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AHP-Based Prioritisation of Cashless Payments in Indonesian SMEs: Evidence from Depok

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Abstract

Cashless payment platforms are increasingly central to the daily operations of Indonesian small and medium enterprises, yet recent Indonesian and regional evidence rarely quantifies the criteria trade-offs that managers confront when choosing among competing alternatives. This study addresses that gap by applying the Analytic Hierarchy Process to a healthy-food SME that accepts remote payments via GoPay, GrabPay, and ShopeePay and conducts in-store digital transactions through Electronic Data Capture and the Quick Response Code Indonesian Standard. Primary data were collected through structured pairwise-comparison interviews with owner-managers during March to April 2025 (n = 5), producing a criteria-level priority structure and ranked preferences that were verified for internal coherence. All final matrices met the AHP consistency requirement with Consistency Ratio values below 0.10, and a sensitivity analysis confirmed that the ordering of alternatives remained stable under plausible variations in criterion weights. The results show that cost and real-time transaction capability dominate the preference structure, while user-friendly features and promotion exert secondary influence. The findings offer actionable guidance for firms and providers through emphasis on effective fee design, reliable real-time settlement, interface simplification, and targeted promotions that strengthen adoption and customer experience.

Keywords: Analytical Hierarchy Process; Sensitivity; SME; Cashless Payment System; Indonesia

INTRODUCTION

Digital platforms that enable e-commerce and cashless payment have improved the circulation of goods and increased the velocity of financial transactions between sellers and buyers, thereby reshaping routine commercial interactions in Indonesia (Bintang Pasya et al., 2023). The transition from cash-based to digital payment systems provides measurable benefits that include time efficiency, fewer arithmetic errors, and the flexibility to transact ubiquitously at any time, which together reduce frictions that often

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burden small firms (Zahroh, 2022; Salam & Taufik, 2020). In parallel, platforms have become integral marketing instruments through targeted promotions, stronger content quality, and deliberate audience engagement, which link payment choice with customer acquisition and retention activities within a single digital journey (Soegoto et al., 2018). Post-pandemic shifts in health awareness have also increased demand for nutritious products, which strengthens the relevance of studying a small and medium enterprise in the healthy food segment, namely a salad-bar business, as the empirical context of this research (Kusumarini et al., 2022; Winando et al., 2023). Notwithstanding these favourable trends, small and medium enterprises frequently struggle with digital adoption because of limited system integration and the operational challenges that accompany procedural change on the shop floor, which indicates that managerial guidance must connect technology choices with day-to-day constraints (Ma'sumatul Maghfiroh et al., 2023).

A focused reading of recent Indonesian and regional studies suggests that the literature has often compared platforms descriptively or enumerated generic adoption drivers without quantifying the structured trade-offs that small and medium enterprises face when selecting among cashless payment alternatives at the level of decision criteria. Evidence is also limited on the systematic verification of internal decision consistency and on the stability of preference rankings when criterion weights change, which creates a gap between high-level narratives and decision-ready guidance for managers who must allocate scarce resources across several payment options. The present study addresses these gaps by translating adoption determinants into a measurable priority structure for an Indonesian small and medium enterprise that operates a salad-bar business. The firm, hereafter referred to as XYZ, accepts remote payments through GoPay, GrabPay, and ShopeePay, and processes in-store digital transactions using Electronic Data Capture machines and the Quick Response Code Indonesian Standard. Data collection and analysis were conducted during March to April 2025 in order to preserve temporal consistency across the manuscript.

The study applies the Analytic Hierarchy Process to decompose the objective into criteria and alternatives, and to derive ratio-scale priorities from pairwise comparisons that are checked for internal coherence. Consistency Ratio values are reported and targeted to remain below 0.10 for all final matrices, while a sensitivity analysis examines the impact of criterion-weight variation on the ranking of alternatives so that managerial robustness can be evaluated explicitly (Saaty and Vargas, 2012). The novelty lies in moving beyond platform comparison toward a consistency-verified, multi-criteria evaluation that yields ranked preferences for a specific Indonesian context. The theoretical contribution is the articulation of a criteria-level priority structure that links service management and digital payment literatures to a decision-analytic framework with explicit treatment of internal consistency and sensitivity. The practical contribution is decision-ready guidance on which criteria most strongly drive preference ordering and on how providers and policy actors can align pricing, real-time settlement practices, interface simplification, and promotion design with the needs of small and medium enterprises in similar settings (Bintang Pasya et al., 2023; Soegoto et al., 2018; Zahroh, 2022).

