Research Article

Enhancing User Satisfaction and System Trust through Gamification in E-Commerce Platforms

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Abstract: The increasing adoption of gamification in e-commerce platforms has significantly transformed how people use, engage, and develop their trust in digital systems. Despite this, few empirical studies have so far investigated the integration of gamification with the DeLong and McLean IS Success Model to develop theories of user satisfaction and system trust in emerging markets. This study examines the influence of System Quality, Information Quality, and Gamification Elements on User Satisfaction and System Trust in e-commerce in Indonesia. The quantitative nature of this research drew on data from 236 online shoppers. Data were analyzed using Partial Least Squares-Structural Equation Modeling to test 10 hypotheses. Results showed that all proposed relationships were significant. Gamification Elements proved to be the most influential driver of satisfaction and trust. The results also revealed that User Satisfaction is a meaningful mediator between system-related variables and the establishment of trust. This model explains 21.5% of the variance in User Satisfaction and 43.1% of the variance in System Trust. These results suggest that user trust in e-commerce systems is driven not only by performance characteristics but also by motivational participation through gamification. The proposed model extends the IS Success Model by adding gamification as a motivational factor.

Keywords: Gamification, E-Commerce, System Trust, User Satisfaction, Information Quality

Introduction

E-commerce has become a vital trade channel, enabling immediate responses to consumer demand and providing a personalized shopping experience. (Rasool Lakhan et al., 2021). Patterns of usage indicate a predominance of users who access platforms like Lazada and Tokopedia who are between 25 and 34 years of age, of whom 97.22% make purchases via their phones. (Kemp, 2024). Indonesian e-commerce users reached a high of 65.65 million in 2024 and are estimated to reach 99.1 million by 2029. (Jenderal and Perdagangan, 2023).

Shopee, Tokopedia, and Lazada are leaders in terms of the number of visitors, indicating a fiercely competitive environment. As environments become more competitive, even online shopping platforms are making use of gamification in a bid to win the loyalty of shoppers. This is in the context of gamification in terms of reward schemes, leaderboards, and reward programs. (Aparicio et al., 2021).

A content analysis of the app reviews of Shopee, Tokopedia, and Lazada on the Google Play Store shows the grievances of the user in terms of technical issues in gaming, misunderstandings of the gaming mechanics, inappropriate rewards, dissatisfaction with rewards, as well as appeals to continue stopped games. These results point to what the user wants as well as the importance of optimizing the gamification factor in a way that will ensure continued user engagement. This is presented in a tabular form in Table 1.

A content analysis of the reviews of Shopee, Tokopedia, and Lazada in the Google Play store revealed a set of grievances aired by the users in relation to the gamification aspects of the app, as identified in Table 1. This is dominated by issues of technological difficulties arising during the use of the app's gamification functions (341 reports), indicating a weakness in System Quality, specifically in terms of its stability, response time, and usability metrics. Users encountering difficulties in the form of lagging, crashing, or incomplete loads during gaming activities will not be able to enjoy a seamless gaming experience enabled by the app (Alyoussef, 2023; Geebren et al., 2021).

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Table 1: Distribution of User Complaints Based on Google Play Store Reviews

Complaints	Shopee	Tokopedia	Lazada	Total
Technical issues encountered during the execution of game features	234	91	16	341
Difficulties in understanding how to play the game feature	67	143	4	214
User requests for the reinstatement of previously available game features	142	2	15	157
Dissatisfaction with the reward system provided	57	6	3	66

The second most common issue, "troubles in understanding how to play the game features," with a total of 214 reports, revealed issues in the aspect of Information Quality. This is where the user is not able to understand the rules of the system, implying a lack of clarity of the information. Poor communication of the information will result in a negative impact on the ease of use of the system as well as user confidence (Liu et al., 2023; Mamakou et al., 2024).

Moreover, the user demands towards reinstating some of the features that had been available in the past (reporting 157 instances) as well as lack of satisfaction with the reward system (reporting a total of 66 instances) point towards some flaws in Gamification Elements themselves. (Tsou and Putra, 2023; Wu and Santana, 2022).

Taken together, these user complains represent the early warning signs of inefficient gamification integration in online shopping sites. They point to the importance of measuring how well System Quality, Information Quality, and Gamification Elements interact in affecting>User Satisfaction and System Trust in particular, as is the concern of this proposed study

This gives a rationale to apply the DeLone &McLean IS Success Model to evaluate the impacts of such variables on user satisfaction as well as trust of gamification-based online buying applications.

Customer trust, in this environment that is as competitive as can be, is in itself the touchstone of customer loyalty (Maschudah et al., 2023). Platforms that are able to build trust effectively via a gamified experience will ultimately gain a sustainable stance. Therefore, this current study revolves around the influence of gamification factors, system quality, as well as information quality towards user satisfaction and system trust in Indonesian online shopping platforms

It is suggested that trust is not primarily established based on technical performance, but also on positive experiences of use combined with user satisfaction (Maqableh et al., 2021). In this respect, in the gamification context, user satisfaction is both a result and a means of trust establishment in a given online platform. This interplay between the characteristics of system quality, information quality, and gamification factors leads to a multiple-dimensional structure affecting user perceptions of online e-commerce platforms.

Existing studies (Bin Hammad et al., 2024; Liu et al., 2023; Santos et al., 2023) emphasized the importance of a scientific understanding of the empirical effects of gamification not only on user engagement, but also on higher-level constructs like user satisfaction and trust. Even if gamification is a well-researched topic in education, healthcare, and m-commerce, the impact of gamification on system trust in online commerce in Indonesia is a relatively unknown field that this research aims to address.

