

THE ROLE OF PERSONALIZATION, RECOMMENDATION SYSTEMS, INFORMATION QUALITY, AND E-SERVICE QUALITY IN IMPROVING SHOPEE USER SATISFACTION: AN SEM-PLS APPROACH

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ABSTRACT

User satisfaction has become a key determinant of success for e-commerce platforms amid intensifying competition, particularly for Shopee as the most visited platform in Indonesia. This study examines the effects of personalization, recommendation systems, information quality, and e-service quality on Shopee user satisfaction, with Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) serving as mediating variables within the Technology Acceptance Model (TAM) framework. Using a quantitative approach, data were collected from 430 active Shopee users in the Jabodetabek area and analyzed using SEM-PLS with SmartPLS software. The results indicate that recommendation systems are the strongest predictor of PU, while e-service quality most significantly influences PEOU. PU has the greatest direct effect on user satisfaction, followed by PEOU, and all mediation effects are significant. The model explains 73.1% of the variance in user satisfaction, highlighting that the integration of advanced technology and service quality plays a crucial role in shaping perceived usefulness and ease of use, which ultimately drive user satisfaction in e-commerce..

Keywords: User Satisfaction, Recommendation System, E-Service Quality, Technology Acceptance Model (TAM), Shopee.

I. INTRODUCTION

The rapid growth of e-commerce in Indonesia, driven by increasing internet penetration and widespread mobile device usage, has intensified competition among platforms such as Shopee in delivering high-quality digital services. Despite the availability of advanced features, such as personalized recommendations, integrated payment systems, and efficient delivery services, maintaining user satisfaction remains a critical challenge. This issue highlights the need to examine the key factors that influence user satisfaction, particularly personalization, recommendation systems, information quality, and e-service quality, within the context of user technology acceptance. [1].

Various e-commerce platforms such as Tokopedia, Shopee, Lazada, Bukalapak, and Blibli have played a significant role in expanding market access for both consumers and businesses, including micro, small, and medium-sized enterprises (MSMEs). Data on e-commerce site visits in Indonesia shows that Shopee is the platform with the highest number of visits, averaging around 157.9 million visits per month in the first quarter of 2023 [2]. This figure surpasses several of its main competitors, such as Tokopedia, Lazada, Blibli, and

Bukalapak. This high level of traffic indicates that Shopee has a very large user base as well as a high level of interaction between the digital system and users [3].

However, the rapid growth in the number of users is not necessarily accompanied by an improvement in user experience quality. This discrepancy suggests a gap between platform expansion and the effectiveness of service delivery. In the context of Shopee, recurring issues such as mismatches between product descriptions and actual items, unmet consumer expectations, and slow seller responsiveness indicate structural weaknesses in information quality and e-service performance. These shortcomings not only hinder transactional efficiency but also undermine user trust, which is a critical determinant of satisfaction in digital platforms. Prior studies have consistently demonstrated that e-service quality and the accuracy of product information play a pivotal role in shaping consumer satisfaction and loyalty in e-commerce environments, thereby highlighting the urgency of addressing these gaps. [4][5].

Beyond service-related issues, technological aspects of the application system also play a critical role in shaping user experience. Users frequently report problems such as delays in delivery status updates, slow application loading times, and

inadequate customer service responsiveness, indicating inefficiencies in system performance. Such issues may weaken users' perceptions of platform reliability and reduce overall satisfaction [6]. In the context of information systems, the Technology Acceptance Model (TAM) emphasizes perceived ease of use and perceived usefulness as key determinants that influence users' evaluations of digital technology and, ultimately, their satisfaction with the platform [7].

Evolution in modern e-commerce, the execution of data-driven technologies such as personalization and recommendation systems has become a key strategy for enhancing the user experience. Personalization refers to a system's ability to tailor the interface, content, and promotions based on users' preferences and behavior. Meanwhile, recommendation systems suggest products or services relevant to users' interests based on an analysis of historical data and similarities in the behavior of other users [8][9]. The implementation of these two technologies is expected to enhance the relevance of the information users receive, thereby encouraging purchasing decisions and increasing user satisfaction [10].

However, the effectiveness of personalization features and recommendation systems does not always perform optimally. Some studies indicate that inaccurate recommendation algorithms can display products that are irrelevant to users' needs, thereby actually reducing the quality of the user experience. In addition, inappropriate ad personalization strategies can create a sense of intrusiveness or annoyance for users [11]. Therefore, the optimization of personalization technology and recommendation systems must be supported by accurate information and responsive electronic services, to create a more effective and convenient shopping experience for users.

To gain an empirical understanding of the issues occurring on the Shopee platform, this study also utilized user review data from the Google Play Store for the 2024–2025 period. The data were analyzed using a quantitative content analysis approach, involving data coding, categorization, and frequency distribution to identify dominant themes in user complaints. The analysis results show that most user complaints relate with respect to the effectiveness of electronic service delivery (11.3%), the standard of product information (9.8%), and the recommendation system (5.4%), while complaints related to personalization account for 1.0%. These findings indicate that the aspect of digital interac-

tion between users and the application system remains a major challenge in improving user satisfaction on e-commerce platforms.