Although the full findings are presented in subsequent sections, the analysis is designed to inform choices by highlighting the criteria that exert the greatest leverage on alternative rankings and by indicating the conditions under which these rankings remain stable. In sum, the research gap addressed in this Introduction concerns the absence of criteria-level trade-off quantification, the infrequent verification of internal decision consistency, and the limited testing of ranking robustness in Indonesian or regional studies of cashless payments for small and medium enterprises. The study responds by implementing Analytic Hierarchy Process with explicit Consistency Ratio reporting, by specifying criteria that reflect operational realities in a healthy-food small and medium enterprise, and by conducting sensitivity analysis to test stability, thereby aligning academic evidence with the practical requirements of managerial decision-making in the Indonesian context (Kusumarini et al., 2022; Ma'sumatul Maghfiroh et al., 2023; Saaty and Vargas, 2012; Winando et al., 2023).

LITERATURE REVIEW

Service Management

A sustainability-oriented service strategy requires the coordinated management of people, technology, and information systems to deliver reliable outcomes and protect competitive advantage (Slack, 2017). Continuous improvement tools such as service blueprinting and BPMN make process flows and handovers visible, which enables targeted interventions that improve customer experience and operational efficiency (Kazemzadeh et al., 2015). Beyond the capability to produce valuable products, firms must orchestrate end-to-end e-business capabilities that support supply chain coordination, inventory and order fulfilment, and workflow control in order to reduce variability and shorten cycle time (Tiwana et al., 2001). The diffusion of internet services, platform ecosystems, and cashless payment facilities enhances process performance by raising convenience and efficiency, while enabling round-the-clock transactions that reduce waiting time and errors from manual handling (Alifah Fakriah & Dheo Alfhito, 2025). This perspective justifies four decision criteria in the present study. Cost shapes daily feasibility for SMEs. Real-time transaction capability affects cash flow reliability and service dependability. User-friendly features determine interaction quality. Promotion influences channel utilisation and demand activation.

E-commerce Growth in a Global Perspective

E-commerce reconfigures value creation through digital channels, broadening promotional reach, accelerating interaction, and lowering transaction costs for both sellers and buyers (Nanda Amiliya & Hermawan, 2023; Soegoto et al., 2018). Customers increasingly access platforms through mobile devices, which substitutes for physical visits and shifts consumption towards contactless and standardised transactions (Kusumarini et al., 2022; Sidharta et al., 2021). In collaborative ecosystems, e-commerce removes bargaining inefficiencies and improves timeliness, which reduces inventory and opportunity costs (Ma'sumatul Maghfiroh et al., 2023; Anisah, 2023). These benefits strengthen brand building, enhance communication, and increase satisfaction and sales

when pricing is designed to support long-term sustainability rather than short-term gains (Edhie Rachmad, 2022; Sudiantini et al., 2024). The evidence confirms that effective cost and price management remain central to SME utility, while ease of use and speed of service shape perceived value when transactions are fully digital.

Food Delivery Services Growth in Indonesia

Growth in food delivery services in Indonesia is propelled by platform development and financial technology, which together enable non-cash transactions and the standardisation of payment practices (Putri et al., 2022; Faiqoh et al., 2025). GoFood, GrabFood, and ShopeeFood connect merchants and consumers at scale and raise expectations for delivery speed and order accuracy, particularly for perishable products (Kitab Bulloh et al., 2024; Seghezzi & Mangiaracina, 2021). This transformation has shifted many restaurants from dine-in to delivery models, although in-store experiences continue to create specific value for some customers (Li et al., 2020). In physical points of sale, EDC and QRIS remain relevant for standardised offline transactions (Rahadi et al., 2022). Mapping to criteria. The on-demand context highlights the importance of real-time transaction capability for maintaining daily liquidity for payroll and restocking. At the same time, interoperability through QRIS reduces acceptance frictions and broadens the merchant network, which reinforces the perceived reliability of non-cash payments.

Payment Gateway Features

The success of cashless payments depends on functional reliability, perceived security, and interface simplicity that reduces cognitive effort during checkout (Kusumarini et al., 2022; Prabowo & Nugroho, 2019). Applications that present clear information, consistent visual design, and intuitive navigation build trust and encourage repeated use (Aprilia Benhardy & Ronadi, 2020). Partnerships between gateways and dominant e-wallets within the Gojek, Grab, and Shopee ecosystems create network value and facilitate coordinated promotions such as bundling, delivery fee discounts, seasonal deals, and minimum-order discounts (Cahyaning Tyas et al., 2024; Faiqoh et al., 2025). For SMEs in particular, bundling can enhance menu visibility, reduce food waste, and increase sales through periodic programmes such as twin-date and payday flash sales (Ilhan Mansiz et al., 2025). Mapping to criteria. The literature supports the role of user-friendly features in lowering user effort at checkout and the influence of promotion in stimulating demand and channel utilisation.

