Optimizing user loyalty through user interface quality in MSME mobile application: A study on product customization's mediating role

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Abstract: This study investigates the complex relationships among user interface quality, product customization, and gamification, with the aim of determining their combined impact on user loyalty in mobile marketplace applications targeted at Indonesian MSMEs. Utilizing SmartPLS 4 and structural equation modeling (SEM), the research analyzes data from 400 users of the Umkm Bangkit mobile application in Central Java, based on the Stimulus-Organism-Response (S-O-R) paradigm. The findings highlight the critical role of a high-quality user interface in enhancing user loyalty by encouraging increased user engagement and facilitating effective customization. Interestingly, the anticipated moderating effect of gamification on the relationship between customization and user loyalty was not supported. Platform stakeholders should prioritize improving user interface design and customization tools to foster user loyalty. Despite gamification's potential, cautious implementation is recommended until more empirical evidence is available. The study's focus on Central Java limits the generalizability of its findings. Potential sample bias and reliance on self-reported data may also influence the applicability of the results to a broader population. Additionally, the impact of external factors on user loyalty remains unexplored. This research offers new insights into the interaction between user interface quality, product customization, and gamification in mobile marketplace applications, contributing valuable knowledge to the field. It provides practical recommendations for stakeholders seeking to enhance user engagement and loyalty strategies, emphasizing the importance of user interface design and customization while advocating a cautious approach to integrating gamification elements.

Keywords: Gamification, Loyalty, MSME, Product customization, User interface quality.

1. Introduction

Indonesia has seen significant growth in mobile marketplace apps [1] presenting challenges for platform owners to maintain competitiveness and user loyalty in a saturated market [2]. With numerous options available, sustained engagement and loyalty are crucial for platform sustainability and growth.

As Indonesia's digital landscape evolves, understanding user loyalty in mobile apps has become critical [3]. Marketplace platforms face unique challenges in securing and retaining users [4]. A key factor is User Interface design, which serves as the gateway for user interaction and significantly impacts long-term retention and loyalty [5]. Additionally, customization features offer personalized experiences that meet individual user preferences and needs [6, 7].

Many studies highlight the significant role of User Interface (UI) in shaping user loyalty toward mobile applications [8-12]. These findings affirm that a well-designed UI can greatly enhance long-term user retention and engagement.

UI is crucial in mobile applications, serving as both the visual representation and the initial interaction point for users [13, 14]. In a competitive market, an appealing and intuitive UI is essential

for an app's success [15, 16]. Effective UI design includes aesthetically pleasing visuals, well-structured information, easy navigation, and swift responsiveness [17, 18].

Moreover, UI should incorporate features that fulfill users' functional needs, enhancing satisfaction and loyalty [19, 20]. User-friendliness is key, aiming to provide an intuitive and enjoyable experience [21]. Users comfortable and satisfied with the UI are more likely to continue using the app. Thus, optimal UI design balances aesthetics, functionality, and user experience [22] creating an emotional bond and a foundation for sustained loyalty [23, 24].

However, unlike prior research [25-28] suggesting that UI is less significant than functionality for customer loyalty, our study reexamines this perspective in the context of marketplace app users. While some argue that a well-functioning app overshadows UI importance, we explore the nuanced relationship between UI and user loyalty in mobile applications.

Product customization is crucial for enhancing user loyalty in mobile apps [29]. By offering personalized profiles, customizable interfaces, and tailored content, apps empower users to shape their experiences [30, 31]. This customization fosters a sense of ownership and personal connection, boosting user satisfaction and engagement. Users are more likely to develop a strong affinity for apps that resonate with their preferences and values [32-34].

Product customization contributes to positive word-of-mouth referrals and user advocacy [35, 36]. Satisfied users who customize their experiences are more likely to recommend the app to others [37], facilitating new user acquisition and reinforcing existing user loyalty. This creates a self-sustaining cycle of engagement and growth. Customization, by providing personalized experiences, fosters loyalty and commitment, making the app indispensable in users' digital lives [38, 39].

Additionally, incorporating gamification in mobile apps enhances user engagement and loyalty [38, 39]. Game-like mechanics such as rewards, challenges, and social interactions increase interactivity and enjoyment, encouraging continued use and fostering a sense of community [40-42].

