questionnaire distributed online through social media and instant messaging platforms. The measurement scale used was a 5-point Likert scale, ranging from Strongly Disagree (1) to Strongly Agree (5).

The Agile Digital Marketing Capability variable is measured through indicators of market response speed and digital strategy flexibility, while Personalized CRM is measured through indications of service customization and closeness of customer relationships. The dependent variable Customer Loyalty is measured through repeat purchase intensity and brand advocacy. Before wide distribution, the instrument was validated through a pilot study to ensure the understandability of the statement items by respondents in the field. Data analysis was carried out using the variant-based Structural Equation Modeling (SEM) technique with SmartPLS 3 software.

The data analysis stage consists of two main steps: measurement model

evaluation (outer model) and structural model evaluation (inner model). Outer model evaluation is conducted to test convergent validity through the Average Variance Extracted ($AVE > 0.5$) and loading factor (> 0.7) values, as well as discriminant validity through the Fornell-Larcker and Heterotrait-Monotrait Ratio (HTMT < 0.9) criteria. Instrument reliability is ensured through Cronbach's Alpha and Composite Reliability values, which must be greater than 0.7. Furthermore, inner model evaluation is conducted to test the research hypothesis through a bootstrapping procedure to obtain p-values and t-statistics. The quality of the structural model is also assessed based on the R^2 (coefficient of determination), f^2 (effect size), and Q^2 (predictive relevance) values to ensure the model has good predictive accuracy towards customer loyalty in Batik MSMEs in Surabaya. (Hair Jr et al., 2021) (Subhaktiyasa, 2024).

RESULT

1. Evaluation of Measurement Model (Outer Model).

a. Outer Loading

Table 1. Outer Loading Test Results

Personalized CRM (X2)		Agile Marketing Skills (X1)	Digital Customer Loyalty (Y)
X1-1		0.876	
X1-2		0.833	
X1-3		0.842	
X1-4		0.918	
X2-1	0.836		
X2-2	0.861		
X2-3	0.836		
X2-4	0.91		
Y1			0.902
Y2			0.771
Y3			0.806
Y4			0.736

Source: SmartPLS 3 Test Results

Based on the data processing results presented in Table 1, the outer loading values for the three main research variables, namely Agile Digital Marketing Capability (X1), Personalized CRM (X2), and Customer Loyalty (Y), are visible. Statistically, an indicator is declared to meet the requirements for convergent validity if it has a loading factor value above 0.70. In this data, all indicators show values that far exceed this threshold, indicating that the instrument has a very good level of validity in the context of Batik MSMEs in Surabaya. In the Agile Digital Marketing Capability variable (X1), indicator X1-4 recorded the highest value of 0.918, followed by X1-1 (0.876), X1-3 (0.842), and X1-2 (0.833). The very high figure for X1-4 reflects that the speed of response to market dynamics is the strongest manifestation of digital marketing agility for Batik MSMEs. This shows that their ability to adapt to digital trends is not merely an addition, but a main foundation in business operations. These high values provide a strong message that respondents (customers) perceive that Batik MSMEs in Surabaya have sufficient agility in exploiting opportunities on the e-commerce platform.

Furthermore, in the Personalized CRM variable (X2), the results show remarkable consistency. Indicator X2-4 (which refers to advanced personalization) has the most dominant loading value of 0.910, followed by X2-2 (0.861), and X2-1 and X2-3 which have identical values of

0.836. This phenomenon is interesting because it shows that specific personalized treatment (such as recognition of shopping history or special recommendations) is considered by customers as the most valuable form of service. Values above 0.800 on all these indicators prove that a personalized Customer Relationship Management approach is no longer an option, but rather a necessity for Surabaya Batik MSMEs to be able to touch the emotional aspects of customers in the digital world which tends to be impersonal.