Drawing on these issues, this study investigates the impact of personalization, recommendation systems, information quality, and e-service quality on user satisfaction with the Shopee application. The analysis is grounded in the Technology Acceptance Model (TAM), incorporating the constructs of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). These variables are selected due to their established role as key determinants shaping users' perceptions of the usefulness and ease of use of digital systems

II. LITERATURE REVIEWS

The development of e-commerce platforms has spurred increased scholarly attention to the determinants of user satisfaction in digital commerce environments. In the context of information systems, user satisfaction is commonly explained through the Technology Acceptance Model (TAM), which emphasizes the role of perceived usefulness and perceived ease of use in shaping users' acceptance of technology. However, prior studies tend to examine these factors in isolation, resulting in a fragmented understanding of how multiple system attributes simultaneously influence user satisfaction. Studies conducted by Mustakim et al. (2022) indicate that trust and user friendliness are strongly associated with customer satisfaction on the Shopee platform in Malaysia, where system security and ease of navigation emerge as primary determinants rather than promotional aspects or price alone [12].

This finding is supported by Mbete and Tanamal (2020), who identify system usability as a key determinant of purchasing decisions on Shopee [13]. Furthermore, Rohwiyati et al. (2024) emphasize that e-service quality plays a significant role in enhancing customer loyalty through the intermediary role of effect of user satisfaction, indicating that the standard of digital interactions between users and the application system is a crucial factor in the success of e-commerce platforms [14]. Taken together, these studies highlight the importance of system usability and service quality; however, they largely overlook the

integration of these factors within a unified theoretical framework such as TAM.

Beyond elements such as user friendliness and service quality, advancements in data technology and artificial intelligence are also driving the implementation of personalization in e-commerce systems to enhance the user experience. Personalization allows platforms to tailor content, promotions, and product suggestions tailored to user preferences and behavior. Irene (2023) found that customized advertisements have a significant positive impact on the satisfaction of e-commerce app users in Indonesia, particularly when the displayed content is relevant to users' needs and does not infringe upon their privacy [15].

These findings are consistent with the research by Enderwati et al. (2024), which shows that product personalization can enhance customer satisfaction both directly and through improved user experience and trust in digital platforms. The results of this study indicate that personalization not only increases the relevance of information for users but also plays a crucial role in creating a shopping experience that is more personalized and responsive to consumer needs [16]. Nevertheless, existing studies predominantly focus on the direct effects of personalization, with limited attention to its interaction with users' cognitive perceptions as conceptualized in TAM.

In addition to personalization, recommendation systems are a key component in enhancing the effectiveness of interactions between users and e-commerce platforms. These systems utilize data analysis algorithms and machine learning to present products that align with users' preferences. Joe et al. (2024) developed a reinforcement learning-based recommendation system that has been shown to improve the accuracy, diversity, and novelty of product recommendations compared to traditional methods [17]. Improving the quality of these recommendations directly contributes to increased user satisfaction and loyalty.

The study by He et al. (2024) further demonstrates that the influence of recommendation systems on user satisfaction is mediated by users' perceptions of how well products match their needs; specifically, users with specific purchase goals value the accuracy of recommendations more highly, while users with an exploratory mindset prefer a greater variety of recommendations [18]. However, Studies conducted by Thwe et al. (2021) revealed that the product category recommendation system on the Shopee e-commerce platform still

has a relatively high classification error rate, which could potentially affect the accuracy of the product information received by users and ultimately reduce the quality of the shopping experience [19]. This inconsistency suggests a gap between technological advancement and its perceived effectiveness from the user perspective.

On the other hand, the standard of information and the effectiveness of electronic service delivery are also key factors in shaping users' perceptions of e-commerce platforms. Research by Mustika and Arifin (2021) shows that the standard of product information exerts a significant influence on consumer purchasing decisions on the Shopee application, where the accuracy and completeness of product information can increase users' trust in the digital platform [20]. Meanwhile, a study by Harlan et al. (2024) found logistics services play a substantial role in shaping customer satisfaction and user loyalty toward e-commerce platforms [21]. Despite these findings, prior research tends to treat information quality and e-service quality as separate constructs, without examining their combined influence within an integrated behavioral model.

Le et al. (2024) in his research explains that which applied a machine learning approach to hundreds of thousands of user reviews, shows that sentiment analysis of digital reviews can be used to accurately predict customer satisfaction levels. These findings substantiate that the standard of digital services in e-commerce is determined not solely by application features, but also by the quality of information and the reliability of the services provided to users [22]. However, the study primarily focuses on predictive analytics and lacks a theoretical explanation of how these factors influence user acceptance and satisfaction behaviorally.

Overall, a critical review of the literature reveals three main gaps: (1) the lack of integrative analysis combining personalization, recommendation systems, information quality, and e-service quality; (2) limited application of the TAM framework to explain how these variables influence user satisfaction simultaneously; and (3) insufficient attention to the interaction between technological system performance and users' cognitive perceptions. Therefore, this study aims to integrate these variables into the Technology Acceptance Model framework to analyse their impact on user satisfaction on the Shopee platform,

thereby offering a more comprehensive and theoretically grounded explanation of user experience in the modern e-commerce ecosystem.

Furthermore, based on this synthesis, this study proposes a conceptual framework in which personalization, recommendation systems, information quality, and e-service quality act as exogenous variables, perceived usefulness and perceived ease of use serve as mediating variables, and user satisfaction represents the endogenous outcome variable. This framework illustrates the structural relationships among variables and provides a basis for empirical testing using SEM-PLS.

III. RESEARCH METHOD

This study develops a research model based on the Technology Acceptance Model (TAM) to examine the impact of personalization, recommendation systems, information quality, and e-service quality on user satisfaction on the Shopee platform [23]. The model positions perceived usefulness and perceived ease of use as mediating variables that explain how users evaluate and respond to the platform [24]. Furthermore, personalization, recommendation systems, information quality, and e-service quality are specified as exogenous variables, while user satisfaction is treated as the endogenous variable, forming a structural model that is empirically tested using SEM-PLS.

