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Enhancing Digital Service Quality in Real Estate Platforms with AI-Augmented E-SERVQUAL and Topic Modeling

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ABSTRACT

Digitalization has accelerated the growth of the property technology (proptech) industry, particularly in real estate marketplaces. As competition intensifies, platforms must enhance their digital service quality to meet the evolving needs of both users and agents. This study aims to develop an improvement model by focusing on the service dimension with the highest gap between importance and performance. A mixed-methods approach was employed using user reviews collected from Google Play, comprising a total of 400 reviews from the four most widely used real estate applications in Indonesia. The analysis considered importance (aspects most frequently discussed) and performance (aspects with the highest ratings). Thematic analysis of user and agent feedback was first conducted to construct the initial E-SERVQUAL model. This qualitative insight was then validated using Latent Dirichlet Allocation (LDA) and refined through Importance–Performance Analysis (IPA) to identify key service gaps. Results show that the System Availability dimension, particularly subdimension X19 (core feature functionality), exhibits the largest gap score of 3.464, placing it in the top-priority quadrant. LDA results reinforce this finding through Topic 6, which highlights complaints about app quality, especially regarding property advertisements and listing accuracy. To address this, the study proposes an AI-augmented core feature functionality model that integrates ad optimization, intelligent listing validation, and automated error detection to enhance operational efficiency, system accuracy, and overall user experience. The findings are particularly relevant for PT ABC, a new real estate platform currently facing declining performance. By benchmarking user feedback from top Indonesian property marketplaces, this study provides strategic insights for improving service quality, competitiveness, and digital transformation within the proptech ecosystem.

Keywords: e-servqual, property technology, real-estate marketplace, importance-performance analysis, core feature functionality

ABSTRAK

Digitalisasi telah mempercepat pertumbuhan industri teknologi properti (proptech), terutama di pasar real estat. Seiring meningkatnya persaingan, platform harus meningkatkan layanan mereka untuk memenuhi kebutuhan pengguna dan agen. Studi ini bertujuan untuk mengembangkan model peningkatan dengan berfokus pada dimensi layanan dengan kesenjangan tertinggi antara kepentingan dan kinerja. Pendekatan metode campuran digunakan, dimulai dengan analisis tematik umpan balik pengguna dan agen untuk membangun model E-SERVQUAL awal. Wawasan kualitatif ini divalidasi menggunakan Latent Dirichlet Allocation (LDA) dan disempurnakan melalui Importance–Performance Analysis (IPA) untuk mengidentifikasi kesenjangan layanan utama. Hasil menunjukkan bahwa dimensi Ketersediaan Sistem, terutama subdimensi X19 (fungsionalitas fitur inti), memiliki skor kesenjangan tertinggi sebesar 3,464 dan berada dalam kuadran prioritas utama. LDA mengonfirmasi hal ini melalui Topik 6, menyoroti keluhan tentang kualitas aplikasi, terutama yang terkait dengan iklan properti dan akurasi daftar. Untuk mengatasi hal ini, studi ini mengusulkan model fungsionalitas fitur inti yang diperkuat AI yang menggabungkan optimasi iklan, validasi daftar cerdas, dan deteksi kesalahan otomatis. Model ini bertujuan untuk meningkatkan efisiensi operasional, akurasi sistem, dan pengalaman pengguna. Temuan ini khususnya relevan bagi PT ABC, sebuah platform real estat baru yang saat ini mengalami penurunan kinerja. Dengan membandingkan umpan balik pengguna dari berbagai marketplace real estat terkemuka di Indonesia, studi ini menawarkan wawasan strategis untuk meningkatkan kualitas layanan dan daya saing di lanskap proptech.

Kata kunci: e-servqual, teknologi properti, pasar real estat, analisis kepentingan-kinerja, fungsionalitas fitur inti

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1. Introduction

The rapid growth of digital technology in Indonesia has driven the expansion of the property technology (proptech) industry, particularly real estate marketplaces. This transformation aligns with Indonesia's Digital Vision 2045, which emphasizes the role of digitalization in boosting future economic and social development (Kementerian Komunikasi dan Informatika Republik Indonesia, 2023). The property sector continues to play a significant role in Indonesia's economic growth, contributing approximately 15% to the national GDP in 2023, according to the Property Market Report 2023 published by the Lembaga Manajemen Aset Negara (Lembaga Manajemen Aset Negara, 2023). This strong performance underscores the sector's strategic position within the national economy and its potential to support sustainable development. The growth of the property industry has also been reinforced by the rapid advancement of property technology (*proptech*), with 32 active startups identified in Indonesia—59% of which operate as digital marketplaces (Kharisma, 2024). This trend indicates that digital transformation has become a pivotal factor in reshaping the real estate landscape, particularly in how consumers search for, evaluate, and transact property online.

Proptech reflects the integration of advanced technologies into real estate services (Siniak et al., 2020), but the dominance of automated, impersonal interactions can reduce trust, raise uncertainty, and weaken customer relationships (Muljono & Setiyawati, 2022). Enhancing user experience and service quality has become a key priority for platforms seeking to remain competitive in a dynamic market. One such platform is PT ABC, a relatively new real estate marketplace offering a variety of integrated services, including property transactions, household services, and mortgage facilitation. However, internal data indicates that 67% of user interactions are concentrated on household services, suggesting that its core property trading feature remains underutilized (Afraah et al., 2023).