Accordingly, this study attempts to examine the impact of gamification, in combination with system and information quality, on user satisfaction as well as trust of the e-commerce sites. Through the use of a modified form of the DeLone & McLean IS Success Model (Urbach and Müller, 2012), However, in this particular study, the objective is to propose a holistic model that captures the realities of gamification systems in commercial behaviors.

Accordingly, based on the research background and the identified gaps in the existing studies, this study formulates the following research questions:

RQ1: How does gamification influence user perceptions of system quality and information quality one-commerce platforms?

RQ2: How do system quality and information quality impact user satisfaction on gamified e-commerce platforms?

RQ3: How does user satisfaction affect system trust in the context of gamified e-commerce platforms?

Related Work

IS Success Model

The DeLone and McLean Information System (IS) Success Model, developed in 1992 and updated in 2003, is one of the major theoretical frameworks used worldwide for assessing information system effectiveness. IS success, within the model, is a function of six associated dimensions: System quality, information quality, service quality, use, user satisfaction, and net benefits. These dimensions cover both technical and behavioral aspects of system success.

According to Anaam et al. (2023) the model's robustness is also applicable to electronic Customer

Relationship Management (e-CRM). The authors found that system quality, information quality, and service quality significantly influenced both system use and user satisfaction. The former, in turn, affected net benefits, leading to improved decision-making and operational efficiency. This finding supported the inherent rationality of the D and M model: Greater technical and content attributes of a system lead to greater use and higher satisfaction, and ultimately generate value for individuals and organizations.

As a supplementary view, Widyaningrum et al. (2024) had used the model to predict user satisfaction in the context of an online learning management system, where he found that system use as well as information quality had no direct influence on system use. However, system use, information quality, as well as service quality, had influenced user satisfaction. This corroborates the model's assertions that service and information qualities play a pivotal role in forming perceptions of satisfaction, where system use further reinforces this perception.

In sum, empirical evidence confirms that the D&M IS Success Model is as relevant in today's online environment of e-commerce, e-learning, and e-CRM as it appeared in the earlier model of IS Success. This is particularly true in the context of systems where continued user interplay is essentially a factor in measuring the overall performance of the system.

E-Commerce

E-commerce is described as "the purchasing, selling, or exchange of goods, services, money, and information via an electronic network, particularly the internet" (Sulova, 2023). As a result of technological advancements, e-commerce has moved from simple purchasing to a full-fledged online environment. This is in addition to advances in data analysis and cloud computing, which have increased efficiency as businesses strive to provide faster services to consumers (Luo, 2022). Mobile commerce is evident in Indonesia, where it follows international directions in digital consumerism.

E-commerce in Indonesia has been a phenomenal phenomenon, influenced by the widespread use of the internet, handsets, as well as the development of digital infrastructural systems. Also, the number of "e-users" in this region reached a record high of 65.65 million in the year 2024, which will continue to grow to a record high of 99.1 million in the year 2029, amidst a transition of consumer behavior as well as the scalability of online platforms (Jenderal and Perdagangan, 2023). Mobile commerce has emerged as a distinct phenomenon in this respect, where most of the purchases are done via the phone that is, a whopping 97.22% of Lazada buyers (Kemp, 2024).

Indonesia's e-commerce industry is marked by stiff competition among the major platforms, which include Shopee, Tokopedia, and Lazada, that acquired the bulk of the user base not only through offering pricing superiority as well as product diversity but also through value-adding services that aim to promote user engagement (Maschudah et al., 2023). In this process, the element of gamification through points, medals, leaderboards, tasks, and awards has emerged as a defining element (Aparicio et al., 2021). Through making dull shopping activities interesting, gamification is expected to generate greater user satisfaction, loyalty, and trust in the system. This is a clear pointer that the state of the Indonesian e-business environment today is no longer anchored on facilitating simple transactional activities between buyers and sellers but is instead centered around offering wholesome, exciting, and trustworthy online experiences in keeping with evolving consumer attitudes.

Gamification Theory

Gamification is the use of game design techniques in a wider context than gaming to encourage user behavior. (Izzuddin Abd Kadir et al., 2024). On online shopping platforms, gamification is used to encourage customer loyalty and user engagement. Factors that are important in the use of gamification in this particular case include the use of points and rewards to encourage user activity, the use of challenges in achieving goal-directed behavior, the use of leaderboards in encouraging competitive behavior, as well as the use of badges to celebrate user achievement (Tsou and Putra, 2023; Wu and Santana, 2022). Gamification is defined as the use of mechanics from gaming like points, leaderboards, badges, tasks, and feedback beyond gaming in order to shape user behavior, encouraging them to participate more. Using Self-Determination Theory (SDT), gamification can be explained as having the ability to fulfill the basic psychological needs of autonomy, competence (Zhang et al., 2021). A positive response to the three needs results in a transition from external to internal motivation, producing a higher level of emotional identification with the service and satisfaction with use.

A system perspective reveals that gamification improves user satisfaction by making repeated interactions interesting and relevant. Utilization of feedback processes not only increases the enjoyment of task performance, as theorized in the SEM model of technology acceptance, but also influences system response and user customization, which are important factors of overall user satisfaction. Moreover, gamification environments result in a reduction in mental a complexity, easing user ease of use perceptions.

