

DIGITAL PAYMENTS AND FINANCIAL INCLUSION AMONG PARATRANSIT OPERATORS: ASSESSING THE TRANSITION TOWARDS FORMAL FINANCE

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Abstract: The expansion of digital payment systems has created new opportunities for economically informal workers to participate in more visible and structured financial activities. However, the adoption of digital payments does not automatically result in meaningful financial inclusion or sustained engagement with formal financial systems. This study examines the pathway through which digital payment adoption may contribute to the transition towards formal finance among paratransit operators by considering the intermediary roles of transaction formalization and financial inclusion. A quantitative explanatory approach was employed using an analytical sample of 350 observations. The proposed relationships were assessed through Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings indicate that digital payment adoption was positively associated with transaction formalization ($\beta = 0.488$, $p < 0.001$) and financial inclusion ($\beta = 0.306$, $p < 0.001$). Transaction formalization also demonstrated a significant positive relationship with financial inclusion ($\beta = 0.396$, $p < 0.001$), while financial inclusion emerged as a strong predictor of the transition towards formal finance ($\beta = 0.612$, $p < 0.001$). The model explained 23.8% of the variance in transaction formalization, 36.9% in financial inclusion, and 37.5% in the transition towards formal finance. In addition, the sequential indirect relationship linking digital payment adoption to the transition towards formal finance through transaction formalization and financial inclusion was positive ($\beta = 0.118$), supporting the proposed process-oriented pathway. The study highlights that the contribution of digital payments extends beyond payment convenience when digitally recorded transactions facilitate financial visibility and broader participation in formal financial arrangements. The findings offer a structured perspective for understanding how digital financial practices may support the progressive integration of workers operating in economically informal transport sectors into the formal financial ecosystem.

Keywords: Digital payment adoption; transaction formalization; financial inclusion; formal finance; paratransit operators; PLS-SEM

1. Introduction

The rapid expansion of digital payment infrastructure is reshaping the relationship between individuals, economic activity, and formal financial systems. Mobile-based payment applications, instant payment platforms, and QR-enabled transactions have reduced the practical dependence on cash and created new forms of interaction between economically marginalized populations and regulated financial institutions. Financial inclusion, however, extends beyond access to a transaction account or the ability to execute electronic payments. It encompasses meaningful access to and use of appropriate financial services, including savings, credit, insurance, and other mechanisms that support economic security and resilience (Allen et al., 2016; Demirgüç-Kunt & Klapper, 2013; Pesqué-Cela et al., 2021). Consequently, the growing visibility of digital transactions raises an important question: does the adoption of digital



payments genuinely facilitate deeper participation in formal finance, or does it merely replace physical cash with an electronic mode of exchange?

This question is particularly relevant in emerging economies characterized by large informal workforces. Workers operating outside conventional employment arrangements frequently experience irregular income, limited financial documentation, restricted access to institutional credit, and inadequate social protection. Although digital financial technologies have the potential to reduce transaction costs and extend the reach of financial services, technological access alone does not necessarily eliminate the structural barriers associated with financial exclusion (Gabor & Brooks, 2017; Ozili, 2018). The transition from digital access to substantive financial inclusion therefore requires closer examination, particularly among occupational groups whose economic activities remain partially embedded within informal systems.

Paratransit operators represent an important yet underexplored group in this context. Auto-rickshaw drivers, shared-transport operators, local taxi drivers, and other self-employed mobility providers generate income through frequent and predominantly small-value transactions. Their livelihoods often involve daily fluctuations in earnings, operational expenses, vehicle financing obligations, and limited employment-based financial protection. While these operators increasingly encounter passengers who prefer cashless payment options, their participation in digital payment ecosystems may not necessarily correspond with broader access to formal financial services. Baker (2021) demonstrates the importance of examining digital financial inclusion among India's paratransit micro-entrepreneurs critically, highlighting the complex relationship between financial technologies, precarity, credit, and informal economic practices.

India provides a particularly relevant environment for investigating this relationship because the expansion of digital public infrastructure has substantially transformed everyday payment behaviour. The Unified Payments Interface (UPI) has enabled low-cost and instantaneous transactions across individuals and businesses, thereby expanding opportunities for small-scale service providers to participate in digital payment networks. Recent evidence suggests that UPI adoption may contribute to wider financial participation by integrating individuals and small economic actors into digitally mediated financial ecosystems (Haque et al., 2025). Nevertheless, participation in a digital payment network should not be automatically interpreted as evidence of comprehensive financial inclusion. An individual may regularly receive electronic payments while continuing to rely on informal borrowing, maintaining limited savings, lacking insurance protection, or remaining disconnected from institutional credit and social security systems.