Given this condition, the E-SERVQUAL model becomes relevant as a framework to assess and redesign digital service quality (Halvorsrud et al., 2016). Previous studies have implemented the E-SERVQUAL model to enhance customer satisfaction (Sinarta & Haryani, 2025; Wulan et al., 2024). Moreover, E-SERVQUAL has been widely applied to similar challenges in various domains such as the IT industry (Elmobark et al., 2023), video player and editor applications (Ariyanti et al., 2023), *public procurement platforms* (MIR et al., 2024), and Islamic financial and technical applications (Helmi et al., 2024). E-SERVQUAL functions as a framework for assessing service quality in digital environments, with its dimensions adaptable to various digital business processes, especially on digital platforms (Sindi, 2024). Bonina et al. (Bonina et al., 2021), associate digital platforms with a variety of startup models that leverage internet-based applications to mediate transactions across multiple user groups while harnessing network effects. In this research, the term "platform" specifically refers to real estate transaction platforms in Indonesia, which are accessible via digital app marketplaces such as the Google Play Store.

To support the evaluation of E-SERVQUAL dimensions on digital platforms, this study employs thematic analysis and Latent Dirichlet Allocation (LDA) to analyze user reviews. This combination enables both automatic topic extraction and deeper interpretation of user perceptions. Such an approach has been widely applied in previous research. For instance, thematic analysis and LDA have been used to evaluate user sentiment and extract dominant themes from mobile diabetes app reviews (Ossai & Wickramasinghe, 2023), compare multi-brand review characteristics on e-commerce platforms (Guo et al., 2022), and explore IT freelancers' challenges through thematic analysis of digital forum discussions (Gussek et al., 2023). These studies demonstrate the relevance of integrating LDA with thematic analysis to identify the key dimensions and subdimensions of service that matter most to digital platform users.

In parallel, current innovation and product development strategies are increasingly intertwined with the application of Artificial Intelligence (AI). AI has been successfully integrated into Customer Relationship Management (CRM) systems to optimize engagement and personalization (Calvo et al., 2023; Chatterjee et al., 2020), acted as a moderating tool for voice-of-customer initiatives and product lifecycle management (Armutcu et al., 2025), improved operational efficiency in sectors like furniture manufacturing (Adiguzel et al., 2025), and enhanced service delivery in the tourism and hospitality industries (Dwivedi et al., 2024). These applications illustrate AI's potential to deliver practical solutions and improve digital service experience quality (Stanciu & Rîndaşu, 2021).

Building on this foundation, the present study aims to support PT ABC's strategic development by benchmarking user feedback from leading real estate platforms in Indonesia. It makes three key contributions: (1) analyzing and reconstructing the E-SERVQUAL model through thematic analysis and LDA for empirical validation, (2) identifying service quality gaps using Importance–Performance Analysis (IPA), and (3) proposing an AI-enhanced service model to address the most critical service quality gaps.

2. Methods

The selection of real estate marketplace samples were conducted using a purposive sampling approach. This decision was based on their market popularity, diversity of business models, and accessibility of user data

relevant to analyzing digital service quality within Indonesia's online property sector. These platforms represent the most visited and influential players in the national real estate marketplace ecosystem, offering a comprehensive range of services from property listings and virtual tours to user interaction features. Their inclusion ensures that the study captures a representative and comparative perspective on how different marketplace models deliver and manage digital service quality, thus strengthening the generalizability and analytical rigor of the findings. The research framework is illustrated in Figure 1. This recommendation is also to improve the customer journey on real-estate marketplace to increase customer experience (Afraah & Aghniya, 2025).

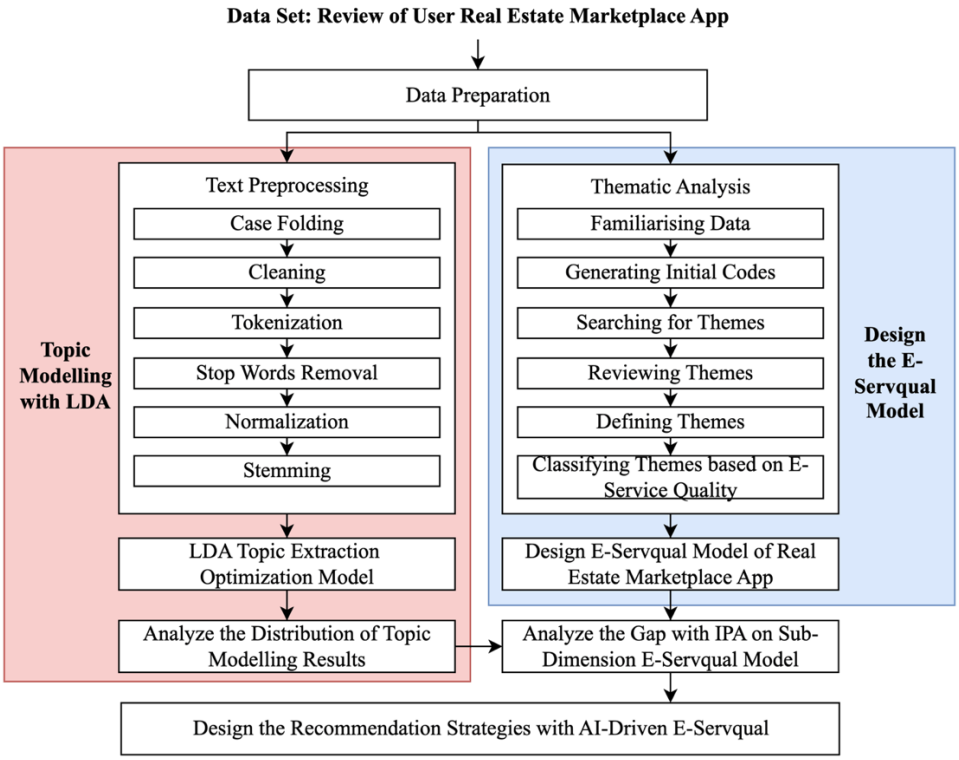

Figure 1. Research Flow

2.1 Data Preparation

User reviews were collected from Google Play using the Sort.MOST_RELEVANT filter, which prioritizes reviews with higher engagement metrics such as likes, replies, and perceived helpfulness. This option was chosen because reviews categorized as most relevant tend to provide more detailed, meaningful, and contextually rich feedback, allowing for a deeper qualitative interpretation. In contrast, many entries under the Most Recent filter consist of very short, vague, or even emoji-only comments, which contribute little analytical value and may distort textual analysis outcomes. Therefore, the Most Relevant dataset was considered more suitable for identifying substantive user perceptions regarding the functionality and service quality of property marketplace applications.