Concerning system trust, gamification becomes a system-level utilization tool that enhances user trust in the system's dependability, openness, and fairness. Gamification is a structural apparatus that aids in

encouraging employee participation and innovation by managing tasks and benefits (Mou et al., 2024). This implies that in a digital system, gamification will help in creating a user interface that gives prompt feedback, is governed by a set of well-defined norms, and entails achievement systems that give signals of system dependability. This is important in reducing user ambiguity in online platforms such as those that deal with online commerce.

System Quality

System Quality is the ability of the information system that is capable of supporting user needs in terms of performance. In the context of ecommerce systems, System Quality entails three factors: Usability, accessibility, and response time. Hence, usability is the factor that determines the ease with which a user is able to navigate through the site as well as the functionalities of the ecommerce system, including the gamification functionality (Alyoussef, 2023). Accessibility entails the ability of the system to provide a comparable experience no matter the various systems one uses, including the consideration that enables one to engage in gamification functionalities in whatever device one uses. Response time is one of the factors that influence user satisfaction, especially in gamification functionalities where one needs a prompt response. Good systems promote user experience by providing stability, speed, as well as user-friendly functionalities (Geebren et al., 2021).

Gamification Elements

Gamification Elements are those gaming mechanics that are employed in the e-store platforms in order to generate user satisfaction. Points and rewards act as time-bound motivators that trigger positive activities in the form of certain rewards that encourage user participation Challenges act as motivational tools that set a target for the users to achieve, thereby activating the user in activity-based roles (Tsou and Putra, 2023). Leaderboards act as a trigger that brings in a certain level of completion as the user is ranked in a cumulative list that motivates him to perform better than his competitors. Badges act as a reward that triggers the user's achievement sentiment in a tokened form that is a role played in activating user satisfaction as a result of achieving a certain milestone (Wu and Santana, 2022).

Information Quality

Information Quality is the extent to which the information offered in the e-shop allows the user to form knowledgeable inferences. It is comprised of four large factors: Accuracy, relevance, completeness, and accessibility (Mamakou et al., 2024). Accuracy examines if the information obtained by the user is correct with no discrepancies, thereby increasing user trust in the online

environment. Relevance examines if the information is relevant in forming answers to the user's pressing inquiries, such as what benefits gamification entails and what is the latest piece of information on the online environment. Completeness is what is used in defining the extent of offering information that is sufficient to ensure no allowance is given to questions of ambiguity and curiosity. Accessibility examines the extent of offering the necessitated information via any device that will be utilized (Bin Hammad et al., 2024).

User Satisfaction

User Satisfaction is the level of satisfaction of the user in his dealings with a system or platform (Maqableh et al., 2021). Several factors, including system usability, information quality, as well as the quality of gamification experience, respectively, act as moderators in this process. Various constructs, including overall satisfaction, as a measure of overall attitude towards the system platform, contentment as a measure of the user's comfort with use, information satisfaction as a measure of the quality of information presented according to user needs, as well as interface satisfaction, as a means of assessing user attitude towards the functionalities of a system/platform, help estimate user satisfaction (Kao et al., 2023). This is not only a determinant of continuous use of a system/platform, including various online platforms, but also loyalty towards them.

System Trust

System trust is the user's trust in the system's ability to operate effectively and securely in the long term (Ku and Mitzen, 2022). This is one of the most important predictors of user loyalty in online shopping platforms. This is built by various factors that include security, referring to the ability of the system to ensure the safety of user data as well as order data, performance, referring to the ability of the system to operate effectively in a way that will not collapse, as well as usability, referring to the ease with which a user is able to utilize the system as well as the gamification components in place in the system (Le, 2021). A system that is deemed safe, trustworthy, and usable will build more trust in the system that will in turn encourage the user to use the system more often through repeated purchases.

Materials and Methods

Research Design and Methods

This proposed study uses a quantitative research methodology to gauge the effects of gamification on system trust in online shopping platforms or systems, as well as the mediating roles of system quality, information quality, and user satisfaction in enhancing these effects. Also, the proposed overall design of this study is based on

the extended IS Success Model as proposed by DeLone & McLean (Urbach and Müller, 2012) which has been modified to include gamification as a new dimension

Figure 1 shows that the research model includes five key latent variables: Gamification Elements, System Quality, Information Quality, User Satisfaction, and System Trust. This set of constructs was selected through careful review of literature and their appropriateness to the digital commerce environment, particularly in the context of gamified user interfaces.
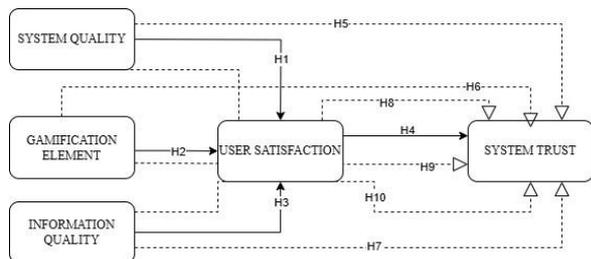

Fig. 1: Research Model

Research Hypotheses

This study proposes a set of hypotheses that help in exploring the roles of various variables of gamification, system quality, and information quality in shaping user satisfaction and system trust on online shopping sites. The hypothesis will also help in exploring how user satisfaction acts as a mediator in the relationship between the independent variables and system trust The direct hypotheses are as follows:

H1 : Gamification elements have a significant effect on user satisfaction

H2 : System quality has a significant effect on user satisfaction

H3 : Information quality has a significant effect on user satisfaction

H4 : User satisfaction has a significant effect on system trust

H5 : System Quality has a Significant effect on System Trust

H6 : Gamification Elements have a significant effect on System Trust

H7 : Information Quality has a significant effect on System Trust

To further understand the mechanism of influence, the study also includes mediating hypotheses:

H8: User Satisfaction mediates the effect of System Quality on System Trust

H9: User Satisfaction mediates the effect of Gamification Elements on System Trust

H10: User Satisfaction mediates the effect of Information Quality on System Trust

Instrument Development

The measurement items for each variable were adapted from validated instruments in previous literature.

