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Users and Non-Users Perspective for Cashless Transactions in Rapid Rail Services

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ABSTRACT

This study investigates the determinants of adoption and continued use of cashless fare payment systems in Malaysia's Rapid Rail services. Drawing on survey data from 420 respondents (210 users and 210 non-users), the research employs factor analysis and correlation techniques to identify key influences. Six critical dimensions emerged: convenience and comfort, frequency of service use, customer-added value, enforcement and security, promotion and advertisement, and customer experience. Results show that promotion and advertisement exert the strongest effect across both groups, while convenience and service frequency are particularly salient for existing users. Conversely, enforcement mechanisms play a mixed role—encouraging adoption among non-users but eliciting resistance among current users, highlighting the need for voluntary, trust-based strategies. Notably, 84% of non-users expressed willingness to adopt cashless payment in the future, indicating significant growth potential. Findings contribute to fare innovation and technology adoption literature by contextualizing the Malaysian experience within emerging economies, and they provide actionable guidance for transport policymakers and operators to enhance digital payment inclusivity and sustainability.

1. Introduction

Urban public transportation systems are critical infrastructures that support sustainable city development by enhancing mobility, reducing traffic congestion, and promoting environmentally friendly transit options. In Malaysia, Rapid Rail operates several key urban rail services, including the MRT Kajang Line, Putrajaya Line, LRT Kelana Jaya Line, Ampang/Sri Petaling Line, and Monorail, serving thousands of commuters daily. As urban populations grow and commuter expectations evolve, there is a pressing need to modernize fare payment systems and expand inclusive transportation products.

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Rapid Rail has responded proactively by introducing a diversified range of cashless and concession-based payment products to meet varied commuter needs. Central to this is the various cashless products that facilitate quick and convenient access to multiple rail and bus services without the need for cash transactions, thereby reducing boarding times and enhancing operational efficiency [1,2]. Table 1 presents the RapidKL Cashless Products and Usage.

Table 1
RapidKL cashless product cost and usage

RapidKL Cashless Product	Cost/Usage
i) MyTourist Pass 	These multi-day passes (offered for 1, 2, or 3 days) provide unlimited rides for both Malaysians and non-Malaysians. MyTourist Pass is an unlimited daily travel pass offering unlimited rides on Rapid KL LRT, MRT, Monorail, BRT, Rapid KL bus and MRT feeder bus services in Klang Valley for 1 day, 2 days and 3 days. On the top of that, user is also enjoying exclusive perks and discounts at more than 20 amazing partners, from dining to shopping and entertainment. MyTourist Pass is based on day-cycle count, and you can purchase the pass at any time of the month. For Malaysian (1 day =RM20, 2 days =RM30, 3 days =RM40) and non-Malaysian (1 day=RM40, 2 days=RM60, 3 days=RM80). This pass use Touch N Go card platform and activate at any RapidKL Customer Service Office at all LRT, MRT, Monorail and BRT stations.
ii) MyCity Pass 	MyCity Pass is an unlimited daily travel pass offering unlimited rides on Rapid KL LRT, MRT, Monorail, BRT, Rapid KL bus and MRT feeder bus services in Klang Valley for 1 day, 2 days and 3 days. MyCity Pass is based on day-cycle count, and you can purchase the pass at any time of the month. There are three types of MyCity Pass: 1-day pass (Malaysian =RM6 & non-Malaysian =RM10) 2-day pass (Malaysian = RM11 & non-Malaysian =RM18) and 3 days (Malaysian =RM 15 and non-Malaysian =RM25). Same as MyTourist Pass, MyCity Pass using Touch N Go card platform and activate at any counter customer service at any station of LRT, MRT, Monorail and BRT.
iii) My50 Pass 	Exclusively for Malaysian residents, this monthly unlimited travel pass priced at RM 50 enables cost-effective and flexible commuting across all Rapid Rail and RapidKL bus networks. The pass capitalizes on the MyKad's Touch 'n Go functionality, promoting usage among frequent riders.
iv) OKU Smile Pass 	Launched as a social inclusion measure, the OKU Smile Pass grants free rides to registered persons with disabilities (OKU), promoting accessibility and equitable mobility. Activation is facilitated at major transit hubs, reflecting the government's commitment to barrier-free transport.
v) Concession Cards	These cards offer a 50% fare discount for students and senior citizens, encouraging greater ridership among socioeconomically vulnerable groups and supporting

	affordability goals. Rigorous verification and annual renewal processes ensure proper access.
vi) Touch n Go Card 	MyRapid Touch n Go Card is a contactless smart card used for the payment of public transportation fares of Rapid KL services in Malaysia and also can use in the parking payments for Rapid KL Park N Ride facilities. This card also known as Cashless Fare or Stored Value Ticket. This ticket product is entitled to lower 'Cashless Fare Rate' if compared to 'Cash Fare Rate'.

Further enhancing these offerings is Rapid Rail's shift towards comprehensive cashless payment systems. Contactless payments via debit/credit cards, mobile wallets, and digital platforms such as Apple Pay and Samsung Pay now complement traditional fare media like the MyRapid and Touch 'n Go cards. This transition reduces cash-handling risks, accelerates boarding times, and enables real-time data gathering to optimize transit operations. Such modernization aligns with national digital transformation agendas and enhances overall rider experience. Understanding the factors influencing customer adoption and continued use of these fare products is essential. User perceptions of convenience, security, customer value, promotion, and satisfaction collectively shape uptake and loyalty. This study investigates these determinants within the rapidly evolving Malaysian urban transit landscape, providing insights to guide service improvements, policy planning, and targeted marketing.