Nevertheless, this method could introduce exposure and negativity bias, as reviews with higher visibility and user interaction are more likely to appear. To address this limitation, a sensitivity analysis was conducted by comparing thematic and topic distributions between datasets sorted by Most Relevant and Most Recent. The comparison showed no significant variation in the dominant themes or topic proportions, suggesting that the findings are robust and methodologically consistent across different data-sorting criteria.

The study analyzed user-generated reviews from four leading property marketplace applications in Indonesia—Lamudi, 99.co Indonesia, Trovit, and Rumah123. A total of 400 reviews (100 per application) were collected from Google Play Store using the *Sort.MOST_RELEVANT* filter between 2018-2024. Only reviews written in Bahasa Indonesia was included to ensure semantic consistency and contextual relevance. Prior to analysis, all duplicate entries, advertisements, and non-textual responses (e.g., emoji-only or repetitive spam comments) were removed. Additionally, reviews showing signs of bot-generated or template-like patterns were excluded through manual inspection and keyword-based filtering. This cleaning process ensured that the final dataset reflected authentic and informative user experiences suitable for qualitative and text-mining analysis.

2.2 Topic Modelling with LDA

The collected data underwent several preprocessing stages to ensure consistency and accuracy. First, case folding was applied to convert all text to lowercase, preventing redundancy in word analysis. Second, cleaning was conducted by removing irrelevant characters such as numbers, punctuation marks, and URLs. Third, tokenization was performed to split the text into individual words or tokens. Fourth, stop word removal eliminated commonly used words with minimal analytical value, such as "ya," "tapi," "tidak," "saja," "yang," "pakai," and "sih." Fifth, normalization standardized different word forms. Lastly, stemming reduced words to their root form. After preprocessing, the cleaned data was analyzed using the LDA model to extract key topics and map their distribution across user reviews.

2.3 Design the E-Servqual Model

Thematic analysis was conducted manually using a structured six-phase framework to ensure accurate and meaningful interpretation (Braun & Clarke, 2006) (Braun & Clarke, 2006). First, familiarization with the data involved repeatedly reading user reviews to understand the overall content and context. Second, generating initial codes consisted of identifying and labeling key words, phrases, or text segments related to user experience and digital service quality. Third, during the searching for themes phase, the generated codes were grouped into broader thematic categories based on emerging patterns across reviews. Fourth, reviewing themes was performed to refine and validate the thematic structure by merging similar themes and removing redundancies. Fifth, in the defining and naming themes stage, each theme was clearly articulated with distinct conceptual boundaries and operational definitions. Sixth, all finalized themes were classified according to the E-SERVQUAL dimensions proposed by (Li & Suomi, 2009) to align the findings with the established digital service quality framework. To ensure the reliability and consistency of manual coding, two independent coders were involved in the thematic analysis process. The level of agreement between coders was assessed using Cohen's Kappa coefficient. Any discrepancies were discussed and resolved through consensus before finalizing the theme structure.

2.4 Analyze the Gap with IPA on Sub-Dimension E-Servqual Model

In the next stage, the Importance–Performance Analysis (IPA) method was applied to evaluate service quality gaps within each dimension and subdimension of the E-SERVQUAL model. This approach quantitatively compares users' perceived importance and performance values, both derived from the text-based analysis of user reviews. The analytical unit in this study was a review, not an individual respondent; therefore, all equations and variable definitions were adjusted accordingly to represent text-based data rather than survey responses. Equations (1)–(3) were revised for clarity to ensure all mathematical symbols were properly represented.

Equation (1) calculates the average performance score (Xi) for each subdimension based on the sentiment polarity of review j. Equation (2) defines the importance score (Yi) as a normalized measure of mention frequency, based on the assumption that attributes appearing more frequently across user reviews are perceived as more salient and cognitively prioritized by users. This interpretation is supported by Alaimo & Kallinikos (2022), who conceptualize data as epistemic artifacts that mediate organizational knowledge in digital contexts. Within this framework, user reviews operate as *data objects* through which platforms perceive user priorities, making the recurrence of particular themes an indicator of their relative importance. Equation (3) computes the percentage gap (%Gap$_i$) between inferred importance and performance values, highlighting subdimensions that require managerial attention.

To validate and enrich the interpretation, the resulting subdimensions with the largest gaps were cross-verified using Latent Dirichlet Allocation (LDA) topic modeling, focusing on the most frequently discussed and sentimentally polarized topics. This dual-analysis framework served as a diagnostic tool to prioritize and design targeted service improvement strategies. The gap calculation was developed and refined from the performance–importance suitability model proposed by Fahriza et al. (2023), adapted to accommodate a text-based data structure in the context of digital real estate marketplaces.

$$\boldsymbol{Xi} = \frac{\mathbf{1}}{\boldsymbol{n}} \sum_{\boldsymbol{j=1}}^{\boldsymbol{ni}} \boldsymbol{x_{ij}} \tag{1}$$

$$\boldsymbol{Yi} = \frac{(\boldsymbol{n_i})^2}{\boldsymbol{S_{max}\, x\, N}} \tag{2}$$

$$\%\boldsymbol{Gapi} = \frac{\boldsymbol{Xi}}{\boldsymbol{Yi}}\ \boldsymbol{x}\ \mathbf{100}\% \tag{3}$$

Where:

Xi : The average performance score for subdimension i, derived from the sentiment score of

all reviews that mention subdimension i.
x_{ij} : The performance score (sentiment polarity) of subdimension i in review j.
n_i : The number of reviews that contain references to subdimension i.
Yi : The importance score for subdimension i, calculated based on normalized mention frequency to represent salience of the theme.
S_{max} : The maximum possible sentiment score, standardized on a 5-point scale (e.g., +5 = very positive).
N : The total number of reviews analyzed across all subdimensions.
$\%Gap_i$: The importance-performance gap expressed as a percentage, used to identify priority attributes for improvement.

