Ranking Malaysian Domestic E-Logistics System Providers Using Fuzzy TOPSIS Based on E-Service Quality Criteria

Chow Puiteng[1], Soo-Fen Fam[2*], Tan Choryuin[3], Sentot Imam Wahjono[4], Zun-Liang Chuan[5], Wendy Ling Shinyie[6]

[1,2]Faculty of Technology Management and Technopreneurship, Universiti Teknikal Malaysia Melaka, 75450 Melaka, Malaysia

[3]Faculty of Information & Communication Technology, Universiti Teknikal Malaysia Melaka, 75450 Melaka, Malaysia

[4]Faculty of Economics and Business, Universitas Muhammadiyah Surabaya, Indonesia,

[5]Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, Malaysia,

[6]Faculty of Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

[*]Corresponding Author

DOI: https://doi.org/10.47772/IJRISS.2026.100601472

Received: 08 July 2026; Accepted: 13 July 2026; Published: 25 July 2026

ABSTRACT

The rapid expansion of e-commerce in Malaysia has intensified competition among domestic e-logistics providers, making the objective comparison of their e-service quality a pressing practical concern for sellers, consumers, and policymakers alike. While our earlier work established the relative importance of five e-service quality criteria, reliability, responsiveness, privacy and security, ease of use, and website design, using the Fuzzy Analytic Hierarchy Process (Fuzzy AHP), the question of how individual providers actually perform against those weighted criteria remained unanswered. This study addresses that gap by applying the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS) to rank four major Malaysian domestic e-logistics providers, namely DHL eCommerce, J&T Express, Ninja Van, and Shopee Express, against the previously derived criteria weights. Evaluations were obtained from ten top Shopee sellers in the Home Living category, who were purposively selected for their extensive transactional experience across all four providers. Their linguistic assessments were aggregated into a fuzzy decision matrix, normalised, weighted, and compared against fuzzy positive and negative ideal solutions to compute a closeness coefficient for each provider. The analysis confirms privacy and security (0.2472) and website design (0.2285) as the most influential criteria and produces a clear provider ranking in which DHL eCommerce achieves the highest closeness coefficient (0.895), followed by Ninja Van (0.601), J&T Express (0.586), and Shopee Express (0.105). The results reveal a notable gap between platform familiarity and perceived service quality, since Shopee Express, despite being the primary platform for all participating sellers, ranks last. By integrating expert-derived criteria weights with a distance-based ranking method, the study delivers an actionable, data-driven framework that helps logistics providers benchmark their performance, target the criteria that matter most, and identify priority areas for improvement within Malaysia's digital economy.

Keywords: E-Service Quality, E-Logistics, Fuzzy TOPSIS, Provider Ranking, Multi-Criteria Decision Making

INTRODUCTION

Malaysia's logistics system is a vital component of the country's economic progress, acting as a foundation

for key sectors such as manufacturing, retail, and trade (Makmor et al., 2023). The rapid expansion of e-commerce, driven by platforms such as Shopee, Lazada, and Zalora, has created soaring demand for delivery services that are fast, reliable, and cost-efficient (Hu et al., 2022). This trend has spurred the development of a domestic e-logistics system that leverages digital technologies, electronic tracking, automated sorting, and AI-powered logistics solutions to serve increasingly tech-savvy consumers (Iraz et al., 2020; Jain et al., 2021). Within this competitive landscape, several providers, including Pos Malaysia, J&T Express, DHL, Ninja Van, and Shopee Express, now compete for market share by investing heavily in digital transformation (Chen et al., 2023).

As competition intensifies, e-service quality has emerged as a decisive differentiator among these providers (Puiteng et al., 2025a). E-service quality refers to customers' overall evaluation of the standard of online services offered by a business, especially within digital or e-commerce environments (Cheng et al., 2021). Superior e-service quality contributes to higher customer satisfaction, fosters trust, and enhances operational efficiency and competitiveness (Mamakou et al., 2023). Yet the e-service quality delivered across Malaysian providers remains inconsistent: issues such as unclear tracking, poor website usability, and delayed customer support continue to affect user satisfaction (San et al., 2020). This raises a practical question that matters directly to sellers and policymakers: among the available domestic providers, which ones actually deliver the highest e-service quality?

Answering this question requires two analytical steps. The first is to establish which e-service quality criteria matter most, and by how much. In our earlier study (Puiteng et al., 2025b), the Fuzzy Analytic Hierarchy Process (Fuzzy AHP) was applied to prioritise five e-service quality criteria, namely reliability, responsiveness, privacy and security, ease of use, and website design, drawing on structured expert elicitation from ten top Shopee sellers. That study established the relative importance weights of the criteria but did not rank the individual logistics providers; it explicitly deferred provider ranking to a subsequent phase. The present study constitutes that second phase.

The second step, and the central contribution of this paper, is to rank the actual providers against those weighted criteria. To achieve this, the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS) is applied to four major Malaysian domestic e-logistics providers: DHL eCommerce, J&T Express, Ninja Van, and Shopee Express. Fuzzy TOPSIS is well suited to this task because it ranks alternatives according to their closeness to an ideal solution while accommodating the subjectivity and uncertainty inherent in human judgment (Rane & Choudhary, 2023). By combining the criteria weights derived through Fuzzy AHP with a distance-based ranking of alternatives, this study completes the two-part decision framework and delivers a concrete, actionable ranking that logistics providers can use to benchmark performance and target improvements. This integrated approach supports Malaysia's vision of becoming a regional logistics and transportation hub by 2025.