By analysing demographic profiles, usage behaviours, and attitudinal responses, this research contributes to the literature on public transport fare innovation and customer acceptance. The findings offer actionable recommendations for leveraging cashless technology and concession schemes to increase sustainable public transit use across diverse commuter segments.

The adoption of cashless transaction systems in rapid rail services is fundamentally reshaping how passengers engage with public transportation. By leveraging technologies such as contactless cards, mobile apps, and digital wallets, these systems offer numerous advantages that directly enhance travel convenience and operational efficiency. Among the key benefits are the elimination of the need to carry cash or exact change and the removal of time-consuming queues at ticket counters, which together facilitate faster boarding and smoother passenger flow [1]. This seamless payment experience not only reduces delays but also enables real-time fare processing across multiple transit modes, creating a more integrated and user-friendly transit network. Studies show cashless systems contribute to reduced dwell times at stops, leading to shorter journey times and encouraging mode shift from private cars to public transit [2].

Beyond convenience, cashless transactions improve security by minimizing cash handling, thus reducing risks of theft and promoting hygiene a concern heightened in post-pandemic contexts [1]. For transit agencies, digital fare collection offers valuable data insights that enable better service planning and resource allocation, enhancing operational performance [2,3].

However, despite these advantages, the shift toward cashless payments presents significant challenges related to inclusivity and accessibility. Vulnerable groups including older adults, low-income populations, and individuals lacking digital literacy or access to banking and smartphone technologies may be inadvertently marginalized Golub *et al.,* [4]. Research underscores the risk of social exclusion for those technologically or self-excluded, highlighting the need for transit agencies

to design mitigating strategies such as cash alternatives, training programs, and accessible ticketing options to ensure equity [5,6].

Accordingly, this study explores the contrasting perspectives of users who embrace cashless transactions for their convenience and efficiency, and non-users who experience barriers or express concerns about exclusion. By examining these viewpoints, the study emphasizes the importance of balancing innovative transit solutions with equitable access, ensuring that rapid rail services remain inclusive and beneficial to all segments of the population. The aim of this study is to identify factors influencing customers' choice to use the cashless product and determine which factors have the greatest impact. It seeks to understand travellers' decisions regarding cashless product adoption and explore methods to attract non-users. A combination of qualitative and quantitative surveys was conducted for this purpose.

2. Literature Review

2.1 Cashless Payment in Public Transport

Cashless fare payment systems have transformed public transport operations by reducing cash-handling risks, shortening queuing times, and improving boarding efficiency [7,8]. These systems also generate valuable big data for transit planning [2]. Studies in developed economies report increased ridership when cashless systems are integrated across multimodal networks [1].

In Malaysia, Rapid Rail's adoption of contactless cards, mobile wallets, and concession passes reflects broader digitalization policies. However, adoption rates remain uneven, especially among low-income, elderly, and digitally excluded groups. This highlights the importance of understanding both adoption drivers and barriers in emerging economy contexts.

2.2 Determinants of Adoption

2.2.1 Convenience and comfort

Ease of use and time savings are consistently reported by Mogaji *et al.,* [9] as primary motivators. Avoiding queues and not needing exact change improves passenger satisfaction and willingness to adopt [10].

2.2.2 Frequency of service use

Habitual transit riders are more likely to adopt and continue using smart cards due to repeated exposure and familiarity [11]. Infrequent users, by contrast, may resist due to perceived low value or card expiration concerns [6].

2.2.3 Customer-added value

Incentives such as rebates, discounts, loyalty points, and lifestyle-oriented card designs enhance uptake Nguyen & Tran [9]. Concessions for students, seniors, and persons with disabilities also encourage equitable adoption [5,6].

2.2.4 Enforcement and security

Evidence from Hong Kong shows that enforcement, such as phasing out cash tickets, accelerates adoption [12]. Security features are critical in building user trust [13].

2.2.5 Promotion and advertisement

Targeted campaigns and integrated marketing communications increase awareness and positively shape perceptions [14]. Empirical studies in Southeast Asia demonstrate that promotion significantly influences first-time adoption of transit payment innovations [15].

2.2.6 Customer experience

Customer Experience Management Theory highlights the role of emotional engagement, seamless integration, and satisfaction in fostering loyalty. Applied to transit, unified "one card" systems across multiple lines improve perceived value and long-term adoption [16].

Table 2: summarizes key studies on cashless transit adoption. While prior research highlights determinants such as convenience, security, enforcement, and promotion, most studies are concentrated in developed contexts or single-country analyses [17]. Limited research has compared users vs non-users in a Malaysian setting, leaving a gap that this study addresses.