This distinction between digitization and substantive formal integration represents an important conceptual issue. Digital transactions generate records that may improve the visibility and traceability of economic activity. In principle, such records could strengthen relationships with formal financial institutions and facilitate access to products that traditionally depend upon verifiable financial information. Payment systems may therefore serve as an entry point through which informal economic actors gradually develop a financial footprint. However, formalization is not a single event produced simply by digital registration or technological participation. Recent research on India cautions against equating digital inclusion with meaningful formalization, arguing that digitally connecting informal workers to institutional systems may create only a limited or “narrow” form of formalization when deeper improvements in economic security and access to benefits do not occur (Sinha et al., 2026).

Existing research has extensively investigated the determinants of technology adoption, emphasizing perceived usefulness, ease of use, trust, and behavioural intention (Davis, 1989; Venkatesh et al., 2003, 2012). Similarly, studies of digital finance have examined the capacity of mobile technologies to expand financial access and reduce transaction barriers (Beck et al., 2018; Gomber et al., 2017). However, comparatively less attention has been directed toward understanding what happens after adoption, particularly among self-employed informal workers. The crucial analytical question is not only why an individual adopts a digital payment system but whether sustained digital payment engagement contributes to a measurable transition toward broader financial inclusion and formal financial participation.

Addressing this gap, the present study examines digital payments as a potential transitional mechanism connecting informal economic activity with formal finance among paratransit operators. It proposes that digital payment engagement may enhance the documentation and visibility of transactions, which can subsequently support broader engagement with formal financial services. Accordingly, the study investigates the pathway linking digital payment adoption, transaction formalization, financial inclusion, and formal financial participation. By distinguishing the act of making or receiving digital payments from the deeper process of financial integration, the study contributes to a more nuanced understanding of whether digital finance can function as meaningful transitional infrastructure for workers operating at the boundary between informal livelihoods and formal financial systems.

1.1 Statement of the Problem

The rapid diffusion of digital payment systems has created new opportunities for economically marginalized and informally employed populations to participate in digitally mediated financial ecosystems. In India, the expansion of mobile banking applications and the Unified Payments Interface (UPI) has enabled small-scale service providers to receive and make electronic payments with relatively low transaction costs. Despite this technological expansion, an important distinction remains between participation in digital payment systems and meaningful integration into formal finance. The ability to accept a QR-code payment does not necessarily imply access to formal credit, savings instruments, insurance, or other financial services associated with substantive financial inclusion.

This concern is particularly relevant for paratransit operators, including auto-rickshaw drivers, taxi operators, and other self-employed mobility providers. These workers frequently operate within conditions characterized by irregular income, small-value daily transactions, limited financial documentation, and continued dependence on informal financial arrangements. Although digital payments may generate electronic records of their economic activity, it remains unclear whether such transaction records contribute to greater financial visibility and subsequently facilitate broader engagement with formal financial institutions.

Existing research has predominantly examined digital payment adoption from the perspective of technology acceptance, consumer convenience, behavioural intention, or transaction efficiency (Davis, 1989; Venkatesh et al., 2003, 2012). Financial inclusion research, meanwhile, has largely focused on account ownership, access to financial services, and macro-level determinants of exclusion (Allen et al., 2016; Demirgüç-Kunt & Klapper, 2013). Comparatively limited attention has been directed toward understanding the process through which digital payment participation may transform the financial position of informal self-employed workers. In particular, the sequential pathway through which digital payment adoption generates transaction visibility, contributes to financial inclusion, and potentially supports a transition toward formal finance remains insufficiently examined.

The existing evidence on Indian paratransit workers further indicates that technological participation should not automatically be interpreted as substantive economic formalization. Digital financial engagement may coexist with financial precarity, unstable income, and continued reliance on informal credit arrangements (Baker, 2021). Consequently, there is a need to move beyond the assumption that digitalization itself constitutes financial inclusion and to investigate the mechanisms through which digital transactions may—or may not—support deeper integration with formal financial systems.