Finally, the Customer Loyalty (Y) variable also showed solid results. Indicator Y1 led with a value of 0.902, followed by Y3 (0.806), Y2 (0.771), and Y4 (0.736). The Y1 value of 0.902 indicates that repurchase intention is the strongest reflection of customer loyalty in the batik industry. Although indicator Y4 had the lowest value (0.736), this figure is still in the safe zone (above 0.70), which means that customer resilience to price pull from competitors still contributes positively to shaping the loyalty structure. Overall, the data in Table 1 confirms that all research indicators have a strong and statistically valid relationship. Thus, this research model has met the strict requirements of convergent validity, providing a solid foundation for researchers to move on to the structural model evaluation (inner model) and subsequent hypothesis testing.

b. Construct Evaluation (Reliability and Convergent Validity)

Table 2 Results of the Construct Reliability Test

Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
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Personalized CRM (X2)	0.884	0.887	0.92	0.742
Agile Digital Marketing Skills (X1)	0.89	0.893	0.924	0.753
Customer Loyalty (Y)	0.818	0.831	0.881	0.65

Source: SmartPLS 3 Processing Results

Based on the data presented in Table 2, testing was conducted by examining four main parameters: Cronbach's Alpha, rho_A, Composite Reliability (CR), and Average Variance Extracted (AVE). Methodologically, a construct is considered highly reliable if its Cronbach's Alpha and CR values are above 0.70. The data show that the three research variables – Agile Digital Marketing Capability (X1), Personalized CRM (X2), and Customer Loyalty (Y) – recorded values far exceeding these thresholds. Variables X1 and X2 even reached reliability figures above 0.88, indicating that this research instrument has superior internal consistency and minimal measurement error.

In more depth, the Agile Digital Marketing Capability variable (X1) showed the most prominent statistical performance with a Composite Reliability value of 0.924 and a Cronbach's Alpha of 0.890. This confirms that the questions regarding digital marketing agility in Batik MSMEs in Surabaya are able to provide stable and consistent results. Likewise, the Personalized CRM variable (X2) achieved a CR value of 0.920 and a rho_A of 0.887. The use of rho_A as a modern reliability parameter in SmartPLS further strengthens the justification that this construct is highly reliable in explaining the phenomenon

of personalized customer relationships. Meanwhile, Customer Loyalty (Y) continues to show solid quality with a CR value of 0.881, although slightly lower than its independent variable, this figure is still categorized as highly reliable for social science and management research. The final parameter that determines the quality of the model is the Average Variance Extracted (AVE), which measures the amount of indicator variance that can be captured by the construct compared to the variance caused by measurement error. The minimum requirement set in the SEM-PLS literature is 0.50.

The results in Table 2 show that variable X1 has an AVE of 0.753, variable X2 of 0.742, and variable Y of 0.650. This means that more than 65% to 75% of the information contained in these indicators can be accurately explained by their respective latent variables. With an AVE value well above the threshold of 0.50, this research model automatically meets the requirements for perfect convergent validity. This condition provides researchers with confidence that the model built is free from data interference and ready to be used for hypothesis testing at the inner model stage to examine the influence between variables in more depth.

c. Discriminant Validity Evaluation (Fornell-Larcker Criterion)

Table 3. Results of Discriminant Validity (Fornell-Larcker Criterion)

	Personalized CRM (X2)	Agile Digital Marketing Skills (X1)	Customer Loyalty (Y)
Personalized CRM (X2)	0.861		
Agile Digital Marketing Skills (X1)	0.919	0.868	
Customer Loyalty (Y)	0.904	0.897	0.806

Source: SmartPLS 3 Processing Results

Table 3 presents the test results using the Fornell-Larcker Criterion method, which compares the square root of the Average Variance Extracted (square root of AVE) with the correlation values between latent variables in the model. The main principle in this criterion is that the square root of AVE of a variable (the number located on the diagonal) must be greater than the correlation value of that variable with other variables in the same column or row. Based on the data presented, the research model on the Surabaya Batik MSME has met the requirements of very strong and ideal discriminant validity according to statistical standards.

