

Research Paper

Usability Assessment of E-Commerce Systems Using McCall's Quality Model

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Abstract: E-commerce platforms rely fundamentally on business database transaction systems that must balance user experience with security and data integrity. Traditional usability assessment methodologies often overlook critical security elements and transactional integrity requirements. This study employs McCall's Quality Model to comprehensively evaluate the usability characteristics of three prominent e-commerce platforms: Temu, Shopee, and Lazada. Through structured task-based evaluations and Likert-scale questionnaires, eight quality factors were assessed: Correctness, Reliability, Efficiency, Integrity, Usability, Maintainability, Flexibility, and Testability. Thirty participants aged 20-40 years with varying levels of e-commerce experience completed the evaluation protocol. Data reliability was confirmed using Cronbach's Alpha, while Analysis of Variance (ANOVA) identified statistically significant differences across platforms. Results demonstrate that Shopee excels in most usability subcategories, particularly in Integrity and Usability, reflecting superior security implementation and user-centered design. The findings provide actionable recommendations for platform developers to enhance usability while strengthening transactional security mechanisms. Specifically, the study proposes improvements to checkout procedures, navigation architecture, and system performance optimization. By integrating security-critical factors into usability assessment, this research addresses a significant gap in existing evaluation frameworks that traditionally prioritize user satisfaction metrics over transactional integrity. The study concludes by advocating for AI-driven usability testing methodologies that enable automated user interaction analysis and real-time bottleneck identification in future e-commerce platform evaluations.

Keywords: E-commerce Usability, McCall's Quality Model, Business Database Transactions, Transactional Integrity, User Experience Evaluation, Platform Security, Comparative Usability Analysis

Introduction

Modern e-commerce platforms depend on robust business database transaction systems to ensure secure payment processing, reliable order management, and accurate inventory control. Platforms such as Temu, Shopee, and Lazada serve millions of users daily, making system usability and transactional security paramount to operational success and user retention. Effective e-commerce systems must seamlessly integrate intuitive design, rapid response times, and comprehensive security safeguards to protect sensitive user data while maintaining transactional integrity.

Despite the critical importance of security in e-commerce environments, existing usability research has predominantly focused on surface-level user experience metrics such as satisfaction, learnability, and task completion efficiency (Jain & Purandare, 2021), frequently neglecting the underlying transactional security and system reliability factors. Conventional evaluation frameworks, including the System Usability Scale (SUS) (Hamid et al., 2020; Adilla et al., 2022; Alisya et al., 2023; Hasudungan et al., 2024) and Nielsen's heuristic evaluations (Hamid et al., 2020), provide valuable insights into user

satisfaction and interface design but systematically underrepresent back-end security considerations, data integrity mechanisms, and error recovery capabilities. This methodological limitation creates a significant gap in comprehensive platform assessment, particularly for transaction-intensive systems where security breaches or data inconsistencies carry substantial financial and reputational consequences.

This research addresses this critical gap by employing McCall's Quality Model as a comprehensive evaluation framework that integrates both usability and security-critical attributes. McCall's model structures software quality assessment across three dimensions: Product Operation (addressing day-to-day functionality), Product Revision (facilitating system maintenance and modification), and Product Transition (enabling system adaptability). Within these dimensions, the model encompasses eight fundamental quality factors—Correctness, Reliability, Efficiency, Integrity, Usability, Maintainability, Flexibility, and Testability—operationalized through 33 specific attributes derived from established literature. Notably, McCall's emphasis on Integrity (secure access control and unauthorized use prevention) and Reliability (consistent system performance under operational conditions) provides a structured approach to evaluating transaction security alongside traditional usability metrics.

The present study applies McCall's Quality Model to conduct a comparative usability assessment of three major e-commerce platforms: Temu, Shopee, and Lazada. Through structured task completion scenarios and validated Likert-scale questionnaires, this research evaluates critical attributes including secure authentication mechanisms, data protection protocols, transaction completion efficiency, navigation intuitiveness, and error recovery effectiveness. Thirty participants aged 20-40 years with diverse e-commerce experience levels completed the evaluation protocol, ensuring representation across varying user expertise. Statistical analysis employed Cronbach's Alpha to verify instrument reliability and Analysis of Variance (ANOVA) to identify statistically significant performance differences across platforms.