Therefore, the central problem addressed by this study is the limited understanding of whether and how digital payment adoption facilitates the transition of paratransit operators from predominantly informal financial practices toward greater participation in formal finance. Specifically, the study examines whether digital payment adoption enhances transaction formalization, whether transaction formalization contributes to financial inclusion, and whether financial inclusion subsequently supports the transition toward formal financial participation. By examining these relationships simultaneously, the study seeks to clarify whether digital payment infrastructure functions merely as a convenient transaction mechanism or as a meaningful pathway toward broader financial formalization.

1.2 Research Objectives

The primary objective of this study is to examine how digital payment adoption contributes to the transition toward formal finance among paratransit operators.

The specific objectives are:

To examine the effect of digital payment adoption on transaction formalization among paratransit operators.

To investigate the influence of transaction formalization on financial inclusion among paratransit operators.

To assess the direct effect of digital payment adoption on financial inclusion.

To examine the influence of financial inclusion on the transition toward formal finance among paratransit operators.

To analyse the sequential mediating roles of transaction formalization and financial inclusion in the relationship between digital payment adoption and the transition toward formal finance.

1.3 Research Questions

Based on the identified research problem, the study addresses the following questions:

RQ1: Does digital payment adoption influence transaction formalization among paratransit operators?

RQ2: Does transaction formalization contribute to greater financial inclusion among paratransit operators?

RQ3: Does digital payment adoption directly enhance financial inclusion?

RQ4: Does financial inclusion facilitate the transition of paratransit operators toward formal finance?

RQ5: Do transaction formalization and financial inclusion sequentially mediate the relationship between digital payment adoption and the transition toward formal finance?

2. Literature Review And Hypotheses Development

2.1 Digital Payments and the Changing Financial Landscape

Digital payment technologies have altered the way small economic actors participate in financial exchange. Unlike conventional banking channels, mobile-based and instant payment systems allow individuals to transfer and receive money without depending extensively on physical banking infrastructure. The significance of this transformation is particularly pronounced in developing economies, where a substantial proportion of workers operate through informal or self-employed occupations. Digital payment systems can reduce transaction friction, improve convenience, and create electronic records of economic activity that were previously embedded primarily in cash-based transactions (Arner et al., 2016; Beck et al., 2018; Gomber et al., 2017).

The expansion of digital finance has consequently generated optimism regarding its capacity to extend financial services to populations traditionally underserved by formal institutions. Mobile money and related technologies have demonstrated the potential to reduce transaction costs and improve the ability of households to manage financial risks (Jack & Suri, 2014; Suri & Jack, 2016). However, the availability of a digital payment mechanism does not necessarily imply meaningful integration into the broader financial system. Receiving payments through a mobile application may increase transactional convenience without automatically improving access to savings products, affordable credit, insurance, or other formal financial services.

This distinction is particularly important when examining informal economic actors. Digital payment adoption represents an observable technological behaviour, whereas financial inclusion represents a broader condition involving access, usage, quality, and suitability of financial services (Allen et al., 2016; Pesqué-Cela et al., 2021). Therefore, the consequences of digital payment adoption should be examined not merely in terms of technological acceptance but also in relation to whether repeated digital transactions facilitate deeper connections with formal financial institutions.

2.2 Digital Payment Adoption among Paratransit Operators

Paratransit services occupy an important position within urban mobility systems, particularly in developing economies where flexible and small-scale transport services complement formal public transportation. Operators frequently function as self-employed micro-entrepreneurs whose daily earnings depend on numerous small-value passenger transactions. Their financial activities are characterized by fluctuating income, recurring operational expenditure, vehicle maintenance costs, and, in many cases, continuing repayment obligations.

The increasing preference for cashless transactions among passengers has created pressure and opportunity for paratransit operators to participate in digital payment ecosystems. QR-code-based payments and mobile applications can enable operators to accept fares electronically without investing in sophisticated point-of-sale infrastructure. Nevertheless, adoption occurs within the realities of informal work rather than in a conventional organizational environment.

Existing evidence from India demonstrates that the relationship between digital financial technologies and paratransit livelihoods is complex. Baker (2021) shows that auto-rickshaw operators may engage with digital payment technologies while simultaneously remaining economically precarious and dependent on financial arrangements outside mainstream banking. Digital systems may create greater visibility of transactions, but visibility alone does not resolve the structural challenges associated with unstable income, expensive credit, and limited bargaining power. More recent scholarship similarly emphasizes that digital transformation in paratransit involves not only technological opportunities but also challenges relating to digital capability, financing constraints, and regulatory fragmentation.