Conceptually, this study proposes eight hypothesis to explain the relationships among the research variables.

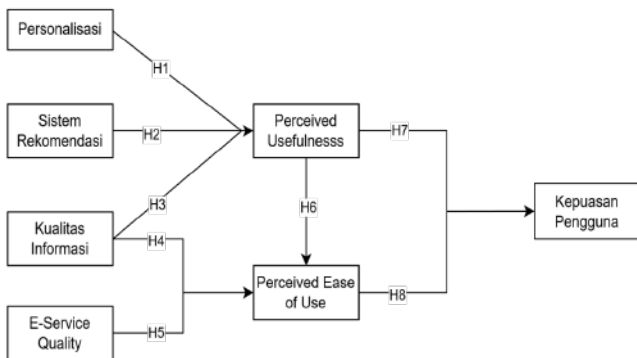


Figure 1. Research Model

- H1: Personalization has a positive effect on perceived usefulness.
- H2: Recommendation systems have a positive effect on perceived usefulness.
- H3: Information quality has a positive effect on perceived usefulness.
- H4: Information quality has a positive effect on perceived ease of use.
- H5: E-service quality has a positive effect on perceived usefulness.
- H6: E-service quality has a positive effect on perceived ease of use.
- H7: Perceived usefulness has a positive effect on user satisfaction.
- H8: Perceived ease of use has a positive effect on user satisfaction.

Furthermore, this study develops a conceptual model in which personalization, recommendation systems, information quality, and e-service quality are positioned as exogenous variables; perceived usefulness and perceived ease of use function as mediating variables; and user satisfaction serves as the endogenous variable. The conceptual model illustrates the structural relationships among these variables, forming a path framework that is empirically tested using SEM-PLS.

This research model is designed to explain how data-driven technological features within an e-commerce platform can enhance perceived usefulness and perceived ease of use, which ultimately contribute to user satisfaction.

The study population comprises Shopee users residing in the Greater Jakarta (Jabodetabek) area who have made purchases through the platform. The geographical limitation to the Jabodetabek area is justified by its high level of e-commerce penetration, digital literacy, and user activity, making it a representative region for examining user behavior in Indonesia’s e-commerce context. Given the extremely large and unidentifiable population size, this study employs an infinite population approach. Therefore, the sample size was determined using the Lemeshow (Cochran) formula with a 95% confidence level and a 5% margin of error [25]. Based on these calculations, the minimum required sample size was 384 respondents; however, to enhance statistical robustness and account for potential invalid or incomplete responses, the final sample size was increased and fixed at 430 respondents.

The sampling technique used was non-probability sampling with a purposive sampling approach, which involves selecting respondents

based on specific criteria relevant to the research objectives [26]. Respondents in this study must meet several criteria: they must be active users of the Shopee app residing in the Greater Jakarta area, have made at least two purchases in the past three months, and have interacted with the product recommendation feature or personalized ads on the Shopee app.

Data collection was conducted through an online survey instrument distributed via various social media and messaging platforms, including WhatsApp, Instagram, and Twitter/X. Prior to the main data collection, a pilot test was conducted on 30 respondents to evaluate the clarity, reliability, and validity of the measurement items, resulting in minor revisions to improve the instrument's comprehensibility. To measure respondent attitudes, the survey utilized a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), enabling a nuanced assessment of participants' perceptions.

The research instrument included seven primary constructs: personalization, recommendation systems, information quality, e-service quality, perceived usefulness, perceived ease of use, and user satisfaction, each measured using multiple indicators. Specifically, personalization was measured through indicators such as content relevance and customization. recommendation systems through accuracy and usefulness of suggestions. information quality through accuracy, completeness, and timeliness. e-service quality through responsiveness and reliability. perceived usefulness through performance enhancement. perceived ease of use through system simplicity, and user satisfaction through overall evaluation of the platform.

All measurement items were adapted from established and validated scales in prior studies, including the Technology Acceptance Model for perceived usefulness and perceived ease of use, as well as e-service quality and information systems literature, ensuring content validity and construct reliability [24][27].

Statistical analysis was performed using Partial Least Squares-Based Structural Equation Modeling (PLS-SEM), facilitated by the SmartPLS software suite. The PLS-SEM method was chosen because it is capable of analyzing complex research models, including those with mediating variables, and does not require the strict assumption of a normal data distribution [28]. In addition, this method is also considered suitable for both exploration and predictive research involving theory-based concep-

tual models in the fields of information systems and digital marketing.

The second phase of analysis involved assessing the measurement model (outer model) to ensure the validity and reliability of the research constructs, following established guidelines in SEM-PLS literature [29][30]. Convergent validity was verified through outer loadings and the Average Variance Extracted (AVE), indicators were deemed valid with loadings exceeding 0.70 and an AVE surpassing 0.50. Furthermore, construct reliability was established using Cronbach's Alpha and Composite Reliability (CR), both of which were required to meet the recommended threshold of 0.70 [28].

In addition to convergent validity, discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT). Discriminant validity is considered adequate when the square root of AVE for each construct exceeds its correlations with other constructs, and when HTMT values are below the threshold of 0.85 (or 0.90 for more lenient criteria). This step ensures that each construction is empirically distinct and measures phenomena that are not represented by other constructions in the model.

