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Strengthening E-Wallet User Loyalty through Gamification Mechanisms: A Multidimensional Perspective of Perceived Value

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Abstract

This study aims to investigate the mechanism of e-wallet user loyalty formation through the integration of gamification elements, specifically by exploring the mediating roles of perceived hedonic and utilitarian values. In an increasingly competitive digital financial landscape, maintaining user retention remains a crucial challenge for service providers. Diverging from prior research that predominantly relies on sufficiency logic, this study adopts a dual-analytic approach by combining Partial Least Squares-Structural Equation Modeling (PLS-SEM) and Necessary Condition Analysis (NCA). This dual-analytic approach provides complementary insights into both the primary drivers and the absolute prerequisites of loyalty in a concise manner. Based on the empirical evaluation using PLS-SEM, the findings reveal that gamification significantly stimulates the enhancement of both users' hedonic and utilitarian values. Furthermore, these two dimensions of perceived value successfully validate their roles as robust mediators in bridging the effect of gamified features toward long-term loyalty commitment. Within this sufficiency equation, hedonic value occupies the position as the predictor with the strongest driving force. However, evaluating the bottleneck matrix through the NCA algorithm uncovers complementary theoretical dynamics. The necessity evaluation postulates that utilitarian value—rather than hedonic value—acts as the highest floor limit and the most fundamental prerequisite. The absence of guaranteed functional benefits and economic advantages will inevitably collapse the entire retention scheme, regardless of how visually attractive or entertaining the gamified features are presented. Comprehensively, the conclusions of this research provide academic and managerial justifications that retention management tactics cannot be executed asymmetrically. To secure user loyalty at the maximum level, e-wallet developers are obliged to orchestrate a balanced ecosystem; the stability of practical utility must be secured as the primary foundation before maximizing investments in visual interactivity and entertainment sensations.

Keywords: Gamification, User Loyalty, Hedonic Value, Utilitarian Value, PLS-SEM, NCA

1. Introduction

The global digital payment system landscape has experienced massive disruption with the high penetration of financial technology (fintech), which has positioned electronic wallet (e-wallet) applications as a primary transaction instrument for modern society. In the early stages of their development, e-wallet service providers' business strategies focused on aggressively acquiring new users. However, as the industry's life cycle matures, the fundamental challenge has shifted from technology adoption to long-term user retention [1]. The current e-wallet market is characterized by very low switching costs, where consumers can easily switch between platforms solely due to price differences or short-term financial incentives [2], [3], [4]. Therefore, building user loyalty that is resistant to the temptations of competitors is crucial.

In response to this "hopper" phenomenon (defined as disloyal users who switch platforms purely for short-term incentives) [5], [6], the m-commerce and e-wallet industries have begun adopting game-based design interventions, known as gamification. Gamification is defined as the integration of game mechanics, dynamics, and aesthetics into non-game environments with the aim of modifying behavior and motivating user engagement [7], [8]. Features such

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as point-collection systems, user tiering, achievement badges, and daily surprises are no longer merely interface decorations but have transformed into core strategies for creating psychological attachment between users and applications [9].

Despite increasing investment in gamification features, the psychological mechanisms explaining how these mechanical features translate into long-term loyalty remain a subject of academic debate. Based on Uses and Gratifications Theory (UGT) and the extended technology acceptance model, user interactions with information systems are driven by cognitive and affective evaluations that culminate in two primary value spectrums: utilitarian and hedonic [10]. Utilitarian value represents rational instrumental evaluations, such as transaction efficiency, feature utility, and economic savings derived from gamification rewards. On the other hand, hedonic value captures purely affective, emotional, and experiential dimensions, such as the sense of accomplishment, challenge, and escapism experienced when interacting with game elements [11], [12].