The indicators listed in Table 2 were adapted from validated measurement items in previous studies to ensure construct reliability and contextual relevance. .

Table 2: Variable and Indicator

Construct	Indicator	Code	References
System Quality	Usability Accessibility	SQ1 SQ2	(Alyoussef, 2023; Geebren et al., 2021)
	Response Time	SQ3	
	Consistency	SQ4	
Gamification Element	Points and Rewards	GE1	(Tsou and Putra, 2023;
	Challenges	GE2	Wu and Santana, 2022)
	Leaderboards	GE3	
	Badges	GE4	
	Progress Bars	GE5	
	Invite Friends	GE6	
Information Quality	Accuracy Relevance	IQ1 IQ2	(Bin Hammad et al., 2024; Sayaf, 2023)
	Completeness	IQ3	
	Clarity	IQ4	
User Satisfaction	Overall Satisfaction	US1	(Kao et al., 2023; Maqableh et al., 2021;
	Contentment	US2	Santos et al., 2023)
	Information Satisfaction	US3	
	Interface Satisfaction	US4	
System Trust	Security	ST1	(Ku and Mitzen, 2022; Le, 2021)
	Performance	ST2	
	Transparency	ST3	
	Helpful System Features	ST4	

System Quality, Information Quality, and User Satisfaction were derived from the DeLone and McLean (2003) IS SuccessModel and later operationalized in e-commerce setting. Alyoussef (2023); Geebren et al. (2021); Kao et al., (2023) System Trust indicators were modified from Ku and Mitzen, 2022); Le (2021) to reflect user perceptions of performance, transparency, and security in online platforms.

Gamification Element indicators were originally adapted from Tsou and Putra (2023); Wu and Santana (2022). These indicators emphasize the use of common gamification elements found in Indonesian e-commerce sites, including the use of points, challenge, leaderboard, badges, as well as progress bars. Some minor modifications in terms of wording and scaling are implemented based on the behavioral context of people who use e-commerce sites. This modification is done to ensure that the theoretical alignment during the construction of these indicators is appropriate to the context of this particular research.

The data gathering instrument developed is in the form of online survey questions consisting of a total of 22 questions embracing the five key dimensions. Every question is accompanied by a scale of 7 Likert scale values ranging from the lowest response choice of "Strongly Disagree" (1) to the highest response choice of "Strongly Agree" (7). A scale of 7 is employed to measure user response in a more refined way as recommended in previous studies.

Items measuring each conceptual construct will be adapted from existing literature (Kusmaryono et al., 2022).

Sampling and Data Collection

This research targeted Indonesian consumers who had already experienced aspects of gamification, such as in-app games, digital reward systems, and loyalty systems. The sampling procedure used purposive sampling, selecting people who met the following criteria: Currently living in Indonesia, at least 18 years old, and with experience or knowledge of gamification through Shopee, Tokopedia, or Lazada.

The survey questionnaire was distributed online via Google Forms, social networks, and instant messaging.

Sample size sufficiency was established by means of the "10-times rule" recommended by Hair et al. (2017) who advises that the minimum sample size should be at least 10 times the largest number of indicators used to measure a single construct. The maximum number of indicators per construct in this research case was 6, yielding a minimum acceptable sample size of 60. The 200 usable responses indicated that the sample size was sufficient to provide reliable findings for the PLS-SEM analysis.

Data Analysis Procedure

Data analysis employed Partial Least Squares Structural Equation Modeling (PLS-SEM) through the SmartPLS 4.0 computer program. The method was opted for considering that it can accommodate large and complex models with numerous constructs, that it can be used in exploratory research, and that it can accommodate reflective and formative measurement models for analysis (Zulkifli et al., 2022).

The analysis went through two phases. The first was the evaluation of the measurement model to test the validity and reliability of the constructs. Reliability was assessed using Cronbach's Alpha and Composite Reliability (CR), with values of 0.70 or higher deemed acceptable. Convergent validity was assessed using Average Variance Extracted (AVE), with values greater than 0.50 providing strong evidence of convergence. Discriminant validity was tested using the Fornell-Larcker criterion and Heterotrait-Monotrait Ratio (HTMT) such that each construct remained unique from the remaining constructs

Results

Respondents Demographics

This study involved 254 respondents. However, 18 respondents had never used gamification features. Therefore, the researcher obtained 236 valid respondents who had used gamification features on e-commerce platforms in Indonesia. The descriptive analysis shows that female respondents slightly outnumbered male respondents, suggesting that women are more engaged in gamification-based shopping experiences. In terms of age distribution, the majority belonged to Generation Z (17 28years), followed by Millennials (29 44 years), with minimal representation from older age group.

In terms of occupation, most respondents were students, followed by employees in both public and private sectors. Entrepreneurs and civil servants accounted for a smaller proportion, while other occupations such as housewives and retirees were least represented. Regarding the frequency of e-commerce platform usage, most respondents accessed these platforms several times a week, with a considerable proportion accessing them daily.

Shopee and Tokopedia emerged as the dominant platforms for e-commerce activities, while Shopee was the most preferred platform for engaging with gamification features, followed by Tokopedia and Lazad.