The final stage of the analysis involved evaluating the structural model (inner model) to examine the hypothesized relationships within the research framework. The model's explanatory power was assessed using the coefficient of determination (R^2), while the strength and direction of the relationships were determined through path coefficient analysis. To assess statistical significance, a bootstrapping technique was employed; hypotheses were supported if the t-statistic exceeded 1.96 and the p-value was below 0.05. Furthermore, a mediation analysis of specific indirect effects was conducted to ascertain whether perceived usefulness and perceived ease of use effectively mediate the relationship between the independent variables and user satisfaction.

IV. RESULTS AND DISCUSSIONS

A. Respondent Characteristics

A total of 430 valid responses were obtained from active Shopee users in the Greater Jakarta (Jabodetabek) area who had made at least two transactions in the past three months. Prior to analysis, the dataset was screened to remove

incomplete responses and outliers, ensuring data quality and consistency. Additionally, common method bias was assessed using Harman’s single-factor test, with results indicating no significant bias in the data. The distribution of respondents by gender and age is presented in Table 1.

Table 1. Respondent Characteristics

Category	Count	Percentage
Men	195	45.3%
Women	235	54.7%
17–25 years old	275	64.0%
26–35 years old	130	30.2%
36–45 years old	20	4.7%
>45 years old	5	1.4%

The results show that the 17–25 age group accounted for most respondents (64%), indicating that Generation Z represents the most active user group on the Shopee e-commerce platform in urban areas. This finding is consistent with prior studies which suggest that younger consumers, particularly Generation Z, tend to exhibit higher levels of digital adoption, familiarity with mobile technology, and engagement in online shopping activities [31]. Additionally, the proportion of female respondents (54.7%) was slightly higher than that of male respondents (45.3%), indicating that online shopping activity on the marketplace is predominantly carried out by female users within the context of this study. This result aligns with previous research highlighting that female consumers are generally more active in browsing, comparing products, and engaging in online purchasing behavior due to higher involvement in shopping-related decision-making [32].

In addition to demographic characteristics, the geographic distribution of respondents was also analyzed to ensure geographic representation.

Table 2. Distribution of Respondents by Place of Residence

Region	Count	Percentage
DKI Jakarta	150	34.9%
Tangerang	80	18.6%
Depok	75	17.4%
Bogor	65	15.1%
Bekasi	60	14.0%

This distribution shows that most respondents are from the DKI Jakarta region, which serves as the primary epicenter of economic and digital activity in Indonesia. This concentration reflects the dominance of urban users in Indonesia’s e-commerce ecosystem, where higher levels of digital infrastructure, internet accessibility, and purchas-

ing power are prevalent. Therefore, the findings of this study are particularly relevant for understanding user behavior in urban digital environments, where technology adoption and platform interaction tend to be more intensive.

Furthermore, the relatively balanced distribution across the Jabodetabek area enhances the external validity of the study, allowing the results to be generalized within similar metropolitan contexts. However, this also implies that caution should be exercised when extending the findings to rural or less digitally developed regions, where user behavior and technology acceptance may differ.

B. Evaluation of the Measurement Model

Before proceeding to the structural analysis, the measurement model is evaluated to establish the construct validity and reliability of the research framework.

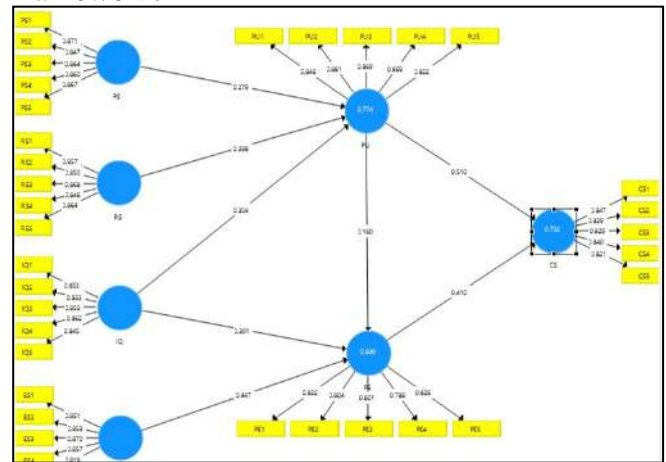


Figure 2. SEM-PLS Model of the Study (Structural model diagram generated by SmartPLS)

Convergent Validity

Convergent validity was assessed by examining the outer loading values of each indicator in relation to its respective latent construct. Adhering to the benchmarks established by Hair et al. (2021), an indicator is deemed valid if its loading value exceeds the threshold of 0.70. The results indicate that most indicators meet this criterion, suggesting that each construct is well represented by its measurement items and that the indicators share a high proportion of variance.

This finding confirms that the measurement model demonstrates adequate convergent validity, thereby supporting the reliability of the constructions in capturing the underlying theoretical concepts. Consequently, the validated indicators provide a strong foundation for subsequent structural model analysis, as they minimize measure-

ment error and enhance the accuracy of the estimated relationships among variables.

Table 3. Outer Loading of Research Constructs

Structure	Load Range
Personalization	0.847 – 0.871
Recommendation Systems	0.846 – 0.868
Information Quality	0.833 – 0.862
E-Service Quality	0.819 – 0.870
Perceived Usefulness	0.822 – 0.881
Perceived Ease of Use	0.788 – 0.832

All indicators yielded factor loadings exceeding 0.70, demonstrating that each item possesses a strong correlation with the latent construct being measured. The highest loading value was found in indicator PU2 (0.881), while the lowest value was found in indicator PE4 (0.788). The relatively narrow range of loading values indicates low variability among indicators, suggesting a consistent level of contribution across measurement items in representing their respective constructs. This consistency implies that no single indicator disproportionately dominates or weakens the construct measurement, thereby enhancing the stability and reliability of the model. Thus, all indicators were deemed valid, and no indicators were eliminated from the research model.