While previous studies have extensively explored the antecedents of loyalty, a fundamental methodological and theoretical research gap remains. The majority of information systems and marketing literature remains trapped in a linear asymmetric paradigm, where model testing generally relies solely on regression analysis or traditional Structural Equation Modeling (SEM) [13]. This conventional model operates on sufficiency logic, which assumes that increases in gamification attributes or perceived value will automatically lead to increased loyalty. This approach fails to capture the dynamics of necessity logic, which identifies critical conditions or minimum thresholds for a variable to be present. Without it, loyalty is impossible to form [14]. For example, is enjoyment (hedonic) merely a value-adding factor, while the reliability of basic (utilitarian) functions is the absolute foundation that cannot be compromised?

To address this gap in the literature, this study proposes an integrated framework that combines Partial Least Squares Structural Equation Modeling (PLS-SEM) with the Necessary Condition Analysis (NCA) method. This dual-methodology integration offers superior analytical rigor because it not only confirms the extent to which gamification elements drive hedonic and utilitarian values that mediate user loyalty (through PLS-SEM), but also specifically extracts the degree of "necessity" (necessity effect size) of each variable to prevent user retention failure (through NCA). The findings of this study are expected to provide new theoretical contributions to the digital consumer behavior literature and serve as pragmatic guidance for e-wallet developers in optimally allocating their design resources between functionality and entertainment.

2. Literature Review

2.1. Gamification Concept

Gamification refers to the integration of elements, dynamics, and design mechanics commonly found in video games into non-game environments or systems [7]. In the context of digital financial services such as e-wallets, gamification operates dually: as a 'choice architecture' involving mechanical design (such as points, levels, and badges) and as a 'psychological stimulus' that influences users' cognitive and affective states [15]. Affectively, elements such as badges and interactive challenges trigger intrinsic motivation. Users experience a sense of pleasure, escapism, and a sense of accomplishment upon successfully completing a mission, which directly shapes hedonic value [16], [17].

Cognitively and rationally, gamification in e-wallets generally takes the form of accumulating coins or loyalty points that can be exchanged for discounts, cashback, or waived administrative fees. These economic and functional benefits directly enhance users' perceptions of the application's utilitarian value [6]. Therefore, the following hypothesis is proposed:

H1: Gamification has a positive and significant effect on e-wallet users' perceived hedonic value.

H2: Gamification has a positive and significant effect on e-wallet users' perceived utilitarian value.

2.2. Hedonic Values and Utilitarian Values

Consumer evaluation of an information technology is not only based on pure functionality, but also on the accompanying emotional experience [18]. Contrasting Babin's classic definitions with more contemporary functional and experiential value models, two dominant dimensions emerge in technology adoption research [10], [19].:

Hedonic Value: This is an affective evaluation related to emotional experiences, pleasure, and psychological escapism [11]. Interaction with game elements, such as the thrill of winning a challenge or the pride of reaching the

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highest level, fosters hedonic value, which makes users feel entertained while using the application. Utilitarian Value: Refers to cognitive evaluations that focus on the functionality, efficiency, and instrumental benefits of using a system [18]. In the context of e-wallet gamification, utilitarian value is represented by user perceptions of economic benefits (such as cashback or discounts from point redemption) and functional ease of managing finances.

Perceived customer value is a key antecedent of loyalty. When users perceive high utilitarian value—that is, when an app operates efficiently, seamlessly, and provides financial savings—they develop a calculative commitment that prevents them from switching to competitors [19]. On the other hand, hedonic value creates an emotional commitment. Users who feel entertained and enjoy interacting with an app will have a stronger psychological drive to continue using the service and recommend it to others [20]. Therefore, the following hypothesis is proposed:

H3: Hedonic values have a positive and significant influence on e-wallet user loyalty.

H4: Utilitarian values have a positive and significant influence on e-wallet user loyalty.

To clearly illustrate the proposed relationships, the conceptual framework mapping the hypothesized relationships (H1 through H4) is presented in Figure 1.