Table 2
Summary of key Studies on cashless transit adoption

Author(s), Year	Context / Country	Method	Key Findings	Relevance / Gap for Current Study
[2], [7], [18], [19]	Global review	Literature review	Smartcard data improves planning and reduces dwell time	Focuses on technical benefits; less on adoption barriers
Lathia *et al.,* [20]	London	Empirical	Smartcard ticketing increased patronage and reduced queuing	Lacks user vs non-user behavioural comparison
Pelletier *et al.,* [2]	Canada & international	Review of smartcard data	Smartcard data is valuable for demand analysis	Data-driven; does not address adoption motivations
Golub *et al.,* [4]	USA	Policy analysis	Cashless systems risk exclusion of vulnerable groups	Highlights equity concerns, relevant to Malaysia's inclusivity issues
Golub *et al.,* [4]	International	Comparative study	Equity and exclusion in cashless transit	Useful framework for inclusivity, but limited Southeast Asian focus
Mogaji *et al.,* [9]	China	Survey study	Reduced queuing time is critical for adoption	Supports convenience as a driver; single-country context
Lok [12]	Hong Kong	Empirical (Octopus card)	Enforcement accelerated adoption	Shows short-term enforcement effects; lacks resistance analysis
[10]	Malaysia	Survey study	Consumer awareness drives adoption	Malaysian case, but limited to awareness; does not contrast users vs non-users
Lathia *et al.,* [20]	South Korea	Survey (users vs non-users)	Behavioural differences are significant between groups	Closest model to the current study; gap: not applied in Malaysia
Zaimah [21]	Malaysia	Survey	Fare concessions boost ridership	Supports customer-added value; limited to concessions only
[13,14]	India	Survey	Trust and security are crucial for adoption	Reinforces security factor; context differs from Malaysia
[14,15]	Southeast Asia	Empirical study	Promotion is a major determinant of adoption	Strong regional evidence; Malaysia-specific gap remains

Author(s), Year	Context / Country	Method	Key Findings	Relevance / Gap for Current Study
	Vietnam	Survey	Lifestyle value (design, rewards) attracts youth	Suggests role of lifestyle marketing; gap: not tested in Malaysia
[16,17]	Theoretical	Customer Experience Model	Customer experience drives loyalty	Provides theoretical base; needs empirical Malaysian validation

2.3 Inclusivity and Equity Concerns

Despite benefits, cashless systems risk excluding vulnerable groups lacking digital access or literacy [4]. Social equity considerations emphasize the need for accessible alternatives, training, and concessions to prevent digital divides in mobility.

2.4 Research Gap

Most existing research is based on developed contexts (e.g., Hong Kong, Europe, Australia). Limited studies address developing economies, where digital readiness, affordability, and inclusivity remain uneven. In Malaysia, despite policy emphasis on cashless transit, little empirical evidence exists on contrasting user vs non-user perspectives. This study addresses that gap by identifying the determinants of adoption and continued use, comparing motivators and barriers across users and non-users and providing evidence-based recommendations for inclusive and sustainable adoption strategies. Table 3 highlights the research gaps identified in prior literature. While global studies have confirmed several determinants of cashless adoption, limited evidence exists from Malaysian or Southeast Asian contexts, particularly in comparing users and non-users. This study addresses these gaps by providing empirical evidence from Malaysia's Rapid Rail system, examining six determinants simultaneously, and integrating both functional (e.g., convenience, promotion) and perceptual (e.g., trust, inclusivity) dimensions.

Table 3
Identified research gaps

Area of Focus	What Previous Studies Covered	Identified Gap	Contribution of the Current Study
Convenience & Comfort	Studies show time-saving and ease [9,8].	Mostly developed contexts; limited focus on Malaysia	Examines convenience in Malaysian Rapid Rail and contrasts user vs non-user perceptions
Frequency of Service Use	Regular riders linked to adoption [11]	Few studies test this factor in emerging economies	Tests the role of service frequency in adoption and loyalty in Malaysia
Customer-Added Value	Discounts, rebates, and lifestyle designs attract adoption [12,13]	Prior studies focus on single dimensions (e.g., concessions only)	Explores a wider range of added value factors (discounts, design, partnerships)
Enforcement & Security	Enforcement accelerates adoption [12,22], trust is critical [13]	Enforcement's *negative side effects* (resistance, autonomy loss) rarely explored	Compares enforcement effects on users (resistance) vs non-users (motivation)
Promotion & Advertisement	Promotion shapes adoption [14]	A few Malaysia-specific empirical tests	Demonstrates promotion as the strongest determinant in Malaysian Rapid Rail
Customer Experience	Theory stresses satisfaction and loyalty [16]	Lack of empirical validation in Malaysia	Tests customer experience as both an adoption driver and a loyalty factor

Inclusivity & Equity	Cashless may exclude vulnerable groups [4,5].	Few Southeast Asian studies linking inclusivity and cashless adoption	Highlights the risks of exclusion in the Malaysian context and provides policy recommendations
User vs Non-User Comparison	[18,20]	Rare in Southeast Asia; none in Malaysia	Provides the first comparative study of Malaysian Rapid Rail users vs non-users

2.5 Research Framework

The study framework is adapted from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasize perceived ease of use, perceived usefulness, social influence, and facilitating conditions as drivers of technology adoption. Drawing on these models and contextualized for public transport, six independent variables were hypothesized to influence cashless fare adoption. Convenience and Comfort – perceived ease of transactions, reduced queuing, and freedom from cash handling. Frequency of Service Use – habitual use of Rapid Rail services as a reinforcing factor for adoption. Customer-Added Value – rebates, discounts, collaborations, and lifestyle-oriented product designs. Enforcement and Security – regulatory push and security features that affect user trust and compliance. Promotion and Advertisement – awareness-building campaigns and media outreach influencing perceptions. Customer Experience – overall satisfaction with integrated, seamless travel across lines.

