The Influence of User Experience on Customer Engagement in Grab Application: A SERVQUAL Approach for Service Quality Evaluation

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Abstract

Digital transformation has fundamentally changed transportation services, yet existing research has predominantly applied traditional SERVQUAL frameworks without systematic integration with contemporary User Experience theories for Generation Z users. Limited research exists specifically investigating ride-hailing platforms among digital-native populations, creating a critical gap in understanding how generational characteristics influence service quality evaluation patterns. This study investigates the influence of User Experience (UX) on Customer Engagement (CE) in the Grab application among Generation Z users, utilizing the Service Quality (SERVQUAL) framework adapted for digital contexts. The research employed a quantitative approach with purposive sampling targeting 150 active Grab users aged 13-28 years who met specific usage criteria. Data collection utilized online questionnaires measuring five SERVQUAL dimensions, User Experience, and Customer Engagement variables through Likert scales, analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Results revealed fundamental shifts in how Generation Z users evaluate digital service quality. Among SERVQUAL dimensions, only visual interface elements (Tangibles) significantly influenced User Experience ($\beta = 0.586$, $p = 0.001$), while traditional interpersonal service dimensions showed no meaningful impact. User Experience demonstrated exceptionally strong influence on Customer Engagement ($\beta = 0.945$, $p < 0.001$), with the model explaining 89.3% of variance. These findings indicate that conventional service quality models require substantial adaptation for digital service contexts, particularly for Generation Z users who prioritize aesthetic design and interface functionality over traditional service elements. The study contributes to understanding how digital-native consumers evaluate technology-mediated transportation services, suggesting that service providers should focus primarily on user interface design and overall experience architecture to enhance customer engagement in the digital economy.

Keywords: User Experience, Customer Engagement, SERVQUAL, Grab Application, Generation Z, Digital Service Quality, Online Transportation

I. INTRODUCTION

Digital transformation has fundamentally changed the landscape of transportation services, creating a smarter and more efficient mobility ecosystem [1]. The phenomenon of transportation digitalization is no longer merely a technological trend but has become a fundamental necessity for urban society that increasingly depends on digital-based solutions to meet their mobility needs. Digital-based transportation platforms have transcended the traditional concept of movement from one point to another, presenting a comprehensive service ecosystem that connects various aspects of urban life [2]. This revolution not only changes the way people move, but also creates new paradigms in social, economic, and technological interactions in urban environments.

The digital era has brought fundamental changes in consumer expectations regarding transportation services. Modern society is no longer satisfied with conventional transportation services that are often unpredictable, lack transparency, and have limitations in terms of comfort and safety. Digital transformation in transportation is not merely about service digitalization, but about fundamental redesign of human mobility experiences in the contemporary era. Technology has enabled the creation of more responsive, personal, and integrated solutions that can adapt to the specific needs of each user [3].

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Grab as one of the leading digital transportation applications in Indonesia has consolidated various mobility services, delivery, and digital services into one integrated platform. The technological complexity supporting this platform involves a series of advanced innovations, ranging from intelligent route determination algorithms, real-time mapping systems, to artificial intelligence technology integration that enables user experience personalization at previously unimaginable levels. Since being founded in 2011 by Anthony Tan and Hooi Ling Tan from Malaysia and operating in Indonesia since 2012, Grab has transformed the way society travels by offering safer, more transparent, and efficient solutions [4].

Grab's success in adapting to local market needs while maintaining global technology standards demonstrates the complexity of digital transportation industry dynamics. This platform not only provides transportation services, but has also evolved into a comprehensive digital ecosystem, connecting millions of users with various services including transportation, food delivery, digital payments, and financial services. This multi-service integration creates a holistic and interconnected user experience, where every interaction contributes to the platform's understanding of individual user preferences and needs.

Generation Z born between 1997-2012, has become a key demographic group in digital service transformation, particularly on platforms like Grab. As the first digital natives, they have unique characteristics that directly influence their preferences for online transportation service consumption [5]. This generation grew up in the internet and mobile technology era, forming consumption behavior patterns that are very different from previous generations. They tend to expect instant, personalized, and seamless services, with low tolerance for inefficiencies or unnecessary complexity in digital experiences.

Survey data from Alvara Research Center in 2022 shows that 20.9% of Generation Z spends 7-10 hours per day in online activities, which not only reflects their dependence on mobile technology, but also indicates market potential that is very responsive to digital innovation [6]. The Indonesian Internet Service Providers Association (APJII) 2024 report which recorded 87.02% of Generation Z connected to the internet confirms significant market potential. Generation Z characteristics that demand applications that are not merely functional, but also intuitive, fast, and provide personal experiences, directly align with their expectations for convenience and speed offered by digital platforms like Grab.

Generation Z's consumption behavior towards digital transportation services shows complex and multidimensional patterns [7]. They not only evaluate services based on functional aspects such as speed and reliability but also consider experiential factors such as interface ease of use, interaction quality, and the extent to which services can adapt to their individual preferences. Generation Z also tends to be more vocal in expressing their satisfaction or dissatisfaction through digital platforms, creating feedback loops that can influence reputation and public perception of online transportation services.