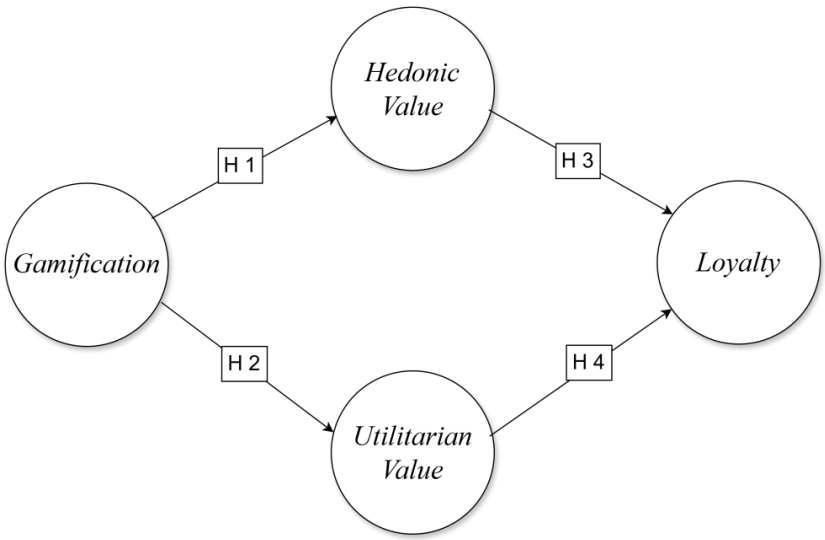

Figure 1. Conceptual Framework

2.1. E-Wallet User Loyalty

According to [21], consumer loyalty is a deep commitment to repurchase or continuously purchase a preferred product/service in the future, regardless of situational influences and competitors' marketing efforts that could potentially lead to switching behavior. In an e-wallet landscape with low switching costs, loyalty can no longer be measured solely by mechanical repeat transactions. Loyalty in the mobile commerce (m-commerce) realm goes beyond mere subscription retention, it reflects a user's deep psychological commitment to a platform [22]. E-wallet user loyalty is measured by their intention to continue using the service in the future (continuance intention), their willingness to recommend the app to others (positive word-of-mouth), and their level of resistance or reluctance to switch to a competitor's app despite attractive promotions [2].

3. Research Methodology

3.1. Research Design

This research uses a quantitative approach with a causal-explanatory research design. Explanatory design aims to test, explain, and validate the causal relationships between variables formulated in the hypothesis [16]. This approach was chosen because the researchers intended to precisely measure the extent to which gamification elements influence e-wallet user loyalty, both directly and through the mediation of hedonic and utilitarian values.

3.2. Population, Sample, and Sampling Techniques

The target population in this study is all individuals in Indonesia who are active users of e-wallet applications (such as GoPay, OVO, DANA, ShopeePay, etc.) that integrate gamification features. Sampling was conducted using a

purposive sampling approach. Although non-probability sampling introduces potential selection bias, this was mitigated by ensuring a diverse representation across ages (18–35 years) and multi-platform users (DANA, GoPay, ShopeePay) to maintain generalizability.

In determining the sample size for variance-based structural equation modeling (PLS-SEM), an a priori analysis using G*Power software was performed. The results confirmed that a sample size of 200 respondents yields statistical power well above the 0.80 threshold required for PLS-SEM evaluation, thus providing a robust justification beyond the traditional 10-times rule. To provide a comprehensive understanding of the dataset characteristics, the demographic profile of these 200 respondents is detailed in Table 1.

Table 1. Respondent profile

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	90	45.0%
	Female	110	55.0%
Age Group	18 – 24 years	95	47.5%
	25 – 30 years	75	37.5%
	31 – 35 years	30	15.0%
Primary E-Wallet Platform	DANA	70	35.0%
	ShopeePay	60	30.0%
	GoPay	45	22.5%
	OVO / Others	25	12.5%

3.3. Operational Definition and Measurement Scale

The operationalization of the Gamification construct is specifically focused on reward-based mechanics (e.g., points, levels, and badges). All questions are measured using a 5-point Likert Scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Gamification (Independent Variable): Operationalized as user perceptions of the game mechanics within e-wallets. Indicators include the appeal of the points system, the pride of achieving a certain level, and motivation from rewards [11], [23], [24].