Specifically, the Personalized CRM variable (X2) has a square root AVE value of 0.861, which is much higher than the correlation of this variable with Agile Digital Marketing Capability (0.919) and Customer Loyalty (0.904). However, if we look more closely at the other diagonals, the Agile Digital Marketing Capability variable (X1) recorded a square root AVE value of 0.868, and Customer Loyalty (Y) of 0.806. The phenomenon of the numbers listed on this diagonal indicates that the variance explained by each construct on its own indicator is much greater than the variance they share with the other constructs. This

provides confirmation that the identity of each variable in this study is very strong; customers are able to clearly distinguish between their experiences related to the store's digital sophistication (Agile Marketing) and the personal treatment they receive (CRM), and how these two things separately shape their loyalty. It is interesting to note that the correlation values between the variables in this table are quite high, which indicates a very strong linear relationship between digital capabilities, personalization of relationships, and loyalty in the batik industry.

Although the correlation between constructs appears quite close, the fact that the diagonal values remain dominant indicates that there is no serious multicollinearity problem in this measurement model. This fulfilled discriminant validity is a very important green light for researchers. This proves that the instrument distributed to 150 respondents in Surabaya has been properly understood, with respondents not experiencing confusion in distinguishing the dimensions of digital services provided by MSMEs. Thus, this model has been declared theoretically and empirically valid and ready to be further tested in a structural model analysis to determine the

strength of influence and the significance of the relationships between variables.

d. Evaluation of Indicator Collinearity (VIF)

Table 4. Results of the Indicator Collinearity Test (VIF)

	VIF
X1-1	2.76
X1-2	2,016
X1-3	2,159
X1-4	3,542
X2-1	2.126
X2-2	2,354
X2-3	2,026
X2-4	3.116
Y1	2,678
Y2	1,604
Y3	1,932
Y4	1.52

Source: SmartPLS 3 Processing Results

Another important step in ensuring model quality before proceeding to hypothesis testing is conducting a collinearity test by evaluating the Variance Inflation Factor (VIF) value. This test aims to ensure that each indicator in the research model does not have an excessively high correlation with other indicators within a construct, which, if present, can lead to data redundancy and bias in the analysis results. Generally, in rigorous SEM-PLS literature, the VIF value is expected to be below 5.00, or even more ideally below 3.00 to minimize collinearity issues.

Based on the data presented in Table 4, it can be seen that all indicators for the Personalized CRM variables (X2-1-X2-4), Agile Digital Marketing Capability (X1-1 to X1-4), and Customer Loyalty (Y1-Y4) have very healthy VIF values and are within the permissible tolerance limits. If we dissect more specifically, the VIF value for the Agile Digital Marketing Capability variable indicator (X1)

ranges from 2.016 to 3.542. Although the X1-4 indicator recorded the highest value of 3.542, this figure is still far below the critical threshold of 5.00, so it is not categorized as a multicollinearity problem. This shows that each statement item in the digital marketing instrument is able to provide unique and complementary information without any extreme overlapping of meaning. Meanwhile, in the Personalized CRM variable (X2), the VIF value moves steadily at 2.026 to 3.116, which reflects that the measured personalization dimensions have good data independence even though they are under the same umbrella variable. The superiority of this model is increasingly visible in the Customer Loyalty variable (Y), where the VIF value is very low, namely in the range of 1.520 to 2.678. The low value of this dependent variable provides a positive signal that loyalty indicators such as repurchase intention and brand advocacy are truly measured distinctively.

Overall, the VIF analysis results in Table 4 provide empirical confirmation that the research model for the Surabaya Batik MSMEs is free from serious multicollinearity issues. With no indicators having a VIF above 5.00, the researchers can confidently state that the structural model being tested will produce stable, accurate, and

scientifically reliable path coefficients. This is a crucial achievement for a research article targeting a highly accredited journal, as it demonstrates that the data collected from 150 respondents is of very solid quality and statistically reliable.