LITERATURE REVIEW

As outlined by Rouse (2023), Malaysian Domestic E-Logistics System refers to the structured and technology-driven ecosystem that facilitates the movement, storage, and distribution of goods within Malaysia through digital platforms and automation. This system integrates various logistics services with electronic and digital innovations, allowing for efficient supply chain management, enhanced tracking capabilities, and improved customer experiences (Wang, Kumar, Kumari, & Kuzmin, 2022).

The e-logistics system in Malaysia primarily caters to the growing e-commerce industry, ensuring seamless connectivity between sellers, third-party logistics providers (3PL), warehouse operators, and end consumers (Ainomugisha, 2022). This system includes various key functions such as inventory control, order processing, real-time shipment tracking, last-leg delivery operations, and digital payment technologies.

Government-led programs like the National eCommerce Strategic Roadmap (NESR) and the Malaysia Logistics and Trade Facilitation Masterplan have significantly contributed to advancing the digital capabilities of the country's logistics landscape (Archetti et al., 2022). These policies are intended to boost logistics infrastructure,

modernise regulations, and promote digital technology adoption to meet rising expectations in both local and international markets.

The surge in online purchases, digital payments, and intelligent warehousing systems has significantly driven the progress of Malaysia's e-logistics industry, positioning it as an essential element in the nation's digital economic framework (Kaur, 2023). This infrastructure supports the operations of enterprises, especially small and medium-sized businesses (SMEs), by enabling them to optimise their supply chains and meet the growing demands of consumers seeking faster, dependable, and budget-friendly delivery options (Ganguly, 2023).

Among the key players in the industry are Shopee Express, J&T Express, Ninja Van, and DHL eCommerce, which have developed their own logistics systems to ensure fast and reliable deliveries. Below is an overview of their company background and e-logistics system.

Shopee Express is the in-house logistics arm of Shopee, designed to ensure fast and reliable deliveries exclusively for Shopee sellers and buyers (Mat Ali et al., 2023). With its first-party logistics (1PL) model, Shopee Express operates its own delivery fleet and warehouses, streamlining the shipping process from sellers to customers (Mustakim et al., 2022). Its system includes automated warehouses, real-time tracking through the Shopee app, and same-day or next-day delivery services in selected areas. Shopee Express also supports cash-on-delivery (COD) payments, catering to customers who prefer offline payment methods.

J&T Express, originally founded in Indonesia in 2015, expanded to Malaysia in 2018 and has quickly become one of the top logistics service providers for e-commerce businesses (Muhammad Khodri Harahap et al., 2023). Operating 365 days a year, J&T Express boasts an extensive network covering both urban and rural areas. It utilises AI-driven automated sorting hubs to speed up parcel processing and offers real-time tracking via its mobile app. Additionally, J&T Express provides door-to-door pickup services for sellers, ensuring a seamless shipping process. Its same-day and next-day delivery options make it a preferred choice for e-commerce businesses needing rapid logistics solutions (Alifah, 2023).

Another major player, Ninja Van, entered the Malaysian market in 2015 and positioned itself as a tech-driven logistics company specialising in last-mile delivery. Its logistics system incorporates smart routing technology, which optimises delivery routes using AI-powered algorithms, reducing delays and improving delivery efficiency. Customers benefit from real-time parcel tracking via SMS and the Ninja Van app, while businesses enjoy automated API integration that simplifies shipping processes. To enhance customer flexibility, Ninja Van has introduced Ninja Points, which serve as collection and drop-off locations for added convenience. Additionally, the company offers COD services, making it easier for e-commerce businesses to reach a broader customer base.

Lastly, DHL eCommerce Malaysia stands out as a globally recognised logistics provider with a strong presence in the domestic market (Nabila et al., 2023). It specialises in automated warehousing and fulfilment services, utilising AI-powered smart warehouses to enhance inventory management. DHL's logistics system features a self-service digital platform, enabling businesses to manage, track, and automate their shipping needs efficiently. With nationwide and cross-border delivery capabilities, DHL provides a range of flexible shipping options, including its On-Demand Delivery (ODD) system, which allows customers to select their preferred delivery time and location (Wu, 2024).

E-Service Quality and Criteria Selection

E-service quality refers to a network-based service that enhances the overall functionality of a website (Faisal et al., 2020). Unlike traditional service operations, managing e-services presents distinct challenges: the interaction occurs in a virtual environment, physical elements are absent, and customers must navigate and fulfil service tasks independently (Kaya et al., 2019; Khan, 2019). Numerous scholars have adapted the SERVQUAL and e-SERVQUAL frameworks to capture these differences, proposing dimensions such as efficiency, fulfilment, system availability, privacy and security, responsiveness, website design, reliability, and ease of use (Parasuraman et al., 2005; Raza et al., 2020; Mohd Salleh et al., 2024).

Because the parameters of e-service quality differ substantially across studies, a systematic prioritisation is required before individual providers can be meaningfully compared. In our earlier work (Puiteng et al., 2025b), a comprehensive review of prior e-SERVQUAL studies was conducted and five criteria, reliability, responsiveness, privacy and security, ease of use, and website design, were selected and weighted using Fuzzy AHP. These five weighted criteria form the evaluative basis for the provider ranking undertaken in the present study; the detailed literature synthesis and weighting procedure are documented in that earlier paper and are summarised in the Materials and Method section below.