Hedonic Value (Mediator Variable 1): Operationalized as the user's affective experience. Indicators include a sense of entertainment, enjoyment while playing, and release from boredom [6], [18], [25]. Utilitarian Value (Mediator Variable 2): Operationalized as perceptions of functionality and efficiency. Indicators include transaction smoothness, feature convenience, and direct financial benefits (cashback/discounts) [6], [10]. Loyalty (Dependent Variable): Operationalized as user commitment. Indicators include intention to continue using the platform in the future, willingness to provide positive recommendations (Word of Mouth), and resistance to competitor promotions [2], [19], [26].

3.4. Data Analysis Stages

This study used Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS software. PLS-SEM was chosen due to its advantages in handling complex research models (having multiple mediation effects) and its prediction-oriented nature [27]. While PLS-SEM is used to determine how much gamification is sufficient to increase loyalty, the Necessary Condition Analysis (NCA) method is used to examine whether the variable is an absolute requirement [14]. This analysis is crucial for identifying bottlenecks or key obstacles that can hinder customer retention. By integrating bootstrapping (PLS-SEM) and effect size (NCA) results, this study will be able to present a comprehensive synthesis of which functions are merely complementary entertainment and which functions are essential for the sustainability of an e-wallet business.

4. Results and Discussion

4.1. Respondent Profile Description

This study successfully collected primary data from 200 respondents who met the inclusion criteria (at least 18 years old, active e-wallet users for at least 6 months, and have experience with gamification features). Based on

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demographic analysis, the majority of respondents were in the 18–25 years old age group (62%) and 26–35 years old (28%), representing the dominance of Generation Z and Millennials as early adopters of financial technology. In terms of platform usage, DANA (35%), GoPay (30%), and ShopeePay (25%) were the three most frequently used e-wallets. The frequency of respondents' interactions with gamification features was dominated by daily (45%) and weekly (38%) activities, indicating an adequate level of stimulus exposure for model testing.

4.2. Measurement Model Evaluation (Outer Model)

The initial phase of the PLS algorithm testing evaluates the measurement model (outer model) to confirm convergent validity, as visualized in Figure 2. Rather than redundantly examining each variable, the estimation results analytically demonstrate a highly robust and stable measurement architecture across all constructs. The outer loadings for Gamification (0.818–0.901), Hedonic Value (0.850–0.899), Utilitarian Value (0.794–0.826), and Loyalty (0.794–0.912) consistently exceeded the recommended critical threshold of 0.70 [28], [29]. Analytically, this strong item retention without the need for indicator deletion (item trimming) confirms excellent indicator reliability. It implies that the questionnaire items possess a strong binding power to precisely capture both the psychological evaluations and behavioral responses of e-wallet users. Consequently, absolute convergent validity is established, ensuring that the model is methodologically sound to proceed to structural path evaluations.