C. Construct Reliability Test

The internal consistency of the constructs was ascertained through the calculation of Cronbach’s Alpha and Composite Reliability (CR).

Table 4. Reliability Test Results

Structure	Cronbach's Alpha	Description
E-service Quality	0,904	Reliable
User Satisfaction	0,892	Reliable
Quality of Information	0,904	Reliable
Perceived Ease of Use	0,869	Reliable
Perceived Usefulness	0,910	Reliable
Personalization	0,913	Reliable
Recommendation System	0,910	Reliable

Every construct yielded Cronbach’s Alpha coefficients surpassing the 0.70 threshold, signify-

ing that the research instrument possesses robust internal consistency. The highest reliability value was found for the personalization construct (0.913), while the lowest value was found for the perceived ease of use construct (0.869).

D. Construct Validity (Average Variance Extracted)

Construct validity was tested using the Average Variance Extracted (AVE) value.

Table 5. AVE Values for Research Constructs

Structure	Average Variance Extracted (AVE)	Description
E-service Quality	0,723	Valid
User Satisfaction	0,698	Valid
Quality of Information	0,722	Valid
Perceived Ease of Use	0,657	Valid
Perceived Usefulness	0,736	Valid
Personalization	0,743	Valid
Recommendation System	0,735	Valid

All constructs have an AVE value above 0.50, indicating that the indicators account for more than half of the variance in the measured constructs. This suggests that the research model possesses adequate convergent validity.

E. Structural Model Evaluation

The structural model was evaluated by examining the R-square (R^2) values to assess its explanatory power, along with the Stone–Geisser’s Q^2 values obtained through the blindfolding procedure to evaluate predictive relevance [29].

R^2 values indicate the proportion of variance in the endogenous constructs explained by the model, while Q^2 values greater than zero confirm that the model has adequate predictive capability in estimating observed data [30].

In addition, effect size (f^2) was assessed to determine the relative contribution of each exogenous variable to the endogenous constructs, with values indicating small, medium, and large effects [33].

The combined evaluation of R^2 , Q^2 , and f^2 provides a comprehensive understanding of the model’s explanatory strength, predictive relevance, and the magnitude of relationships among

variables, thereby demonstrating the robustness of the structural model.

Table 6. Coefficient of Determination (R²) Values

Endogenous Variables	R Square	R Square Adjusted	Category
User Satisfaction	0,732	0,731	Strong
Perceived Ease of Use	0,699	0,697	Moderate - Strong
Perceived Usefulness	0,774	0,772	Strong

The R² value indicates that 77.4% of the variation in perceived usefulness is explained by personalization, the recommendation system, and information quality. Furthermore, information quality and e-service quality accounted for 69.9% of the variance in perceived ease of use. Simultaneously, 73.2% of the fluctuations in user satisfaction were attributed to perceived usefulness and perceived ease of use. These values demonstrate that the proposed model possesses robust predictive capabilities in characterizing the behavior of e-commerce users.

F. Hypothesis Testing

Direct Effect Analysis

Table 7. Results of the Direct Effect Test

Relationship Path (Hypothesis)	Coefficient	P Value	Decision
Personalization -> Perceived Usefulness	0,279	0,000	Significant
Recommendation System -> Perceived Usefulness	0,398	0,000	Significant
information Quality -> Perceived Usefulness	0,304	0,000	Significant
Information Quality -> Perceived Ease of Use	0,301	0,000	Significant
E-service Quality -> Perceived Ease of Use	0,447	0,000	Significant
Perceived Usefulness -> Perceived Ease of Use	0,160	0,000	Significant

Perceived Usefulness -> User Satisfaction	0,510	0,000	Significant
Perceived Ease of Use -> User Satisfaction	0,410	0,000	Significant

All relationships between variables had a p-value of less than 0.05, so all research hypotheses were accepted.

Analysis of Indirect Effects

Table 8. Results of the Mediation Test

Mediation Path	Coefficient	P Values	Description
Personalization -> PU -> PEOU	0,045	0,001	Significant
Recommendation System-> PU -> PEOU	0,064	0,000	Significant
Information Quality-> PU ->PEOU	0,049	0,001	Significant
Personalization PU -> User Satisfaction	0,143	0,000	Significant
Recommendation System-> PU -> User Satisfaction	0,203	0,000	Significant
Information Quality-> PEOU -> User Satisfaction	0,123	0,000	Significant
Information Quality-> PU -> User Satisfaction	0,155	0,000	Significant
E-service Quality -> PEOU -> User Satisfaction	0,184	0,000	Significant
Perceived Usefulness PEOU -> User Satisfaction	0,066	0,000	Significant
Personalization -> PU -> PEOU -> User Satisfaction	0,018	0,002	Significant
Recommendation System-> PU -> PEOU -> User Satisfaction	0,026	0,001	Significant
Information Quality-> PU -> PEOU -> User Satisfaction	0,020	0,001	Significant

The findings demonstrate that perceived usefulness and perceived ease of use function as critical mediating variables, bridging the connection between technology-related factors and user satisfaction.