2.5 Design the Recommendation Strategies with AI-Driven E-Servqual

Based on the results of LDA, thematic analysis and IPA, a set of strategic recommendations is formulated. These recommendations serve as prescriptive solutions for improving service quality dimensions, particularly those with performance gaps. Each recommendation addresses specific issues identified within the existing E-SERVQUAL dimensions.

3. Result and Discussion

3.1 Data Preparation

Electronic marketplaces are platforms where buyers and sellers conduct transactions through electronic means (Wang & Archer, 2007). These platforms may be physical, virtual, or conceptual in nature. In the context of real estate marketplaces, customers or property seekers act as buyers, while agents who list properties for sale serve as sellers. Therefore, both parties play an integral role in the operational dynamics of the marketplace ecosystem. The real estate business is defined as commercial activity related to land and buildings (Samosir, 2024).

Based on the data presented in Figure 2, a total of 400 user reviews were analyzed, comprising 38.8% from customers and 61.3% from agents. The stakeholder classification process was manually conducted by two independent coders, and the Cohen's Kappa coefficient was calculated to assess inter-coder reliability, yielding a value of 0.797, which indicates substantial agreement between coders (Landis & Koch, 1977). This strong level of agreement confirms the consistency and validity of the stakeholder categorization used in the analysis.

The results indicate that PropTech adoption within real estate marketplaces has gained significant traction among property agents as a means to expand their sales outreach. Conversely, customer engagement with these platforms remains relatively limited. This pattern is reflected in the distribution of user ratings shown in Figure 2b, where 53.2% of the total reviews assigned a rating of 1 ("strongly dissatisfied"). However, since the data were collected using the *MOST_RELEVANT* filter on Google Play, potential exposure and negativity bias may have influenced the prominence of negative reviews. To address this concern, a sensitivity test was conducted by comparing the rating distribution with data obtained from the *MOST_RECENT* filter, which produced consistent results. This robustness check supports the validity of the observed dissatisfaction trend. Overall, these findings emphasize the need for enhanced service quality and user experience to strengthen customer trust and encourage broader adoption of PropTech-based real estate solutions.

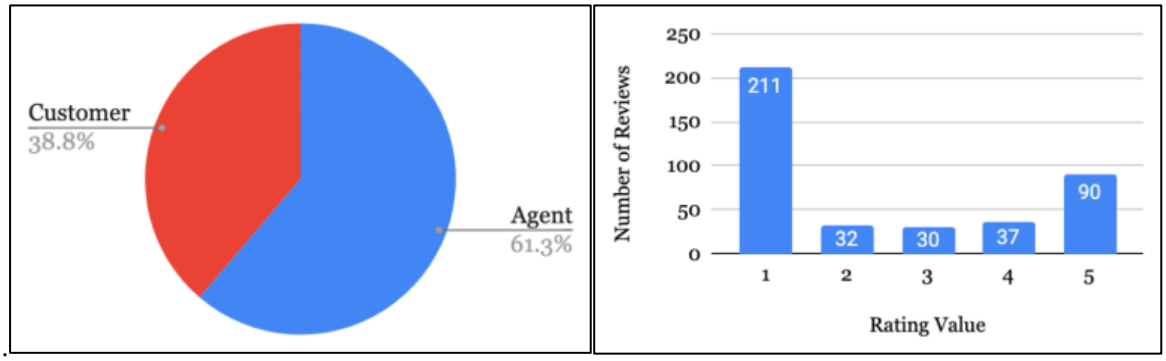

Figure 2. Distribution of User Reviews (a) Comparison of Stakeholder Types in Submitted Reviews (b) Rating Scores Provided by Reviewers

3.2 Topic Modelling with LDA

Figure 3 presents the results of evaluating the optimal number of topics in topic modeling using the LDA method. The horizontal axis (x-axis) represents the number of topics tested, while the vertical axis (y-axis) shows the coherence score, a metric used to measure the interpretive quality of the topics generated. Based on Figure 3, the highest coherence score was achieved when the number of topics was nine, with a value of 0.3427. This indicates that the model with nine topics produced the most semantically consistent topics. Therefore, nine topics were selected as the optimal number for this study, as they offered the best balance between informational granularity and interpretability.