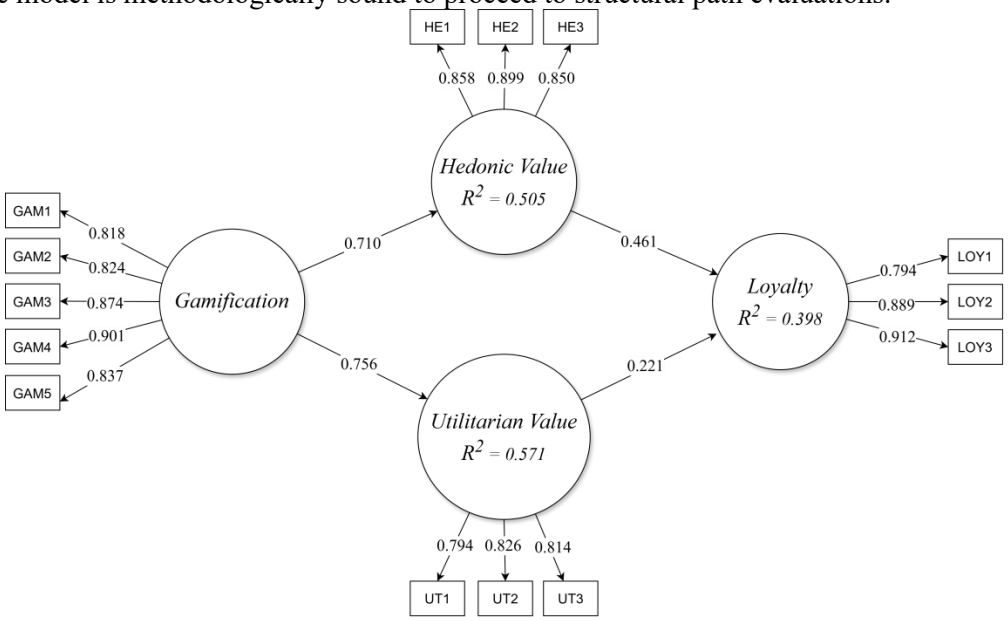

Figure 2. PLS-SEM Result

4.3. Construct Validity and Reliability

The next crucial step in the outer model testing phase is to evaluate the instrument's reliability and ensure its convergent validity at the construct level. A summary of the statistical computational results for this test is comprehensively presented in Table 2. To assess the robustness and internal consistency of each measurement instrument, this analysis relies on two key statistical parameters: Cronbach's Alpha and Composite Reliability (CR). Referring to authoritative literature on variance-based structural equation modeling, a latent construct can be claimed to have a sufficient level of reliability if both reliability indicators record scores exceeding the minimum threshold of 0.70 [27], [29].

Based on the empirical data presented in the table, all variables involved in this research architecture convincingly met the eligibility criteria. The Gamification construct demonstrated significantly superior instrument performance, with a Cronbach's Alpha of 0.905 and a CR score of 0.929. A robust consistency pattern was also recorded in the mediating variables, with Hedonic Value securing an Alpha value of 0.838 (CR = 0.903) and Utilitarian Value achieving an Alpha value of 0.742 (CR = 0.853). As the output of this model, the Loyalty variable also demonstrated its measurement robustness, with an Alpha value of 0.832 and a CR of 0.900. This series of values, well above the tolerance limit, confirms that all items answered by respondents were highly consistent, reliable, and free from potential bias due to random measurement error.

In addition to diagnosing reliability, the table above also summarizes the results of convergent validity testing using the Average Variance Extracted (AVE) metric. This indicator is essential for verifying how much of the variance in the manifest indicators is ultimately explained by the underlying latent construct. Academic standards require a minimum AVE value of 0.50 [29]. Based on the algorithm's calculations, the Gamification construct recorded an AVE value of 0.725, followed by Hedonic Value at 0.756, Utilitarian Value at 0.659, and finally Loyalty at 0.751. The fact that all latent variables achieved AVE scores above 0.50 provides undeniable statistical justification. This postulates that each construct in this research model is capable of explaining more than half of the variance of its constituent indicators, thus fully meeting the convergent validity postulate at the outer model stage.

Table 2. Variable Construct Reliability and Validity

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Gamification	0.905	0.929	0.725
Hedonic Value	0.838	0.903	0.756
Utilitarian Value	0.742	0.853	0.659
Loyalty	0.832	0.900	0.751

4.4. Discriminant Validity

Discriminant validity was evaluated to ensure that each construct is empirically distinct from other constructs in the research model. In this study, testing was conducted using the Heterotrait-Monotrait (HTMT) Ratio approach, which is considered more accurate and sensitive than the traditional Fornell-Larcker criteria in PLS-SEM models.

Based on the HTMT matrix presented in the Table 3, all HTMT ratio values between constructs are below the conservative threshold of 0.90 [30]. For instance, the ratio between Gamification and Hedonic Value is 0.812, and between Loyalty and Hedonic Value is 0.830. These results confirm that there are no collinearity issues between the latent constructs. Therefore, it can be concluded that discriminant validity is established, meaning each variable in the model represents a unique concept and does not overlap statistically.