G. Discussion

The Effect of Personalization on Perceived Usefulness

The empirical results demonstrate that personalization exerts a positive and statistically significant influence on perceived usefulness ($\beta = 0.279$, $p < 0.001$), indicating that higher levels of tailored user experience enhance users' evaluation of the platform's utility and value. This finding suggests that personalization operates not merely as a functional feature, but as a cognitive stimulus that shapes users' perceptions of system effectiveness within digital environments.

Theoretically, these findings align with the concept of personalization in digital environments, which aims to tailor services to users' preferences in order to enhance their experience and engagement [34][35]. However, while prior studies primarily emphasize the direct impact of personalization on engagement, this study extends the literature by demonstrating its indirect role through perceived usefulness as conceptualized in the Technology Acceptance Model (TAM). In the context of e-commerce, personalization helps users reduce the time spent searching for products and avoid choice overload, thereby improving the efficiency of the shopping process.

Previous research has also shown that personalization can increase customer satisfaction by enhancing the user experience and building trust in the platform [36][15]. Compared to these studies, the present findings provide a more integrative perspective by positioning perceived usefulness as a mediating mechanism, thereby offering a deeper explanation of how personalization translates into favorable user outcomes.

From a critical standpoint, the effectiveness of personalization is contingent upon its accuracy and perceived relevance; excessive or poorly targeted personalization may lead to user discomfort or privacy concerns, which can attenuate its positive impact. This highlights a potential limitation in existing literature that often assumes personalization effects to be uniformly positive.

Practically, these findings imply that e-commerce platforms should prioritize the development of adaptive and user-centric personalization systems, ensuring that recommendations and content are both accurate and contextually relevant. Theoretically, this study contributes to the extension of TAM by incorporating personalization as an antecedent of perceived usefulness, thereby enriching the model's explanatory power in the context of modern e-commerce systems. Thus, personalization not only enhances the system's functional usefulness but also strengthens the relationship between users and the platform.

The Effect of the Recommendation System on Perceived Usefulness

The recommendation system exerts a positive and statistically significant influence on perceived usefulness, with a path coefficient of 0.398 ($p < 0.001$). This relatively high coefficient indicates that recommendation systems represent a dominant determinant in shaping users' evaluation of the platform's functional value. This suggests that the ability of the system to deliver relevant and timely product recommendations plays a critical role in enhancing users' cognitive assessment of usefulness.

Recommendation systems work by analysing user behaviour and product preferences to proactively predict user needs. By automatically displaying relevant products, users can find desired items more efficiently, thereby improving the overall shopping experience.

These findings are consistent with prior research by Joe et al. (2024), which demonstrates that user-behavior-based recommendation systems enhance customer satisfaction by delivering real-time and relevant product suggestions [37]. They are also supported by earlier studies highlighting that recommender systems improve decision quality and perceived usefulness by reducing information overload and increasing relevance [38]. However, compared to previous studies that primarily emphasize direct effects on satisfaction, this study provides a more nuanced contribution by positioning perceived usefulness as a mediating mechanism.

From a critical perspective, the effectiveness of recommendation systems depends on algorithm accuracy, data quality, and user trust. Prior studies indicate that irrelevant or repetitive recommenda-

tions may reduce perceived usefulness and negatively affect user experience [39].

Theoretically, this study extends the Technology Acceptance Model (TAM) by incorporating recommendation systems as an antecedent of perceived usefulness. Practically, these findings suggest that e-commerce platforms should invest in advanced analytics and machine learning to improve recommendation relevance and diversity, thereby enhancing user engagement and satisfaction.

The Effect of Information Quality on Perceived Usefulness

Information quality was found to exert a positive and statistically significant influence on perceived usefulness ($\beta = 0.304$, $p < 0.001$), indicating that accurate, relevant, up-to-date, complete, and easy-to-understand product information enhances users' evaluation of the Shopee platform's utility. This finding suggests that information quality serves as a critical cognitive driver that reduces uncertainty and facilitates more efficient decision-making in digital environments.

In the e-commerce context, information quality is particularly important because users cannot physically inspect products. Therefore, product descriptions, images, specifications, pricing, and stock availability become essential cues in shaping user decisions [40].

These findings are consistent with the study by Krista-lin et al. (2023), which shows that information quality has a significant influence on consumer purchase intent. Conversely, a mismatch between the product description and the product received can reduce user trust in the platform [41].

However, compared to previous research that primarily focuses on direct effects on purchase intention, this study provides a more comprehensive explanation by identifying perceived usefulness as a mediating mechanism.

Conversely, prior research also indicates that inconsistencies between product descriptions and actual products can reduce user trust and negatively affect platform evaluations [41]. From a critical perspective, this highlights that the impact of information quality is not merely dependent on availability, but on its accuracy and credibility, suggesting that misleading or incomplete information may undermine perceived usefulness.

Theoretically, this study reinforces and extends the Technology Acceptance Model (TAM) by positioning information quality as an antecedent

of perceived usefulness, thereby strengthening its explanatory power in e-commerce settings. Practically, these findings imply that e-commerce platforms should prioritize information accuracy, transparency, and standardization to enhance user trust and decision efficiency. By ensuring high-quality information, platforms can improve perceived usefulness, reduce perceived risk, and ultimately strengthen user satisfaction and loyalty.

The Effect of Information Quality on Perceived Ease of Use

The results indicate that information quality has a positive and statistically significant effect on perceived ease of use ($\beta = 0.301$, $p < 0.001$), suggesting that clear, structured, and well-presented information enhances users' perception of system usability. This finding implies that information quality not only supports decision-making but also reduces cognitive effort, thereby facilitating smoother interaction with the platform.