This study examines the interplay between UI design, customization, gamification, and user loyalty in Indonesian mobile marketplace apps. It aims to reveal how customization mediates and gamification moderates the relationship between UI design and user loyalty. The research offers insights and practical implications for platform owners and stakeholders in the Indonesian mobile app market, aiding in the cultivation of lasting user loyalty.

2. Theoretical Background and Hypotheses Development
2.1. A perspective S-O-R Framework

In today's rapidly evolving digital landscape, comprehending the factors influencing user loyalty towards mobile applications is imperative for ensuring platform sustainability and growth. To tackle this challenge, scholars have turned to theoretical frameworks such as the Stimulus-Organism-Response (S-O-R) model pioneered by Mehrabian and Russell [43]. This model offers a comprehensive framework for analyzing the intricate interplay between external stimuli, individual perceptions, and resultant behaviors [44-46].

- Stimulus: External factors that elicit responses from individuals. In this study, the stimuli are the elements of the UI in mobile marketplace applications, including visual design, layout, features, and user interactions [46, 47]. The aim of these stimuli is to elicit reactions or responses from users towards the application.
- Organism: Refers to the recipients of stimuli and their reactions. In this study, the organism is product customization, which allows users to tailor their application experience to their preferences, needs, and individual characteristics [48]. This customization fosters heightened engagement and a sense of control over their interaction with the application [49].
- Response: This represents the outcomes resulting from the interaction between stimuli and the organism, reflected in user actions or behaviors. In this study, the response is user loyalty towards mobile marketplace applications. Loyalty is measured by usage frequency, retention

rates, recommendations to others, and emotional attachment to the app [50]. These responses reflect the degree to which users are positively influenced and engaged with the application due to the stimuli and personalized experiences provided.

2.2. Enhancing Marketplace Loyalty: Insights from UI Strategies

In mobile marketplace applications, the UI is the primary means through which users interact with the platform [24, 51]. The UI's design, layout, features, and interactivity greatly influence user experiences and perceptions [52]. Research highlights the critical role of the UI in fostering user loyalty. The UI is not only a point of interaction but also a key factor in determining user loyalty levels towards the platform [53]. Studies consistently show that UI elements—such as design aesthetics, intuitive navigation, feature richness, and overall usability—significantly impact user experiences. These elements help cultivate a sense of attachment and commitment to the platform. Therefore, the design and functionality of the UI are essential in shaping user perceptions, attitudes, and loyalty towards the marketplace [54, 55]. Therefore, in this study, we hypothesize that:

H_1: proposes that the quality of the UI significantly impacts user loyalty within the marketplace, emphasizing the critical role of design in fostering user engagement.

2.3. The Role of Product Customization in Driving User interface and Loyalty

A study titled "Object-Oriented User Interface Customization: Reduce Complexity and Improve Usability and Adaptation" examines the link between UI and customization. Adaptation, which involves personalization and customization, uses AI and machine learning to predict user preferences and tailor interfaces to enhance relevance [48]. Researchers and practitioners see customization as a powerful tool for management, enhancing user control, reducing errors, and increasing acceptance in human-machine interactions [56]. Effective customization also helps users quickly find desired products, saving time [57].

This perspective advocates for improving user engagement by facilitating product discovery. Human-computer interaction research emphasizes a shift towards individualized design, enhancing user performance [58]. Empirical evidence supports a strong positive correlation between customization and loyalty [57, 59, 60]. Superior website customization leads to higher loyalty, while inadequate customization diminishes it, reinforcing the significant influence of customization on loyalty [61-63]. Building upon empirical observations and theoretical foundations, the authors propose the following hypotheses:

H_2: suggests that UI effectiveness extends to influencing product customization, thereby highlighting user interactions and preferences within the marketplace environment.

This hypothesis posits that UI quality significantly influences customization levels, impacting customer perceptions and loyalty. Research underscores UI's pivotal role in shaping user experiences and loyalty.

H_3: states that product customization significantly affects user loyalty by providing tailored experiences that drive user engagement and retention.