Table 3 presents the demographic characteristics of the respondents, indicating a dominance of young, digitally active users with frequent e-commerce interactions, which is relevant for evaluating gamification adoption. This demographic profile suggests that respondents are highly familiar with digital shopping environments, making them an appropriate population for analyzing the influence of gamification on user trust.

Table 3: Respondents' Demographic Information

Category	Subcategory	Respondents	Percentage
Gender	Male	115	45.3%
	Female	139	54.7%
Age	17-28 Years	181	71.3%
	29-44 Years	67	26.4%
Category	Subcategory	Respondents	Percentage
	45-60 Years	5	2.0%
	>60 Years	1	0.4%
	Student	89	35.0%
	University	15	5.9%
	Student	27	10.6%
	Housewife		
	Public Secto		
	Employee		
	State-Owned		
Occupation	Enterprise		
	RegionalOwned	83	32.7%
	Enterprise		
	Private		
	Employee		
	Entrepreneur	38	15.0%
	Unemployed /	1	0.4%
	Retired		
Frequency of Accessing or	1–2 times 3–5 times	92	35.8%
Using E-	Every day	116	45.7%
Commerce		47	18.5%
Platforms per Week			
Most	Shopee	165 170	65.0%
Frequently	Tokopedia	111	66.9%
Used E-	Lazada	6	43.7%
Commerce	Others		2.4%
Platforms			
ECommerce	Shopee	118	50.0%
Platform	Tokopedia	71	30.1%
Used for	Lazada	47	19.9%
Gamification			
Features			

Measurement Model Evaluation

Before assessing the structural relationships among constructs, it is essential to examine the measurement model to ensure that the constructs are measured accurately and consistently. This evaluation aims to verify that the measurement items used in the study adequately represent their respective constructs, exhibit sufficient validity, and meet the required levels of reliability.

Following the guidelines suggested by Hair et al. (2017), in particular, this appraisal emphasizes three distinct criteria: Convergent validity, discriminant validity, and construct validity.

A well-specified measurement model will ensure that any results derived from the structural model will be trustworthy. Without valid and reliable constructs, any form of structural results that follow will be questionable. As such, the SEM-PLS process is not complete if a thorough analysis of the measurement model is not conducted

Figure 2 illustrates the proposed structural research model developed based on the DeLone and McLean IS Success Model integrated with gamification theory. The model conceptualizes that System Quality (SQ), Information Quality (IQ), and Gamification Elements (GE) influence User Satisfaction (US) and System Trust (ST) in e-commerce platforms. The direct paths from SQ, IQ, and GE to US assume that higher technical, informational, and interactive quality will enhance user satisfaction. Similarly, the direct effects from these variables to ST capture the notion that system performance and content reliability can directly foster user trust.

Moreover, the role of User Satisfaction as the mediating factor between the system and information quality measures, as well as between the gamification element and System Trust, has been identified. This takes into account the theoretical assumption that trust in the system can develop only from positive experiences in interactions between the user and the system. The inclusion of the gamification factors as the exogenous constructs expands the D&M model.
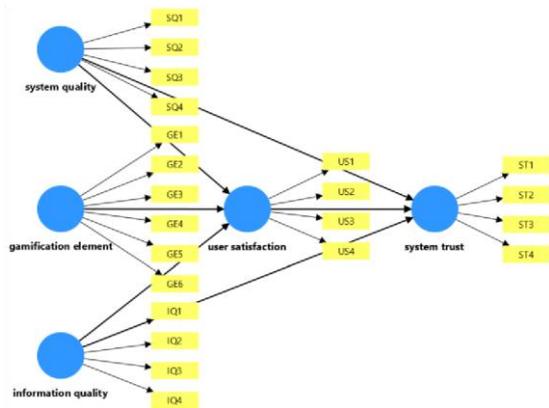
Fig. 2: Structural Research Model

Convergent Validity

Convergent validity refers to the extent to which a set of indicators represents the same underlying construct demonstrating a high degree of common variance. According to Sarstedt et al. (2021) convergent validity is established when outer loadings exceed 0.70 and Average Variance Extracted (AVE) values exceed 0.50.

Table 4 shows the outer loadings of the measurement model. The initial loading of the indicator GE1 (Points and Rewards) was quite low at 0.317. Nonetheless, the item was retained for its theoretical significance in capturing a fundamental dimension of gamification underlying user engagement on e-commerce sites.

Table 4: Intial and final outer loading

Construct	Indicator	Initial Outer Loading	Final Outer Loading
System	SQ1 SQ2	0.807	0.807
Quality (SQ)		0.92	0.921
	SQ3	0.897	0.896
	SQ4	0.828	0.827
Gamification	GE1	0.317	0.295
Element (GE)	GE2	0.784	0.782
	GE3	0.800	0.798
	GE4	0.794	0.796
	GE5	0.79	0.791
	GE6	0.771	0.769
Information	IQ1 IQ2	0.921	0.921
Quality (IQ)		0.826	0.826
	IQ3	0.828	0.828
	IQ4	0.847	0.846
User	US1 US2	0.848	0.848
Satisfaction		0.89	0.890
(US)			
	US3	0.853	0.853
	US4	0.848	0.848
System Trust (ST)	ST1 ST2	0.845	0.844
		0.834	0.836
	ST3	0.829	0.833
	ST4	0.428	-

Though the loading reduced to 0.295 during the re-evaluation stage, the reliability and validity of the construct were still in the desirable ranges to retain the item GE1 to detect the intrinsic reward-related aspects of gamification (Tsou and Putra, 2023; Wu and Santana, 2022).