Consumer Behaviour

An integrated and secure service ecosystem strengthens trust and experience, especially in food delivery where ordering and payment are tightly coupled (Aprilia Benhardy & Ronadi, 2020). Customer preferences are shaped by price sensitivity, shopping experience, and perceived ease, which means that firms that adapt to these dynamics tend to achieve stronger sales performance (Juli Winando Lumban Toruan et al., 2024). As digital platforms and fintech continue to expand, ongoing monitoring of preferences and behaviour becomes a strategic requirement (Putri et al., 2022). Mapping to criteria. Behavioural evidence suggests that cost influences willingness to pay and switching, ease

of use affects adoption and retention, and promotion modulates usage intensity and channel choice.

Analytic Hierarchy Process in Cashless-Payment Decisions

To translate adoption determinants into a measurable priority structure, the present study applies the Analytic Hierarchy Process. AHP decomposes the objective into criteria and alternatives and derives ratio-scale priorities through pairwise comparisons that are verified for internal coherence. The manuscript uses authoritative AHP sources for theory and practice, corrects the methodological citation to Saaty and Vargas, and reports that all final matrices meet the Consistency Ratio threshold of CR < 0.10 to ensure the reliability of the priority vector. Based on the empirical evidence reviewed above, the model specifies four criteria for the AHP hierarchy, namely cost, real-time transaction capability, promotion, and user-friendly features, each supported by recent Indonesian or regional studies published in the last five years.

METHODOLOGY

This study adopted a mixed-method approach, combining both qualitative and quantitative methods to comprehensively address the research objectives. The qualitative stage began with structured interviews involving five business owners in the food and beverage sector who have experience using online payment systems. These interviews are conducted to explore the sellers' perspectives and to define the decision-making criteria. The results of these interviews form the foundation for the AHP model, which was applied in the subsequent quantitative stage.

The quantitative stage employed the AHP method to evaluate and rank payment method alternatives based on the identified criteria. The AHP method was a widely recognized multi-criteria decision-making (MCDM) technique that enabled decision-makers to derive priority rankings among alternatives by performing structured pairwise comparisons (Vargas & St, 2022). The AHP method has been applied in various contexts, such as selecting slicing machines (Chang et al.,2007),identifying credit approval (Komang et al., 2022), and evaluating e-payment platforms in digital marketplaces (Mirsuma & Rosyida, 2024).

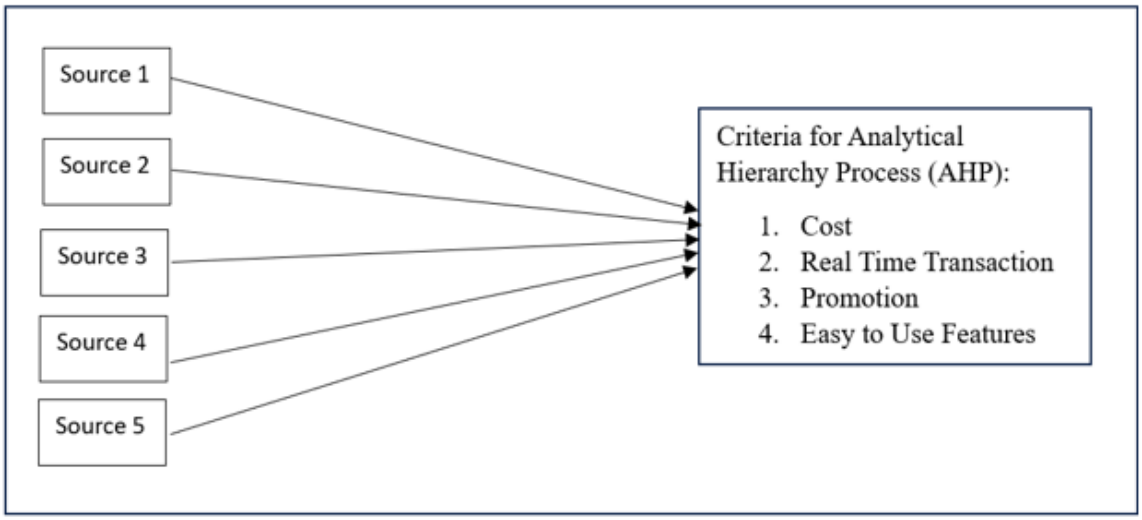
This research applied the model to a specific case: XYZ SME, a small and medium enterprise operating a salad bar in Depok, West Java, Indonesia. The company has a specialty in providing salads with many variations of sauces and cold-pressed juices. The company was currently transitioning from offline to cashless payment systems and determining the most effective and beneficial payment method to support operational growth and customer convenience.