Table 3. Discriminant Validity HTMT

	Gamification	Hedonic Value	Utilitarian Value
Hedonic Value	0.812	-	-
Utilitarian Value	0.715	0.589	-
Loyalty	0.803	0.830	0.697

4.5. Explanation of Variance

After all measurement indicators passed validity and reliability tests, the next evaluation phase focused on testing the structural model (internal model) to assess the predictive power of exogenous variables against fluctuations in endogenous variables using the coefficient of determination (R^2). Based on standard thresholds (e.g., [27], [31]), the results demonstrate moderate to substantial predictive power. As shown in Table 4, the r-squared values confirmed that the presence of gamification features acted as a strong predictor, explaining 57.1% of the variability in Utilitarian Value ($R^2 = 0.571$) and 50.5% in Hedonic Value ($R^2 = 0.505$). Furthermore, at the extreme end of the model, the path integration between Hedonic Value and Utilitarian Value perceptions collectively explains 39.8% (R2 = 0.398) of the puzzle of e-wallet user loyalty formation. This level of prediction is considered adequate for the digital consumer behavior research ecosystem [28], [29].

Table 4. R-square

	R-square	R-square adjusted
Hedonic Value	0.505	0.502
Loyalty	0.398	0.391
Utilitarian Value	0.571	0.568

4.6. Effect Size

In addition to testing statistical significance, this study generates an effect size value (f^2) to determine the relative contribution of each exogenous variable to the endogenous variable in the model. Based on the estimation results in Table 5, the Gamification feature is proven to be a very dominant predictor with a massive impact (large effect size) on the formation of Utilitarian Value ($f^2 = 1.330$) and Hedonic Value ($f^2 = 1.019$). This value, which far exceeds the 0.35 threshold, indicates that gamification is not just an additional element, but rather a major driver that fundamentally changes the user's perception of value in e-wallet applications.

In the context of loyalty formation, there are interesting differences in contribution to note. Hedonic Value provides a medium level contribution (medium effect size) to Loyalty with a value of $f^2 = 0.193$. In contrast, Utilitarian Value contributes to the small category (small effect size) with a value of $f^2 = 0.044$. This finding provides analytical insight that in the sufficiency logic model, emotional aspects and pleasant experiences (hedonic) have a stronger driving force in strengthening user loyalty than purely functional aspects.

Table 5. F-square

	Hedonic Value	Utilitarian Value	Loyalty
Gamification	1.019	1.330	-
Hedonic Value	-	-	0.193
Utilitarian Value	-	-	0.044

4.7. Path Coefficient

A crucial stage in evaluating the structural model is hypothesis testing through path coefficient significance analysis, which is computationally executed using a bootstrapping procedure (5,000 resamples) [28], [31]. Referring to Table 6, all hypothesized paths proposed in this research architecture were empirically confirmed and declared supported. Specifically, the Gamification element was shown to significantly boost the formation of Hedonic Value (T-statistic = 18.203; p-value < 0.001) and Utilitarian Value (T-statistic = 19.459; p-value < 0.001).

In the subsequent transmission phase, both value perceptions also successfully manifested their significant influence on the formation of e-wallet user loyalty. Hedonic Value recorded a very solid track record of significance (T-statistic = 6.118; p-value < 0.001), followed by the role of Utilitarian Value, which was also recognized for its statistical reliability (T-statistic = 2.320; p-value = 0.020). Referring to the general fixed parameters where the T-statistic value must exceed the threshold of 1.96 and p-values are below the tolerance level of 0.05 [29], the conclusion of these findings confirms that gamification mechanisms are valid and convincingly capable of weaving users' psychological paths to long-term loyalty through fulfilling entertainment and functionality expectations.