According to Davis (1989), perceived ease of use refers to the belief that using a system does not require significant effort. Product information presented systematically and in an easy-to-understand manner can reduce the cognitive load on users in understanding the product and using the application [24].

These findings are consistent with prior research indicating that high-quality information improves system usability and user interaction efficiency [42]. However, compared to previous studies that predominantly examine usability from a technical or system design perspective, this study highlights the critical role of information presentation as a cognitive facilitator of ease of use.

From a critical perspective, the impact of information quality on perceived ease of use is contingent upon both clarity and consistency. Information overload, excessive detail, or poorly structured content may instead increase user effort and diminish usability, indicating that more information does not necessarily lead to better user experience [43].

Theoretically, this study extends the Technology Acceptance Model (TAM) by emphasizing information quality as a key antecedent of perceived ease of use, thereby enriching the model's explanatory scope in digital commerce contexts. Practically, these findings suggest that e-commerce platforms should focus on optimizing information architecture, including standardized product descriptions, intuitive layouts, and concise content

presentation, to enhance usability and reduce user effort. By improving these aspects, platforms can strengthen user experience, increase engagement, and support more efficient decision-making processes.

The Effect of E-Service Quality on Perceived Ease of Use

The results indicate that e-service quality has a positive and statistically significant effect on perceived ease of use ($\beta = 0.447$, $p < 0.001$), representing the strongest influence among all predictors of perceived ease of use. This finding suggests that the quality of digital service delivery is a primary determinant in shaping users' perceptions of how effortless a system is to use.

E-service quality encompasses various aspects of digital services such as system speed, ease of navigation, reliability, and responsiveness. A responsive system and intuitive navigation enable users to complete transactions more efficiently and with minimal effort.

These findings are consistent with prior studies demonstrating that high e-service quality enhances usability and user satisfaction [44]. Blut et al. (2015) further emphasize through a meta-analysis that dimensions such as website design, responsiveness, and system reliability significantly influence user perceptions of ease and overall service quality [45].

However, compared to previous research that often focuses on satisfaction outcomes, this study provides a more nuanced contribution by identifying perceived ease of use as a key mediating mechanism linking e-service quality to user behavior.

From a critical perspective, the impact of e-service quality is not universally positive; technical issues such as slow loading times, system errors, or poor interface design can significantly reduce perceived ease of use and create user frustration [46]. This indicates that maintaining consistent service performance is as important as delivering high-quality features, highlighting a limitation in prior studies that tend to emphasize service attributes without sufficiently addressing system reliability risks.

Theoretically, this study extends the Technology Acceptance Model (TAM) by incorporating e-service quality as a key antecedent of perceived ease of use, thereby strengthening its explanatory relevance in digital service contexts. Practically, these findings suggest that e-commerce platforms should prioritize system performance optimization,

including fast loading speeds, seamless navigation, and responsive service features, to enhance usability and overall user experience.

The Effect of Perceived Ease of Use on Perceived Usefulness

The results indicate that perceived ease of use has a positive and statistically significant effect on perceived usefulness ($\beta = 0.160$, $p < 0.001$), supporting the Technology Acceptance Model (TAM), which posits that systems that are easier to use are more likely to be perceived as useful [24]. This finding suggests that ease of use acts as a facilitating mechanism that lowers cognitive effort, enabling users to better recognize and utilize the functional benefits of the system.

When users perceive an application as user-friendly, they are more likely to make effective use of its features, allowing them to derive greater benefits from the system.

These findings are consistent with prior studies indicating that perceived ease of use significantly influences perceived usefulness and technology adoption [47]. Gefen & Straub (2000) further highlight that ease of use enhances user trust and reduces uncertainty in online environments, which indirectly strengthens perceived usefulness [48].

However, compared to previous studies that often report stronger relationships, the relatively modest coefficient ($\beta = 0.160$) in this study suggests that ease of use, while important, may not be the primary driver of perceived usefulness in contemporary e-commerce contexts.

From a critical perspective, this indicates that users increasingly prioritize other factors such as personalization, recommendation systems, and service quality over mere usability when evaluating the usefulness of digital platforms [49]. This reflects a shift from traditional TAM assumptions toward a more complex, multi-dimensional evaluation of digital systems.

Theoretically, this study reinforces TAM while extending its applicability by demonstrating that the influence of perceived ease of use on perceived usefulness may vary depending on contextual factors such as platform sophistication and user expectations. Practically, these findings suggest that developers should complement usability improvements with advanced functionalities and intelligent features to maximize perceived usefulness and overall user value.

The Effect of Perceived Usefulness on User Satisfaction

The findings of this study demonstrate that perceived usefulness exerts the strongest and most significant impact on user satisfaction ($\beta = 0.510$, $p < 0.001$), indicating that the perceived benefits of the application are the primary determinants of user satisfaction. This result highlights that users evaluate digital platforms predominantly based on their ability to enhance task efficiency and decision quality.

In the online retail environment, users are more likely to be satisfied when the application enables them to find desired products quickly and efficiently. When the system improves the efficiency of shopping activities and supports better purchasing decisions, users perceive the application as delivering tangible value.

These findings are consistent with prior research showing that perceived usefulness is a key predictor of user satisfaction and continuance intention in digital platforms [50]. Furthermore, previous studies also highlight the mediating role of perceived usefulness in linking service quality to user satisfaction [44].

However, compared to earlier studies that often treat perceived usefulness as one of several equally important predictors, the relatively high coefficient ($\beta = 0.510$) in this study suggests that its role is more dominant in the context of e-commerce platforms. This indicates that users place greater emphasis on functional value and performance outcomes rather than solely on experiential or hedonic aspects.