Accordingly, digital payment adoption among paratransit operators should be understood as a potential first stage of financial transformation rather than as evidence that formal financial inclusion has already been achieved.

2.3 Digital Payments and Transaction Formalization

One of the potentially important consequences of digital payment adoption is the transformation of previously undocumented transactions into electronically traceable economic activity. Cash transactions often leave limited systematic evidence of income flows, particularly for self-employed workers who do not maintain formal business accounts. In contrast, repeated digital transactions can generate records related to payment frequency, transaction value, customer flows, and income patterns.

This process can be described as **transaction formalization**, referring to the increasing visibility, traceability, and recordability of economic exchanges through recognized digital payment channels. Transaction formalization does not imply that an occupation becomes fully formal in legal or employment terms. Rather, it represents a narrower transformation in which previously opaque economic activities acquire a documented financial footprint.

For informal workers, this distinction is significant. Digital participation may connect individuals to institutional systems without necessarily changing their employment status or providing comprehensive social protection. Research on digital financial inclusion among Indian paratransit operators cautions against assuming that technological integration automatically eliminates financial precarity (Baker, 2021). Similarly, contemporary research on informal workers emphasizes that digital registration and institutional visibility can produce only partial forms of formalization when broader economic and social protections remain absent.

Nevertheless, transaction formalization may provide an important foundation for subsequent financial engagement. A consistent record of digital receipts can potentially improve the ability of self-employed individuals to demonstrate economic activity. Consequently, greater adoption and regular use of digital payment systems are expected to increase the degree to which financial transactions become visible and documented.

H1: Digital payment adoption positively influences transaction formalization among paratransit operators.

2.4 Transaction Formalization and Financial Inclusion

Financial exclusion is frequently associated with the absence of reliable information regarding an individual's economic capacity and financial behaviour. Formal financial institutions often rely on documented income, transaction histories, and other verifiable indicators when assessing customers for financial products. Informal workers may therefore encounter exclusion not solely because of low income but also because their economic activity is insufficiently visible to institutional systems.

Transaction formalization may help reduce this informational gap. When economic exchanges become consistently recorded through recognized digital channels, informal workers may gradually develop a financial footprint that can support engagement with formal financial institutions. Such visibility may improve opportunities to access banking services, formal savings mechanisms, payment-linked products, and potentially more appropriate forms of credit.

Financial inclusion should, however, be interpreted as more than account ownership. A meaningful transition requires the ability to access and effectively use financial services that correspond to the economic needs of individuals (Demirgüç-Kunt & Klapper, 2013; Sarma & Pais, 2011). The systematic documentation of transactions may therefore function as an enabling mechanism rather than a direct guarantee of inclusion.

The relationship proposed in this study is based on the premise that greater financial visibility can reduce the informational distance between informal economic actors and formal financial institutions. Thus, when paratransit operators increasingly conduct transactions through traceable channels, they are expected to demonstrate stronger engagement with formal financial services.

H2: Transaction formalization positively influences financial inclusion among paratransit operators.

2.5 Digital Payments and Financial Inclusion

Digital financial technologies have increasingly been recognized as potential instruments for expanding access to formal financial services. By lowering transaction costs and reducing geographical barriers, digital systems can provide economically marginalized populations with alternative entry points into the financial ecosystem (Ozili, 2018). The expansion of mobile money has similarly demonstrated that digital technologies can improve participation in financial activities among populations that previously faced limited access to conventional banking infrastructure (Donovan, 2012; Jack & Suri, 2014).

From a technology adoption perspective, the usefulness and accessibility of digital systems influence whether individuals incorporate them into routine economic activities (Davis, 1989; Venkatesh et al., 2012). For paratransit operators, digital payment acceptance may extend beyond passenger convenience. Continued engagement with payment applications can increase familiarity with formal financial technologies and encourage the use of linked banking services.

However, the relationship is unlikely to be purely automatic. Digital payment systems may facilitate financial inclusion while still leaving inequalities in access to affordable credit, financial literacy, and consumer protection. Therefore, the present study does not assume that digital payments completely solve financial exclusion. Instead, it proposes that regular adoption and use of digital payments can positively contribute to financial inclusion by creating repeated interaction with formal financial infrastructure.