The dependent variable differs for the two cohorts which is for users: *Satisfaction and continued use* and for non-users: *Adoption intention*. This dual outcome allows comparison of determinants shaping both loyalty and initial adoption.

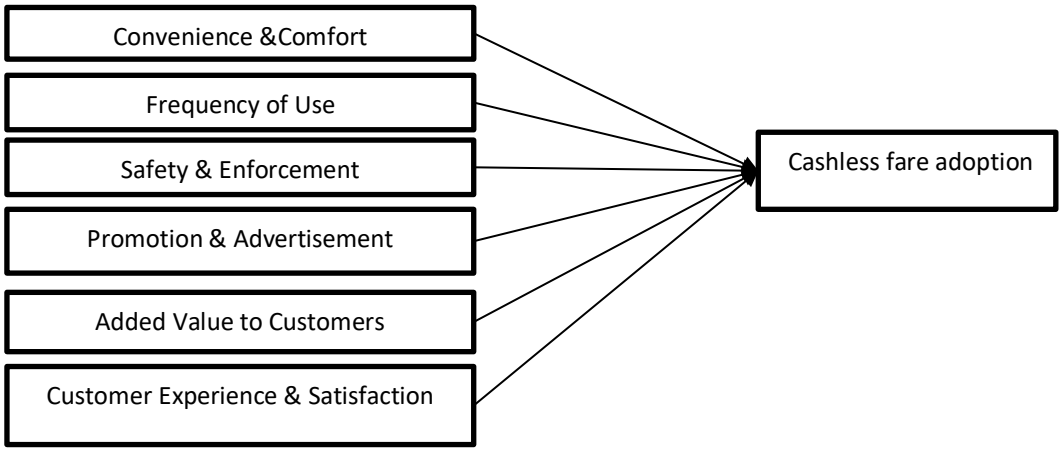

Fig. 1. Framework theoretical relationship between factors influencing and uses of cashless products

3. Methodology

3.1 Research Design

This study adopted a cross-sectional quantitative survey design, complemented by limited qualitative inputs from open-ended questions. The primary aim was to examine determinants of cashless payment adoption among both users and non-users of Rapid Rail services. Although open-ended responses provided contextual insights, the study remains primarily quantitative in orientation.

3.2 Population and Sampling

The research population comprised commuters of the LRT Kelana Jaya, Ampang/Sri Petaling, Monorail, and MRT Kajang and Putrajaya lines, operated by Prasarana Malaysia Berhad. A total of 420 respondents were selected through stratified random sampling, with equal representation of users (n = 210) and non-users (n = 210). Stratification was based on station type and passenger volume to capture diverse commuter segments. The response rate was 100%, achieved because questionnaires were distributed and collected immediately at selected stations under the researcher's supervision. This minimized missing data and ensured completeness.

3.3 Instrument Development

The service quality measurement instrument employed in this study is adapted from the seminal framework developed by Friman and Fellazzon[23], Ebdi and Mazzulla [24] and Yaya *et al*., [25]. This research report, although classified as grey literature, represents an original and foundational source for assessing service quality within public transportation settings. Grey literature, such as technical reports and institutional papers, often provides critical empirical and theoretical contributions that are indispensable to specialized fields like transport research [26,27].

Friman and Fellazzon [23], Ebdi and Mazzulla [24] and Yaya *et al*., [25]works has been widely used and cited in subsequent academic studies due to its comprehensive operationalization of service quality dimensions relevant to urban transit systems. Incorporating this instrument ensures theoretical fidelity and continuity in measuring constructs such as tangibles, reliability, responsiveness, assurance, and empathy, which are central to this study's examination of Malaysia's Rapid Rail service quality. Thus, while the report does not appear in peer-reviewed journals, its methodological rigor and pioneering status justify its inclusion as the primary source of the instrument.

It consisted of three sections which is demographic and travel characteristics (nominal/ordinal scales). Factors influencing cashless adoption, measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) and open-ended questions to capture user and non-user suggestions. The instrument measured six hypothesized constructs: convenience and comfort, frequency of service use, customer-added value, enforcement and security, promotion and advertisement, and customer experience.

3.4 Reliability and Validity

Instrument reliability was tested using Cronbach's alpha, with coefficients of 0.897 (users) and 0.917 (non-users), indicating strong internal consistency. Content validity was established through expert review (academic and industry specialists in transport marketing), while construct validity was assessed via exploratory factor analysis (EFA).

3.5 Data Collection

Data were collected at 16 strategically selected stations representing high-, medium-, and low-volume ridership. Trained enumerators approached passengers during peak and off-peak periods to capture varied travel behaviours. Ethical considerations, including voluntary participation and anonymity, were ensured throughout.

3.6 Data Analysis

Data were analysed using SPSS. The following techniques were employed Descriptive statistics to profile respondents. Exploratory Factor Analysis (EFA) to identify underlying constructs. Pearson correlation analysis (one-tailed, $p < 0.05$) to test hypothesized relationships between independent variables and adoption intentions. While qualitative comments were analysed thematically to enrich interpretation, they were not subjected to systematic qualitative coding due to their limited scope.