Despite extensive research on service quality and customer engagement, significant and unaddressed gaps remain in understanding these relationships within the specific context of ride-hailing services and Generation Z users. Previous studies have predominantly treated all user groups uniformly, fundamentally overlooking Generation Z's distinct digital-native characteristics that influence their service quality perceptions and engagement behaviors in ways that differ markedly from other generational cohorts. There is a notable absence of empirical studies that systematically integrate SERVQUAL frameworks with user experience theories specifically within ride-hailing platforms. Liu et al. (2009) examined service quality in general e-commerce contexts with mixed demographics, finding all traditional SERVQUAL dimensions significant, but their findings may not translate to ride-hailing specific environments where real-time interactions, location-based services, and multi-sided market dynamics create fundamentally different service paradigms [8]. Similarly, Wong and Sohal (2003) studied online banking services among adult professionals using modified SERVQUAL, emphasizing technology focus importance, yet different service contexts yield different user expectations and evaluation criteria [9].

Existing research has failed to adequately address how Generation Z's unique digital consumption patterns influence their evaluation of app-based transportation services. While numerous studies have applied SERVQUAL to e-commerce and traditional services, limited research exists specifically examining ride-hailing platforms through the lens of digital-native users who have distinct expectations regarding interface design, interaction quality, and engagement mechanisms [10]. Parasuraman et al. (2005) developed E-S-QUAL for e-commerce websites, identifying efficiency and system availability as key factors, but their pre-smartphone era framework may not capture contemporary mobile-first service experiences that Generation Z expects [11]. There is a critical void in understanding how user experience design elements specifically influence customer engagement behaviors among Generation Z users in ride-hailing contexts. Akter et al. (2016) explored digital service quality in mHealth services, finding interaction quality matters significantly, yet healthcare user expectations differ markedly from transportation service users, particularly among digital natives who prioritize visual aesthetics, intuitive navigation, and personalized experiences [12].

Furthermore, existing research has largely applied conventional SERVQUAL frameworks without systematic integration with contemporary User Experience theories, missing opportunities to understand how traditional service dimensions interact with modern digital experience elements that are particularly important to Generation Z users. This gap is particularly pronounced in the Indonesian market context, where most existing research has been conducted in Western contexts or other Southeast Asian markets, with insufficient attention to the unique characteristics of Indonesian Generation Z users and their specific cultural and technological adoption patterns. There is a substantial gap in empirical validation of how visual interface elements, user

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experience design, and traditional service quality dimensions collectively influence customer engagement among digital-native populations in ride-hailing services. The majority of existing studies have focused on isolated aspects of either service quality or user experience, but no comprehensive framework exists that integrates these dimensions specifically for Generation Z users in the Indonesian ride-hailing market.

To address these critical gaps, this research aims to empirically examine and validate the relationship between SERVQUAL dimensions, User Experience design, and Customer Engagement among Indonesian Generation Z users of the Grab application. Specifically, this study seeks to identify and validate SERVQUAL dimensions that are most significant for Generation Z users in evaluating ride-hailing service quality within the Indonesian market context, examine the mediating role of User Experience in the relationship between service quality dimensions and customer engagement behaviors among Indonesian Generation Z Grab users, and develop and validate an integrated theoretical framework that combines traditional SERVQUAL measurements with contemporary UX evaluation metrics specifically tailored for digital-native ride-hailing service users. Additionally, this research aims to provide empirical evidence of how visual interface design elements and user experience factors influence customer engagement patterns among Generation Z users, contributing to both theoretical understanding and practical platform optimization strategies, while generating actionable insights for ride-hailing platform developers and service providers on optimizing service quality and user experience design to enhance customer engagement among Indonesian Generation Z users.

This research addresses the identified gaps by providing the first comprehensive examination of SERVQUAL dimensions specifically tailored to Generation Z users in the Indonesian ride-hailing context, integrating traditional service quality measurement with digital UX evaluation frameworks, and offering empirical validation of how these integrated factors influence customer engagement among digital-native populations.

II. METHODOLOGY

A. Research Phases

This research employs a systematic and structured approach to investigate the influence of user experience on customer engagement in Grab application using the SERVQUAL framework. The methodology is designed to provide comprehensive insights into Generation Z users' perceptions and behaviors towards digital transportation services. The research process is organized into six distinct phases, each serving a specific purpose in building a robust empirical foundation for understanding the complex relationships between service quality dimensions, user experience, and customer engagement in the digital transportation ecosystem.

1. Literature Review

The literature review phase constitutes a comprehensive and systematic examination of existing scholarly works related to the research topic, serving as the cornerstone for establishing a solid theoretical foundation. This extensive review encompasses the analysis of international and national journal articles, reference books, academic publications, and peer-reviewed research focusing on SERVQUAL methodology, User Experience principles, and Customer Engagement theories within digital service contexts. The literature review process involves multiple stages of systematic search, screening, and analysis to identify relevant studies that contribute to understanding the relationships between service quality dimensions and user engagement in digital platforms. This phase serves as the foundation for establishing a robust theoretical framework that underpins the research hypotheses and provides essential context for interpreting research findings.

The review process includes critical analysis of previous empirical studies that have explored the relationships between service quality dimensions and user engagement in digital platforms, with particular attention to studies conducted within the transportation, technology, and mobile application sectors. Special emphasis is placed on research that has successfully adapted traditional service quality models to digital environments, examining how conventional SERVQUAL dimensions translate into meaningful metrics for digital service evaluation. Beyond technology-mediated service quality research, this literature review also encompasses broader customer engagement theories including emotional commitment frameworks, co-creation value theories, and social influence models to ensure comprehensive theoretical coverage. Studies examining emotional commitment in digital platforms are analyzed to understand how affective bonds between users and applications influence long-term engagement patterns, while co-creation literature provides insights into how Generation Z users actively participate in service value creation through feedback, reviews, and community interactions. Social influence theories are incorporated to understand how peer recommendations, social media sharing, and network effects impact Generation Z engagement behaviors in ride-hailing contexts.