From a critical perspective, this finding implies that even if a platform offers advanced features or high service quality, user satisfaction may remain limited if these features do not translate into clear and practical benefits. Prior studies support this argument, indicating that system quality and service quality do not automatically lead to satisfaction without perceived value realization [51]. Moreover, users may evaluate digital platforms based on outcome-based utility rather than feature availability, suggesting that perceived usefulness acts as a central evaluative mechanism in post-adoption behavior [52][49].

Theoretically, this study reinforces the central role of perceived usefulness within the Technology Acceptance Model (TAM) while also integrating insights from post-adoption models such as ECM, thereby strengthening its explanatory power in the

context of e-commerce. Practically, these findings suggest that e-commerce platforms should prioritize functionalities that directly enhance user efficiency, such as intelligent search systems, accurate recommendations, and streamlined transaction processes, to maximize user satisfaction and retention.

The Effect of Perceived Ease of Use on User Satisfaction

This study demonstrates that perceived ease of use exerts a positive and statistically significant influence on user satisfaction ($\beta = 0.410$, $p < 0.001$), indicating that system usability is a key determinant in shaping a positive shopping experience. This finding suggests that reducing user effort and simplifying interaction processes directly enhances users' affective evaluation of the platform.

Applications with clear navigation structures and streamlined transaction processes reduce user frustration and increase comfort during the shopping experience. Intuitive interactions enable users to complete transactions more efficiently and with minimal cognitive effort.

These findings are consistent with prior research indicating that perceived ease of use significantly influences user satisfaction and continuance behavior in digital platforms [42]. Wixom & Todd (2005) further explain that ease of use contributes to satisfaction by improving both system interaction quality and user perceptions of system effectiveness [53].

However, compared to studies that position perceived ease of use as a primary determinant of satisfaction, the results of this study suggest that its influence, while substantial ($\beta = 0.410$), remains secondary to perceived usefulness ($\beta = 0.510$). This indicates that users may initially be attracted by ease of use, but their overall satisfaction is more strongly determined by the tangible benefits derived from the system.

From a critical perspective, this finding implies that improving usability alone may not be sufficient to sustain user satisfaction in highly competitive e-commerce environments. Prior research suggests that ease of use must be complemented by functional value and system performance to produce long-term satisfaction [52]. Additionally, excessive simplification without adequate functionality may limit users' ability to achieve their goals, thereby reducing perceived value.

Theoretically, this study reinforces the role of perceived ease of use within the Technology Acceptance Model (TAM) while highlighting its complementary relationship with perceived usefulness in explaining user satisfaction. Practically, these findings suggest that e-commerce platforms should balance usability and functionality by designing intuitive interfaces while ensuring that key features deliver real value to users, thereby maximizing satisfaction and user retention.

V. CONCLUSION

The findings reveal that e-service quality and recommendation systems are the strongest predictors of perceived ease of use and perceived usefulness, respectively, while information quality and personalization also contribute significantly to shaping user perceptions. Furthermore, perceived usefulness emerges as the most influential determinant of user satisfaction, followed by perceived ease of use, indicating that functional value plays a more dominant role than usability alone in driving satisfaction with the Shopee application.

Personalization enhances functional value by presenting content relevant to user preferences ($\beta = 0.279$, $p < 0.001$), while the recommendation system emerges as the strongest determinant of perceived usefulness ($\beta = 0.398$, $p < 0.001$), indicating its dominant role in proactively delivering relevant product suggestions compared to other predictors. Furthermore, information quality significantly contributes to both perceived usefulness ($\beta = 0.304$, $p < 0.001$) and perceived ease of use ($\beta = 0.301$, $p < 0.001$), through the provision of accurate, clear, and easily understandable product information that reduces user cognitive effort and enhances system efficiency.

The research findings also indicate that e-service quality is a primary determinant in shaping the perception of operational simplicity, reflecting the importance of system stability, access speed, and the responsiveness of digital services in creating an optimal user experience. Furthermore, this study confirms the core relationship within the TAM model, where perceived ease of use increases perceived usefulness, and both variables significantly influence user satisfaction. Thus, user satisfaction in the context of e-commerce is primarily shaped by a combination of the system's functional benefits and an intuitive, barrier-free user experience.

In practical terms, these findings underscore the importance of developing adaptive recommendation systems, improving the quality of digital

services, and continuously monitoring product information quality to enhance the user experience on e-commerce platforms. From an academic perspective, this study reinforces the relevance of the Technology Acceptance Model in explaining user behavior on digital commerce platforms while extending its applicability in explaining post-adoption satisfaction in mobile commerce contexts.

However, this study has several limitations. First, the data were collected using a cross-sectional design, which limits the ability to capture changes in user perceptions over time. Second, the study focuses only on users of a single e-commerce platform, namely Shopee, which may limit the generalizability of the findings to other platforms or digital ecosystems. Third, this study does not explicitly consider contextual or psychological factors such as trust dynamics, perceived risk, or user experience heterogeneity, which may also influence satisfaction and usage behavior.

Therefore, future research is encouraged to employ longitudinal or experimental designs to capture dynamic changes in user behavior over time. In addition, further studies could expand the research model by incorporating additional constructs such as trust, perceived risk, data security, and hedonic motivation, as well as exploring moderating variables such as age, digital literacy, and usage intensity. Moreover, comparative studies across multiple e-commerce platforms are recommended to enhance the generalizability of the model and provide deeper insights into user behavior differences in digital commerce environments.

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