This cross-sectional study employed descriptive and inferential statistical techniques to examine factors influencing the usage of cashless among rail commuters. The research population consisted of both cashless users and non-users from the LRT Kelana Jaya, Ampang/Sri Petaling, Monorail and MRT Kajang and Putrajaya line. A total of 420 participants—210 users and 210 non-users—were selected through stratified random sampling. Data for users and non-users were collected via surveys at 16 strategically selected stations.

Data collection utilized a structured questionnaire adapted from McDonald (2000). The instrument included demographic and travel-related variables measured on nominal scales, and a series of 5-point Likert scale items assessing factors affecting cashless usage, ranging from convenience and customer value to security and promotion. Open-ended questions provided qualitative insights into user and non-user perceptions and suggestions.

Data analysis involved descriptive statistics to summarize respondent characteristics, Pearson correlation to test hypothesized relationships at a significance level of $p < 0.05$, and exploratory factor analysis for data reduction and construct identification. Instrument reliability was verified through Cronbach's Alpha coefficients, with values between 0.70 and 0.90 indicating satisfactory internal consistency.

This methodological approach ensures rigorous quantitative evaluation while incorporating qualitative feedback, supporting a comprehensive understanding of factors influencing cashless adoption in the studied urban rail network.

4. Results

4.1 Respondent Profile

Table 4 presents respondents profile consisting of gender, age, income, ethnic group and occupation information. A total of 420 valid responses were collected, equally divided between cashless users (n = 210) and non-users (n = 210). The sample was balanced by gender, with 33% male and 67% female respondents. The majority were aged 18–29 years (72%), reflecting the youth dominance in urban rail ridership. Income distribution revealed that 40% of users earned less than RM2,000 monthly, while 34% of non-users reported no personal income (students, retirees, or homemakers), highlighting socioeconomic diversity.

Ethnically, Malays represented the largest group (72%), followed by Chinese (15%), Indians (6%), and others (7%). Occupationally, users were predominantly from the private sector (61%), while non-users were concentrated among unemployed/retired groups (38%), suggesting that employment status influences adoption patterns.

Table 4
Respondents profile

Gender	**User (n=210)**	**%**	**Non-User (n=210)**	**%**
Male	69	32.8	71	33.8
Female	141	67.2	139	66.2
Age (years)				
Below 18	3	1.4	9	4.3
18 - 29	150	71.4	151	71.9
30 - 55	49	23	47	22.4
55 and above	8	3.8	2	1
Income (RM)				
Less than 2,000	85	40.5	78	37.1
2,001 – 5,000	72	34.3	50	23.8
More than 5,000	11	5.2	10	4.8
None (Retired/Housewife/Student)	42x	20	71	34
Ethnic Group				
Malay	158	75.2	145	69
Chinese	36	17.2	27	12.9
Indian	6	2.9	19	9.1
Others	10	4.7	18	8.6
Occupation				
Government Sector	13	6.2	10	4.8
Private Sector	127	60.5	30	14.3
Other Blue Collar	7	3.3	50	23.8
Hawker/Petty Trader	6	2.9	30	14.3
Student	50	23.8	10	4.8
Unemployed (Retired/Housewife)	7	3.3	80	38.1

4.2 Reasons for using Public Transport

Table 5 presents the reasons for public transport usage comparison between users and non users. Among users, commuting to work (70.5%) was the most common reason for using public transport. In contrast, non-users were more likely to use public transport occasionally for shopping/leisure (57.1%), or business-related travel (23.8%). This suggests habitual vs incidental use patterns between the groups.

Table 5
Reasons for public transport usage among users and non-users

Reasons	User (n=210)	%	Non-User (n=210)	%
School/University	50	23.8	5	2.4
Work	148	70.5	15	7.1
Shopping/Leisure	5	2.4	120	57.1
Business	5	2.4	50	23.8
Others	2	1.0	20	9.5

4.3 Ticket Type Usage

Table 6 presents type of tickets used by respondents, among users, Touch 'n Go cards (50.5%) and the My50 pass (39%) were most frequently used. In contrast, all non-users relied exclusively on cash/token tickets, underscoring a clear behavioural divide between groups.

Table 6
Type of tickets used by respondents

Ticket Type	User (n=210)	%	Non-user (n=210)	%
Touch n Go	106	50.5	NA	-
My50	82	39.0	NA	-
MyCity Pass	4	1.9	NA	-
MyTourist Pass	1	0.5	NA	-
Concession Student card	10	4.8	NA	-
Concession Senior Citizen	6	2.8	NA	-
OKU Smile	1	0.5	NA	-
Token (Cash)	NA	-	210	100%

4.4 Reliability and Factor Analysis

Table 7 presents Cronbach's alpha analysis whereby the values confirmed strong internal consistency for both users ($\alpha = 0.897$) and non-users ($\alpha = 0.917$).

Table 7
Reliability analysis results for users and non-users

Group	Cronbach's Alpha (α)	Number of Items
Users	0.897	22
Non-Users	0.917	22

Table 8 presents the Exploratory Factor Analysis (EFA) extracted six distinct constructs consistent with the conceptual framework: Convenience and Comfort Frequency of Service Use, Customer-

Added Value, Enforcement and Security, Promotion and Advertisement and Customer Experience. Together, these factors explained a substantial proportion of variance across both user and non-user datasets, validating the framework's applicability.