Define Criteria for The Analytical Hierarchy Process (AHP)

The increasing accessibility of digital payment systems presented both opportunities and challenges (Putrevu & Mertzanis, 2024). Business owners must carefully evaluate which payment method aligns most effectively with their operational requirements, customer

preferences, and financial constraints. The company's strategy significantly influenced decision-making processes related to digital payment adoption, particularly in areas such as strategic pricing, which can improve operational efficiency and drive higher sales volumes (Nugroho et al., 2025). Furthermore, several factors must be considered when choosing a digital payment system, including promotional capabilities, real-time transaction processing, interface design, and ease of use (Aprilia Benhardy & Ronadi, 2020).To enhance this study, four main criteria were identified through structured interviews with five informants from the food and beverage sector who had been using cashless payment systems for 6 months to 2 years.

Figure 1. Framework Criteria



Structured interviews indicate that the business owner evaluates digital platforms through four intertwined priorities. Cost is paramount: providers levy different transaction fees that can cascade into higher retail prices, eroding competitiveness and dampening customers' willingness to buy. Equally important is usability; the platform must be intuitive and accessible to users across ages and educational backgrounds, since a genuinely user-friendly interface accelerates adoption and encourages repeat use. Promotional capability also shapes platform choice: features that enable influencer tie-ins, social content, and app-based discounts boost brand visibility and engagement, making the platform more attractive to SMEs. Finally, real-time settlement is critical in cash-constrained operations; immediate fund availability supports payroll, replenishment of inventory, and overall agility, ensuring that day-to-day liquidity is not compromised by payment delays.

Analytical Hierarchy Process (AHP) Model

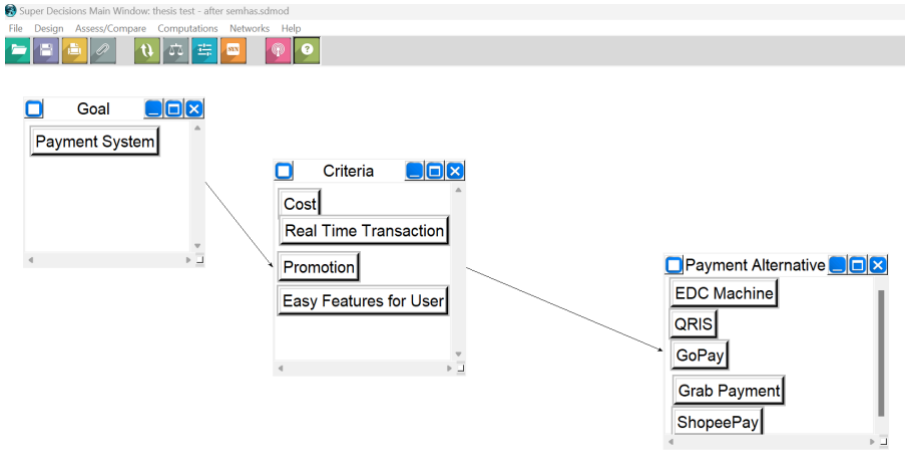
Based on the criteria above, the AHP model was constructed to assess and rank available payment alternatives. The goal of the model was to identify the most effective payment method for supporting the operational efficiency and growth of XYZ SME.

This research maps the priority level of payment systems using the AHP method. The AHP process involved some steps. First, the groups were classified on a scale between 1 and 9 (Saaty scale 1-9) that describes the most important alternatives.

In the next step, AHP used setting goals and pairwise comparisons to synthesize data using criteria and alternatives. The model calculation of the AHP methods used the software *Super Decision ANP version 2.10.0* in Figure 2. The comparison pairwise can reflect a Consistency Ratio < 0,10, which means that the pairwise and AHP models were consistent and indicated reliable decision-making.

This study evaluated criteria such as price, real transaction, promotion, and user-friendly features. Then, this research used five alternatives. EDC Machine and QRIS represented physical cashless payment systems. GoPay, Grab Payment, and ShopeePay represented remote cashless payment systems. The following steps, criteria, and alternatives will contribute to AHP methods that use XYZ SMEs as the main sources for analysis.

Figure 2. Analytical Hierarchy Process Model



The analysis was conducted using Super Decisions ANP version 2.10.0, which also includes a sensitivity test to examine how changes in the weight of each criterion affect the final ranking of alternatives. This provides deeper insight into which criteria are most influential and ensures the robustness of the final decision.