MATERIALS AND METHOD

This study employs a two-stage Multi-Criteria Decision Making (MCDM) framework. In the first stage, the relative importance of five e-service quality criteria was established using the Fuzzy Analytic Hierarchy Process (Fuzzy AHP). In the second stage, which is the focus of the present paper, the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS) is applied to rank four domestic e-logistics providers against those weighted criteria. Data for both stages were obtained from the same panel of ten top Shopee sellers in the Home Living category, selected purposively for their extensive transactional experience with the providers under evaluation.

Summary of Fuzzy AHP Criteria Weights

The criteria weights used in this study were derived through Fuzzy AHP in our earlier work (Puiteng et al., 2025b), where the full literature synthesis, hierarchical model, pairwise comparison procedure, and consistency testing are documented in detail. In that study, a hierarchy of five main criteria and twenty sub-criteria was constructed and evaluated using triangular fuzzy numbers converted from a 1–9 linguistic scale. All pairwise comparison matrices satisfied the consistency requirement ($CR \leq 0.10$), and the resulting fuzzy weights were defuzzied using the centre-of-area method and normalised. Rather than re-deriving these weights here, the present study adopts them directly as the criterion importance vector for the Fuzzy TOPSIS ranking. Table 1 summarises the normalised weights that serve as the evaluative basis for the analysis that follows.

Table 1. Normalised e-service quality criteria weights derived via Fuzzy AHP (Puiteng et al., 2025b)

Criterion	Weight	Rank
Privacy & Security	0.2472	1
Website Design	0.2285	2
Responsiveness	0.1958	3
Reliability	0.1705	4
Ease of Use	0.1580	5

As shown in Table 1, privacy and security carry the greatest weight (0.2472), followed by website design (0.2285), responsiveness (0.1958), reliability (0.1705), and ease of use (0.1580). These weights are applied uniformly across all four providers in the Fuzzy TOPSIS stage described below, ensuring that the criteria most valued by expert sellers exert proportionally greater influence on the final ranking.

Fuzzy Topsis Method

To evaluate Malaysia's e-logistics system provider, experts assess multiple criteria by rating their agreement levels on a scale of 1 to 5, where 1 indicates "very poor" and 5 means "very good." Table 2 provides the fuzzy rating scale for linguistic variables. After gathering expert opinions, a decision matrix is formulated using the Fuzzy TOPSIS method. The initial step in the methodology is to normalise the decision matrix, which standardises the data to ensure it is comparable across various criteria. This is followed by computing the weighted normalised decision matrix by applying the relative importance (weights) assigned to each criterion, thereby enhancing the precision of expert preferences.

Following this, the fuzzy positive ideal solution (FPIS) and the fuzzy negative ideal solution (FNIS) are established, representing the most and least desirable performance outcomes respectively. The distance between each alternative and both FPIS and FNIS is calculated to assess how closely each e-logistics option aligns with the ideal performance. Finally, a closeness coefficient is derived from each alternative to indicate its relative performance compared to the ideal solution. Based on these coefficients, alternatives are ranked, with higher values reflecting more favourable options in the context of Malaysia's e-logistics performance. This structured methodology supports a robust and data-driven decision-making framework for identifying potential improvements in the logistics sector.

The following steps outline how the Fuzzy TOPSIS method is applied to rank Malaysia's e-logistics system providers:

Table 2. Fuzzy evaluation scale

Fuzzy Number	Definition
(1,1,3)	Very Poor (VP)
(1,3,5)	Poor (P)
(3,5,7)	Fair (F)
(5,7,9)	Good (G)
(7,9,9)	Very Good (VG)

Step 1: Create a fuzzy decision matrix using expert ratings. We calculate the decision matrix D, where d represents the quality of the e-commerce website i = 1,2,…,m in the sub-dimension j = 1,2,…,n.

$D = [d_{ij}]_{mxn}$ (1)

Step 2: Normalise the decision matrix. To normalise the matrix, utilise both the best (positive) and worst (negative) ideal values.

$r_{ij} = (a_{ij}/c^*_j, b_{ij}/c^*_j, c_{ij}/c^*_j); c^*_j = max\ c_{ij}$ *(Positive ideal)* (2)

$r_{ij} = (a^-_j/c_{ij}, a^-_j/b_{ij}, a^-_j/a_{ij}); a^-_j = min\ a_{ij}$ *(Negative ideal)* (3)

Step 3: Compute the weighted normalised decision matrix. Apply weights to the normalised matrix by multiplying each normalised value by the corresponding criterion weight.

$v_{ij} = r_{ij} \times w_j$ (4)

Step 4: Determine the fuzzy positive ideal solution (FPIS, A*) and the fuzzy negative ideal solution (FNIS, A^-).

$A^* = (\tilde{v}_1^*, \tilde{v}_2^*, \ldots, \tilde{v}_n^*)$ *where* $\tilde{v}_j^* = max\ v_{ij}$ (5)

$A^- = (\tilde{v}_1^-, \tilde{v}_2^-, \ldots, \tilde{v}_n^-)$ *where* $\tilde{v}_j^- = min\ v_{ij}$ (6)

Step 5: Measure the distance from ideal solutions. Calculate the distance between each alternative and both the FPIS and the FNIS.