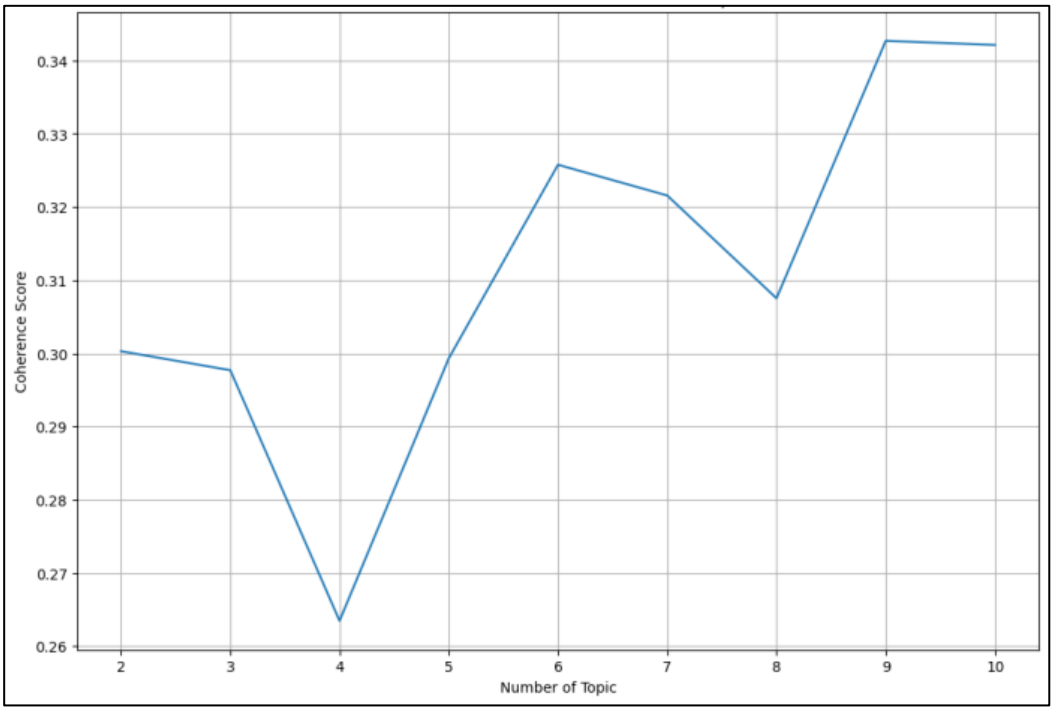

Figure 3. Coherence Score based on Number of Topic

The topic modeling analysis using LDA successfully identified nine topics in user reviews of real estate marketplace applications, labeled as Topic IDs 0 through 8 in Table 1. Each topic was interpreted based on the most frequent keywords and further validated through qualitative re-reading of the associated review documents to ensure contextual accuracy. During this validation process, several topic labels were refined to better represent their underlying meaning. For instance, Topic 6, initially labeled as "App Quality," contained general keywords such as *ad, app, good, sell, property,* and *post*, which did not explicitly reflect the conceptual construct of app quality. Through qualitative examination of the corresponding reviews, this topic was found to focus more on users' experiences, ease of use, and functional interaction with the app, and was therefore redefined as "User Experience and Usability." This human validation approach enhanced topic coherence and ensured that each theme accurately represented user perceptions. as the most frequently discussed themes, each associated with over 65 review documents.

Table 1. Topic and Keywords Analysis

ID Topic	Top Keywords	Topic Interpretation	Distribution Number
0	ad, post, Lamudi, app, contact, number, uninstall, directly, better, send	Ads and Contact	45
1	house, sell, search, rent, app, appear, price, name, time, help	Property Search	39
2	code, guy, enter, time, weird, number, poor, try, add, WhatsApp	Verification Issues	25
3	property, buy, easy, application, response, new, coin, download, available, Indonesia	Transaction Convenience	39
4	ad, app, sell, buy, post, update, property, view, menu, level	App and Ad Updates	41
5	ad, listing, search, house, post, match, app, easy, help, price	Search and Property Match	67

ID Topic	Top Keywords	Topic Interpretation	Distribution Number
6	ad, app, good, sell, property, post, fit, give, help	App Quality	70
7	login, email, app, account, password, wrong, verification, retry, enter, OTP	Login Issues	43
8	app, select, ad, pay, difficult, photo, please, good, user, upload	Payment and Upload Issues	42

These findings indicate that concerns regarding overall app quality and the accuracy of property search and match functions are central to the user experience. This observation aligns with prior studies emphasizing the importance of e-service quality, particularly usability and search effectiveness, as key drivers of user satisfaction and loyalty in digital property platforms (Yalçın & Çatlı, 2024). The critical role of intuitive interface design in enhancing property search efficiency has also been highlighted in recent literature (da Costa, 2024), along with the growing importance of leveraging user-generated content to tailor services and interfaces to user expectations (da Costa, 2024). In conclusion, app quality and property search functionality should be prioritized in future service development efforts, as they represent the most frequently raised concerns and have significant influence on user satisfaction.

3.3 Design E-Servqual Model

Figure 4 presents the results of the thematic categorization of 400 user reviews obtained from real estate marketplace applications. Each feedback theme corresponds to a service quality sub-dimension, analyzed using manual coding with thematic analysis, and includes the number of reviews (Total Feedback) and the average review score (ranging from 1 = “Very Dissatisfied” to 5 = “Very Satisfied”).