The literature review methodology is specifically designed to address the research objectives by examining how traditional service quality measurement can be enhanced through integration with contemporary user experience theories. This approach is chosen because Generation Z users evaluate digital services through multidimensional lenses that extend beyond functional service quality to include experiential, emotional, and social dimensions. The comprehensive literature analysis ensures that the theoretical framework captures the full spectrum of factors influencing Generation Z engagement with ride-hailing services, providing a balanced foundation that incorporates both established service quality principles and emerging digital engagement paradigms. Additionally, this phase involves analysis of theoretical developments in user experience design and customer engagement measurement, identifying gaps in

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current knowledge and establishing the research contribution within the broader academic discourse.

2. Population and Sample

The population for this research consists of Generation Z users of the Grab application, specifically individuals aged 13-28 years (born between 1997-2012) who represent the digital native demographic with inherent familiarity and high expectations regarding digital service quality. This demographic is strategically selected due to their characteristics as early adopters of technology, heavy users of mobile applications, and their significant influence on digital service adoption patterns. The focus on Generation Z is particularly relevant as they constitute a substantial portion of ride-hailing service users and possess unique behavioral patterns and expectations that differ from previous generations in their interaction with digital platforms.

This study employs purposive sampling technique, a non-probability sampling approach that allows researchers to intentionally select respondents based on specific criteria relevant to the research objectives [13]. The selection of purposive sampling is justified by the need for respondents with particular characteristics and direct experience with the Grab application, ensuring that participants possess adequate knowledge and experience to provide meaningful insights into service quality perceptions and engagement behaviors. The purposive sampling approach is particularly appropriate for this research as it requires respondents with specific technological experience and usage patterns that may not be randomly distributed across the general population.

Sample size determination for this study follows established guidelines for Structural Equation Modeling analysis, which requires careful consideration of model complexity and statistical power requirements. Hair et al. (2019) recommend a minimum sample size of 150 respondents for SEM analysis [14], while Kline (2015) suggests a more conservative approach with 10-20 observations per parameter estimated in the model [15]. Given that this research employs an integrated SERVQUAL-UX framework with multiple constructs and measurement items, the estimated model complexity requires approximately 15-20 parameters. Following the conservative approach and accounting for potential data exclusions due to incomplete responses or failure to meet inclusion criteria, this study successfully collected data from 150 respondents through the online survey platform. This sample size provides adequate statistical power while ensuring sufficient data for robust SEM analysis and model validation, particularly important given the complexity of testing relationships between multiple service quality dimensions, user experience factors, and customer engagement constructs.

The sample selection criteria are carefully designed to ensure respondent relevance and data quality while supporting the research objectives of understanding Generation Z engagement patterns. Inclusion criteria specify that participants must be active Grab users who have been registered for at least 3 consecutive months prior to data collection and have completed a minimum of 5 transactions through the application within the month preceding the survey. These criteria ensure that respondents have sufficient experience with the platform to provide informed evaluations of service quality and user experience dimensions. Additional criteria include residence within the Sukabumi region to maintain geographic consistency and willingness to participate in the comprehensive online survey process. Exclusion criteria are established to maintain data integrity, including incomplete survey responses, inconsistent answer patterns such as straight-lining responses, and participants who do not meet the specified age range or usage requirements. This methodological approach ensures that the sample accurately represents the target population while maintaining the methodological rigor and statistical validity required for structural equation modeling applications, ultimately supporting the research objective of providing reliable insights into Generation Z user behavior in ride-hailing contexts.

3. Research Instrument Development

The research instrument development phase involves the systematic construction of a comprehensive questionnaire designed to measure the variables under investigation through a rigorous and methodical approach. The questionnaire development process begins with extensive review of existing validated instruments in service quality research, followed by careful adaptation to the specific context of digital transportation services. The instrument is structured based on the five dimensions of SERVQUAL (Tangibles, Reliability, Responsiveness, Assurance, and Empathy) and incorporates carefully selected indicators for User Experience and Customer Engagement variables that are specifically relevant to mobile application environments.

The questionnaire design process involves meticulous adaptation of traditional SERVQUAL dimensions to the digital context of the Grab application, ensuring that each dimension is appropriately represented through relevant indicators that capture the unique characteristics of digital service delivery. For instance, the Tangibles dimension is redefined to encompass interface design quality, visual appeal, and layout intuitiveness, while Reliability focuses on system stability, accuracy of real-time information, and consistency of service delivery. The Responsiveness dimension addresses application loading speed, customer service response time, and system reaction to user inputs, while Assurance covers data security, transaction safety, and service transparency. The Empathy dimension encompasses personalization features, user-friendly interface design, and accessibility considerations.

The instrument utilizes a 5-point Likert scale to capture respondents' perceptions and attitudes, ranging from strongly disagree (1) to strongly agree (5), providing sufficient granularity for statistical analysis while remaining user-friendly for respondents. The questionnaire structure includes demographic information collection, service usage patterns, and detailed measurement items for each research variable. The instrument is designed for online distribution through Google Forms to accommodate the digital preferences of Generation Z respondents and to ensure efficient data collection across diverse geographical locations. Pre-testing

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procedures are implemented to ensure clarity, comprehensibility, and cultural appropriateness of the questionnaire items before final distribution.