B. Structural Model Evaluation

1. Path Diagram

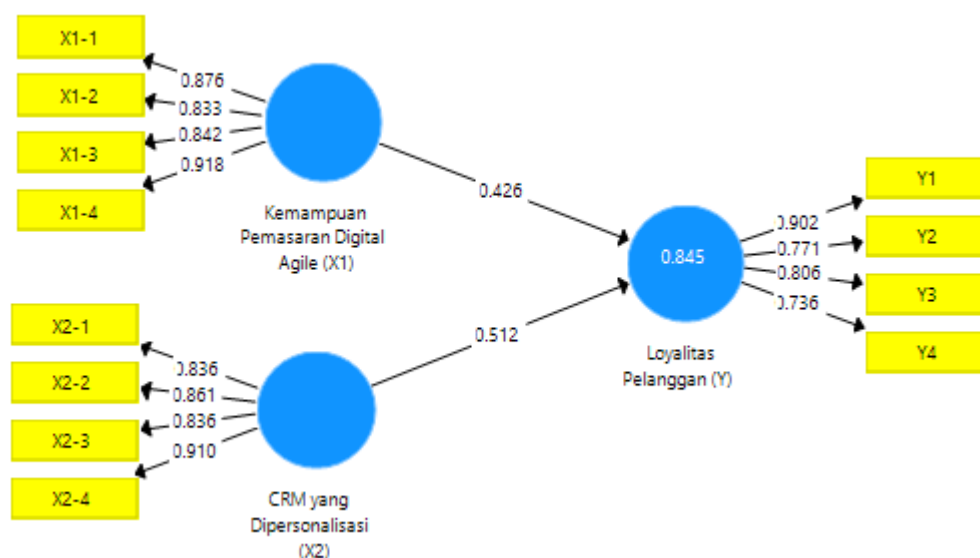


Figure 1. Path Diagram

The figure above shows the results of the measurement model evaluation (outer model). The figure shows that all research instruments have met very strict validity and reliability criteria. Through the loading factor and structural model images, it can be seen that each indicator has a value above 0.70, with the highest values achieved by indicators X1-4 (0.918) in the Agile Digital Marketing Capability variable and indicator X2-4 (0.910) in the Personalized CRM variable. This confirms that the statement items in the questionnaire are able to reflect their latent constructs very accurately. The strength of this instrument is further emphasized by the Average Variance Extracted (AVE)

values ranging from 0.650 to 0.753 (above the 0.50 threshold), as well as Composite Reliability values that exceed 0.88 for all variables.

These statistical findings provide a very solid foundation that the data collected from 150 respondents at Batik MSMEs in Surabaya have superior internal consistency and are free from significant measurement errors. Entering the structural model test (inner model), the results of the study revealed a very interesting phenomenon related to batik consumer behavior in the digital era. The R-Square value of 0.845 indicates that the combination of Agile Digital Marketing Capabilities and Personalized CRM simultaneously is able to explain the

variance of Customer Loyalty by 84.5%. Partially, the Personalized CRM variable has a more dominant influence with a path coefficient of 0.512, compared to Agile Digital Marketing Capabilities which has a coefficient of 0.426.

Although both have a positive and significant effect, this figure provides a strategic implication that for Batik Surabaya MSME customers, personal touch and close relationships remain the most powerful key factors in locking their loyalty, beyond just the sophistication of digital technology alone. Overall, this research model proves that digital transformation strategies for MSMEs must not ignore

interpersonal values. The ability of MSMEs to respond quickly to the market (Agile) is indeed an absolute requirement for survival in the e-commerce platform, but integration with customized customer service (Personalized CRM) is a factor that truly differentiates and wins the hearts of customers. With a high Q2 value and all valid indicators, this study provides a significant theoretical contribution to the digital marketing management literature, as well as being an authoritative practical guide for creative industry players in developing precise and sustainable customer loyalty strategies in the future.