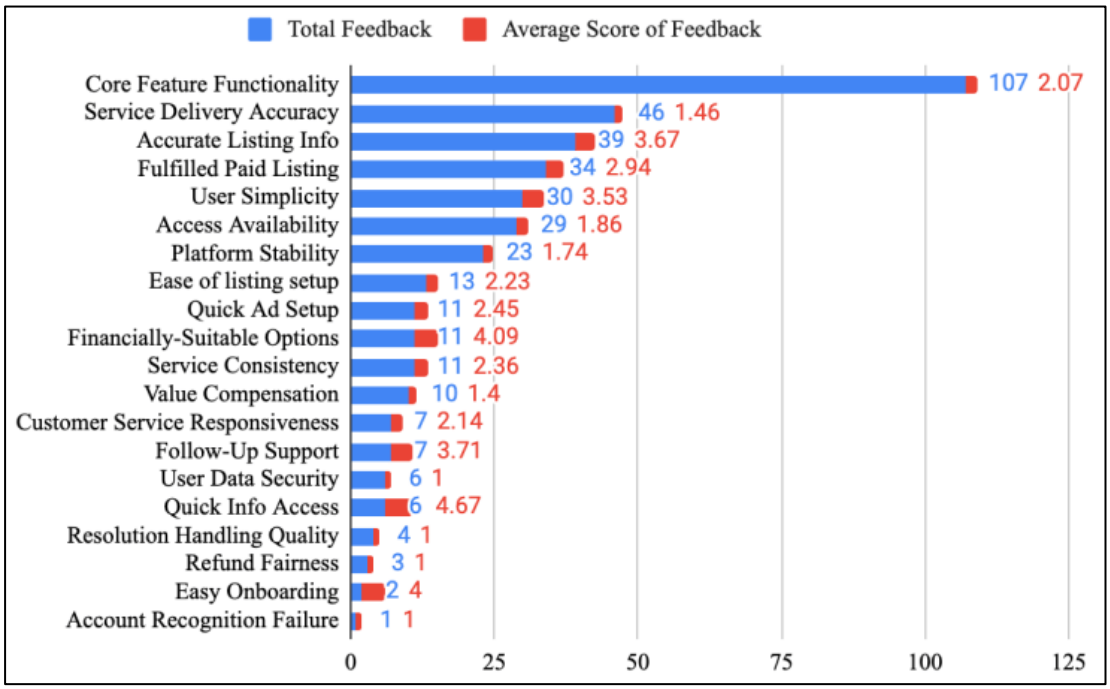

Figure 4. Themes Categorization

The most frequently mentioned theme was Core Feature Functionality, which accounted for 26.75% of the total feedback and received a relatively low average satisfaction score of 2.07, indicating significant user dissatisfaction with the core operational aspects of the platform. This was followed by Service Delivery Accuracy (11.50%) and Accurate Listing Info (9.75%), with the latter receiving a comparatively higher average score of 3.67, suggesting a mix of positive and negative experiences.

Several critical issues emerged from the analysis, particularly those with both low frequency and low satisfaction scores. These include User Data Security, Resolution Handling Quality, and Refund Fairness, all of which received the lowest possible average score of 1.00, highlighting serious concerns among users related to trust, problem resolution, and financial fairness. On the other hand, a few themes, though less frequently

mentioned, such as Quick Info Access (average score 4.67) and Financially-Suitable Options (4.09), were perceived positively, indicating that certain features are appreciated when they function properly.

In conclusion, this thematic analysis underscores that the most pressing issues faced by users are related to platform stability, core functionality, and delivery of promised services. The prevalence of low satisfaction scores across multiple dimensions suggests an urgent need for targeted service improvements. These findings form a critical input for the development of a smart E-SERVQUAL model that is responsive to real user concerns, and serve as a basis for designing AI-driven strategic recommendations aimed at enhancing service quality and increasing PropTech adoption in the real estate marketplace context.

This phase includes the development of an existing E-SERVQUAL model specifically tailored for the context of real estate marketplaces, as illustrated in Figure 5. The model organizes a total of 20 sub-dimensions, derived from the thematic analysis, into six core E-SERVQUAL dimensions: Compensation, Efficiency, Fulfillment, Reliability, Responsiveness, System Availability, and Privacy. Each dimension represents a specific area of digital service quality that is particularly relevant within the real estate marketplace ecosystem.

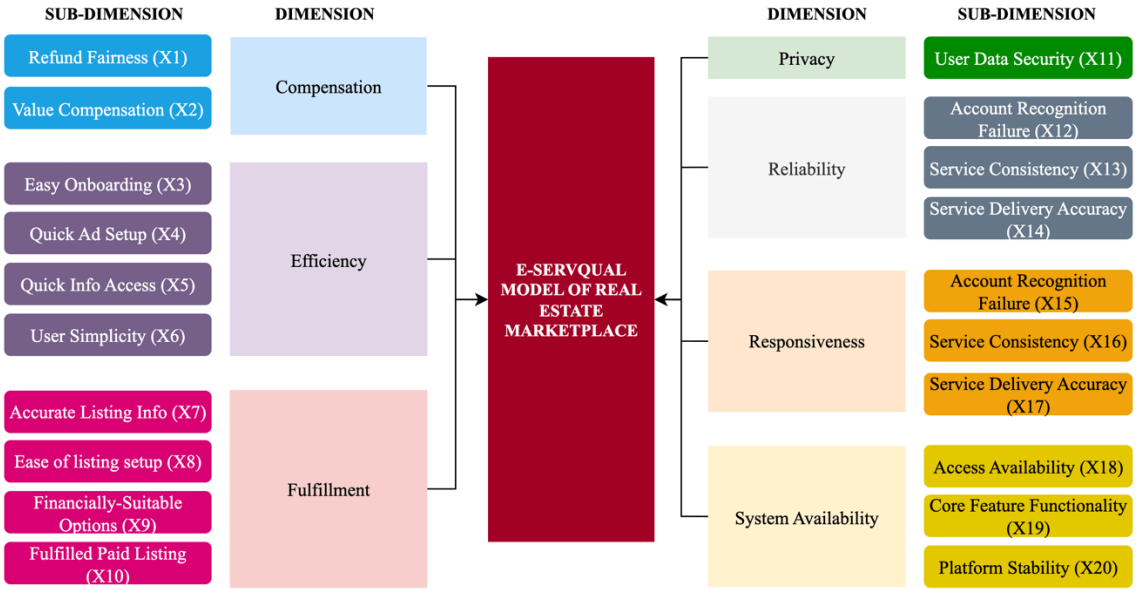

Figure 5. Model E-Servqual of Real Estate Marketplace

4. Discussions

4.1 Analysis the Gap with IPA on Sub-Dimension E-Servqual Model

At this stage, a gap analysis was conducted for each subdimension within the E-SERVQUAL model using the IPA approach. The resulting Cartesian diagram maps the position of each variable based on two axes: importance level and actual performance based on equation 1-3. Each point on the diagram represents a specific service subdimension, labeled from X1 to X20 according to the predetermined groupings. As illustrated in Figure 6, the visualization reveals that most subdimensions fall into the lower-left quadrant (low importance – low performance), indicating service areas that are currently underperforming but not yet perceived as critical by users.