RESULTS

Result of Analytical Hierarchy Process (AHP)

In line with the research objectives, the analysis resulted in a ranking of the payment method alternatives using the Analytical Hierarchy Process (AHP). The AHP method synthesized expert pairwise comparisons to determine the weight of each criterion used in the evaluation.

Table 1. Comparison Pairwise Criteria

Criteria Code	Criteria	Weighted Criteria
C1	Cost	0,12971
C2	Easy Feature for User	0,04885
C3	Promotion	0,58166

C4	Real-Time Transaction	0,23977

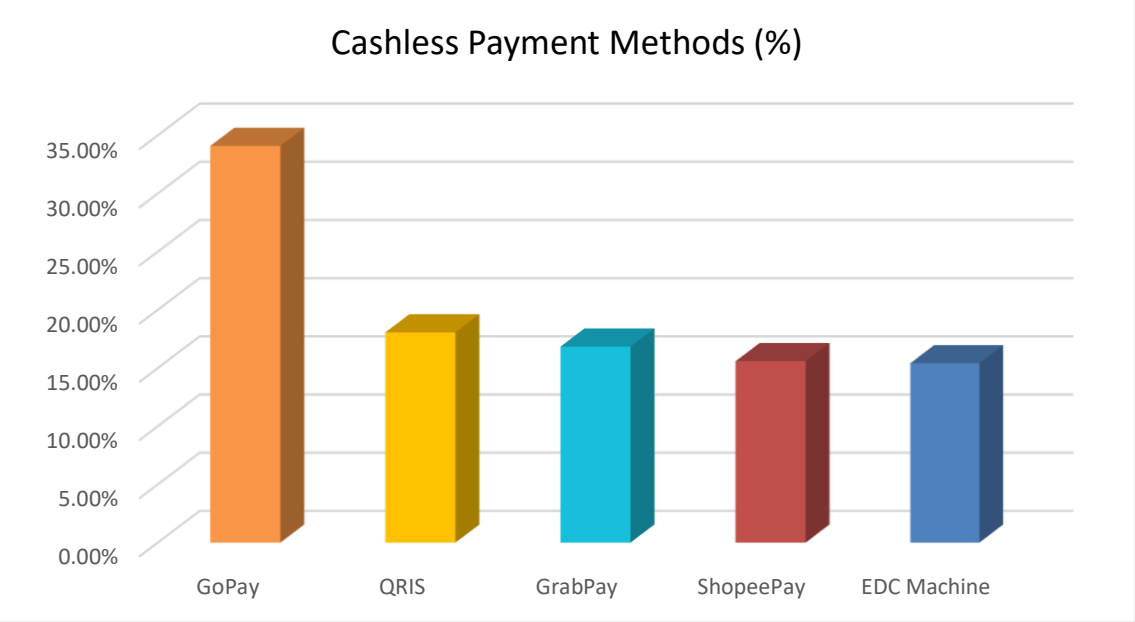
The calculated weights were as follows: promotion (0.581), real-time transaction (0.239), cost (0.129), and user-friendly features (0.048), as shown in Table 1.

Following the determination of the criteria weights, the next stage involved synthesizing the pairwise comparisons of the five alternatives. The results revealed that GoPay ranked first with a priority weight of 34.09%, followed by QRIS (18.07%), Grab Payment (16.84%), ShopeePay (15.59%), and EDC Machine (15.41%). The summary of these rankings is presented in Table 2.

Table 2. Summary of Alternatives Rank

Code	Alternative	Percentage (%)	Accumulation (%)	Rank
A1	GoPay	34,096	34,096	1
A2	QRIS	18,065	52,161	2
A3	Grab Payment	16,835	68,996	3
A4	ShopeePay	15,599	84,595	4
A5	EDC Machine	15,405	100,000	5

Figure 3. Visualization of Alternatives Rank



Result of The Sensitivity Test

The sensitivity test was conducted to complement the AHP Test. The purpose of the Sensitivity Test was to assess the robustness of the ranking results by altering the weight values of each criterion. The test used modified weight values of β 0,1, 0,2, 0,3, 0,4, 0,5, 0,6, 0,7, 0,8, 0,9, and 1 to observe whether changes in the criteria weights would affect the final ranking of alternatives.