4. Validity and Reliability

The validity and reliability testing phase ensures the quality and consistency of the research instrument. Validity testing employs construct validity approach through Confirmatory Factor Analysis (CFA) using SmartPLS 4.0 software. Convergent validity is assessed through loading factors (minimum 0.7) and Average Variance Extracted (AVE) values (minimum 0.5), while discriminant validity is evaluated using Fornell-Larcker criteria and cross-loading analysis [16]. Reliability testing is conducted using two primary parameters: Composite Reliability (CR) and Cronbach's Alpha, both requiring minimum values of 0.7 to ensure adequate internal consistency [17]. The use of both parameters provides a comprehensive evaluation of instrument reliability, with CR offering more accurate estimates for PLS-SEM models by considering varying indicator loadings, while Cronbach's Alpha provides comparison with established reliability standards in research literature.

5. Data Collection

The validity and reliability testing phase ensures the quality and consistency of the research instrument. Validity testing employs construct validity approach through Confirmatory Factor Analysis (CFA) using SmartPLS 4.0 software. Convergent validity is assessed through loading factors (minimum 0.7) and Average Variance Extracted (AVE) values (minimum 0.5), while discriminant validity is evaluated using Fornell-Larcker criteria and cross-loading analysis. Reliability testing is conducted using two primary parameters: Composite Reliability (CR) and Cronbach's Alpha, both requiring minimum values of 0.7 to ensure adequate internal consistency. The use of both parameters provides a comprehensive evaluation of instrument reliability, with CR offering more accurate estimates for PLS-SEM models by considering varying indicator loadings, while Cronbach's Alpha provides comparison with established reliability standards in research literature.

6. Data Processing

The data processing phase begins with comprehensive data preparation procedures that ensure the quality and integrity of collected information before statistical analysis. This initial stage involves meticulous editing procedures to examine completeness and consistency of responses from each participant, including identification of missing values, outliers, and inconsistent response patterns. The editing process also includes verification of demographic information and usage criteria to ensure all respondents meet the established inclusion requirements. Following the editing process, data is systematically tabulated and organized according to research variables including User Experience, SERVQUAL dimensions (Tangibles, Reliability, Responsiveness, Assurance, and Empathy), and Customer Engagement, creating a structured dataset suitable for advanced statistical analysis.

The analytical approach employs Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0 software, which is particularly appropriate for this research due to its ability to handle complex models with multiple constructs and its suitability for exploratory research with predictive objectives. PLS-SEM is chosen over covariance-based SEM due to its flexibility with sample size requirements, minimal distributional assumptions, and capability to handle models with both reflective and formative constructs. The analysis process follows a systematic two-stage approach that includes comprehensive evaluation of both measurement model (outer model) and structural model (inner model) components.

The measurement model evaluation phase assesses construct validity and reliability through multiple criteria including factor loadings, Average Variance Extracted (AVE), composite reliability, and Cronbach's Alpha. Cross-loadings and Fornell-Larcker criteria are examined to establish discriminant validity. The structural model evaluation examines path relationships between constructs, assesses predictive accuracy through R-square values, and evaluates model fit indices including Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI). Hypothesis testing is conducted using bootstrapping procedures with 100 subsamples to generate reliable estimates for statistical inference, with significance levels assessed through t-statistics (>1.96) and p-values (<0.05). Effect sizes are calculated to determine the practical significance of relationships, and predictive relevance is assessed through Q-square values to evaluate the model's predictive capability.

B. Research Method

This study employs a quantitative approach using the SERVQUAL framework to examine the influence of User Experience on Customer Engagement in the Grab application among Generation Z users aged 13-28 years. Data collection was conducted through online questionnaires distributed via purposive sampling to reach active Grab users within the Sukabumi region. A total of 200 questionnaires were distributed through social media platforms (Instagram, WhatsApp groups, Telegram channels) and university partnerships over six weeks from March to April 2024.

The purposive sampling method was specifically chosen to ensure participants met strict inclusion criteria including minimum 3 months of active Grab registration and completion of at least 5 transactions within the month preceding the survey. This sampling approach aligns with the research objectives by targeting Generation Z users with sufficient platform experience to provide meaningful insights into service quality perceptions and engagement behaviors. From the 200 distributed questionnaires, 163 responses were received (81.5% response rate). After data screening to eliminate incomplete responses and participants not meeting criteria, 150 valid responses were retained for analysis, representing a 75% effective response rate that exceeds recommended thresholds for SEM analysis.

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The final sample of 150 respondents demonstrates representative characteristics of Indonesian Generation Z Grab users in the Sukabumi region. Gender distribution shows a clear majority of female respondents with 107 participants (71.3%), while male respondents comprise 43 participants (28.7%). This distribution reflects the higher propensity of female users to participate in online surveys and their active engagement with ride-hailing services, particularly for safety and convenience considerations.

Age distribution within the Generation Z cohort reveals concentration in early adulthood years, with the majority falling within the 20-23 age range. Specifically, 22-year-old respondents represent the largest group with 48 participants (32.0%), followed by 23-year-old respondents with 45 participants (30.0%), and 20-year-old respondents with 25 participants (16.7%). The remaining age groups show smaller representation, with 21-year-olds comprising 10 participants (6.7%), 24-year-olds and 25-year-olds each representing 8-10 participants (5.3-6.7%), and the youngest groups of 18-19 years comprising only 2 participants each (1.3%).

Occupational characteristics reveal that the sample is predominantly composed of students, with students representing 93 respondents (62.0%). This is followed by government/private/state-owned enterprise employees with 33 respondents (22.0%), entrepreneurs with 17 respondents (11.3%), and those currently unemployed with 7 respondents (4.7%). The high proportion of students aligns with the age distribution and reflects Generation Z's status as digital natives who frequently rely on ride-hailing services for their daily mobility needs.