This hypothesis suggests that customization significantly impacts customer loyalty by enhancing satisfaction, engagement, and commitment. Existing literature indicates that customization fosters ownership, relevance, and connection, key drivers of loyalty.

H_4: posits that customization mediates the relationship between UI and loyalty, suggesting that personalized experiences serve as a pathway through which design influences user engagement and retention.

This hypothesis explores how customization mediates the relationship between UI quality and customer loyalty, suggesting that customization channels the effects of UI design into loyalty outcomes. It aims to deepen scholarly understanding of these dynamics and provide empirical insights into enhancing customer loyalty through personalized user experiences.

2.4. Synergizing Dynamics: Gamification's Role as Moderator Between Customization and UI

The integration of customization into gamification frameworks has become a key topic in academic discussions, aimed at identifying game elements that resonate with diverse user profiles [64]. Researchers have focused on finding game elements that match specific user characteristics through customization, emphasizing the importance of understanding different player types. This highlights the crucial role of customization in tailoring gamified experiences to individual user preferences and behaviors [65].

Additionally, the development of adaptable and customizable gamification engines has become a critical area of focus. The goal is to create platforms that allow for the parameterization of various game mechanics, enabling the creation of highly configurable gaming experiences [61]. In customizable gamification platforms, two user roles have emerged: system administrators and end-users. System administrators are responsible for creating and managing gamified tasks, specifically integrating customization elements into the game design process.

Scholarly literature highlights the importance of gamification in boosting loyalty and potentially increasing company profitability [66]. Gamification effectively influences loyalty by tapping into basic human desires such as goal pursuit and recognition [67]. By incorporating game design elements, gamification enhances non-game products and services, increasing customer value and promoting behaviors such as higher consumption, stronger loyalty, greater engagement, and product advocacy. Based on this discussion, we propose the following hypothesis:

H_5: indicates that gamification significantly influences user loyalty, underscoring the role of game elements in enhancing user engagement.

H_6: proposes that gamification moderates the impact of customization on loyalty, suggesting that gamified experiences can amplify the effects of customization in driving user engagement and retention within the marketplace.

This hypothesis proposes that gamification enhances the impact of customization on loyalty, emphasizing their synergistic effects on user engagement and loyalty. It underscores the intricate relationships between customization, gamification, and loyalty in contemporary research.

This study employs the S-O-R framework to investigate how UI influences user loyalty in mobile marketplace apps via product customization. By integrating this framework with mobile apps, it aims to unveil the impact of UI stimuli and customization on loyalty, offering strategies for enhancing user engagement.
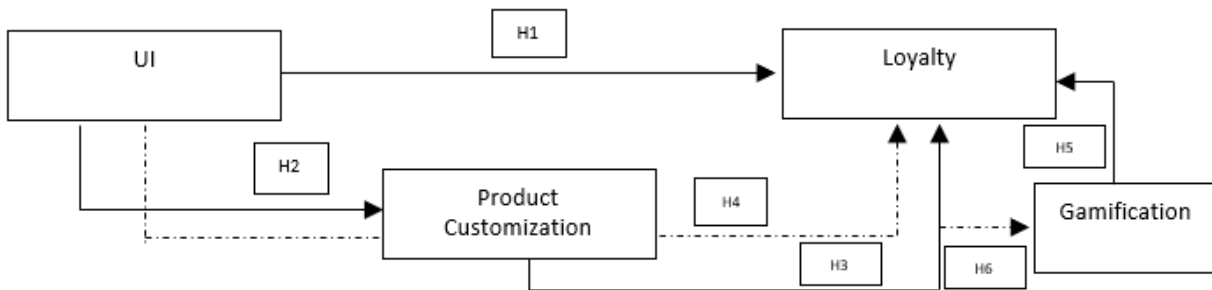

Figure 1.
Summarizes our research framework.

3. Methodology

3.1. Construct Measurement

To evaluate this study's outcomes, operational definitions and measurement items were developed for each construct, based on prior research insights. A total of 47 items were created to assess five constructs using a five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree'). These operational definitions and measurement items are detailed in Table 1.

Table 1.
Operational and measurement.