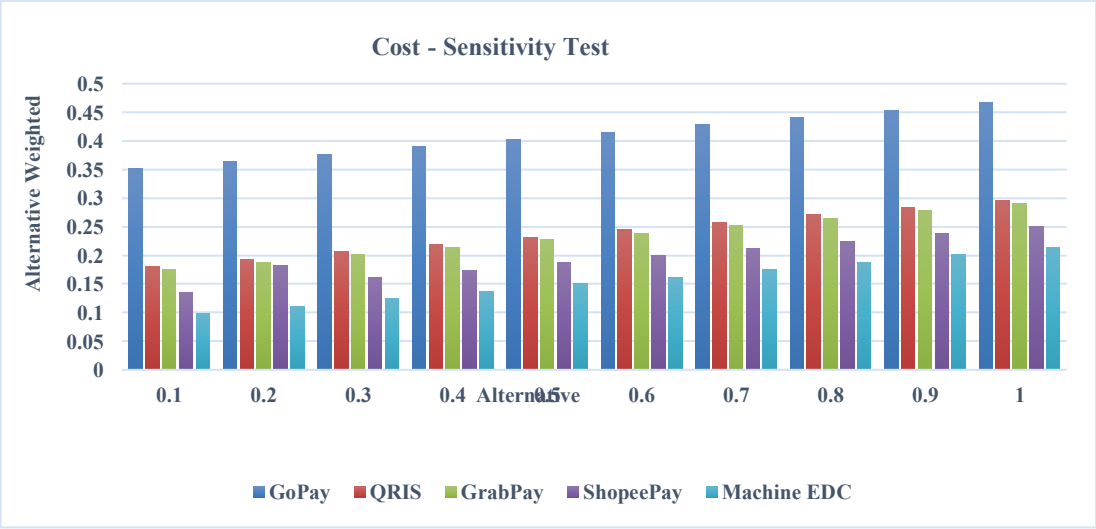
The results of the sensitivity analysis are summarized in Table 3 and Figure 4 for the cost criterion. Figure 4 presented the highest priority alternatives from the cost criteria perspective using β 0,1, 0,2, 0,3, 0,4, 0,5, 0,6, 0,7, 0,8, 0,9, and 1, which was Gopay,

followed by QRIS, as the highest priority alternatives after GoPay, with the weighted β 0,6, 0,8, 0,9 and 1. The company should maintain weighted β 0,1, 0,2, 0,3, 0,4, 0,5, 0,7, and 1, to maintain the rank from the third position of GrabPay. Furthermore, the company should be concerned with the changing weight of β 0,2 to retain the rank ShopeePay and Machine EDC, and the weighted β 0,1, 0,3, 0,4, 0,5, 0,6, 0,7, 0,8, 0,9, and 1, in Shopee and Machine EDC remained the same.

Table 3. Result Cost Criterion - Sensitivity Test

Beta (β)	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
GoPay	0,351	0,364	0,377	0,390	0,402	0,415	0,428	0,441	0,454	0,467
QRIS	0,181	0,193	0,207	0,219	0,232	0,245	0,258	0,271	0,284	0,296
Grab Payment	0,176	0,188	0,202	0,214	0,227	0,239	0,253	0,265	0,278	0,291
ShopeePay	0,135	0,182	0,161	0,174	0,187	0,200	0,212	0,225	0,238	0,251

Figure 4. Visualization of Cost Criterion from Sensitivity Test



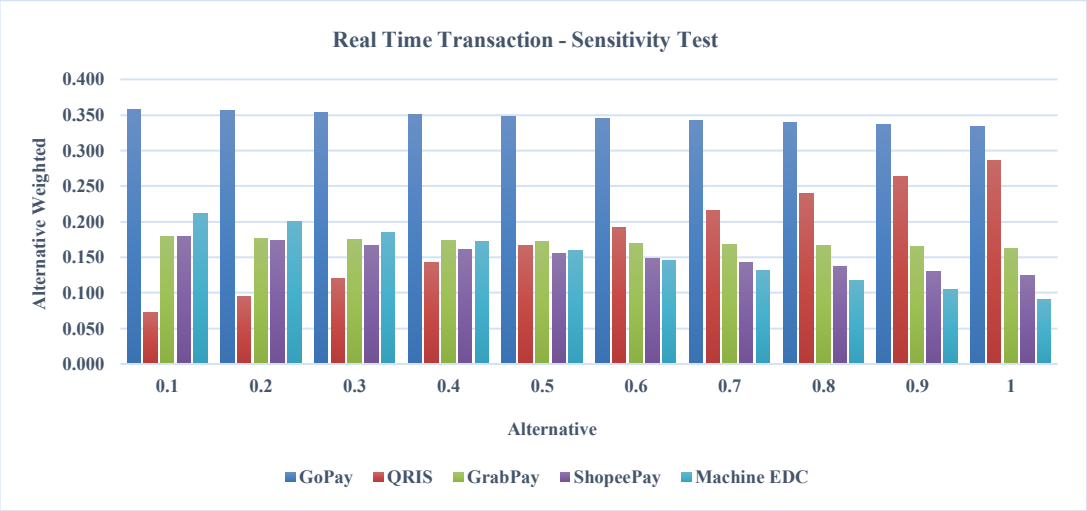
The findings in Figure 4 showed that the cost criterion from the Sensitivity Test with the highest priority was Gopay, followed by QRIS, GrabPay, ShopeePay, and Machine EDC. This was followed by real-time transactions with four changes, promotion with three changes, and user-friendly features with two changes. These results indicate that small changes in the weight of the cost criterion significantly affected the ranking of payment alternatives.