The findings are expected to provide actionable insights for platform developers and user experience designers seeking to optimize both usability and transactional security in e-commerce environments. By demonstrating how security-critical factors can be systematically integrated into usability evaluation frameworks, this research contributes methodological

advances to human-computer interaction scholarship while offering practical recommendations for enhancing checkout processes, navigation architecture, system performance, and security implementation.

This study is conducted solely for academic research purposes, providing an objective comparative analysis of platform usability characteristics without endorsing or criticizing any specific commercial entity. While frameworks such as SUS, ISO 9241, and Nielsen's heuristics have established value in user satisfaction assessment, McCall's Quality Model offers distinct advantages for transaction system evaluation by explicitly incorporating Integrity, Reliability, and Correctness factors essential to secure e-commerce operations. This integrated approach enables holistic assessment that balances user experience quality with the security and reliability requirements fundamental to trustworthy online commerce.

Future research directions include the development of AI-driven usability testing methodologies capable of automated user interaction pattern analysis, real-time performance bottleneck identification, and predictive security vulnerability assessment, potentially revolutionizing how e-commerce platforms are evaluated and optimized for both usability and security.

Literature Review

Usability in Business Database Transaction Systems

Usability is critical in business database transaction systems, as it directly impacts how effectively users accomplish their goals. (ISO, 2018) defines usability as a measure of effectiveness, efficiency, and user satisfaction. In e-commerce platforms, usability extends beyond basic interactions, such as navigation, to include factors like transactional precision, data consistency, and error handling during peak loads. These factors directly shape user satisfaction and trust.

Research indicates that even minor usability flaws in database system interfaces can lead to system failures and financial losses. Booday & Albeshier (2021) highlights how issues such as slow checkouts, unclear error messages, or weak security frustrate users and jeopardize information. Despite this, much of the research overlooks the vital roles of transactional integrity and operational reliability in determining the efficiency of database systems.

McCall's Quality Model

McCall's Quality Model provides a framework for assessing software quality. It categorizes attributes into three primary factors: Product Operations, Product

Revisions, and Product Transitions (Tripathi, 2020). These factors address system functionality, maintainability, and adaptability:

- Product operation encompasses correctness, Reliability, Efficiency, Integrity, and Usability. These characteristics ensure the proper functioning of the system during use.
- Product Revision assesses the modifiability and sustainment of the system. It focuses on sub-attributes such as maintainability and flexibility.
- Product Transition evaluates if a system can operate in a new environment. It also checks how the system interfaces with other systems. It considers reusability and interoperability.

The Integrity factor measures the security of the data and whether unauthorized personnel are restricted from accessing it. It also checks system efficiency and accuracy. This makes McCall's model suitable for database transaction systems, where security and reliability are critical.

Previous Studies on Usability Testing

Several studies have employed standardized usability evaluation frameworks to assess the quality of user interfaces across diverse application domains. Commonly used instruments include the System Usability Scale (SUS; S. Hamid et al., 2020; Adilla et al., 2022; Alisya et al., 2023; Hasudungan et al., 2024), heuristic evaluation methods (S. Hamid et al., 2020), the E-commerce Total Quality Management framework (Abdullah et al., 2021), User-Centered Design approaches (K. Hamid et al., 2022), User Acceptance Testing (Firdaus et al., 2022), and the User Experience Questionnaire (Alisya et al., 2023).

For example, an evaluation of e-commerce websites accessible in Pakistan identified multiple usability shortcomings using SUS; however, the study did not examine transactional integrity or security-related aspects (S. Hamid et al., 2020). Similarly, studies on mobile banking applications applied SUS alongside usability testing to assess user satisfaction, learnability, and effectiveness (Jain & Purandare, 2021), yet failed to investigate data protection mechanisms (Adilla et al., 2022). Furthermore, an assessment of Shopee PayLater services reported favorable usability outcomes but omitted an evaluation of security attributes, including encryption mechanisms and access authorization controls (Hasudungan et al., 2024).