Monthly Grab usage patterns demonstrate active engagement levels among respondents. The most common usage frequency is 10-15 times per month, representing 66 respondents (44.0%), indicating regular reliance on the platform. This is followed by 5-10 times per month usage with 38 respondents (25.3%), 15-20 times per month with 29 respondents (19.3%), and heavy users with more than 20 monthly transactions comprising 17 respondents (11.3%). These usage patterns confirm that respondents have sufficient experience with the Grab platform to provide informed evaluations of service quality and user experience dimensions.

The descriptive analysis (Table 1) reveals varied patterns across service quality dimensions and user experience measures. Among SERVQUAL dimensions, Assurance demonstrates the highest perception (M = 19.61, SD = 4.263), indicating strong user confidence in Grab's security and trustworthiness. Responsiveness (M = 19.16, SD = 4.597) and Empathy (M = 19.25, SD = 4.492) show similarly positive evaluations, reflecting satisfaction with service speed and personalized attention. Tangibles (M = 19.07, SD = 4.494) indicates positive perceptions of interface design and technological quality. Reliability shows the lowest mean (M = 18.59, SD = 4.398) among SERVQUAL dimensions, suggesting potential improvement areas in service consistency.

User Experience demonstrates a mean score of 11.42 (SD = 2.957), indicating generally positive perceptions of interface design and interaction quality. The relatively low standard deviation suggests consistent experiences across users. Customer Engagement shows a mean of 15.56 (SD = 3.859), reflecting moderate to high engagement levels with considerable variation among respondents. The range from minimum to maximum values across all constructs (8-25 for SERVQUAL dimensions, 4-15 for UX, 7-20 for Customer Engagement) indicates sufficient variance for meaningful statistical analysis and suggests that the measurement instruments effectively captured different levels of user perceptions and behaviors.

Table 1. Descriptive Analysis

Descriptive Statistics						
	N	Min	Max	Mean		Std. Deviation
	Stat.	Stat.	Stat.	Stat.	Std. Error	Stat.
TA	150	8	25	19.07	.367	4.494
RB	150	10	25	18.59	.359	4.398
RP	150	8	25	19.16	.375	4.597
AS	150	10	25	19.61	.348	4.263
EP	150	8	25	19.25	.367	4.492
EX	150	4	15	11.42	.241	2.957
CE	150	7	20	15.56	.315	3.859

III. RESULT AND DISCUSSION

A. Evaluation Outer Model

The outer model evaluation is a fundamental step in PLS-SEM analysis designed to assess the quality of research instruments before conducting hypothesis testing on the structural model [18]. This stage involves testing the validity and reliability of all research constructs including the five SERVQUAL dimensions (Tangibles, Reliability, Responsiveness, Assurance, and Empathy), User Experience, and Customer Engagement. The outer model evaluation is conducted through two main approaches: convergent validity, which measures the high correlation level among indicators within a single construct, and discriminant validity, which ensures that each construct is statistically different from other constructs. Additionally, construct reliability is assessed using Composite Reliability and Cronbach's Alpha to ensure internal consistency of the research instrument. The results of this measurement model evaluation will determine data suitability for further analysis and provide a strong foundation for hypothesis testing interpretation.

1. Validity Convergent

The validity convergent assessment was conducted through outer loading factor analysis and Average Variance Extracted (AVE) evaluation (Table 2). Based on the outer loading matrix results, 30 out of 32 indicators demonstrated loading factor values above the 0.7 threshold, indicating strong contribution to their respective constructs [19]. The Customer Engagement construct showed the best performance with all indicators (CE1-CE4) having loading factors ranging from 0.808 to 0.906. User Experience also demonstrated excellent results with indicator UX3 achieving the highest value of 0.919.

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However, two indicators showed loading factors below 0.7: RB4 (0.652) in the Reliability construct and RP5 (0.601) in the Responsiveness construct. These indicators were removed from the research model for not meeting the established convergent validity criteria.

Table 2. Validity Convergent

Variable	Indicator	Outer Loading	Status
Tangibles	TB1	0.813	Valid
	TB2	0.847	Valid
	TB3	0.820	Valid
	TB4	0.885	Valid
	TB5	0.755	Valid
Reliability	RB1	0.796	Valid
	RB2	0.752	Valid
	RB3	0.872	Valid
	RB4	0.652	Invalid
	RB5	0.768	Valid
Responsiveness	RP1	0.795	Valid
	RP2	0.868	Valid
	RP3	0.749	Valid
	RP4	0.783	Valid
	RP5	0.601	Invalid
Assurance	AS1	0.886	Valid
	AS2	0.877	Valid
	AS3	0.870	Valid
	AS4	0.801	Valid
	AS5	0.889	Valid
Empathy	EP1	0.820	Valid
	EP2	0.849	Valid
	EP3	0.847	Valid
	EP4	0.738	Valid
	EP5	0.819	Valid
User Experience	UX1	0.800	Valid
	UX2	0.803	Valid
	UX3	0.919	Valid
Customer Engagement	CE1	0.808	Valid
	CE2	0.906	Valid
	CE3	0.879	Valid
	CE4	0.905	Valid

The AVE assessment (Table 3) revealed that all constructs achieved optimal convergent validity with values above the minimum threshold of 0.5. Customer Engagement recorded the highest AVE value of 0.767, followed by User Experience with 0.760, indicating that both constructs contribute to more than 76% of their indicators' variance. Among SERVQUAL dimensions, Assurance showed the highest AVE (0.692), followed by Tangibles (0.681), Empathy (0.656), Responsiveness (0.640), and Reliability (0.568). Although Reliability had the lowest AVE value, it still met the convergent validity criteria. These results confirm that each construct has adequate convergent validity, with indicators within each construct highly correlated and capable of explaining more than half of the measured construct's variance.