Table 8
Factor analysis for independence and dependence variable

No	Factor/Variable	User			Non-User		
	Convenience & Comfortable	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
1	It's saved time without queuing in front of the ticketing vending machine by using cashless payment.	0.591	4.48	0.854	0.825	4.64	0.879
2	No need to bring cash/change to using cashless payment.	0.752	4.45	0.795	0.733	4.26	0.861
3	Without any obstacle and difficulties to do a process at the Ticketing Vending Machine.	0.654	4.47	0.689	0.718	4.14	0.841
4	Every station been allocated a Ticketing Vending Machine which available to top up Cashless Card for the conveniences to users.	0.657	4.13	1.076	0.421	4.14	0.97
	Consistency using the Rapid Rail service	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
5	Consistency of using the services sense of loyalty to cashless payment.	0.703	4.14	0.957	0.475	3.84	1.001
	Customer Added Value	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
6	The offering of rebate & bonus.	0.680	3.95	0.967	0.680	3.86	0.945
7	The colours and picture of card also influence customers of using Cashless card payment. Eg Touch n Go card.	0.537	3.88	0.90	0.686	3.67	0.982
8	The alternative of the various design i.e. neckless, watches, keychain etc also play the important role to attract the users.	0.656	3.94	0.99	0.749	4.37	0.87
9	Join collaboration with other products as an added-value, i.e. Fast-Food Restaurant, Supermarket, Parking Institution, tourist attractive place etc encourage users for using Cashless eg. My Tourist Pass	0.590	3.94	0.754	0.747	3.96	0.876

10	Awarded to special people i.e. disabled, student, senior citizen infant having discounted.	0.786	4.45	0.815	0.674	4.02	0.948
11	Point of rewards which can be redeemed at the entire selected outlet will influence the user for cashless card.	0.714	4.17	0.846	0.733	3.94	0.883
12	Non-validity on the usage cashless card and can be used at any place and time has also influence the user.	0.594	3.91	0.741	0.725	4.05	0.949
	Enforcement & Security	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
13	Re-enforcement for all manual ticket and cash term in exchange to cashless.	0.534	2.51	0.345	0.670	3.89	1.059
14	Safety features will confidence the user to use cashless.	0.567	4.20	0.82	0.670	3.94	0.941
	Promotion & Advertisement	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
15	Campaign and advertising via printing & electronic media will influence and made known the availability of the cashless product.	**0.687**	4.50	1.113	**0.750**	4.52	0.958
16	The promotion exercises have determination and effectiveness to attract using cashless.	**0.849**	4.41	1.167	**0.831**	4.62	0.915
	Customer Experience	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
17	Freedom Pass – No Limits, Just Go. Unlimited pass gives new experience.	**0.819**	4.50	0.909	**0.436**	4.08	0.848
18	Integration with all lines with one card only ensure Users for choose cashless payment.	**0.762**	4.52	0.854	**0.471**	4.13	0.905
	Desire/Continuous to Use	**Factor Loaded**	**Mean**	**Standard Deviation**	**Factor Loaded**	**Mean**	**Standard Deviation**
19	Continuous to Use	**0.834**	4.64	0.484			
20	Satisfaction when Use	**0.829**	4.50	0.535			
21	Desire to Use				**0.650**	4.55	0.499
22	Intention to Use				**0.610**	4.62	0.486

4.5 Hypothesis Testing

Table 9 presents the hypothesis testing of this study. Pearson correlation results revealed several significant relationships ($p < 0.05$): Promotion and Advertisement were the strongest predictors for both users ($r = 0.531$) and non-users ($r = 0.522$). Convenience and Comfort showed the highest association for users ($r = 0.536$), while non-users reported a weaker but still significant effect ($r = 0.408$). Frequency of Service Use strongly correlated with adoption among users ($r = 0.516$),

consistent with habitual ridership patterns. Customer-Added Value influenced both groups (r ≈ 0.44–0.46), particularly through discounts and rewards. Enforcement and Security produced mixed results: insignificant for users (r = 0.129), but significant for non-users (r = 0.481), indicating that enforcement primarily motivates non-adopters. Customer Experience was significant across both groups (users r = 0.481; non-users r = 0.408), reflecting the importance of integrated, seamless travel. These findings confirm that while all six factors are influential, their relative weight differs between users and non-users.

Table 9
Hypothesis tested the relationship between the independent variable and with dependent variable

Independent Variable	Users			Non-Users		
	Correlation (r)	**p-value**	**Significance**	**Correlation (r)**	**p-value**	**Significance**
Convenience and Comfort	0.536	0.03	Significant (p<0.05)	0.408	0.000	Significant (p<0.05)
Consistency using the Rapid Rail service	0.516	0.043	Significant (p<0.05)	0.408	0.000	Significant (p<0.05)
Customer added Value	0.438	0.043	Significant (p<0.05)	0.463	0.000	Significant (p<0.05)
Enforcement and Security	0.129	0.155	Insignificant (p>0.05)	0.481	0.000	Significant (p<0.05)
Promotion & Advertisement	0.531	0.001	Significant (p<0.05)	0.522	Significant (p<0.05)	0.000
Customer Experience	0.481	0.000	Significant (p<0.05)	0.408	Significant (p<0.05)	0.000

4.6 Supplementary Feedback from Non-Users

Open-ended responses from non-users revealed several recurring themes that explain barriers to adoption. First is Awareness and Information Gaps where many non-users indicated limited awareness of the available cashless products or uncertainty about where and how to purchase or top up cards. Some noted that information at stations was “unclear” or “not visible enough.” This suggests that insufficient communication contributes to continued reliance on cash tokens. Next, *Perceived Complexity of Use*, whereby several respondents expressed hesitation due to perceived difficulties in using ticket vending machines (TVMs) or digital platforms.