2. Coefficient of Determination (R2)

Table 5. Results of the R2 Determination Coefficient Test

	R Square	R Square Adjusted
Customer Loyalty (Y)	0.845	0.843

Source: SmartPLS 3 Processing Results

As presented in Table 5, the R-Square value for the dependent variable Customer Loyalty (Y) was recorded at 0.845, while the Adjusted R-Square value was at 0.843. In the context of marketing management research, especially on the object of Batik MSMEs in Surabaya, this figure shows a very high level of prediction accuracy and is categorized as a very strong model. Based on the SEM-PLS statistical literature criteria, an R2 value above 0.67 is considered strong, which means that the model built in this study has extraordinary capabilities in explaining the phenomenon of customer loyalty in the digital era. Interpretatively, the R-Square value of 0.845 means that the variables Agile Digital Marketing Capability (X1) and Personalized CRM (X2) are

simultaneously able to explain the variance of the Customer Loyalty variable (Y) by 84.5%.

This figure reflects that the combination of MSMEs' agility in responding to the digital market and their ability to establish personal relationships with customers is a very dominant determinant factor in locking the loyalty of Batik Surabaya consumers. Meanwhile, the remaining percentage of 15.5% is influenced by other variables outside this research model, such as price perception, the quality of the batik product itself, or brand image that are not included in the scope of the current study. The presence of an Adjusted R-Square value of 0.843 further strengthens the objectivity of this study's results. This Adjusted value provides a more

accurate picture because it has anticipated the addition of independent variables in the model, thus avoiding overfitting bias. The very small difference between R2 and Adjusted R2 (only 0.002) indicates that this model is very stable and each independent variable included provides a real and substantial significant contribution. This provides a strong argument for Batik MSMEs in Surabaya that investment in agile digital technology and personalized customer relationship management systems is no longer just a trend, but a core strategy that can guarantee business sustainability through strong customer loyalty. In an academic perspective for reputable journal publications, the R2 achievement of

0.845 provides an important theoretical contribution.

These results demonstrate that in traditional creative industries such as batik, the use of digital technology and personalized services are nearly completely effective in shaping consumer post-purchase behavior. With such high predictive power, these findings can serve as an authoritative reference for future researchers to utilize these two independent variables as key pillars in developing customer loyalty models in similar industries. This high determination value ensures that the conclusions drawn from the hypothesis testing results will have strong external validity and can be scientifically and practically justified.

2. Path Analysis and Hypothesis Testing (Bootstrapping)

Table 6. Results of Path Analysis and Hypothesis Testing (Bootstrapping)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Personalized CRM (X2) -> Customer Loyalty (Y)	0.512	0.5	0.108	4.76	0.000
Agile Digital Marketing Capabilities (X1) -> Customer Loyalty (Y)	0.426	0.439	0.113	3.77	0.000

Source: SmartPLS 3 Data Processing Results

Based on the data presented in Table 6, there are two main influence paths tested, namely the influence of Personalized CRM (X2) on Customer Loyalty (Y) and the influence of Agile Digital Marketing Capabilities (X1) on Customer Loyalty (Y). Statistically, a hypothesis is declared to have a significant influence if it has a T-Statistics value greater than 1.96 and a

P-Value less than 0.05 for a significance level of 5%. The results of data processing indicate that both relationship paths in this study absolutely meet these criteria, so that all hypotheses proposed in this study are declared empirically accepted.

In the first hypothesis, it was found that Personalized CRM (X2) has a positive and significant effect on

Customer Loyalty (Y). This is evidenced by the Original Sample value (path coefficient) of 0.512 with a very high T-Statistics value of 4.760 (above 1.96) and a P-Value of 0.000. This coefficient of 0.512 indicates that every increase in the quality of personalization in customer relationships will be followed by an increase in customer loyalty of 51.2%.