Given the centrality of these core features in supporting the overall functionality of the marketplace, the underperformance of subdimension X19 highlights an urgent need for technical improvement and system reliability enhancement. X19 is categorized under the System Availability dimension of the E-SERVQUAL model, which refers to the ability of a system to maintain stable, uninterrupted, and reliable operation throughout the user experience. In the context of digital service platforms, this includes the concept of transactional continuity—the seamless flow of user activities such as listing uploads, registration, ad configuration, and data input without interruptions or system errors (Lai et al., 2002).

Subdimension X19, labeled as “Core Feature Functionality,” includes essential operations like user registration, chat features, ad posting, form submission, and error handling. Malfunctions in these areas reflect poor system availability and can significantly degrade user satisfaction and trust in the platform. This conclusion is strongly reinforced by the results of LDA topic modeling, particularly Topic 6 (App Quality), which had the highest document frequency. Topic 6 encompasses widespread user concerns about technical performance, system bugs, feature instability, and failure to execute expected actions, precisely the kinds of issues reflected in

subdimension X19. The overlap between this thematic evidence and quantitative performance gaps confirms that improving technical robustness is a top strategic priority.

Meanwhile, Topic 5 (Search and Property Match) also appeared as a frequently discussed theme, emphasizing user expectations regarding the accuracy and relevance of property search results. Although this topic highlights a meaningful content-related concern, it is more closely associated with the Information Quality dimension rather than system availability. Therefore, while still important for platform usability, Topic 5 does not directly reflect the same technical deficiencies captured in X19. Nonetheless, it should be monitored as part of broader service quality enhancement strategies.

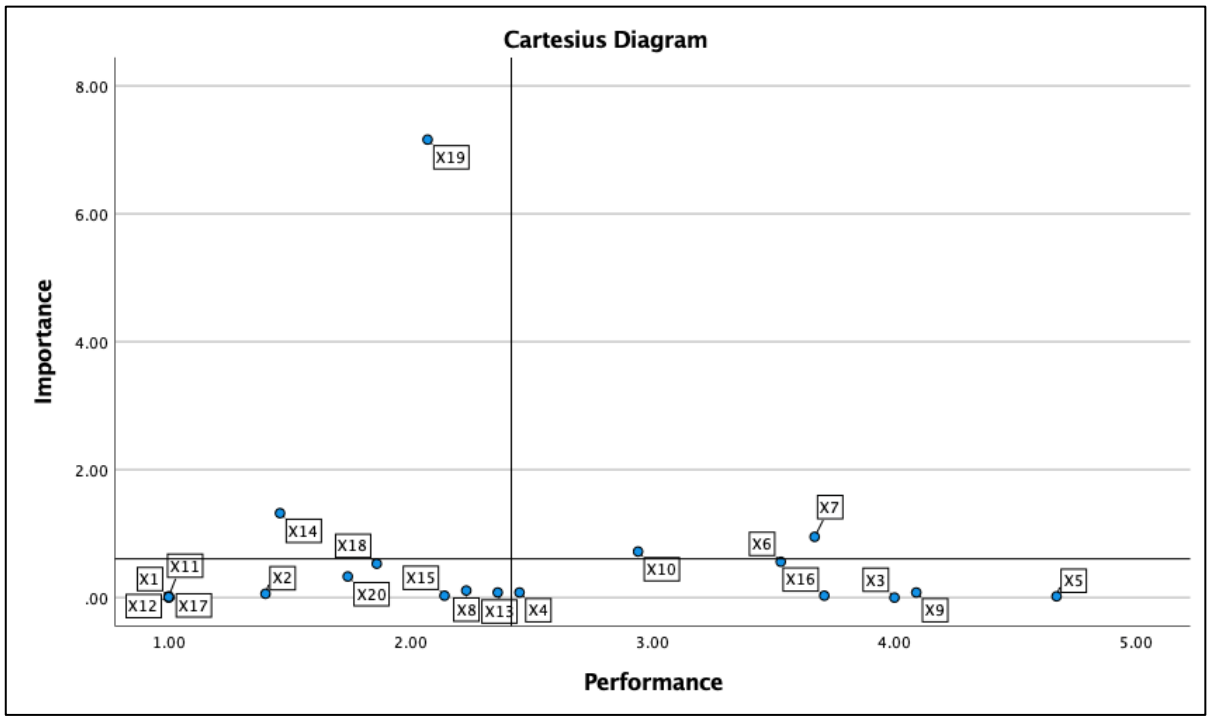

Figure 6. IPA Analysis of Dimension E-Servqual

4.2 Design the Recommendation Strategies with AI-Augmented E-Servqual

Based on the IPA results, the subdimension core feature functionality has been identified as a critical concern due to its high importance and low performance. This subdimension reflects essential operations within the real estate marketplace platform, such as ad posting, photo uploading, and property listing tools—features that directly influence usability and user satisfaction. Analysis of user reviews revealed persistent issues including broken ad submission buttons, failed image uploads, slow system responses, and error-prone validation during form completion. These recurring technical problems not only diminish the user experience but also disrupt the sales process for property agents and individual sellers. To address this, a set of AI-driven strategy recommendations has been developed, as visualized in Figure 7, to optimize and automate key functionalities within the platform.