Additionally, the results of the sensitivity analysis are summarized in Table 4 and Figure 5 for the real-time transaction criterion. Figure 5 presented the highest priority alternatives from the real-time transaction criterion perspective using β 0,1, 0,2, 0,3, 0,4, 0,5, 0,6, 0,7, 0,8, 0,9, and 1, which was Gopay, followed by QRIS, as the highest priority alternatives after GoPay, with the weighted β 0,5, 0,6, 0,7 0,8, 0,9 and 1. Additionally, GrabPayment has the second-highest priority when the weight has been changed below β 0,6; the results were β 0,1, 0,2, 0,3, 0,4, and 0,5.

Table 4. Result Real-Time Transaction Criterion - Sensitivity Test

Beta (β)	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
GoPay	0,358	0,356	0,353	0,350	0,348	0,345	0,342	0,340	0,337	0,334
QRIS	0,072	0,095	0,120	0,143	0,167	0,192	0,216	0,239	0,264	0,286
Grab Payment	0,179	0,177	0,175	0,174	0,172	0,170	0,168	0,167	0,165	0,163
ShopeePay	0,179	0,173	0,167	0,161	0,155	0,148	0,142	0,137	0,130	0,125
EDC Machine	0,212	0,200	0,185	0,172	0,159	0,145	0,131	0,118	0,104	0,091

Figure 5. Visualization of Real-Time Transaction Criterion from Sensitivity Test

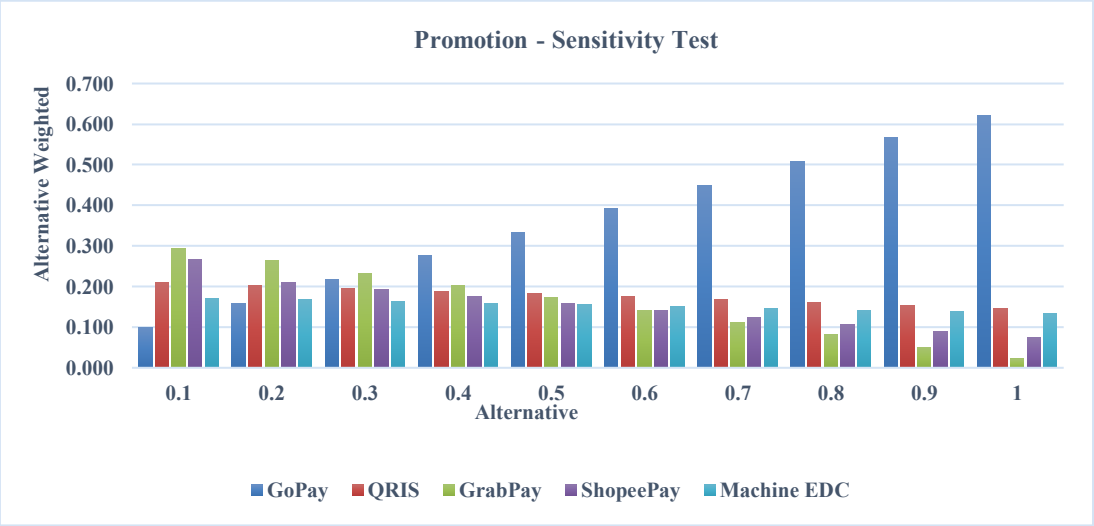


Furthermore, the results of the sensitivity analysis are summarized in Table 5 and Figure 6 for the promotion criterion. Figure 6 presented the highest priority alternatives from the promotion criterion perspective using β 0,4, 0,5, 0,6, 0,7, 0,8, 0,9, and 1, which was Gopay, followed by QRIS, as the highest priority alternatives after GoPay, with the weighted β 0,5, 0,6, 0,7 0,8, 0,9 and 1. Additionally, GrabPayment has the second highest priority when the weight has been changed below β 0,5; the results were β 0,1, 0,2, 0,3, and 0,4.