Table 6. Path Coefficient

	Standard deviation	T statistics	P values	Decision
Gamification → Hedonic Value	0.039	18.203	0.000	Supported
Gamification → Utilitarian Value	0.039	19.459	0.000	Supported
Hedonic Value → Loyalty	0.075	6.118	0.000	Supported
Utilitarian Value → Loyalty	0.095	2.320	0.020	Supported

4.8. Specific Indirect Effect

An essential phase in the feasibility analysis of a structural model is investigating the role of mediating variables through the calculation of specific indirect effects [32]. Referring to the computational output in Table 7, both mediation routes constructed in this study successfully demonstrated empirical significance and were supported. Specifically, the first path proved that Hedonic Value plays a crucial role in bridging Gamification stimulation to user Loyalty commitment with a very strong level of statistical precision (T-statistic = 5.538; p-value < 0.001). In line with this conclusion, the second path also validated the capacity of Utilitarian Value as a reliable mediator in transmitting Gamification impulses into ongoing loyalty (T-statistic = 2.346; p-value = 0.019). The achievement of these statistical indicators provides strong theoretical justification that game features on e-wallet platforms do not

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operate independently in locking in retention; Instead, these elements absolutely rely on the fulfillment of emotional pleasure sensations and functional benefits as their primary transmission mechanisms [30].

Table 7. Specific Indirect Effect

	Standard deviation	T statistics	P values	Decision
Gamification → Hedonic Value → Loyalty	0.059	5.538	0.000	Supported
Gamification → Utilitarian Value → Loyalty	0.071	2.346	0.019	Supported

4.9. Necessary Condition Analysis (NCA)

As a complementary maneuver to the Partial Least Squares (PLS) test, which relies on sufficiency logic, this study also integrates the Necessary Condition Analysis (NCA) instrument. The CE-FDH technique was specifically selected over CR-FDH because the survey data is discrete, and the sample size of 200 respondents is highly adequate for this specific parametric envelopment technique. This approach specifically operates to identify the existence of absolute prerequisite factors (bottlenecks)—conditions whose absence will prevent the formation of loyalty, regardless of how well other variables are optimized [13]. Referring to the graphical visualization of the NCA output in Figure 3, the effect size (d) parameter of each Latent Variable (LV) on the Loyalty variable shows a figure that convincingly exceeds the theoretical minimum threshold of 0.100 [14]. Specifically, the Utilitarian Value pillar demonstrated the highest necessity score at 0.289. This finding places functional utility as the most essential prerequisite foundation; meaning that without adequate guarantees of practical benefits, e-wallet platform user loyalty is essentially impossible.

Following in the next position, the Gamification construct was also validated as a prerequisite condition with a mandatory effect size score of 0.250. Meanwhile, the Hedonic Value perception also proved its capacity as an absolute requirement with a score of 0.181. The configuration of these three predictors, which lead to the Loyalty construct, reveals a complementary theoretical dynamics crucial for strategic governance. Although the previous PLS-SEM evaluation mapped hedonic value as the strongest driver, this NCA scan highlights that the utilitarian aspects and gamification design are floor limits that cannot be substituted or compensated for by high entertainment value alone [33]. In conclusion, to optimally lock in the user loyalty ecosystem, app developers are required to simultaneously meet the minimum feasibility thresholds across these three spectrums.

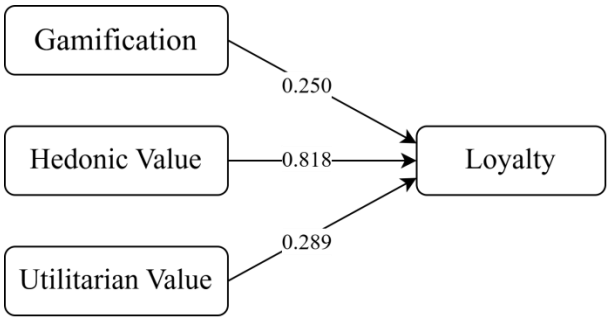

Figure 3. Necessary Condition Analysis (NCA)

4.10. Interpretation of the Bottleneck Table

As a deepening tool in Necessary Condition Analysis (NCA), Table 8 presents the Bottleneck matrix extracted using the Ceiling Envelopment - Free Disposal Hull (CE-FDH) algorithm. Conceptually, this table functions like a precise navigation map detailing the absolute minimum limits (lower thresholds) of each predictor variable that must be met to reach a specific percentage target for the endogenous variable, namely Loyalty [14].