Table 3. Analytic AVE

Variable	Average Variance Extracted (AVE)	Status
Tangibles (TB)	0.681	Reliable
Reliability (RB)	0.568	Reliable
Responsiveness (RP)	0.640	Reliable
Assurance (AS)	0.692	Reliable
Empathy (EP)	0.656	Reliable
User Experience (UX)	0.760	Reliable
Customer Engagement (CE)	0.767	Reliable

2. Validity Discriminant

Discriminant validity was assessed using two approaches: Fornell-Larcker Criterion and Cross Loading analysis. The Fornell-Larcker Criterion results (Table 4) showed that all constructs met good discriminant validity criteria, with the square root of AVE for each construct being greater than the correlation values between that construct and others. Customer Engagement demonstrated the highest square root AVE value of 0.876, followed by User Experience (0.872), and Responsiveness (0.849). The highest inter-construct correlation was observed between User Experience and Customer Engagement (0.945), indicating a very strong relationship between user experience and customer engagement, which is theoretically consistent with customer experience theory.

Table 4. Fornell Larcker Criterion Test

Variable	TB	AS	RB	RP	EP	UX	CE
TB	0.825						
AS	0.821	0.832					
RB	0.883	0.799	0.750				
RP	0.892	0.837	0.800	0.849			
EP	0.889	0.917	0.810	0.815	0.810		
UX	0.803	0.902	0.761	0.813	0.878	0.872	
CE	0.860	0.885	0.716	0.750	0.877	0.945	0.876

The cross loading analysis confirmed that most indicators met good discriminant validity criteria, with each indicator showing higher loading factors on its intended construct compared to other constructs (Table 5). This indicates that each indicator can effectively distinguish the construct it measures from other constructs. The results demonstrate that the research instrument has adequate discriminant validity for proceeding with structural model analysis, with the note that result interpretation should consider the conceptual overlap between some dimensions in the digital application context.

Table 5. Cross Loading Test

Indicator	TB	AS	RB	RP	EP	UX	CE
TB1	0.739	0.749	0.657	0.674	0.784	0.813	0.776
TB2	0.789	0.692	0.729	0.709	0.731	0.847	0.677
TB3	0.796	0.660	0.730	0.714	0.696	0.820	0.693
TB4	0.837	0.864	0.802	0.728	0.774	0.885	0.833
TB5	0.616	0.640	0.750	0.656	0.679	0.756	0.613
AS1	0.896	0.803	0.808	0.603	0.743	0.788	0.781

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AS2	0.827	0.924	0.803	0.638	0.739	0.765	0.790
AS3	0.675	0.539	0.695	0.773	0.680	0.673	0.594
AS4	0.901	0.684	0.757	0.689	0.674	0.763	0.713
AS5	0.889	0.796	0.755	0.676	0.661	0.885	0.815
RB1	0.545	0.494	0.657	0.796	0.578	0.688	0.547
RB2	0.664	0.611	0.621	0.753	0.651	0.672	0.645
RB3	0.610	0.557	0.717	0.872	0.700	0.751	0.616
RB5	0.714	0.596	0.679	0.757	0.695	0.695	0.622
RP1	0.680	0.543	0.631	0.590	0.795	0.649	0.566
RP2	0.623	0.589	0.835	0.676	0.888	0.665	0.650
RP3	0.646	0.592	0.638	0.692	0.749	0.670	0.623
RP4	0.746	0.643	0.737	0.758	0.783	0.831	0.760
EP1	0.636	0.555	0.639	0.649	0.779	0.665	0.684
EP2	0.799	0.918	0.831	0.631	0.613	0.754	0.893
EP3	0.702	0.601	0.847	0.674	0.650	0.657	0.615
EP4	0.605	0.638	0.738	0.847	0.667	0.753	0.600
EP5	0.674	0.570	0.810	0.658	0.609	0.660	0.566
UX1	0.755	0.654	0.733	0.785	0.812	0.849	0.800
UX2	0.799	0.916	0.831	0.631	0.613	0.754	0.893
UX3	0.906	0.879	0.791	0.597	0.723	0.774	0.919
CE1	0.698	0.808	0.735	0.552	0.716	0.696	0.711
CE2	0.792	0.806	0.776	0.663	0.597	0.751	0.844
CE3	0.866	0.879	0.791	0.597	0.723	0.774	0.919
CE4	0.803	0.906	0.836	0.691	0.608	0.745	0.816

B. Evaluation Inner Model

The structural model evaluation (inner model) represents the subsequent phase in PLS-SEM analysis, designed to examine the structural relationships between constructs and measure the predictive capability of the research model. This evaluation is conducted through observation of R-Square values, path coefficients, and statistical significance measures. The R-Square value describes the magnitude of the independent variable's ability to explain or influence the dependent variable. The R-Square value can also illustrate model quality, with R^2 values classified into three categories: 0.75 (strong), 0.50 (moderate), and 0.25 (weak) [20]. Path coefficients indicate the intensity and direction of relationships between constructs, while t-statistics are utilized to determine the statistical significance of these relationships at a 95% confidence level (t-value > 1.96).

1. R-Square Analysis

Based on the R-Square analysis results in Table 6, the research structural model demonstrates excellent predictive capability in explaining the variability of endogenous constructs. The Customer Engagement (CE) variable has an R-Square value of 0.893 and an R-Square Adjusted value of 0.892, indicating that 89.3% of the variation in customer engagement can be explained by the exogenous variables in the model, particularly User Experience and SERVQUAL dimensions. The nearly identical R-Square Adjusted value (0.892) indicates that the model does not experience overfitting and maintains good stability despite involving multiple predictors.