Indicator ST4 (Helpful System Features) was deleted because its loading (0.428) was below the cut-off, thereby undermining the model's significance. This is because in SEM-PLS analysis, the best practice is to get rid of the indicators whose loading factors are less significant (Hair et al., 2017).

Reliability

Reliability refers to the internal consistency of the measurement items used to assess a construct. A reliable construct will yield similar results when measured under consistent conditions, following the recommendations of Sarstedt et al. (2021). The constructs in this study demonstrated adequate reliability and convergent validity, as all Cronbach's Alpha and CR values exceeded 0.70, and AVE values exceeded the 0.50 threshold. In SEM-PLS analysis, three key measures are commonly used to evaluate reliability:

- Cronbach's Alpha: This statistic assesses the degree of internal consistency among the indicators of a construct. Values of 0.70 or above indicate acceptable reliability, although values above 0.80 are preferable for established scales
- Composite Reliability (CR): Unlike Cronbach'sAlpha, CR accounts for each indicator's actual loadings, making it a more accurate measure of internal consistency. A CR value above 0.70 is considered satisfactory
- Average Variance Extracted (AVE): AVE evaluates the amount of variance captured by a construct in relation to the variance attributed to measurement error. An AVE value greater than 0.50 indicates that more than half of the variance of the indicators is explained by the latent construct, demonstrating adequate convergent validity. Higher AVE values also suggest that the

indicators are strongly correlated with their respective construct, reinforcing the construct's validity

Table 5 shows the results of the reliability and convergent validity tests performed for all constructs in the proposed model. The values of Cronbach's Alpha and Composite Reliability (CR) for all constructs exceed the recommended level of 0.70. The values of Cronbach's Alpha lie between 0.788 and 0.886, whereas the values of CR lie between 0.864 and 0.922.

The Average Variance Extracted (AVE) ranges from 0.531 to 0.747, above the lowest required value of 0.50. This verifies that each factor explains more than half the variation in the observed indicators. Thus, the measurement model satisfies the requirements for convergent validity and demonstrates that the chosen indicators adequately capture their respective constructs.

Table 5: Cronbach's Alpha dan Composite Reliability

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Gamification Element	0.827	0.864	0.531
Information	0.878	0.917	0.733
Quality	0.886	0.922	0.747
System			
Quality			
System Trust	0.788	0.876	0.702
User Satisfaction	0.883	0.919	0.740

Structural Model Evaluation

Following confirmation of the measurement model's validity and reliability, the next step is to evaluate the structural model to assess the hypothesized relationships among the constructs. This evaluation focuses on examining the path coefficients, their statistical significance, and the explanatory power of the model through the coefficient of determination (R^2) (Sarstedt et al., 2021).

To assess the structural model, the PLS Algorithm was used to estimate the interrelationships between the latent variables. Figure 3 shows the structural model, outer loadings, path coefficients, and the coefficient of determination (R^2). It is observed that the outer loadings of most indicators exceed the cut-off point of 0.70, denoting the satisfactory indicators' reliability. Moreover, the path coefficients represent the positive as well as negative influences of various constructs on each other. Conversely, the values of R^2 denote the independent variables' explanatory power on the dependent variable.

Figure 3 shows the results of the structural model obtained using the PLS algorithm. The results explain 21.5% of the Total Variance of User Satisfaction and 43.1% of the Total Variance of System Trust. This indicates moderate predictability of the remaining variation, which may arise from factors such as enjoyment or personalization. Among the factors influencing the outcome variables, Gamification Elements have the most dominant effect on User Satisfaction ($\beta = 0.322$), followed

by Information Quality ($\beta = 0.248$) and, finally, System Quality ($\beta = 0.243$)

On the other hand, System Trust has been strongly impacted by Gamification Elements ($\beta = 0.454$), thereby confirming the positive effect of interactive system components on user trust in e-commerce sites. Finally, the effecting factor of User Satisfaction ($\beta = 0.114$) has positively contributed to System Trust, thereby confirming the influence of user satisfaction, as shown in the IS Success Model proposed by DeLone and McLean.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) represents the proportion of variance in an endogenous construct explained by its exogenous constructs. Based on the guidelines from Hair et al. (2017), R^2 values of 0.75, 0.50, and 0.25 can be considered substantial, moderate, and weak, respectively

Table 6 illustrates the Coefficient of Determination (R^2) for the endogenous constructs. The System Trust has an R^2 of 0.431.

This means that 43.1% of the variation in System Trust can be explained by the constructs System Quality, Information Quality, Gamification Elements, and User Satisfaction. On the other hand, the 0.215 R^2 for User Satisfaction indicates that the constructs System Quality, Information Quality, and Gamification Elements can explain 21.5% of its variation. Both constructs explain moderately and weakly to moderately.
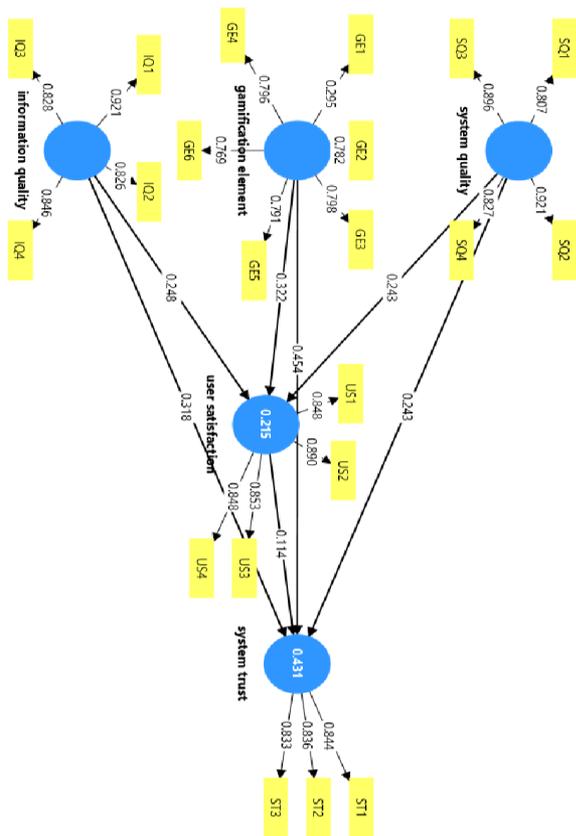
Fig. 3: Structural Model Results Using PLS Algorithm