Construct	Indicator	Source
User interface (X1)	1. User-Friendliness	Roy, et al. [68]
	2. Visual Quality	
	3. Consistency	
	4. Ease of Learning	
	5. Task Suitability	
Product Customization (X2)	1. Advanced Filters and Search	Srinivasan, et al. [27]
	2. User Profiles	
	3. Personal Product Recommendations	
	4. Display Customization	
Gamification (X3)	1. Motivation	Piligrimienė [69]
	2. Engagement	
Loyalty (Y)	1.Word of mouth (WOM)	Kassim and Abdullah [70]
	2.Intention to repurchase	

3.2. Data Collection and Analysis

This study uses an explanatory research design with a quantitative survey method. The target population includes all 4833 users of the Umkm Bangkit mobile application in Central Java. Due to the dynamic nature of user data, this population is considered infinite, as defined by Daniel and Terrell [71]. The sample size of 400 respondents was determined using the Cochran formula. Non-probability sampling, specifically purposive sampling, was employed to meet criteria such as location and age [72]. The survey utilized a five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree'). Data analysis was conducted using Structural Equation Modeling (SEM) with SmartPLS 4. The demographic characteristics of the sample are detailed below.

Table 2.
Demographic characteristic of sample.

Item	Characteristic	Frequency	Ratio
Gender	Male	180	45
	Female	220	55
Age	17-25 yo	71	17,8
	26-36 yo	153	38,3
	37-47 yo	94	23,4
	> 48 yo	82	20,5
Occupation	Student	51	2,8
	Worker	151	37,8
	Government Inst.	104	26
	Others	94	23,5
Last use	Within 1 week	130	32,5
	Within 2 week	153	38,3
	> 1 month	117	29,3
Transaction	2 times	180	45
	3 to 5 times	123	30,8
	more than 5 times	97	24,2

4. Result and Discussion

4.1. Measurement Model Evaluation

The outer model serves as a critical tool for assessing the validity and reliability of the model, particularly due to the reflective nature of the indicators utilized. This measurement encompasses several key components, including convergent validity, discriminant validity, composite validity, and Cronbach's alpha.

4.2. Validy and Reliability Test

4.2.1. Convergent Validity

Convergent validity is assessed by examining the outer loading coefficients of each indicator relative to its latent variable. Indicators are considered valid when their outer loadings are between 0.60 and 0.70, with a significance level of 0.05 [73]. In this study, 47 instruments were initially considered. For the UI variable, 4 out of 20 instruments (UI7, UI1, UI6, UI7) were invalid (loading factor < 0.7), while the rest were valid (loading factor > 0.7). For Customization, 3 out of 14 instruments (CUS6, CUS13, CUS14) were invalid, and for Gamification, 1 out of 6 instruments (GAM4) was invalid. Similarly, in the Loyalty variable, 1 out of 7 instruments (UI3) was invalid. Invalid instruments were eliminated in a subsequent round of data processing to meet the convergent validity threshold (> 0.7).

The UI construct, with 16 items, demonstrated high validity (outer loadings: 0.708 to 0.902), excellent internal consistency (Cronbach's Alpha and Composite Reliability > 0.70), and convergent validity (AVE: 0.647 > 0.50), explaining 64.7% cumulative variance. Customization, with 11 items (outer loadings: 0.727 to 0.911), showed high reliability (Cronbach's Alpha: 0.950, Composite Reliability: 0.957) and convergent validity (AVE: 0.670 > 0.50), explaining 67% variance. Gamification, with 5 items (outer loadings: 0.775 to 0.841), demonstrated commendable reliability (Cronbach's Alpha: 0.874, Composite Reliability: 0.908) and convergent validity (AVE: 0.665 > 0.50), explaining 66.5% variance. Loyalty, measured with 5 items (outer loadings: 0.759 to 0.872), exhibited high reliability (Cronbach's Alpha: 0.874, Composite Reliability: 0.909) and convergent validity (AVE: 0.666 > 0.50), explaining 66.6% variance.

4.2.2. Discriminant Validity

Assessing discriminant validity is vital and follows Fornell and Larcker's criteria. It ensures that variables are theoretically distinct and empirically supported. According to these criteria, the square root of the AVE for each variable should be greater than the correlations between variables. The evaluation table for this analysis is shown below:

Table 3.
Fornell-Larcker Criterion Test.