Comments such as *“I am not confident with the machine”* and *“sometimes it looks complicated”* reflect apprehension tied to digital literacy and fear of technical errors. Followed by *Trust and Security Concerns*. Next is Concerns over system reliability and data security emerged. A few non-users described experiences where cards failed at gates, leading to embarrassment or delays. Others worried about the “safety of linking cards to money,” revealing anxieties about financial control. Lastly is *Motivators for Future Adoption* Despite barriers, many non-users emphasized that they would consider switching if provided with tangible benefits such as loyalty rewards, discounts, or integration with retail outlets. As one respondent put it: *“If the card can also give me points at shops, I would use it.”* Table 10 presents the theme, it’s description, sample quotes and the implication.

Table 10
Non users feedback analysis

Theme	Description	Quotes samples	Implication
Awareness & Information Gaps	Limited knowledge of available passes, unclear instructions at stations	"I didn't know where to buy or top up the card."	Strengthen communication and visibility of cashless products
Perceived Complexity	Apprehension about using vending machines and digital tools	"The machine looks complicated; I'm afraid to use it wrong."	Simplify the user interface and provide staff assistance
Trust & Security Concerns	Worries about system reliability and financial safety	"What if the card doesn't work at the gate?"	Improve reliability and communicate security features
Motivators for Adoption	Interest in rewards, discounts, or retail collaborations	"If the card also gave me points at shops, I would use it."	Introduce loyalty programs and partner discounts

4.7 Supplementary Feedback from Users

Users also shared open-ended reflections on their experiences with cashless products first begin *Convenience as Primary Driver*, most comments highlighted time-saving and queue reduction. A user noted: *"I just tap and go no need to wait for tickets."* This reinforces the quantitative finding that convenience is a major driver of satisfaction. Next is *Operational Issues* whereby a minority reported technical glitches, such as card detection failures at fare gates. While often described as "minor annoyances," these incidents highlight the importance of system reliability for sustaining user confidence. Lastly is *Suggestions for Improvement whereby* several users proposed enhancements such as expanded top-up facilities, clearer instructions for new users, and stronger integration across services. Others recommended targeted discounts for students and senior citizens. Table 11 summarises the feedback analysis from users.

Table 11
Users feedback analysis

Theme	Description	Quotes Samples	Implication
Convenience as Driver	Users value fast access and reduced queues	"I just tap and go — no waiting in line."	Reinforce convenience messaging in promotions
Operational Issues	Minor technical glitches reported at gates	"Sometimes the gate doesn't detect my card."	Improve system reliability and maintenance
Suggestions for Improvement	Requests for more top-up points, clearer instructions, and targeted discounts	"Students and seniors should get more discounts."	Expand concessions and improve service accessibility

For non-users, adoption barriers are not only structural (lack of awareness, TVM access) but also psychological (trust, perceived complexity). For users, satisfaction stems from convenience, but loyalty depends on minimizing technical issues and offering continual value. Together, the qualitative insights underline that successful adoption strategies must address both functional benefits and user perceptions of ease, security, and trust.

5. Discussion

This study examined factors influencing the adoption and continued use of cashless fare payment in Malaysia's Rapid Rail services, using both quantitative survey data and supplementary feedback from open-ended responses. Six key determinants were identified: convenience and comfort, frequency of service use, customer-added value, enforcement and security, promotion and advertisement, and customer experience.

Table 12 synthesizes the quantitative and qualitative findings, highlighting convergence and divergence across user groups. Quantitative correlations established the relative strength of each determinant, while qualitative insights provided context and explanation. Together, the results demonstrate that adoption is shaped not only by functional benefits (e.g., convenience, promotions) but also by perceptions of simplicity, trust, and inclusivity.

Table 12
Quantitative and qualitative findings synthesis

Factor	Quantitative Findings	Qualitative Insights	Interpretation
Convenience & Comfort	Strongest correlation for users (r = 0.536); significant for non-users but weaker (r = 0.408).	Users emphasized *"tap and go, no queues"*; Non-users worried about vending machine complexity.	Convenience drives satisfaction for users, but non-users face *perceived digital barriers*.
Frequency of Service Use	Users with regular ridership show stronger adoption (r = 0.516).	Non-users linked token use to *occasional travel* (e.g., shopping trips).	Habitual ridership sustains adoption; irregular riders see less value in adopting.
Customer-Added Value	Moderate positive influence (r ≈ 0.44–0.46) for both groups.	Users valued discounts for students/seniors; Non-users were attracted by rewards and lifestyle collaborations.	Functional value appeals to users; *symbolic/lifestyle value* appeals to non-users.
Enforcement & Security	Insignificant for users (r = 0.129); significant for non-users (r = 0.481).	Non-users: enforcement may push adoption; Users: enforcement feels restrictive, trust concerns about card failures.	Enforcement helps initial adoption but risks *resistance and loss of trust* among existing users.
Promotion & Advertisement	Most influential determinant across both groups (users r = 0.531; non-users r = 0.522).	Non-users cited lack of information: *"I didn't know where to buy/top-up"*; Users adopted mainly through promotions.	Promotion is the gateway factor; visibility and awareness remain critical.
Customer Experience	Significant correlations for both groups (users r = 0.481; non-users r = 0.408).	Users: seamless integration = satisfaction; Non-users: lack of familiarity reduces confidence.	Positive experience builds loyalty; lack of firsthand exposure limits trial among non-users.