H3: Digital payment adoption positively influences financial inclusion among paratransit operators.

2.6 Financial Inclusion and Transition toward Formal Finance

The ultimate objective of financial inclusion extends beyond participation in basic payment systems. A more substantive outcome involves the movement of individuals from dependence on informal financial arrangements toward sustained engagement with regulated financial institutions. This transition toward formal finance may include increased use of bank accounts, formal savings products, institutional credit, insurance, and other regulated financial services.

For paratransit operators, the transition is particularly important because self-employed workers may rely on informal lenders when institutional finance is inaccessible or difficult to obtain. Such arrangements can provide flexibility but may also expose borrowers to high costs and financial insecurity. Access to formal financial services can potentially provide alternative mechanisms for managing income, saving for future needs, financing productive assets, and reducing dependence on informal sources of credit.

Financial inclusion can therefore be viewed as an intermediate condition connecting access to financial infrastructure with deeper institutional participation. The Global Findex literature emphasizes that the meaningful use of formal financial services is central to understanding inclusion rather than simply measuring account ownership (Demirgüç-Kunt et al., 2022). Accordingly, higher levels of financial inclusion are expected to strengthen the likelihood that paratransit operators move toward sustained participation in formal financial arrangements.

H4: Financial inclusion positively influences the transition toward formal finance among paratransit operators.

2.7 The Mediating Role of Transaction Formalization and Financial Inclusion

The conceptual logic of the present study proposes that the influence of digital payments may extend through sequential stages rather than operating solely as a direct relationship. Digital payment adoption initially changes the manner in which economic transactions are conducted. Repeated use can create electronically visible records, thereby increasing transaction formalization. Greater financial visibility may subsequently facilitate engagement with formal financial services, contributing to financial inclusion. Finally, sustained inclusion may support a broader transition toward formal finance.

This sequential perspective is important because it avoids treating digital technology as an independent solution to financial exclusion. Instead, digital payments are conceptualized as an enabling infrastructure whose broader consequences depend upon intermediate processes. This approach is consistent with the argument that technological participation should be distinguished from substantive economic inclusion. Research involving Indian paratransit operators has specifically demonstrated the limitations of assuming that digital financial technologies necessarily improve the financial security of low-income transport workers (Baker, 2021).

Accordingly, the proposed model considers both direct and indirect pathways. Digital payment adoption is expected to contribute to financial inclusion directly, while also influencing it indirectly through greater transaction formalization. Financial inclusion is subsequently expected to act as the principal mechanism connecting digital engagement with a broader transition toward formal finance.

Based on this theoretical reasoning, the study proposes the following sequential mediation hypothesis:

H5: Transaction formalization and financial inclusion sequentially mediate the relationship between digital payment adoption and the transition toward formal finance among paratransit operators.

2.8 Proposed Conceptual Framework

The proposed conceptual framework positions **Digital Payment Adoption (DPA)** as the initiating construct. Its adoption is expected to increase **Transaction Formalization (TF)** by converting routine economic exchanges into digitally recorded transactions. Transaction formalization is subsequently proposed to strengthen **Financial Inclusion (FI)** by improving engagement with formal financial services. Financial inclusion ultimately contributes to the **Transition toward Formal Finance (TFF)**.

The model also incorporates a direct pathway from Digital Payment Adoption to Financial Inclusion, recognizing that digital payment systems can independently provide an entry point into formal financial infrastructure.

The proposed structural relationships are therefore:

H1: Digital Payment Adoption → Transaction Formalization

H2: Transaction Formalization → Financial Inclusion

H3: Digital Payment Adoption → Financial Inclusion

H4: Financial Inclusion → Transition toward Formal Finance

H5: Digital Payment Adoption → Transaction Formalization → Financial Inclusion → Transition toward Formal Finance

This framework advances the argument that the transition from informal economic activity to greater formal financial participation is a process rather than an immediate consequence of technology adoption. Digital payments may serve as the entry mechanism, but transaction visibility and meaningful financial inclusion constitute the intervening processes through which a broader transition toward formal finance may occur.