	Gamification	Loyalty	Product Customization	User Interface
Gamification	0.815			
Loyalty	0.758	0.816		
Product Customization	0.759	0.768	0.818	
User Interface	0.752	0.757	0.764	0.790

The Gamification construct shows stronger correlations with Loyalty (0.758) and Customization (0.752), meeting discriminant validity. Loyalty (0.816) has larger correlation values compared to Customization (0.768) and UI (0.757), also fulfilling discriminant validity. Customization's correlation with UI (0.764) is notably higher (0.818), indicating discriminant validity.

4.3. Structural Model Evaluation

The structural model evaluation pertains to testing hypotheses regarding the influence among the research variables.

4.4. Inner VIF Multicollinearity Test

The Inner VIF Values are tested to assess the model's fitness, with the model considered suitable if the VIF coefficients are < 5.0. The results of the VIF test can be seen in Table 4 below:

Table 4.
Collinearity Statistic (VIF) - Inner Model.

	Inner VIF	Criteria	Result
Gamification -> Loyalty	4.745	< 5.0	Fit
Product Customization -> Loyalty	1.922	< 5.0	Fit
User Interface -> Loyalty	3.649	< 5.0	Fit
User Interface -> Customization	1.000	< 5.0	Fit
Gamification x Customization -> Loyalty	2.808	< 5.0	Fit

The inner VIF values, all below 5, show no multicollinearity among variables, following Hair, et al. [74] guidelines. As shown in the table, the estimation results consistently confirm inner VIF values below 5, ensuring reliable parameter estimation in PLS SEM and reducing potential biases.

4.5. Hypothesis Test

Hypothesis testing utilizes the bootstrapping technique within the Structural Model framework, drawing on data from the Measurement stage. This approach simulates relationships to determine their direction and significance for each latent variable. The bootstrapping results from SmartPLS 4 provide a detailed analysis of the structural model.
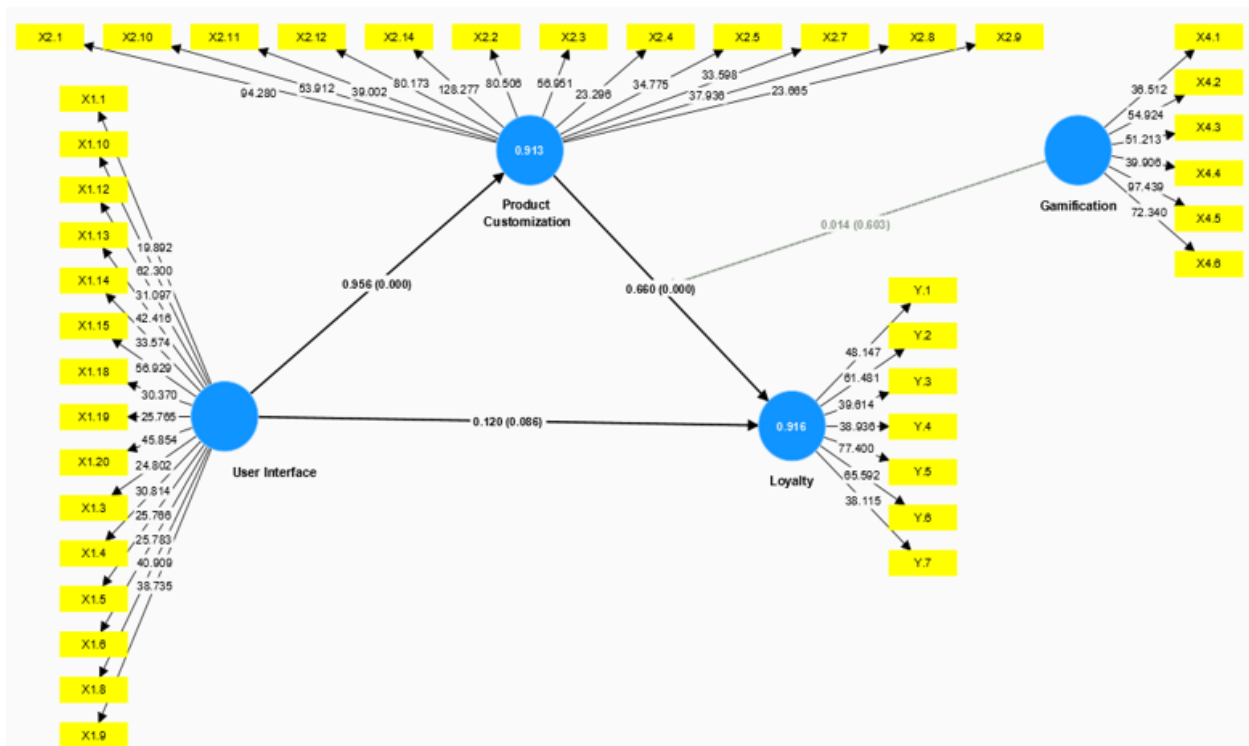