5.1 Convenience and Comfort

Quantitative findings confirmed that convenience was the strongest driver for users (r = 0.536). This was echoed in user feedback, where many described "tapping and going without queues" as the main benefit. Non-users also recognized time-saving advantages but expressed apprehension over ticket machine complexity. These qualitative insights reveal that while ease of use motivates adoption, perceived complexity remains a psychological barrier for some non-users.

5.2 Frequency of Service Use

Frequent commuters demonstrated stronger alignment with cashless adoption, consistent with UTAUT's principle of habitual use. Non-users, however, often reported infrequent reliance on Rapid Rail, linking their preference for tokens to "occasional travel" or "only for shopping." This suggests that sustained adoption is tied to regular travel patterns, whereas infrequent users require stronger promotional triggers.

5.3 Customer-Added Value

Rebates, discounts, and loyalty schemes were moderately correlated with adoption ($r \approx 0.44$–0.46). User narratives emphasized appreciation for student and senior discounts, while non-users highlighted the appeal of lifestyle-oriented incentives: "If the card also gave me points at shops, I would use it." These findings suggest that functional value (discounts) resonates with current users, while symbolic and lifestyle value may attract non-users.

5.4 Enforcement and Security

Enforcement presented contrasting effects. Quantitatively, it was significant for non-users ($r = 0.481$) but insignificant for users ($r = 0.129$). Open-ended comments help explain this divide: non-users saw phasing out tokens as a "push" toward trying cashless, while some users described enforcement as "restrictive" and worried about losing control over their spending. Security concerns such as gate errors or fears about money safety were also noted. These results highlight the need for balanced enforcement strategies: enough to encourage adoption without undermining trust or autonomy.

5.5 Promotion and Advertisement

Promotion was the most influential determinant across both groups (users $r = 0.531$; non-users $r = 0.522$). Respondents emphasized the importance of stronger awareness campaigns, with non-users frequently stating they had "not seen enough information" about products. The qualitative narratives reinforce the quantitative finding that information visibility and clarity are critical. Campaigns must therefore emphasize ease, benefits, and security in a way that reaches digitally and socially diverse audiences.

5.6 Customer Experience

Customer experience was significant across both groups, particularly where integration across multiple lines created a perception of "one card for all travel." Users described this as "convenient and satisfying," while non-users cited lack of familiarity as a reason for hesitation. The contrast suggests that positive experience strengthens loyalty, while perceived unfamiliarity discourages trial. This aligns with Schmitt's Customer Experience Management model, which emphasizes emotional and experiential engagement.

6. Conclusion

The findings show that cashless adoption in Rapid Rail is shaped by six interdependent factors, with promotion and convenience at the forefront. Enforcement can accelerate initial adoption among non-users but risks long-term resistance if perceived as coercive. Qualitative insights highlight that trust, awareness, and perceived simplicity are just as critical as structural incentives.

To sustain adoption and loyalty, Rapid Rail should prioritize inclusive promotion, user-friendly design, and trust-building measures such as transparent security features and reliable operations. By addressing both functional drivers and perceptual barriers, cashless systems can achieve higher penetration while ensuring equitable access for diverse commuter groups.

7. Contribution to Theory and Practice

7.1 Theoretical Contributions

This study validates and extends established adoption models by testing six determinants — convenience, frequency, added value, enforcement & security, promotion, and customer experience — in the context of cashless transit in Malaysia. By comparing users and non-users, it adds nuance to the constructs of perceived ease of use and trust, showing that their influence differs depending on the adoption stage.

While prior studies emphasized either operational efficiency (e.g., reduced queuing) or user perceptions (e.g., trust), this study demonstrates that adoption is shaped by a cluster of interdependent factors. Enforcement emerged as a paradoxical factor: encouraging non-users but creating resistance among users — a dynamic rarely addressed in existing theory.

Most existing studies focus on current users or developed economies. This study provides one of the first empirical comparisons of users vs non-users in an emerging economy's urban rail context, highlighting how socioeconomic and behavioural differences shape technology adoption.

7.2 Practical Contributions

Findings emphasize that promotion and visibility campaigns are the most effective levers for adoption, suggesting that marketing resources should prioritize awareness and ease-of-use messaging. The study shows that vulnerable groups (e.g., students, seniors, non-digital users) remain hesitant. Operators should maintain and expand concessions, provide simplified top-up processes, and ensure alternative options to prevent exclusion. Results warn against over-reliance on strict enforcement, which may alienate current users. A combination of voluntary incentives, trust-building, and transparent communication is more effective than coercive measures in sustaining long-term adoption. Seamless integration across multiple lines and reliable gate performance were highlighted as critical to user satisfaction. Addressing minor operational glitches can strengthen trust and loyalty, supporting sustainable ridership.

7.2 Recommendations for Future Research

Investigate psychological and sociocultural influences on cashless transit adoption. Conduct comparative studies across Malaysian and Southeast Asian transit systems. Assess long-term effects of marketing and enforcement on ridership behaviour. These avenues offer vital insights for evidence-based policy and marketing refinement.

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