Although these works offer valuable findings, no one has incorporated security and reliability into usability theories. This study fills this gap by adopting Integrity and other important attributes from McCall's model for a competent assessment of database systems.

Materials and Methods

This study involved 30 participants, aged 20 to 40, selected through stratified sampling to represent a diverse range of user experience levels. Participants completed structured tasks, including product search, cart checkout, secure login, and order tracking, on Temu, Shopee, and Lazada. These tasks were designed to evaluate the eight McCall attributes.

Participants rated each attribute using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The 5-point scale was chosen for its simplicity and consistency with prior studies. Task design was based on typical user flows observed in e-commerce transactions.

This research uses McCall's Quality Model to assess the usability of business database transaction systems. The model categorizes usability into eight key factors. The company's six major software development principles are correctness, reliability, efficiency, integrity, usability, maintainability, flexibility, and testability. These factors were used to inform and categorize the assessment criteria, addressing all aspects of the interface and the underlying system.

The research also identifies 33 quality attributes identified in earlier usability tests as these eight factors. For instance, security methods and formats for login, privacy, and information protection were assessed in terms of integrity. In contrast, aspects such as the speed of task completion and the level of response were measured in terms of efficiency. Importantly, this categorization ensures that the model addresses both classic usability problem areas and current security risks.

The reliability of the collected data was verified using Cronbach's Alpha, and ANOVA was applied to test the statistical significance of usability differences across platforms. Data were visualized using bar charts, and standard deviations were calculated to support meaningful comparisons.

The participants were chosen to be diverse, encompassing both first-time users and experienced e-commerce platform users, such as those on Temu, Shopee, and Lazada, to model real-life scenarios. Subjects were given specific and predefined activities, such as navigating a product, entering a search query, adding a product to the checkout, involving secure login and payment information, and tracking the order status of a previously made purchase. These tasks were also intended to measure different usability and

transactional dependability facets. Participants provided feedback in the form of Likert scale self-completion questionnaires, capturing their perceived values of attributes such as ease of navigation (Usability), system response time (Efficiency), order processing accuracy (Correctness), and security on login and data handling (Integrity). Each statement was self-evaluated on a Likert-type scale from 1, which represented Strongly Disagree, to 5, representing Strongly Agree.

For this analysis, the three selected and targeted platforms are Temu, Shopee, and Lazada due to high traffic, multiple features, and critical dependency on the transaction database system. In comparing these platforms, the study aimed to factor out the strengths and weaknesses of their usability and security features. Participant ratings were summed up and averaged to yield the mean for each factor in McCall's Quality Model. Comparisons were made to show attributes with high or low performance, and the same attribute comparisons were used to describe areas that required improvement. Descriptive statistics, presented in the form of bar charts and tables, were also used to display platform performance based on the eight McCall factors.

This means that every aspect that needs to be evaluated concerning the usability and security of business database transaction systems can be effectively carried out using this methodology, thus ensuring that the gap between user satisfaction and system trustworthiness is closed.

Findings and Analysis

This study, therefore, highlights the usability advantages and disadvantages of business database transaction systems within the Temu, Shopee, and Lazada platforms. The participants' feedback was obtained using Likert-scale questionnaires to compute the mean scores for each usability attribute under McCall's Quality Model. The results provide a detailed comparison of the platforms across the eight factors. Requirement categories are Correctness, Reliability, Efficiency, Integrity, Usability, Maintainability, Flexibility, and Testability.

The analysis reveals that Shopee outperforms other platforms in Integrity ($M = 4.7 \pm 0.3$), Usability ($M = 4.6 \pm 0.4$), and Correctness ($M = 4.5 \pm 0.4$). Shopee demonstrates success in data encryption, interface usability, and transaction reliability through its measurement scores. The Integrity Index of Temu and Lazada shows positive results, albeit facing efficiency challenges ($M = 3.9 \pm 0.6$ and $M = 3.8 \pm 0.6$, respectively), during peak usage hours.