$d_i^* = \Sigma\, d(v_{ij}, v_j^*),\ i = 1,2,\ldots,m$ (7)

$d_i^- = \Sigma\, d(v_{ij}, v_j^-),\ i = 1,2,\ldots,m$ (8)

$d(A, B) = \sqrt{[(1/3)((a_1-a_2)^2 + (b_1-b_2)^2 + (c_1-c_2)^2)]}$ (9)

Step 6: Compute closeness coefficient and rank alternatives. The closeness coefficient of each alternative can be calculated as follows:

$CC_i = d_i^- / (d_i^* + d_i^-)$ (10)

The best alternative is closest to the FPIS and farthest from the FNIS.

RESULTS AND DISCUSSION

Using the criteria weights summarised in Table 1, the Fuzzy TOPSIS method was applied to rank the four major Malaysian domestic e-logistics providers: DHL eCommerce, J&T Express, Ninja Van, and Shopee Express. The same ten expert sellers who informed the criteria weighting evaluated each provider against the twenty sub-criteria using the linguistic scale in Table 2. Their aggregated ratings formed the fuzzy decision matrix, which was then normalised, weighted by the Table 1 importance vector, and compared against the fuzzy positive and negative ideal solutions. This purposive expert panel is well suited to the task, since all ten sellers have direct, high-volume transactional experience across the four providers, making them uniquely qualified to assess provider performance from a power-user perspective. Although the panel of ten is relatively small, this is consistent with expert-based fuzzy MCDM studies, where a limited number of highly knowledgeable informants is considered methodologically appropriate (Rane & Choudhary, 2023).

Before presenting the provider ranking, it is useful to briefly recall the criteria weighting that underpins it. As established in Puiteng et al. (2025b) and summarised in Table 1, privacy and security (0.2472) and website design (0.2285) are the two most influential criteria, together accounting for nearly half of the total decision weight, while ease of use (0.1580) carries the least. The primacy of privacy and security is consistent with San et al. (2020) and Mamakou et al. (2023), who link perceived security to customer trust and loyalty in the Malaysian context. The comparatively low weight on ease of use likely reflects that experienced power-sellers already regard interface usability as a baseline expectation rather than a differentiator. These weights shape the ranking; providers that perform strongly on privacy, security, and website design are rewarded proportionally more than those that merely offer an easy-to-use interface.

Applying the Fuzzy TOPSIS procedure, the distance of each provider from the fuzzy positive ideal solution (FPIS) and the fuzzy negative ideal solution (FNIS) was computed, as reported in Table 3. These distances were then combined into a closeness coefficient (CC) for each provider, which determines the final ranking shown in Table 4.

Table 3. Distance from positive and negative ideal solutions

E-Logistics Provider	Distance from Positive Ideal	Distance from Negative Ideal
DHL Express	0.063	0.534
J&T Express	0.247	0.350
Shopee Express	0.563	0.031
Ninja Van Express	0.239	0.361

Table 4. Closeness coefficient and ranking

E-Logistics Provider	Closeness Coefficient	Rank
DHL Express	0.895	1
Ninja Van Express	0.601	2
J&T Express	0.586	3
Shopee Express	0.105	4