Figure 2.
Bootstrapping Output.

Figure 2 illustrates the relationships between variables, highlighting the significant influence of the UI on user loyalty. The UI also indirectly affects loyalty through customization. However, gamification does not effectively moderate the impact of customization on user loyalty, as its influence is negative and not statistically significant. According to Solimun [75] moderating variables can be classified into four types:

Table 5.
Moderation Variable Type.

No	Moderation Type	Coefficient
1	Pure Moderation	β1 Not significant β2 Significant
2	Quasi Moderation	β1 Significant β2 Significant
3	Homologizer Moderation	β1 Not significant β2 Not significant
4	Predictor Moderation	β1 Significant β2 Not significant

Source: Solimun [75].

Furthermore, the table below presents the path coefficients for each construct:

Table 6.
Path Coefficient Value.

	Original sample (O)	T statistics (|O/STDEV|)	P values	Result
Gamification -> Loyalty	0.296	6.162	0.000	Significant
Customization -> Loyalty	0.478	9.265	0.000	Significant
UI -> Loyalty	0.219	4.179	0.000	Significant
UI -> Product Customization	0.964	260.877	0.000	Significant
Gamification x Product Customization -> Loyalty	0.006	0.342	0.732	Not Significant

The outcomes depicted in the preceding table elucidate the path coefficients, signifying the results of the direct effect analysis. The deductions drawn from these findings are outlined as follows:

- UI and Loyalty: The UI significantly positively impacts loyalty, with a sample value of 0.296 and a t-statistic of 6.162, meeting statistical significance criteria (t-statistic > 1.977, p-value < 0.05). This supports the hypothesis that a high-quality UI enhances user loyalty.
- UI and Customization: The UI has a highly significant positive effect on customization, with a sample value of 0.964 and a t-statistic of 260.877, confirming the hypothesis that a better UI leads to increased customization.
- Customization and Loyalty: Customization significantly positively influences loyalty, with a sample value of 0.478 and a t-statistic of 9.265, supporting the hypothesis that customized products enhance user loyalty.
- Gamification and Loyalty: Gamification significantly impacts loyalty, with a sample value of 0.296 and a t-statistic of 6.162, meeting the criteria for statistical significance. This supports the hypothesis that gamification enhances user loyalty.
- Gamification as a Moderator: The moderating effect of gamification on the relationship between customization and loyalty is not significant, with a sample value of 0.006 and a t-statistic of 0.342 (t-statistic < 1.977, p-value > 0.05). Thus, the hypothesis that gamification moderates the impact of customization on loyalty is not supported.

The subsequent step entails conducting examinations on the associations between exogenous latent variables and endogenous latent variables via intervening variables. The ensuing results are observable in Table 7 as follows:

Table 7.
Mediation Test Specific Indirect effect.

	Original sample (O)	T statistics (|O/STDEV|)	P values	Result
User Interface -> Product Customization -> Loyalty	0.461	9.246	0.000	Significant

The analysis of the Indirect Effect table confirms a significant indirect effect of the UI variable on loyalty through Customization. With a coefficient of 0.461 and a t-statistic of 9.246, surpassing the threshold of 1.977 (t-table) and a p-value < 0.05, the fourth hypothesis is validated. This underscores Customization's role as a mediator between UI quality and loyalty, enhancing our comprehension of user dynamics within the context.