The proposed strategy leverages Artificial Intelligence (AI) to enhance operational efficiency, data accuracy, and overall service quality across digital real estate platforms. One major component, the Intelligent Listing Validator, integrates Natural Language Processing (NLP) and Computer Vision to automatically verify the completeness and authenticity of uploaded data—such as property images and textual descriptions. This feature benefits multiple user segments, including property agents, internal sales teams, and independent sellers, by ensuring that listings are valid, trustworthy, and high-quality. Prior studies have shown that automated content validation plays a crucial role in minimizing input errors and improving user confidence in digital marketplaces (Kuppan et al., 2024).

Another key module, the Ad Optimization Engine, utilizes AI-driven behavioral analytics to dynamically adjust advertisement placement and exposure. It addresses a recurring issue raised by users who pay for premium listing services but experience minimal engagement. By learning from user interaction data, the engine improves Click-Through Rate (CTR) and conversion performance, ensuring that property ads reach the most relevant audiences—consistent with the findings of Silviu-Ionui (Silviu-Ionui, 2025). In addition, the inclusion of AI-based payment verification streamlines transaction processes and reduces fraud risk through real-time

validation integrated with systems such as Salesforce AI, thereby minimizing manual verification delays (Matrunych, 2022).

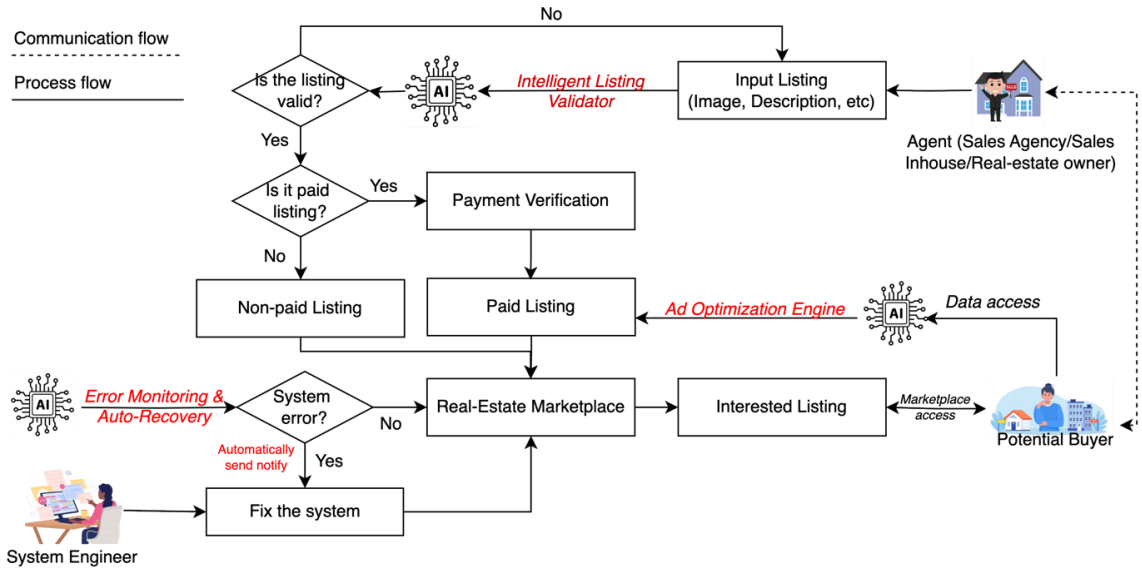

Figure 7. AI Model for Core Feature Functionality

To maintain platform reliability, an AI-powered Error Monitoring and Auto-Recovery System is proposed to detect abnormalities such as bugs or server failures and autonomously trigger resolution procedures. This mechanism improves Mean Time to Detect (MTTD) and Mean Time to Recovery (MTTR), enhancing system resilience—an approach proven effective in critical domains like healthcare (Kalendralis et al., 2021) and increasingly vital for real estate marketplaces (Kobylarz & Kobylarz, 2023).

Although the proposed AI framework remains conceptual at this stage, it is designed to support future experimental validation through standard performance metrics. For classification and validation components, precision, recall, and F1-score will be applied to assess analytical accuracy. For recommendation and ad optimization modules, lift ratio, CTR, and conversion rate will be measured. Additionally, A/B testing will be conducted to evaluate user engagement and satisfaction across different algorithmic configurations. These evaluation procedures will ensure that the proposed system not only improves functional performance but also contributes to a robust, user-centric, and empirically validated digital transformation framework for the property technology sector.

5. Conclusion

This study aimed to enhance the digital service quality of real estate marketplace platforms by integrating advanced analytical and technological approaches. First, the E-SERVQUAL model was analyzed and reconstructed through a combination of thematic analysis and LDA. This dual-method approach enabled the empirical identification of service quality dimensions and subdimensions derived from user-generated reviews, thereby enhancing the model's contextual relevance and analytical rigor within the property technology domain.

Second, the application of IPA revealed significant service quality gaps, with the subdimension core feature functionality (X19) emerging as the top priority for improvement. This subdimension, belonging to the System Availability dimension, represents essential technical features such as ad posting, data entry, and system responsiveness—attributes that are highly valued by users yet underperforming in real-world application. Third, in response to these findings, the study proposed an AI-enhanced service model to address the most critical performance gaps. The model integrates intelligent modules including listing validators, ad optimization engines, automated payment verification, and real-time error monitoring systems. This strategy demonstrates how Artificial Intelligence can be effectively utilized to improve platform stability, ensure seamless service availability, and enhance the overall user experience in digital marketplaces.

While this study presents a comprehensive framework for digital service quality improvement, future research may extend the approach by incorporating additional user feedback channels—such as social media data, call center logs, or chatbot transcripts—to enrich sentiment diversity. Moreover, longitudinal evaluations tracking

post-implementation user satisfaction would provide deeper insights into the sustained impact of AI-driven interventions. Finally, comparative studies across different types of digital platforms beyond real estate could help assess the generalizability and robustness of the AI-enhanced E-SERVQUAL framework in broader digital service ecosystems

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