Hypothesis Testing

Path coefficients measure the strength and direction of the relationship between constructs. According to Sarstedt et al. (2021) hypotheses are considered supported if the p-value is

less than 0.05 and the t-statistic exceeds 1.96 for a two-tailed test at the 5% significance level.

Table 6: R-square

Construct	R-square	R-square adjusted
system trust	0.431	0.422
user satisfaction	0.215	0.204

The analysis was performed using the bootstrapping procedure with 5,000 resamples in SmartPLS, enabling the estimation of t-statistics and p-values to determine the significance of each hypothesized path.

Table 7 summarizes the results of both direct and indirect hypothesis testing. All direct relationships were found to be statistically significant ($p < 0.05$), confirming that System Quality ($\beta = 0.243$, $t = 4.302$), Gamification Elements ($\beta = 0.322$, $t = 4.695$), and Information Quality ($\beta = 0.248$, $t = 4.584$) have positive effects on User Satisfaction. Among them, Gamification Elements emerged as the strongest predictor, indicating that interactive and reward-based features contribute most to user enjoyment and satisfaction within e-commerce platforms.

For the endogenous construct System Trust, results reveal that System Quality ($\beta = 0.243$, $t = 4.716$), Gamification Elements ($\beta = 0.454$, $t = 9.131$), Information Quality ($\beta = 0.315$, $t = 6.223$), and User Satisfaction ($\beta = 0.114$, $t = 2.404$) each exert significant positive effects These findings emphasize that both system performance and users' satisfaction with the gamified experience play crucial roles in building confidence toward e-commerce systems. The mediation tests further indicate that User Satisfaction partially mediates the relationships between System Quality ($\beta = 0.028$, $t = 2.093$), Gamification Elements ($\beta = 0.037$, $t = 2.298$), and Information Quality ($\beta = 0.028$, $t = 2.151$) with System Trust.

Table 7: Direct and Indirect (Mediation) Hypotheses Testing Results

Hypothesis	Construct Relationship	Path Coefficient (β)	T-Statistic	P-Value
H1	SQ → US	0.243	4.302	0.000
H2	GE → US	0.322	4.695	0.000
H3	IQ → US	0.248	4.584	0.000
H4	US → ST	0.114	2.404	0.016
H5	SQ → ST	0.243	4.705	0.000
H6	GE → ST	0.454	9.131	0.000
H7	IQ → ST	0.318	6.178	0.000
H8	SQ→ US→ST	0.028	2.093	0.036
H9	GE→US→ST	0.037	2.298	0.022
H10	IQ→US→ST	0.028	2.151	0.031

This suggests that while technical and informational factors directly affect trust, their influence is strengthened when users also experience satisfaction with the system. Consequently, User Satisfaction serves as a psychological bridge, transforming functional and motivational perceptions into trust in e-commerce platforms.

Discussion

This empirical research offers evidence supporting the integration of DeLone and McLean IS Success Model theory and Gamification theory in assessing user satisfaction as well as trust in online platforms. A relevant

level of correlations between variables in this empirical research confirms that combined technical, informational, and motivational factors impact overall user experience as well as trust in online platforms.

Firstly, System Quality, Information Quality, as well as the role of Gamification Elements in achieving User Satisfaction (H1-H3), demonstrate that functional correctness, appropriateness of information, as well as interactive components, are essential considerations in measuring user satisfaction in a gamification-based online purchasing process. It is in this context that the most important influence factor is Gamification Elements, thereby showing that a higher weightage is given to interactive components compared to either system/service qualities or information. (Tsou and Putra, 2023; Wu and Santana, 2022), as gamification elements promote enjoyment as well as perceptions of usefulness, ultimately leading to increasing user satisfaction.

Secondly, the group of effects including System Quality, Information Quality, and Gamification Elements on System Trust (H5-H7) reveals that trust not only arises from system usefulness and information accuracy, but also from a user's involvement in the gamification process emotionally. A higher path coefficient is observed between Gamification Elements and System Trust, indicating that reward systems, progress bars, and user interactions result in increased user confidence in the system's trust factor. This attests that in the Indonesian online shopping context, gamification is not only effective in making online shopping experiences pleasant, but also in making the online shopping system secure and trustworthy (Ku and Mitzen, 2022; Le, 2021).