The most highly appreciated measure was integrity, the highest-ranked factor across the platforms due to several factors, including secure login processes, effective data encryption, and retention of sensitive information. Transaction securities represent one of the key factors that should not raise any doubts in clients, and this boosts the platform's elevated focus on this aspect. Accuracy, particularly for transactions, and clear presentation of information when carrying out various activities such as checkouts and tracking deliveries, endorsed the platforms' correctness.

Efficiency was found to be moderately beneficial, with participants noting slower system response times during peak hours, particularly on Temu and Lazada, indicating a need for performance optimization. While participants reported overall satisfaction with usability attributes, they pointed out occasional lapses in user flows, such as difficulties applying coupons or organizing refunds.

Maintainability received moderate ratings, as participants considered help documentation and error recovery to be adequate but not optimal. Flexibility was highlighted for providing multiple approaches to task completion, although customization options were noted as limited. Reliability was generally rated high; however, occasional system errors underlined the need for improved error prevention.

A cross-platform comparison confirmed that Shopee demonstrated superior performance across most attributes, particularly in maintaining strong transactional integrity and user-centred navigation design. Temu and Lazada, while competent in transactional security, need further enhancements in Efficiency and Maintainability to elevate user satisfaction.

Table 1. Mean Scores for Each Usability Factor.

Usability Factor	(Mean Score \pm SD)		
	Shopee	Temu	Lazada
Correctness	4.5 \pm 0.4	4.3 \pm 0.5	4.2 \pm 0.5
Reliability	4.4 \pm 0.3	4.2 \pm 0.4	4.1 \pm 0.4
Efficiency	4.3 \pm 0.4	3.9 \pm 0.6	3.8 \pm 0.6
Integrity	4.7 \pm 0.3	4.6 \pm 0.3	4.5 \pm 0.3
Usability	4.6 \pm 0.4	4.4 \pm 0.4	4.3 \pm 0.4
Maintainability	4.2 \pm 0.5	4.0 \pm 0.5	3.9 \pm 0.6
Flexibility	4.3 \pm 0.4	4.1 \pm 0.4	4.0 \pm 0.5
Testability	4.4 \pm 0.4	4.2 \pm 0.4	4.1 \pm 0.5

These results reaffirm the critical importance of transactional security and system responsiveness in maintaining user trust in business database transaction

systems. The recommended strategy for improving operational success requires constant improvements in Efficiency, Maintainability, and Flexibility to enhance overall usability. Table 1 presents the mean scores for each platform usability factor, along with standard deviations to highlight variability.

Discussion

The results of this study provide a detailed comparison of the usability and security performance of business database transaction systems across three major e-commerce platforms: Shopee, Temu, and Lazada. The results reveal major research implications in understanding how these platforms support usability attributes under McCall's Quality Model.

The integrity measurement yielded the highest mean score of 4.7 points at Shopee. The platforms demonstrate their deep concern for secure login methods, robust encryption, and the permanent protection of sensitive information. These essential features are crucial for enhancing customer trust and ensuring secure transaction procedures. However, compared to results in other categories, slightly lower scores indicate their capabilities to enhance the use of different security features, particularly while high traffic levels are expected, such as in the cases of Temu and Lazada.

Usability and Correctness also scored highly, particularly in Shopee, which received mean scores of 4.6 and 4.5, respectively. These results demonstrate that Shopee offers user-friendly interaction models and ensures correct and trustworthy transaction operations, thereby promoting higher user satisfaction. On the other hand, performance is moderate for Temu and Lazada, as users reported occasional problems with the navigation flow and the accuracy of task performance.

Lazada and Temu were rated 3.9 and 3.8, respectively, and efficiency was identified as an area eligible for improvement in both organizations. Some participants repeatedly raised the issue of slower system responses during peak usage times, suggesting that improvements in system performance were necessary to manage periods of heavy usage efficiently. Shopee's score was better than that of the former companies at 4.3. However, there is still room for improvement.