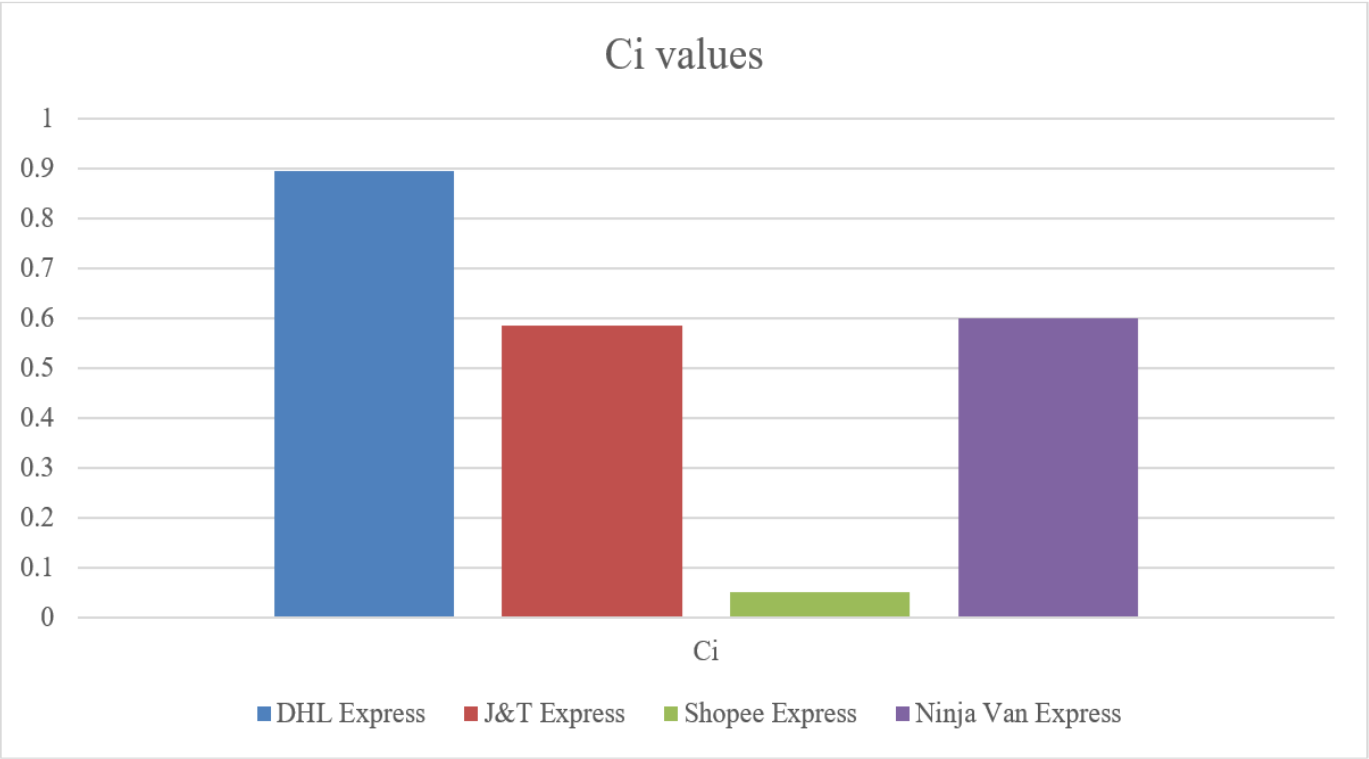

Figure 1. Closeness coefficient comparison of Malaysian domestic e-logistics system providers

The Fuzzy TOPSIS analysis produces a clear ranking of the four Malaysian domestic e-logistics providers. DHL eCommerce achieves the highest closeness coefficient (0.895), ranking first by a substantial margin. It is followed by Ninja Van (0.601) in second place and J&T Express (0.586) in third, which are closely matched, while Shopee Express (0.105) ranks a distant fourth.

DHL eCommerce's clear lead is largely attributable to its strong performance on the two most heavily weighted criteria, privacy and security and website design. As a globally established carrier, DHL benefits from mature data-protection infrastructure, a self-service digital platform, and standardised fulfilment processes, which align closely with the attributes expert sellers value most. Its small distance from the positive ideal solution (0.063) and large distance from the negative ideal (0.534) indicate near-ideal performance across the weighted criteria. This finding reinforces the view that investment in secure, well-designed digital platforms yields a measurable competitive advantage in e-logistics.

The near-tie between Ninja Van (0.601) and J&T Express (0.586) reflects their comparable strengths in responsiveness and reliability, driven by AI-based routing, real-time tracking, and extensive delivery networks. Their mid-range closeness coefficients suggest solid but not category-leading performance: both are competitive on operational criteria yet trail DHL on the privacy, security, and design dimensions that carry the greatest weight. For these providers, the results imply that targeted improvements in data protection and platform design, rather than further gains in delivery speed alone, would most effectively raise their standing.

The most striking result is the last-place ranking of Shopee Express (0.105), despite it being the primary logistics platform used by all ten participating sellers. Its large distance from the positive ideal (0.563) and minimal distance from the negative ideal (0.031) indicate consistently weak performance across the weighted criteria. This reveals a notable gap between platform familiarity and perceived service quality: frequent use does not translate into a favourable e-service quality evaluation. The result suggests that Shopee Express's tight integration with the Shopee marketplace secures transaction volume but has not been matched by competitive performance on privacy, security, and website design. For Shopee Express, these findings pinpoint clear priority areas for improvement if it is to close the gap with established global carriers.

Taken together, the ranking demonstrates the practical value of combining Fuzzy AHP-derived weights with Fuzzy TOPSIS: it moves beyond identifying which criteria matter to showing which providers actually deliver on them. The framework offers logistics managers a transparent benchmarking tool and gives each provider an evidence-based diagnosis of where it stands relative to competitors and where improvement effort would yield the greatest return.

CONCLUSION

This study set out to rank Malaysia's major domestic e-logistics providers according to their e-service quality, completing the second phase of a two-part decision framework. Building on the five weighted criteria, reliability, responsiveness, privacy and security, ease of use, and website design, established through Fuzzy AHP in our earlier work (Puiteng et al., 2025b), the present study applied Fuzzy TOPSIS to rank four providers: DHL eCommerce, J&T Express, Ninja Van, and Shopee Express. Evaluations were obtained from ten top Shopee sellers in the Home Living category, whose extensive operational experience across all four providers makes them well-qualified informants.

The Fuzzy TOPSIS analysis produced a clear and actionable ranking. DHL eCommerce ranked first with a closeness coefficient of 0.895, driven by strong performance on the most heavily weighted criteria of privacy, security, and website design. Ninja Van (0.601) and J&T Express (0.586) followed closely in second and third place, competitive on operational criteria but trailing on data protection and platform design. Shopee Express ranked last (0.105), despite being the primary platform for all participating sellers, revealing a marked gap between platform familiarity and perceived service quality. This ranking constitutes the study's central contribution: it translates abstract criteria weights into a concrete, comparative assessment that logistics providers and policymakers can act upon.

By integrating expert-derived criteria weights with a distance-based ranking method, the study delivers a transparent benchmarking framework for the e-logistics sector. Practically, it enables each provider to identify precisely where it stands relative to competitors and which criteria offer the greatest return on improvement effort, supporting Malaysia's Digital Economy Blueprint (MyDIGITAL) and its broader ambition to become a regional logistics hub.