Table 6. Cronbach's Alpha Test

Variable	R-Square	R-Square Adjusted
Customer Engagement (CE)	0.893	0.892
User Experience (UX)	0.863	0.860

The User Experience (UX) variable shows an R-Square value of 0.863 and an R-Square Adjusted value of 0.860, meaning that 86.3% of the variation in user experience can be explained by the five SERVQUAL dimensions (Tangibles, Reliability, Responsiveness, Assurance, and Empathy). These results demonstrate that service quality measured through the SERVQUAL approach has a highly significant contribution in shaping the user experience of the Grab application.

Based on R-Square evaluation criteria, both R-Square values are categorized as "strong" since they are above 0.75, indicating that the research model has excellent predictive capability. The high R-Square values on both endogenous constructs confirm that the constructed structural model is highly relevant and capable of explaining the phenomenon of relationships between SERVQUAL service quality, User Experience, and Customer Engagement in the context of the Grab application. These results provide strong empirical support for proceeding with hypothesis testing and demonstrate that the SERVQUAL approach is highly effective in evaluating digital application service quality.

The R-Square results demonstrate exceptional model performance, with Customer Engagement achieving an R^2 of 0.893, indicating that the model explains approximately 89% of customer engagement variance. This represents strong predictive capability and confirms the theoretical model's empirical validity. User Experience showed similarly impressive explanatory power (R^2 = 0.863), validating the SERVQUAL dimensions' collective influence on digital experience perceptions.

2. Hypothesis Testing

Based on the path coefficient analysis results in Table 7, out of six hypotheses tested in this study, only two hypotheses show statistically significant relationships at a 95% confidence level (t-value > 1.96 and p-value < 0.05).

Table 7. Hypothesis Test

Hypothesis	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	Result
H1	0.586	0.584	0.178	3.290	0.001	Significant
H2	-0.211	-0.211	0.133	1.705	0.088	Not Significant
H3	0.029	0.022	0.121	0.239	0.811	Not Significant
H4	0.247	0.267	0.189	1.310	0.191	Not Significant
H5	0.296	0.273	0.198	1.497	0.135	Not Significant
H6	0.945	0.947	0.011	86.372	0.000	Significant

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Hypothesis H1 stating that Tangibles positively affects User Experience is accepted with a path coefficient of 0.586 (t-statistic = 3.290, p-value = 0.001). This result indicates that physical evidence aspects such as visual appearance of the application, interface design, and feature completeness have a strong and significant influence on Grab application user experience. The significance of Tangibles as the sole SERVQUAL predictor of User Experience represents a fundamental departure from traditional service quality paradigms. This finding aligns with Media Richness Theory and Cognitive Load Theory, suggesting that Generation Z users process digital services primarily through visual and interface-mediated channels rather than interpersonal interactions.

Hypothesis H6 stating that User Experience positively affects Customer Engagement is accepted with a very high path coefficient of 0.945 (t-statistic = 86.372, p-value = 0.000). This result shows that user experience has a very strong and significant influence on customer engagement. The high path coefficient (approaching 1) indicates that almost all variation in Customer Engagement can be explained by User Experience. This finding is highly consistent with theory and empirical research showing that positive User Experience is the main driver of Customer Engagement in digital application contexts. The results reveal three key thematic insights into Generation Z's evaluation of digital ride-hailing services.

First, visual and interface design dominates user experience formation. The strong influence of tangibles aligns with Media Richness Theory, suggesting that Gen Z processes digital service cues primarily through visual and interactive channels. This is consistent with prior research in mobile commerce, yet contrasts with earlier SERVQUAL studies where interpersonal service dimensions often ranked highest.

Second, traditional interpersonal service attributes reliability, responsiveness, assurance, and empathy no longer serve as differentiators. Their lack of significant impact mirrors findings in mature e-commerce markets, where these factors have evolved into baseline expectations. Kano's model supports this interpretation, classifying them as "must-be" qualities: their absence creates dissatisfaction, but their presence no longer enhances experience. This challenges the relevance of traditional SERVQUAL weighting in mobile-first, on-demand service contexts.

Third, user experience acts as a powerful bridge to engagement. Positive UX not only drives satisfaction but fosters active participation, advocacy, and repeat usage. This echoes engagement models from digital marketing literature, where experience quality fuels emotional and behavioral commitment. Compared with studies in online banking or healthcare apps, our findings suggest that in ride-hailing, visual design and seamless interaction are more potent engagement triggers than trust or empathy factors.

From a practical standpoint, these insights indicate that ride-hailing providers targeting Gen Z should prioritize investment in interface aesthetics, navigation fluidity, and personalization algorithms. Traditional customer service improvements, while necessary for maintaining service standards, may have limited incremental effect on engagement.

3. Rejected Hypotheses:

The rejection of Hypothesis H2, which proposed that Reliability positively affects User Experience, reveals a fundamental shift in how digital natives perceive service quality. The negative path coefficient of -0.211 (t-statistic = 1.705, p-value = 0.088) challenges traditional service quality paradigms and suggests that Gen Z users have fundamentally different expectations in digital environments. This counterintuitive finding aligns with Kano's model of customer satisfaction, where reliability has evolved from a performance attribute to a basic expectation or "must-be" quality. In practical terms, this implies that Grab's investment in reliability improvements may yield diminishing returns on user experience enhancement. Instead, reliability failures are likely to cause dissatisfaction, but reliability excellence does not necessarily drive positive experiences among digital natives who consider seamless functionality as a given rather than a bonus.