A scan of this empirical matrix reveals a crucial pattern of prerequisite escalation. In the initial phase of establishing low-level loyalty (range 0% to 10%), the system registers an indicator of "NN" (Not Necessary), meaning that no specific determinants are absolutely required. However, this dynamic changes drastically when the user retention target is increased to 20% to 30%. At this point, Utilitarian Value emerges as the first prerequisite pillar that must be met, with a minimum score of 2.663 to 2.671. This postulate further strengthens the evidence that ensuring functional benefits is the most fundamental foundation before other aspects can function optimally [13].

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When the target is raised to 40%, user expectations become more complex, requiring a minimum Hedonic Value score of 2.65. Furthermore, to reach the loyalty threshold of 50% and above, all the instruments that make up this model must be activated; with Gamification finally joining as an absolute requirement, with a score of no less than 2.822. Ultimately, if platform developers aim to secure complete user commitment at the maximum level (100%), the system probabilistically demands a balanced orchestration of performance enhancements across all sectors. The system strictly dictates the simultaneous fulfillment of high thresholds in all three sectors: Gamification at 3.765, Hedonic Value at 3.65, and Utilitarian Value at the culmination point of 4. This constellation of data provides managerial justification that retention tactics cannot be executed partially, but rather demands a harmonious performance escalation between game features, entertainment sensations, and practical utilities.

Table 8. Bottleneck Tables CE-FDH

	Loyalty	Gamification	Hedonic Value	Utilitarian Value
0.00%	1.608	NN	NN	NN
10.00%	1.947	NN	NN	NN
20.00%	2.286	NN	NN	2.663
30.00%	2.625	NN	NN	2.671
40.00%	2.965	NN	2.65	2.671
50.00%	3.304	2.822	2.7	2.993
60.00%	3.643	2.822	3	2.993
70.00%	3.982	2.822	3	2.993
80.00%	4.322	3.765	3.301	3
90.00%	4.661	3.765	3.301	3
100.00%	5	3.765	3.65	4

5. Conclusion

This study successfully integrates PLS-SEM and NCA to provide a comprehensive understanding of e-wallet user loyalty. While the sufficiency logic (PLS-SEM) confirms that gamification significantly drives loyalty primarily through the strong mediating effect of hedonic value, the necessity logic (NCA) uncovers a critical complementary theoretical dynamic: utilitarian value acts as the absolute foundational prerequisite. Therefore, retention strategies cannot be executed asymmetrically. E-wallet developers must first secure functional utility and transaction reliability as the baseline before scaling investments in visual interactivity and gamified entertainment.

Despite its empirical contributions, this study possesses several limitations that warrant critical reflection. First, the cross-sectional research design captures user perceptions at a single point in time, limiting the ability to draw definitive causal inferences or track the longitudinal evolution of user loyalty as gamification features become saturated. Second, the reliance on self-reported survey data inherently introduces the potential for subjective respondent bias and common method variance. Finally, the empirical scope of this study is confined to the Indonesian cultural context and focuses predominantly on reward-based mechanics. To enhance academic completeness, future studies are strongly encouraged to employ longitudinal designs, explore broader gamification dimensions (e.g., social and narrative elements), and validate this dual-analytic framework across diverse cross-cultural settings.

6. Declarations

6.1. Author Contributions

Conceptualization: A.A.R., W., C.E.W., and R.P.; Methodology: W.; Software: A.A.R., and R.P.; Validation: A.A.R., W., and C.E.W.; Formal Analysis: A.A.R., W., C.E.W., and R.P.; Investigation: A.A.R.; Resources: W.; Data Curation: W.; Writing Original Draft Preparation: A.A.R., W., C.E.W., and R.P.; Writing Review and Editing: W., A.A.R., C.E.W., and R.P.; Visualization: A.A.R., and R.P.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6.7. Acknowledgments

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