Several limitations should be acknowledged. First, the sample was restricted to ten Shopee sellers in the Home Living category, which limits generalizability to other product categories and platforms. Second, both the criteria weighting and the provider ranking draw on the same expert panel, and independent validation with a larger or separate sample would strengthen robustness. Third, the study captures only the seller's perspective; incorporating end-consumer and logistics-operator viewpoints would provide a more complete picture. Future research should expand the expert panel across multiple categories and platforms, triangulate the rankings with consumer surveys, and explore hybrid MCDM approaches such as Fuzzy AHP-DEMATEL or machine-learning-based service-quality prediction to extend and validate the proposed framework.

ACKNOWLEDGEMENTS

The authors would like to thank the Faculty of Technology Management and Technopreneurship (FPTT), Universiti Teknikal Malaysia Melaka, Malaysia (UTeM). The authors also would like to thanks to Centre of Technopreneurship Development (C-TeD) and research group Sustainable Digital Economics Management (SuITE) for the support. The study is funded by the Fundamental Research Grant Scheme (FRGS/1/2024/FPTT/F00581).

REFERENCES

1. Ainomugisha, E. (2022). Information technology adoption, supply chain integration and logistics performance: A case of logistics firms in Uganda (Doctoral thesis, Makerere University Business School).

2. Akıl, S., & Ungan, M. C. (2022). E-commerce logistics service quality: Customer satisfaction and loyalty. Journal of Electronic Commerce in Organizations (JECO), 20(1), 1–19.
3. Al-Hawary, S. I., & Al-Smeran, W. F. (2017). Impact of electronic service quality on customers' satisfaction of Islamic banks in Jordan. International Journal of Academic Research in Accounting, Finance and Management Sciences, 7(1), 170–188.
4. Archetti, C., Peirano, L., & Speranza, M. G. (2022). Optimization in multimodal freight transportation problems: A survey. European Journal of Operational Research, 299(1), 1–20. https://doi.org/10.1016/j.ejor.2021.07.031
5. Baber, H. (2019). E-SERVQUAL and its impact on the performance of Islamic banks in Malaysia. The Journal of Asian Finance, Economics and Business, 6(1), 169–175. https://doi.org/10.13106/jafeb.2019.vol6.no1.169
6. Badi, I., & Pamucar, D. (2020). Supplier selection for steelmaking company by using combined Grey-MARCOS methods. Decision Making: Applications in Management and Engineering, 3(2), 37–48.
7. Badi, I., Shetwan, A., Abdulshahed, A., & Eltayeb, W. (2019). Evaluation of solid waste treatment methods in Libya by using the analytic hierarchy process. Decision Making: Applications in Management and Engineering, 2(2), 19–35.
8. Barrutia, J. M., & Gilsanz, A. (2009). E-service quality dimensions: A literature review and implications for future research. International Journal of Service Industry Management, 20(5), 502–526.
9. Chen, L., Dong, T., Nan, G., Xiao, Q., Xu, M., & Ming, J. (2023). Impact of the introduction of marketplace channel on e-tailer's logistics service strategy. Managerial and Decision Economics, 44(5), 2835–2855. https://doi.org/10.1002/mde.3850
10. Cheng, C. C., Chang, Y. Y., & Chen, C. T. (2021). Construction of a service quality scale for the online food delivery industry. International Journal of Hospitality Management, 95.
11. Chin, M. Y. (2023). Digital free trade zone in facilitating small medium enterprises for globalisation. Business and Economic Research, 13(2), 40–52.
12. Cox, J., & Dale, B. G. (2002). Key quality factors in Web site design and use: An examination. International Journal of Quality & Reliability Management, 19(7), 862–888.
13. Cristóbal, E., Flavián, C., & Guinalíu, M. (2007). Perceived e-service quality (PeSQ). Managing Service Quality, 17(3), 317–336.
14. Dabholkar, P. A. (1996). Consumer evaluations of new technology-based self-service options. International Journal of Research in Marketing, 13(1), 29–51.
15. Dhingra, S., Gupta, S., & Bhatti, R. (2020). A study of relationship among service quality of e-commerce websites, customer satisfaction, and purchase intention. International Journal of E-Business Research, 6(3), 42–59.
16. Erwin, M. E., & Nugroho, S. (2016). Analisa kualitas jasa pelayanan internet banking Bank Bukopin. Industrial Engineering Online Journal, 4(1).
17. Faisal, A. S., Haque, R., Pang, A. K., Rahman, A., & Connie, G. (2020). The influence of e-service quality dimensions on customer satisfaction and purchase intention. Asian Journal of Technology & Management Research, 10(1), 1–22.
18. Fanny, M., Putri, E., et al. (2014). Pengaruh kualitas layanan elektronik (E-Servqual) terhadap kepuasan nasabah pengguna mobile banking. Telkom University.
19. Fassnacht, M., & Koese, I. (2006). Quality of electronic services: Conceptualizing and testing a hierarchical model. Journal of Service Research, 9(1), 19–37.
20. Field, J. M., Heim, G. R., & Sinha, K. K. (2004). Managing quality in the e-service system. Production and Operations Management, 13(4), 291–306.
21. Ganguly, R., & Singh, D. (2023). Explainable artificial intelligence for the prediction of diabetes management. International Journal of Advanced Computer Science and Applications (IJACSA), 14(7).
22. Goswami, S., & Sarma, M. K. (2019). Modelling customer delight in the hotel industry. Global Business Review, 20(2), 405–419.
23. Gratzer, M., Werthner, H., & Winiwarter, W. (2002). Electronic business in tourism: Trends and competitive advantage.
24. Guo, X., Gao, K., & Wang, S. (2022). Share or not share: The optimal logistics service strategy in a dual-channel e-commerce supply chain. Electronic Commerce Research, 1–47.