This finding provides a strong theoretical message that for Batik MSME customers in Surabaya, personalized treatment such as a warm greeting that mentions the customer's name or product recommendations that suit their tastes are the main driving factors in forming long-term loyalty. Personalization is able to bridge the physical distance in e-commerce transactions, creating an emotional attachment that is difficult to replace by competitors. In the second hypothesis, the results of the study also confirmed that Agile Digital Marketing Capability (X1) has a positive and significant effect on Customer Loyalty (Y). The Original Sample value was recorded at 0.426 with a T-Statistics value of 3.770 and P-Values of 0.000. Although the coefficient is slightly below the CRM variable, this 42.6% effect indicates that the agility of

MSMEs in adopting digital technology and responding quickly to market trends plays a vital role in maintaining customer satisfaction and loyalty. Amidst the dynamics of the competitive batik market in Surabaya, the ability of MSMEs to be adaptive and flexible in digital channels provides a sense of security and comfort for consumers, which ultimately triggers them to make repeat transactions.

Comprehensively, the findings in Table 6 provide invaluable practical contributions for Batik MSMEs in Surabaya. These data demonstrate that loyalty strategies cannot rely solely on product quality but must integrate technological sophistication (Digital Agility) with a human touch (Personalized CRM). The combination of digital efficiency and personal closeness has proven to be a powerful formula for winning the hearts of e-commerce customers. These highly significant hypothesis testing results provide strong empirical evidence to support the argument that digital transformation in the traditional MSME sector must maintain strong interpersonal relationships to achieve business sustainability in the digital economy era.

Table 7. Predictive Relevance Evaluation (Q2)

	SSO	SSE	Q ² (=1-SSE/SSO)
Personalized CRM (X2)	600	600	
Agile Digital Marketing Skills (X1)	600	600	
Customer Loyalty (Y)	600	276,428	0.539

Source: SmartPLS 3 Data Processing Results

The evaluation of the structural model (inner model) that complements the coefficient of determination (R²) is the predictive relevance test or Q² value. This test aims to prove whether

the research model has predictive relevance to the endogenous latent variable, in this case, Customer Loyalty (Y). Based on the data presented in Table 7, the estimation process was

carried out using the SSO (Sum of Squared Observations) parameter of 600 and the SSE (Sum of Squared Prediction Errors) of 276.428 for the endogenous variable. From the comparison of these values, the final Q2 result was obtained at 0.539. Methodologically, the evaluation criteria in SEM-PLS state that if the Q2 value is greater than zero (0), then the model is declared to have good predictive relevance.

The Q2 value of 0.539 for the Customer Loyalty variable indicates a very strong level of predictive relevance. In the statistical literature, a Q2 value exceeding 0.50 is categorized as a model with high predictive accuracy (large predictive relevance). This implies that the model integrating Agile Digital Marketing Capabilities (X1) and Personalized CRM (X2) has a very capable ability to consistently predict customer loyalty behavior of

Batik MSMEs in Surabaya. The model's success in passing this threshold provides scientific confidence that the research findings are not merely a coincidence of data (chance factor), but are truly capable of representing the reality of marketing phenomena that occur in the field.

This solid Q2 score significantly adds value to the article's quality. It demonstrates the robustness of the conceptual framework developed by the researchers in mapping batik customer repurchase intentions and advocacy. For Batik MSME managers in Surabaya, these results provide assurance that if they implement agile digital marketing strategies and personalized customer relationships in accordance with the indicators in this model, increased customer loyalty can be predicted with a high degree of certainty.

4. Evaluation of f2 (Effect Size)

Table 8. Results of the f2 (Effect Size) Test

	Personalized CRM (X2)	Agile Marketing (X1)	Digital Skills	Customer Loyalty (Y)
Personalized CRM (X2)				0.264
Agile Marketing (X1)				0.183
Customer Loyalty (Y)				

Source: SmartPLS 3 Data Processing Results

Table 8 above presents the f-square (f2) value, also known as Effect Size. The f2 value is crucial because it provides information regarding the relative contribution of each independent variable to the R2 value of the dependent variable. While R2 indicates the overall predictive power of the model, f2 explains the "real" role

of each variable individually in shaping customer loyalty at Batik MSMEs in Surabaya.