4.6. f-Square (Effect Size)
The effect size (f-square) analysis was conducted to assess the goodness of the model, revealing the relative influence of latent independent variables on the latent dependent variable. Following Ghozali and Latan [76] criteria:
a. An f^2 value of 0.35 indicates a high substantial impact of latent independent variables on the latent dependent variable.
b. An f^2 value of 0.15 suggests a moderate or moderate-sized influence between latent independent variables and the latent dependent variable.
c. An f^2 value of 0.02 signifies a small/low impact of latent independent variables on the latent dependent variable.
In conclusion, the f-Square values, as presented in Table 8, indicate the following:

Table 8.
f-square Value.

	f-square	Result
Product Customization -> Loyalty	0.244	Moderate
Gamification -> Loyalty	0.114	Low
User Interface -> Product Customization	13.272	High
User Interface -> Loyalty	0.060	Low

Customization's effect on Loyalty has a moderate effect size ($f^2 = 0.244$), while Gamification's effect on Loyalty is small ($f^2 = 0.114$). UI's influence on Customization is notably substantial ($f^2 = 13.272$), whereas its impact on Loyalty is small ($f^2 = 0.060$).

4.7. Statistical Measurement of Upsilon (V)
The statistical measurement of Upsilon (V) assesses the effect size of the mediating variable, indicating the magnitude of its impact at the structural level. Following guidelines by Ogbeibu, et al. [77] effect sizes of 0.175 indicate a high mediating effect, 0.075 signify a medium mediating effect, and 0.01 suggest a low mediating effect. The formula for Upsilon (V) calculation is $= \boldsymbol{\beta_{MX}^2 \beta_{YM.X}^2}$. Below presents the statistical measurement of the Upsilon (V) statistic to evaluate the effect on the mediating variables of Customization.

Table 9.
The Upsilon (V) Statistical Measurement.

Construct	Upsilon (V) Statistic	Result
User Interface -> Product Customization -> Loyalty	$(0{,}964)^2$ x $(0{,}478)^2 = 0{,}212$	High mediating effect

The computed Upsilon (V) value of 0.212 indicates a substantial mediating effect of Customization between UI and Loyalty, surpassing the threshold of 0.01 and categorized as high mediation. This

statistic offers vital insights into the significance of the mediating variable within the study's structural framework, enhancing our understanding of the underlying dynamics.

4.8. Model Fit Evaluation (Goodness of Fit)

The questionnaire's validity and reliability support the credibility of the utilized indicators. Hypothesis testing was then performed to examine the impact of UI Customization, and Gamification on Loyalty. Additionally, Structural Equation Model (SEM) analysis assessed model fit, meeting satisfactory criteria including R-square, Q-square, Residual Square Mean Root Standard (SRMR), and Normed Fit Index [78].

4.9. R-Square Analysis

R-square quantifies the variance in the endogenous variable explained by the exogenous variables. Chin [79] suggests qualitative interpretations: 0.19 (low influence), 0.33 (moderate influence), and 0.66 (high influence). The analysis presents R-square values for this study, indicating the model's explanatory power.

Table 10.
R-Square.

	R-square adjusted	Criteria
Loyalty	0.951	High influence
Product Customization	0.930	High influence

The table displays R-square values for Customization and Loyalty, indicating their influence from model factors. Customization's R-square of 0.930 signifies 93.0% variability explained by the UI variable, with 7% attributed elsewhere. Loyalty's R-square is 0.951, with 95.1% variability explained by UI and Customization, and 4.9% influenced by external factors. All R-square values surpass the threshold for high influence, emphasizing model variables' significant impact compared to unaccounted external factors.

4.10. Q-Square Analysis

The Predictive Relevance Analysis, using Q-square values, evaluates the model's ability to predict changes in variables affecting the endogenous variable. As per Hair, et al. [74] Q-square values are interpreted as follows: 0 for low impact, 0.25 for moderate impact, and 0.50 for high impact. Table 11 presents these values for the model, indicating its predictive relevance.