25. Harahap, A. Z. M. K., et al. (2023). Business process innovations for courier service sector: Case study in J&T Dungun. Journal of Tourism, Operations & Management (JTOM).
26. Hasan, Z., Mohammad Asri, M. F., Bashirun, S. N., & Mustakim, N. A. (2024). Re-visiting the E-SERVQUAL and expectancy disconfirmation theory. Information Management and Business Review, 16(3(I)S), 981–993.
27. Hemmati, N., et al. (2020). An integrated fuzzy-AHP and TOPSIS approach for maintenance policy selection. International Journal of Quality & Reliability Management, 37(9/10), 1275–1299.
28. Hongxiu, L., Yong, L., & Reima, S. (2009). A proposed scale for measuring e-service quality. International Journal of u- and e-Service, Science and Technology, 2(1), 1–18.
29. Hu, M., Chaudhry, P. E., & Chaudhry, S. S. (2022). Linking customized logistics service in online retailing with e-satisfaction and e-loyalty. International Journal of Engineering Business Management, 14. https://doi.org/10.1177/18479790221097528
30. Hua, L., & Wu, Y. (2024). Strategic analysis of vertical integration in cross-border e-commerce logistics. Transportation Research Part E, 188, 103626.
31. Ilyas, S., & Rahmad, Y. (2022). MCDM techniques for evaluating website service quality.
32. Iraz, U., Yurdakul, A., & Zaim, S. (2020). An integrated fuzzy AHP and fuzzy VIKOR approach for personnel selection. Journal of Intelligent & Fuzzy Systems, 38(2), 2171–2184.
33. Jain, N. K., Gajjar, H., & Shah, B. J. (2021). Electronic logistics service quality and repurchase intention. Journal of Retailing and Consumer Services, 59, 102360.
34. Janda, S., Trocchia, P. J., & Gwinner, K. P. (2002). Consumer perceptions of Internet retail service quality. International Journal of Service Industry Management, 13(5), 412–431.
35. Javed, S., Md.Salamun, R., & Liu, B. I. N. (2018). Assessing the e-services of the banking sector by using e-Servqual model. Journal of Internet Banking and Commerce, 23(1), 1–12.
36. Kaur, B. (2023). E-service quality: Development and validation of the scale. SAGE.
37. Kaya, B., Behravesh, E., Abubakar, A. M., Kaya, O. S., & Orús, C. (2019). The moderating role of website familiarity. Journal of Internet Commerce, 18(4), 369–394. https://doi.org/10.1080/15332861.2019.1668658
38. Khan, M. A., Zubair, S. S., & Malik, M. (2019). An assessment of e-service quality, e-satisfaction, and e-loyalty. South Asian Journal of Business Studies, 8(3), 283–302. https://doi.org/10.1108/SAJBS-01-2019-0016
39. Khatib, S. M., Lim, C. S., Wong, S. C., & Hong, K. Y. (2019). Factors of e-service quality among Malaysian millennial streaming service users. International Journal of Engineering and Management (IJEM), 13(1).
40. Long, M., & McMellon, C. (2004). Exploring the determinants of retail service quality on the Internet. Journal of Services Marketing, 18(1), 78–90.
41. Madu, C. N., & Madu, A. A. (2002). Dimensions of e-quality. International Journal of Quality & Reliability Management, 19(3), 246–258.
42. Makmor, M. F. M., Jamaluddin, Z., & Saad, M. (2023). Logistics best practices towards logistics performance in Malaysia. Advances in Economics, Business and Management Research, 225–238. https://doi.org/10.2991/978-2-494069-99-2_1
43. Mamakou, X. J., Zaharias, P., & Milesi, M. (2023). Measuring customer satisfaction in electronic commerce. International Journal of Quality and Reliability Management. https://doi.org/10.1108/IJQRM-07-2021-0215
44. Mat Ali, S. A., et al. (2023). Customer satisfaction with online shopping: Shopee. Universiti Teknologi MARA.
45. Meuter, M. L., Ostrom, A. L., Roundtree, R. I., & Bitner, M. J. (2000). Self-service technologies. Journal of Marketing, 64(3), 50–64.
46. Mohd Khirzan Badzli A. Rahman, Abdul Kadir Othman, & Nurulhuda Amrin. (2018). The effects of e-service quality on users' satisfaction: A case of e-Filing at LHDN.
47. Mohd Salleh, M. Z., et al. (2024). E-service quality dimensions using a modified SERVQUAL framework.
48. Mustakim, N., Hasan, Z., Sauid, M., Begum, Z. E., & Mokhtar, N. (2022). Factors affecting customer satisfaction on Shopee. HRMARS.