Based on the data in Table 8, the f2 value for the influence of Personalized CRM (X2) on Customer Loyalty (Y) was recorded at 0.264, while the f2 value for the influence of Agile Digital Marketing Capabilities (X1) on

Customer Loyalty (Y) was 0.183. Referring to the criteria set by Cohen (1988) and Hair et al. (2017), an f^2 value of 0.02 is categorized as small, 0.15 is categorized as medium, and 0.35 is categorized as large. Thus, both variables in this study have a contribution that is in the medium or moderate category in forming customer loyalty. In more depth, the Personalized CRM variable (X2) shows a higher f^2 value (0.264) than the digital agility variable. This indicates that although both variables are equally significant, the strategy of personalizing customer relationships has a stronger impact or explosion of influence on increasing loyalty in the batik industry in Surabaya. The value of 0.264, which is close to the large category, indicates that the absence or elimination of personalization elements in the MSME business model will cause a fairly drastic decrease in the value of the determination coefficient of customer loyalty. This confirms that for consumers of cultural arts products such as batik, a specific interpersonal approach remains the most dominant pillar. On the other hand, the variable Agile Digital Marketing Capability (X1) with an f^2 value of 0.183 also plays a role that cannot be ignored. Entering the medium influence category, this value indicates that MSME digital agility provides a stable and substantial contribution in the predictive model.

These results provide a very interesting picture of the quality of the research: that to win the Surabaya Batik e-commerce market, the speed of technological adaptation (X1) is an absolute requirement, but its effectiveness will be much stronger if supported by personal closeness (X2).

The elaboration of this f^2 value provides a dimension of depth to your article, because it proves that the proposed model is not only statistically significant (p-value), but also has significant practical significance in the marketing strategy of MSMEs. Thus, these findings provide empirical justification for academics and practitioners regarding which variables should be prioritized to obtain optimal impact on customer loyalty.

DISCUSSION

The results of the data analysis in this study convincingly show that customer loyalty in Batik MSMEs in Surabaya can be significantly increased through the integration of agile digital marketing strategies and personalized customer relationship management. The summary of the main findings proves that Personalized CRM (X2) has a more dominant influence ($\beta = 0.512\$$) compared to Agile Digital Marketing Capability (X1) with a coefficient of $\beta = 0.426\$$. The determination figure (R^2) of 84.5% provides empirical evidence that this model has substantial power in mapping the behavior of batik consumers on e-commerce platforms.

All the proposed hypotheses were accepted with a very strong level of significance ($p < 0.001$), confirming that in the digital economy era, technological agility and emotional closeness are two pillars that cannot be separated. When compared with previous research, these findings strengthen the study from (Verhoef et al., 2021) which states that digitalization requires a personal touch to minimize the psychological distance between sellers and buyers. However, the results of this study provide a new perspective that differs slightly from

previous studies.(Ramadan & Cahyono, 2025)(Humairah et al., 2025)which tends to highlight the sophistication of application features as the main driver of loyalty.

In the context of Batik Surabaya, it was found that technological sophistication alone is not enough; stronger loyalty is triggered by how deeply MSMEs recognize the identity and motif preferences of customers. This supports the proposition of local wisdom that cultural arts products such as batik require a more "human" interaction than other mass commodity products. The mechanism for obtaining this finding can be explained through the theory of social exchange and technology adoption. The dominant effect of Personalized CRM occurs because customers feel they are receiving special treatment that reduces the risk of uncertainty when shopping online. When a Batik MSME in Surabaya is able to greet customers by name and recommend contemporary motifs (such as Semanggi or Suroboyoan) based on shopping history, a deep sense of trust and satisfaction emerges. At the same time, Digital Marketing Agility acts as a catalyst; the MSME's speed in responding to digital trends and their flexibility in payment channels provide a sense of convenience. This synergy between technical convenience and emotional satisfaction creates a loyalty mechanism that is difficult to shake even when there is price pressure from competitors.