Regarding the findings for Maintainability and Flexibility, the levels of adaptability and system updating appear moderate. While Shopee again topped the competition, scoring 4.2 and 4.3 in that order, Temu and Lazada fell short during these two factors, reflecting that more work had to be done on help documentation and

customization. In addition, Testability scores suggest that although performance across all platforms is adequate in terms of providing testing facilities, improvements in debugging and system stability when subjected to stress tests are more efficient.

Globally, the trend highlights the need to strike a tradeoff between usability and security in business database transaction systems. Shopee's successful performance on most metrics demonstrates the effectiveness of combining strong security features with an easy-to-use design. On the other hand, strengths in functionality domains exist in Temu and Lazada. Still, there are also weaknesses in system efficiency and maintainability that need to be overcome to gain comparable usability and security. These results provide practical insights into how e-commerce platforms can optimize their database transaction systems to meet new user needs.

The usability findings highlight key areas for improvement, including error recovery and performance optimization. Both automatic error detection and user-friendly recovery features, such as real-time payment retries and alerts when systems malfunction, must be developed by system developers. Load balancing, content delivery networks (CDNs), and database query optimization can be used to improve peak traffic performance. Implementing encryption, multi-factor authentication, and fraud detection systems will enhance security by protecting user data and preserving user trust.

Developers should streamline the checkout process by reducing the number of steps, creating a more intuitive navigation flow, and ensuring the site is optimized for mobile devices to enhance user engagement. The user experience will also be greatly enhanced by UI/UX adjustments, such as more obvious button placements and quicker loading times. Developers should employ stringent penetration testing to identify security flaws, encrypt data in transit and rest, and establish a robust database firewall to prevent unauthorized access to private user data.

Conclusion

This paper assessed the usability of business database transaction systems on leading e-commerce platforms, including Shopee, Temu, and Lazada, using McCall's Quality Model. The model divides 33 usability attributes into eight components: Correctness, Reliability, Efficiency, Integrity, Usability, Maintainability, Flexibility, and Testability. The study thoroughly examined the advantages and disadvantages of each platform.

The assessment outcomes identified Integrity as the leading factor, with the implied essentiality of security components like per-user or dedicated access credentials, personal information security, and transparent and secure transaction options. Shopee outperformed the other platforms in almost all categories, including usability and correctness, and was also faster. Temu and Lazada have demonstrated high levels of security; however, they have experienced difficulties with system response times when actively used and some variability in navigation. These areas highlight opportunities for further improvement of the search algorithm to enhance its efficiency and for the recovery modalities in cases of failed locates.

This research highlights the need to incorporate security-oriented metrics into usability testing paradigms. The integration of McCall's Quality Model proved successful in providing a balanced assessment that focused not only on the system's user perspective and ease of operation but also its security and reliability, which conventional usability assessments seldom report. The findings of this study are beneficial to developers and managers alike in search of ways to improve the use of database transaction systems in e-commerce. Future work can build on this study by applying the identified evaluation framework to a wider selection of platforms and incorporating real-time tension testing to enhance the evaluation results.

This study focuses on conventional usability testing techniques; however, future research may incorporate AI-driven usability testing to automatically analyze user interactions and identify bottlenecks instantly. Large user behaviour datasets can be analyzed by AI tools, revealing insights that would be challenging for conventional approaches to find. Additionally, machine learning models could be used to predict how changes to the interface or system would affect user satisfaction, making usability testing faster and more scalable.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. No financial, personal, or other relationships have inappropriately influenced the research or the preparation of this article.

Author's Contributions

Siti Solehah Othman contributed to the conceptualization, methodology, investigation, data curation, formal analysis, visualization, and writing of the original draft. A. Noraziah provided supervision, monitored the student's progress, contributed to manuscript writing, review, and editing, and guided the overall structure of the paper. Roslina Mohd Sidek co-supervised the study, contributed to manuscript review and editing, managed project administration, acquired funding, and served as the corresponding author.

Ethics

The author affirms that this study was conducted ethically, with all participants providing informed consent prior to data collection. No sensitive or personal data was disclosed, and all findings were reported with integrity and transparency. The author commits to addressing any ethical concerns that may arise following the publication of this manuscript.

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