Third, the positive influence of User Satisfaction on System Trust (H4) once again highlights the mediatorial role of user satisfaction in linking functional & experience value to trust in the system. Analysis of the results of the mediation tests (H8-H10) indicates that user satisfaction partially mediates the influence of System Quality, Information Quality, and Gamification Elements on System Trust. This suggests that the variables of system quality affect user trust in a direct as well as indirect (through satisfaction) manner. This is in line with the conceptual framework of the DeLone & McLean IS Success Model, whereby user satisfaction is presented as a crucial mediator that captures the interplay of various system qualities and user behaviors & attitudes Lastly, the R-squared values confirm that the model has a moderate explanatory power as approximately 21.5% of the variance in User Satisfaction is explained by the proposed predictors, as well as a variance of approximately 43.1% in System Trust. Even as the results above confirm the robustness of the model, they also hint towards the presence of a host of factors that act as a determinant of user satisfaction towards a gamified online environment in a way that is not addressed in this current piece of research. It is proposed that factors such as user enjoyment, customization, usability, and reputation of the brand name can help increase a user's loyalty towards online shopping sites.

Theoretical Implications

This article presents a significant step in the theoretical development of DeLone & McLean IS Success Model by introducing the Gamification Elements as another ingredient that influences the User Satisfaction and System Trust. It is revealed that the traditional components of IS Success Information Quality, System Quality, and User Satisfaction, could also use design as a motivational means. Here, gamification essentially has a dual role in recognizing that usage of the ecommerce platforms is not only a function of the technological process behind the ecommerce platforms, but also a process of engaging with the ecommerce platforms in a positive, interactive way.

Moreover, the major mediating factor of the User Satisfaction between the variables of system attributes and System Trust supports the conceptual rationale that trust development is a behavioral consequence of experience-driven satisfaction, as opposed to a purely cognitive assessment of the system's qualities. This explanatory refinement of the Information System Success Model highlights that user satisfaction continues to play a bridging role between technological efficiency and emotional trust. Hence, this proposed research empirically supports that a gamification context improves the conceptual applicability of the Information System Success Model in today's online retailing environment, where user participation is a key factor of commercial success

Practical Implications

There are a number of lessons that can be taken from the findings that could be beneficial to those in the field of e-commerce as well as developers. Firstly, since Gamification Elements have played a significant role in enhancing both User Satisfaction as well as System Trust, this means that developers of e-commerce platforms need to ensure that high quality gamification elements such as points, tasks, badges, as well as tracking, are integrated into the platforms in order to help entice customers to continue visiting the site. This will offer a significant boost towards increasing Feelings of Pleasure in relations to purchase/browsing activity, thereby enhancing Trust in the Dependability of the site

Secondly, the positive effects of System Quality and Information Quality emphasize the need to ensure that the system functions smoothly and data is accurate and relevant. Optimum system modification, product display, and transaction process disclosure are critical factors in enhancing user satisfaction with the platform.

Thirdly, given that the explanatory power of the models is only moderate (R-squared values of 0.215 and 0.431 respectively), one of the inferences that can be drawn from the results is that Pearson needs to ensure that the Pearson platform managers attend to additional factors, including some form of customization, possibly involving social functions and trust factors such as verified credentials (and secure ways of making payments).

Conclusion

This paper examines the effects of System Quality, Information Quality, and Gamification Elements towards User Satisfaction and System Trust in Indonesian e-commerce systems. These empirical results verify that the integration of DeLone & McLean's IS Success Model with gamification theory is a more holistic approach in explaining user behavior in digital commerce environments.

What emerged from the outcomes is that system quality, information quality, and user satisfaction are established predictors of system trust, thereby confirming the importance of system performance as well as the accuracy of information in contributing towards user perceptions. Nevertheless, Gamification Elements stood out as a significant determinant in this analysis, thereby underlining the importance of motivational components of gamification in enhancing user satisfaction in addition to shaping user trust. Moreover, user satisfaction is observed to impact system trust in a significant way, thereby acting as a mediator in translating the importance of the three variables in the generation of user trust.

This model explains a variance of 21.5% in User Satisfaction and a variance of 43.1% in System Trust, indicating a moderate level of explanatory power, implying that certain behaviors not yet measured in this model, such as user enjoyment, user personalization, or corporate credence, could be added benefits in fostering trust in online shopping systems

In conclusion, this research contributes to the theoretical framework of the Information System Success Model by highlighting the importance of gamification as a techno-motivational factor in the digital marketplace. From a practical point of view, the findings of this experiment highlight the importance of optimizing systems, making information available, as well as effectively implementing gamification factors that promote consumer loyalty in digital markets.

Limitations

This explains a variance of 21.5% in User Satisfaction and 43.1% in System Trust, indicating that a host of psychological variables not measured here like fun enjoyment, personalization, or corporate credence may influence user attitudes towards gamification in online shopping systems as well. Also, this study involved Indonesian respondents, recording data via a cross-sectional design, which restricts temporal as well as cultural generalization of this empirical analysis

Future Research

These results form a foundation on which future studies can build upon by considering extra variables that could potentially improve the model's accuracy. A comparison of various platforms as well as culture-based studies could potentially lead to a greater understanding of the way gamification affects satisfaction as well as trust in a digital environment. A longitudinal study could possibly shed more insight into the dynamic process of user trust in a gamified ecommerce environment

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Author's Contributions

Montela Livanto: Research design, data analysis, investigation, and manuscript drafting.

Viany Utami Tjhin: Project oversight, funding, administration, and editorial review.

Ethics

This research used a quantitative survey approach. Respondents participated voluntarily and were informed of the study's purpose and confidentiality prior to data collection. All responses were anonymized, and no personally identifiable information was recorded. This study adhered to academic ethical standards and institutional guidelines, ensuring the protection of participant privacy and data integrity throughout the research process.

Data Availability

The data that support the findings of this study are openly available at https://doi.org/10.5281/zenodo.16900069.

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