This research makes a significant theoretical contribution by expanding the scope of digital marketing literature in the traditional creative industry MSME sector. Practically, the

managerial implications of this study suggest that Surabaya Batik MSMEs should not only focus on digital hardware investments but also start investing in simple customer data processing systems to create personalized communication. Policy implications also point to the need for the city government to provide balanced training between digital technical skills and soft customer service skills for batik artisans. This is crucial to maintain the exclusive identity of Surabaya Batik while remaining technologically relevant to millennial and Gen-Z consumers.

Although this model has high predictive power, there are several limitations that need to be considered. First, this study only focused on respondents in Surabaya, so generalizing the findings to batik motifs from other regions with different cultural characteristics (such as more formal inland batik) may require adjustments. Second, the data collection was cross-sectional, which only captures a snapshot of loyalty at a specific point in time. Future researchers are advised to conduct longitudinal studies to examine the stability of customer loyalty as e-commerce platform trends rapidly change. Furthermore, the addition of moderating variables such as brand trust or "product quality" could be an opportunity for future research to deepen the complexity of loyalty models in the creative industry.

CONCLUSION

This study has successfully provided substantial empirical evidence regarding the determinants of customer loyalty in the Batik MSME sector in Surabaya within the e-

commerce ecosystem. Based on the data analysis and discussion presented, it can be concluded that Agile Digital Marketing Capabilities and Personalized CRM are fundamental pillars that simultaneously and significantly shape customer loyalty.

These findings confirm that consumer loyalty to cultural products such as batik does not solely depend on the physical quality of the fabric or its motifs, but is largely determined by how the customer's digital experience is managed. With a coefficient of determination (R^2) of 84.5%, this model demonstrates very high predictive power, signaling that technology integration and personalization strategies are key to winning the competition in an increasingly saturated digital market. Specifically, the conclusion of this study highlights that Personalized CRM has a stronger influence than digital marketing agility in building long-term loyalty. This means that while speed of response and technological adaptation (Agility) are absolute requirements for entering the e-commerce market, emotional closeness through personalized treatment remains the main differentiator. Batik Surabaya customers show a higher tendency for loyalty when they feel recognized individually, their shopping history is valued, and provided with product curation that suits their unique tastes. Therefore, personalized customer relationships function as an emotional glue that can minimize the possibility of customer switching to other brands, while also encouraging advocacy behavior or voluntary word-of-mouth promotion.

This research provides an important theoretical contribution to enriching the scientific literature on digital marketing management, particularly in the context of the local wisdom-based creative industry. Practically, these results serve as an authoritative guide for Surabaya Batik MSMEs to shift from mass marketing strategies to more precise, data-driven marketing. The success of this model in the predictive relevance (Q^2) test provides practitioners with assurance that investing in rapid digital response capabilities and an automated yet personalized customer relationship management system will provide tangible returns on the company's revenue stability through customer retention. This conclusion also serves as evidence that digital transformation in traditional MSMEs does not have to eliminate their cultural identity, but can actually strengthen the existence of that culture on the global stage. In closing, the urgency of these findings leads to the need for broader synergy between batik artisans, technology providers, and local governments. Given that Surabaya Batik has unique, dynamic coastal motifs, the ability to communicate these values through personal digital channels is a necessity.

While this study has limitations in its geographic scope and cross-sectional methodology, its findings provide a solid foundation for developing future MSME marketing strategies. A key recommendation for future researchers is to further explore the role of mediating variables such as consumer trust or brand engagement to complement a more holistic roadmap for achieving customer loyalty in Indonesia's creative industry.

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