49. Mwatsika, C. (2016). Impact of ATM banking performance on customer satisfaction. International Journal of Business and Economics Research, 5(1).
50. Nabila, E. Y., et al. (2023). Determinants of repurchase intention. East African Scholars Journal of Economics, Business and Management, 6(1), 29–36.
51. Pandey, M., & Shukla, D. (2019). Evaluating the human performance factors of air traffic control using fuzzy MCDM. Journal of Air Transport Management, 81, 101708.
52. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64(1), 12–40.
53. Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). E-S-QUAL: A multiple-item scale for assessing electronic service quality. Journal of Service Research, 7(3), 213–233. https://doi.org/10.1177/1094670504271156
54. Phan, C. A., & Nham, P. T. (2015). Impact of service quality on customer satisfaction of ATM service. Business: Theory and Practice, 16(3), 280–289.
55. Puiteng, C., Fam, S.-F., Choryuin, T., & Wahjono, S. I. (2025a). E-service quality and customer satisfaction: Insights and trends from a bibliometric analysis. International Journal of Academic Research in Business and Social Sciences, 15(2), 538–551. https://doi.org/10.6007/IJARBSS/v15-i2/24534
56. Puiteng, C., Fam, S.-F., Choryuin, T., Chuan, Z.-L., & Shinyie, W. L. (2025b). A study to evaluate e-service quality in Malaysia's domestic e-logistics system through Fuzzy AHP. International Journal of Academic Research in Business and Social Sciences. (Manuscript submitted for publication).
57. Rachmawati, D. Z., & Agus, A. A. (2020). E-service and logistics service quality in e-commerce: Shopee Indonesia. 3rd International Conference on Computer and Informatics Engineering. doi:10.1109/IC2IE50715.2020.9274597
58. Rane, N., & Choudhary, S. P. (2023). Fuzzy AHP and Fuzzy TOPSIS as an effective MCDM method for subjective judgements in selection process.
59. Raza, S. A., Umer, A., Qureshi, M. A., & Dahri, A. S. (2020). Internet banking service quality, e-customer satisfaction and loyalty. TQM Journal, 32(6), 1443–1466. https://doi.org/10.1108/TQM-02-2020-0019
60. Rosyid, M. I., Ariyanty, M., & Kusumahadi, K. (2019). Pengaruh E-Servqual dan kepuasan pengguna mobile banking terhadap loyalitas nasabah. E-Proceeding of Management, 6(3), 5557–5566.
61. Safi'i, I. (2018). Klasifikasi atribut pelayanan mobile banking dengan Kano model berdasarkan dimensi E-Servqual. Jurnal Sistem dan Manajemen Industri, 2(2), 77. https://doi.org/10.30656/jsmi.v2i2.696
62. San, W. H., Von, W. Y., & Muhammad Imran Qureshi. (2020). The impact of e-service quality on customer satisfaction in Malaysia. Journal of Marketing and Information Systems, 3(1), 46–62.
63. Santos, J. (2003). E-service quality: A model of virtual service quality dimensions. Managing Service Quality, 13(3), 233–246.
64. Sasono, I., et al. (2021). E-service quality and customer perceptions on online platforms.
65. Singh, A., & Prasher, A. (2019). Measuring healthcare service quality from patients' perspective using Fuzzy AHP. Total Quality Management & Business Excellence, 30(3–4), 284–300.
66. Surjadjaja, H., Ghosh, S., & Antony, J. (2003). Determining and assessing the determinants of e-service operations. Managing Service Quality, 13(1), 39–53.
67. Tan, K. T., et al. (2018). E-service quality in internet retailing. International Journal of Quality & Reliability Management, 35(4), 825–840.
68. Tan, Y. K., et al. (2023). Exploring the relationship between online lesson design and student-perceived learning in polytechnics. Asian Journal of the Scholarship of Teaching and Learning, 13(1), 3177.
69. Trisnawati, O. M., & Fahmi, S. (2017). Pengaruh kualitas layanan elektronik terhadap kepuasan nasabah mobile banking. Jurnal Manajemen dan Bisnis Indonesia, 4(2), 174–184. https://doi.org/10.31843/jmbi.v4i2.116
70. Wang, X., Kumar, V., Kumari, A., & Kuzmin, E. (2022). Impact of digital technology on supply chain efficiency. In Digital Transformation in Industry (pp. 347–371). Springer. https://doi.org/10.1007/978-3-030-94617-3_25
71. Waruwu, H. (2021). The impact of e-service quality and satisfaction on customer loyalty. The Journal of Asian Finance, Economics and Business, 8(4), 465–473. https://doi.org/10.13106/jafeb.2021.vol8

72. Wolfinbarger, M., & Gilly, M. C. (2003). eTailQ: Dimensionalizing, measuring, and predicting e-tail quality. Journal of Retailing, 79(3), 183–198.
73. Yang, Z., Jun, M., & Peterson, R. T. (2004). Measuring customer perceived online service quality. International Journal of Operations & Production Management, 24(11), 1149–1174.
74. Yoo, B., & Donthu, N. (2001). Developing a scale to measure the perceived quality of an Internet shopping site (SITEQUAL). Quarterly Journal of Electronic Commerce, 2(1), 31–47.
75. Zavareh, F. B., et al. (2012). E-service quality dimensions and their effects on e-customer satisfaction in internet banking services. Procedia - Social and Behavioral Sciences, 40, 441–445. https://doi.org/10.1016/j.sbspro.2012.03.213
76. Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through Web sites. Journal of the Academy of Marketing Science, 30(4), 362–375.