Table 5. Result Promotion Criterion - Sensitivity Test

Beta (β)	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
GoPay	0,100	0,159	0,218	0,276	0,333	0,391	0,448	0,509	0,567	0,622
QRIS	0,209	0,203	0,195	0,188	0,182	0,175	0,168	0,161	0,154	0,147
Grab Payment	0,293	0,264	0,232	0,202	0,172	0,142	0,111	0,081	0,051	0,022
ShopeePay	0,266	0,209	0,192	0,175	0,158	0,141	0,124	0,107	0,090	0,074
EDC Machine	0,171	0,167	0,163	0,159	0,155	0,150	0,146	0,142	0,138	0,134

Figure 6. Visualization of Promotion Criterion from Sensitivity Test



The result of the AHP indicates that GoPay (34,09%) ranks first, followed by QRIS (18,07%) in second place, and GrabPay (16,84%) in third place, as the preferred cashless payment services among sellers in this research. Moreover, the summary results from the Sensitivity Test also show that through criterion cost, real-time transaction, and promotion, the highest priority alternatives were Gopay, QRIS, and GrabPay. GoPay offers a wide range of services, a convenient application, many driver partners, good relations with merchants, and additional after-sales services with a rating section for customers, increasing customer trust and loyalty in using Gojek and GoPay as the priority for online delivery services and payment services (Zahroh, 2022). Additionally, Gojek and Gopay offer many competitive advantages through their promotion programs. The program can enhance service management from merchant to customer, for instance, bundling discounts, GoPlus coupons, payday flash-sale, and seasonal discounts (Nanda Amiliya & Hermawan, 2023). Moreover, QRIS also makes the transaction processes easier and increases real-time transactions, which all providers and merchants can use for cashless payment providers that are already certified by Bank Indonesia (Bintang Pasya et al., 2023). Furthermore, GrabPay has continuous improvements to improve its services, including developing a discount program and analyzing big data to address the weaknesses regarding building and maintaining relationships between the platform, the merchant, and driver partners (Nugroho et al., 2025).

CONCLUSION

This research analyzes the priority ranking of the most efficient and effective cashless payment methods and the potential development of a digital platform for XYZ using the Analytical Hierarchy Process (AHP) method. The finding reveals that the number one rank from the AHP method is GoPay (34,09%), then QRIS (18,07%), Grab payment (16,84%), ShopeePay (15,59%), and EDC machine (15,41%). Moreover, the results from the sensitivity test indicate that cost is the most sensitive criterion, followed by real-time transaction capability, promotion advantages, and user-friendliness. Cost and real-time transactions are critical considerations for sustaining cash flow, especially for small and

medium enterprises (SMEs). The business operation depends heavily on the availability of liquid capital to support day-to-day business and production activities.

The theoretical implication of this study lies in its contribution to the analysis of multi-criteria decision-making (MCDM), evaluating five cashless payment alternatives—GoPay, GrabPay, ShopeePay, QRIS, and EDC machines—against four key criteria: cost, promotion, real-time transactions, and user-friendly features, using the AHP method.

From a managerial perspective, the study recommends integrating features, discount programs, and promotional offers on digital platforms. The company can focus on allocating resources in dealing with effective cost, real-time transactions, and promotion programs using GoPay, QRIS, and Grab Payment, as the priority rank of alternatives from this research. Furthermore, companies can enhance their promotional strategies by forming collaborations with cashless payment providers, leveraging partnerships with digital media platforms such as TikTok and Instagram, organizing joint promotional events with e-commerce platforms, and aligning with digital ecosystems focused on healthy food applications, such as Qpon, DOOfood, Footspot, and Eatever. To promote faster transaction processes and sustain cash flow, adopting QRIS from some providers to back up other payment methods as a standard for real-time payments is highly recommended.

This study has some limitations, including methodological and data constraints in the analytical process, which means that the research only utilizes the AHP method and a single primary source for implementing the AHP test. The quantitative approach has a limitation on the period to collect interview data from March to April 2025. Therefore, in the future, further research can utilize broader data ranges to enhance the relevance of results to current conditions, such as different regions, economic growth levels, and variations of business sectors. Additionally, internet facilities factors can enrich insights from future research. Finally, there is a significant opportunity for future research to explore broader industry contexts and adopt diverse quantitative methods for MCDM, including techniques such as TOPSIS, VIKOR, Simple Additive Weighting (SAW), or SEM-PLS, to enhance the robustness and applicability of the findings.

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