The simultaneous rejection of Hypotheses H3, H4, and H5 examining Responsiveness, Assurance, and Empathy respectively reveals a cohesive pattern that fundamentally challenges the applicability of traditional SERVQUAL dimensions in Generation Z digital contexts. These three interpersonal service dimensions, while statistically non-significant, collectively demonstrate path coefficients ranging from 0.029 to 0.296, suggesting that human-centric service elements have been superseded by algorithmic and interface-driven experiences. This finding has profound practical implications for digital platform strategy, indicating that resource allocation toward traditional customer service training and empathy-building initiatives may be less effective than investments in user interface optimization and algorithmic personalization. The displacement of interpersonal service quality by digital experience quality reflects broader societal shifts where Gen Z users prefer self-service capabilities and automated interactions over human intervention, viewing efficiency and control as more valuable than personal connection.

These non-significant relationships also illuminate the unique characteristics of on-demand platforms within the broader digital ecosystem. Unlike traditional service contexts where responsiveness, assurance, and empathy serve as competitive differentiators, the commoditization of these attributes in mature digital platforms like Grab has transformed them into hygiene factors. This transformation suggests that the competitive landscape for digital platforms has evolved beyond basic service delivery toward more sophisticated value propositions centered on user experience innovation. The practical implication for platform managers is that competitive advantage now lies in creating distinctive, engaging experiences rather than perfecting traditional service delivery metrics.

The overwhelming significance of the User Experience-Customer Engagement relationship (path coefficient approaching unity) provides crucial strategic insights that extend beyond statistical validation. This finding suggests that in digital-native markets, customer engagement strategies should prioritize experience design over traditional service

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quality improvements. From a resource allocation perspective, this implies that marketing budgets, development priorities, and performance metrics should center on user experience optimization rather than conventional service quality enhancements. The strength of this relationship also indicates that user experience serves as a multiplier effect, where incremental improvements in experience design can generate disproportionate increases in customer engagement and, by extension, business performance.

The dominance of the Tangibles dimension as the sole significant predictor of User Experience reflects the visual and interface-centric nature of Gen Z digital behavior. This generation, having been raised in highly visual digital environments, demonstrates heightened sensitivity to aesthetic design, intuitive navigation, and visual coherence. The practical implications are substantial: development resources should prioritize user interface design, visual consistency, and aesthetic appeal over backend reliability improvements or customer service training programs. This finding also suggests that platform differentiation increasingly occurs at the intersection of functionality and aesthetics, where superior visual design becomes a proxy for overall service quality in users' mental models.

These collective findings necessitate a reconceptualization of service quality measurement in digital contexts, moving away from traditional SERVQUAL frameworks toward experience-centric models that better capture the preferences and behaviors of digital native generations. The results suggest that successful digital platforms must excel at creating engaging, visually appealing experiences while maintaining reliability and interpersonal service quality as baseline expectations rather than differentiating factors. This paradigm shift has significant implications for competitive strategy, suggesting that platforms should focus on experience innovation and aesthetic excellence as primary drivers of customer engagement in Generation Z markets.

IV. CONCLUSION

This study investigated how SERVQUAL service quality dimensions influence user experience and customer engagement in the Grab application among Indonesian Generation Z users. By integrating SERVQUAL with modern UX principles, it addressed a critical gap in the literature regarding the lack of research applying this combined framework to ride-hailing services for digital-native populations. The findings demonstrate a paradigm shift in service quality perceptions, revealing that for Generation Z users, interface aesthetics and usability outweigh traditional interpersonal service dimensions in shaping user experience. User experience emerges as the dominant pathway to customer engagement, underscoring its strategic importance in digital service design.

This research extends service quality theory by demonstrating the contextual limitations of traditional SERVQUAL when applied to mobile-first digital services consumed by digital natives. The study advances customer engagement theory by empirically validating user experience as a critical mediating mechanism between service quality and engagement behaviors, challenging previous models that treated these as directly related constructs. The validated integrated SERVQUAL-UX framework provides a theoretical foundation for experience-centric evaluation models specifically tailored for digital-native populations, addressing the gap between conventional service quality measurement and contemporary digital service realities.

For Grab and similar ride-hailing platforms, the findings suggest prioritizing interface design optimization, visual coherence enhancement, and interaction simplicity as primary engagement drivers. Platforms should invest heavily in user interface development, ensuring intuitive navigation, aesthetically pleasing design elements, and seamless user journeys while maintaining service reliability as a baseline standard. Marketing strategies should emphasize user experience benefits rather than traditional service features, and platform developers should implement continuous UX testing and iteration cycles specifically designed for Generation Z preferences. Additionally, customer engagement initiatives should focus on experience-enhancing features such as personalized interfaces, gamification elements, and social sharing capabilities that resonate with digital-native behavioral patterns.

This study's limitations include its focus on a single platform (Grab), restriction to Indonesian Generation Z users in the Sukabumi region, and cross-sectional design that prevents causal inference establishment. The sample's demographic homogeneity (predominantly female students) may limit generalizability across different user segments. Future research should examine the framework's applicability across multiple ride-hailing platforms (Gojek, Uber) to test cross-platform validity, investigate generational differences by comparing Generation Z findings with Millennial and Generation X users, and conduct longitudinal studies to establish causal relationships between service quality improvements and engagement changes. Additionally, research should explore cultural variations by replicating the study in other Southeast Asian markets and examine specific UX subdimensions (usability, hedonic experience, interaction flow) to provide more granular insights for platform optimization strategies.

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