Table 11.
Q-Square.

	Q² Predict	Criteria
Product Customization	0.618	High impact
Loyalty	0.628	High impact

The Q-square values suggest high predictive accuracy for both the Customization and Loyalty variables. Customization has a Q-square of 0.618, and Loyalty has a Q-square of 0.628. Hence, both variables effectively predict the model's outcomes.

4.11. Fit Model Measurement

The model fit test results in Table 12 show that the Standardized Root Mean Square Residual (SRMR) is below 0.08, indicating a good fit. Additionally, the Normed Fit Index (NFI) yields values between 0 and 1, suggesting a satisfactory fit for all indicators.

Table 12.
Fit Model Test.

	Saturated model	Estimated model
SRMR	0.081	0.081
d_ULS	4.613	4.646
d_G	11.330	11.412
Chi-square	14.036	14.073
NFI	0.477	0.475

Table 12 indicates an SRMR value of 0.081, suggesting an acceptable fit for the model. The values of d_ULS (4.646) and d_G (11.412) align with this interpretation. Additionally, the Chi-Square value of 14.073 and the Normed Fit Index (NFI) of 0.475 fall within the acceptable range, indicating satisfactory model fit across all indicators [80].

Based on the explanations provided above, the following table summarizes the results of the research hypotheses:

Table 13.
The summary of Hypothesis Test Result.

Hypothesis	Description	Result
H1	Quality of the UI significantly impacts user loyalty within the marketplace, emphasizing the critical role of design in fostering user engagement.	Accepted
H2	UI effectiveness extends to influencing product customization, thereby highlighting user interactions and preferences within the marketplace environment.	Accepted
H3	Product customization significantly affects user loyalty by providing tailored experiences that drive user engagement and retention.	Accepted
H4	Customization mediates the relationship between UI and loyalty, suggesting that personalized experiences serve as a pathway through which design influences user engagement and retention.	Accepted
H5	Gamification significantly influences user loyalty, underscoring the role of game elements in enhancing user engagement.	Accepted
H6	Gamification moderates the impact of customization on loyalty, suggesting that gamified experiences can amplify the effects of customization in driving user engagement and retention within the marketplace.	Rejected

5. Conclusions

5.1. Findings and Implications

This study examines how the UI influences loyalty, mediated by customization and moderated by gamification. Results support the first hypothesis, indicating a significant positive impact of the UI on user loyalty. Similarly, the second hypothesis is validated, showing the UI's influence on product customization. The third hypothesis is also supported, highlighting the positive impact of customized products on loyalty. Effect size analysis reveals varying degrees of influence: the UI has a low effect, customization has a moderate effect, and the UI on customization has a high effect. Mediation analysis indicates a strong mediating effect of customization between the UI and loyalty. However, the moderation analysis of gamification shows a non-significant negative effect.

Theoretical contributions expand the Stimulus-Organism-Response (S-O-R) model to include customization, offering deeper insights into mobile commerce dynamics. Practically, the study suggests strategies for improving service quality and boosting user loyalty in the Umkm Bangkit mobile application, such as regular UI updates, enhanced customization features, and potential gamification integration. In summary, integrating findings from each variable can help Umkm Bangkit develop effective strategies for enhancing service quality and retaining customer loyalty.

5.2. Limitations and Future Research

The study has several limitations requiring careful consideration. Firstly, its scope is confined to Central Java, Indonesia, cautioning against broad application to regions with different user

demographics. Secondly, with only 400 respondents from Umkm Bangkit's extensive user base, generalization risks are present. Additionally, sample imbalance, skewed towards more females and private sector employees, limits applicability to diverse groups. Thirdly, reliance on self-reported questionnaire data may introduce bias, impacting result validity. Fourthly, external factors like economic influences, not accounted for, could affect user loyalty. Lastly, the insignificance of gamification in impacting the UI-loyalty link suggests potential overlooked factors.

Addressing these limitations is essential for contextualizing the results and avoiding overgeneralization. For future research, broadening the sample's diversity and geographic representation can enhance understanding of user preferences. Additionally, exploring additional loyalty-influencing factors and employing diverse research methods can yield richer insights into user motivations.

Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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