3. Research Methodology

3.1 Research Design

The study adopted a quantitative and explanatory research design to examine the relationships between digital payment adoption and the transition toward formal finance among paratransit operators. This design was appropriate because the investigation sought to test theoretically proposed relationships among multiple latent constructs while simultaneously examining direct and indirect effects within an integrated structural framework. The proposed model positions Digital Payment Adoption (DPA) as the initiating construct, Transaction Formalization (TF) and Financial Inclusion (FI) as intervening constructs, and Transition toward Formal Finance (TFF) as the principal outcome.

The analytical framework was based on the premise that engagement with digital payment systems may extend beyond transactional convenience. Regular use of digital payment mechanisms can generate a documented financial footprint, improve the visibility of economic activity, and potentially strengthen engagement with regulated financial institutions. Accordingly, the study examined the following relationships:

Digital Payment Adoption → Transaction Formalization

Transaction Formalization → Financial Inclusion

Digital Payment Adoption → Financial Inclusion

Financial Inclusion → Transition toward Formal Finance

Digital Payment Adoption → Transaction Formalization → Financial Inclusion → Transition toward Formal Finance

Accordingly, the study employed a latent-variable modelling approach to investigate the sequential pathway through which digital payment engagement may contribute to broader participation in formal financial systems.

3.2 Study Population and Unit of Analysis

The target population comprised paratransit operators whose occupational activities involve frequent passenger-based transactions and independent financial decision-making. The study focused on operators engaged in small-scale passenger transportation activities, including auto-rickshaw drivers, local taxi operators, shared transport operators, and comparable self-employed mobility service providers functioning within predominantly informal economic settings.

Paratransit operators constitute an important population for examining the relationship between payment digitization and financial inclusion because their livelihoods are generally characterized by frequent small-value transactions, fluctuating income streams, recurring operational expenditures, and varying levels of engagement with

formal financial institutions. The growing availability of QR-based and mobile payment mechanisms has also increased opportunities for these operators to receive and manage digitally mediated transactions.

The individual paratransit operator constituted the unit of analysis. Each respondent was assessed in relation to engagement with digital payment systems, transaction documentation and visibility, participation in formal financial services, and orientation toward formal financial arrangements.

3.3 Study Context

The study focused on paratransit operators in India, including auto-rickshaw, taxi, shared transport, and similar independent passenger transport providers. This context was appropriate because these operators routinely manage small-value passenger transactions and independently handle their daily financial activities. The individual operator constituted the unit of analysis.

3.4 Sampling Procedure

A non-probability purposive sampling approach was employed to select actively operating paratransit operators relevant to the objectives of the study. Respondents were approached through paratransit operational locations and included based on their active involvement in passenger transportation and willingness to participate. As a comprehensive sampling frame was unavailable, purposive selection was considered appropriate. Following screening, 350 valid responses were retained for analysis.

3.5 Sample Size and Dataset Structure

The study dataset comprised 350 respondent records, with each observation representing an individual paratransit operator. The analytical sample was considered adequate for evaluating the proposed latent-variable model and examining the hypothesized direct and sequential indirect relationships.

The measurement structure consisted of four principal latent constructs: Digital Payment Adoption, Transaction Formalization, Financial Inclusion, and Transition toward Formal Finance. Each construct was represented by five observed indicators, resulting in a total of 20 measurement items.

Construct	Abbreviation	Number of Indicators
Digital Payment Adoption	DPA	5
Transaction Formalization	TF	5
Financial Inclusion	FI	5
Transition toward Formal Finance	TFF	5
Total		20

The dataset also included respondent-level background characteristics for describing the study sample and providing contextual information regarding the participants.

3.6 Data Collection Procedure and Period

Data were collected through a structured questionnaire during the designated study period. Respondents were informed about the academic purpose of the study, and participation was voluntary. Completed questionnaires were screened for completeness and usability before analysis. After screening, 350 valid responses were retained and analysed using descriptive statistics and Partial Least Squares Structural Equation Modelling (PLS-SEM).

3.7 Measurement Instrument

The research instrument was structured around four latent constructs derived from the proposed Digital-to-Formal Finance Transition Framework. The measurement domains were designed to capture the progression from

digital payment engagement to transaction visibility, broader participation in formal financial services, and an increasing orientation toward regulated financial arrangements.

All construct indicators were assessed using a five-point Likert response scale:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Higher scores reflected stronger agreement with the statements representing the respective constructs. The questionnaire comprised four measurement domains: Digital Payment Adoption, Transaction Formalization, Financial Inclusion, and Transition toward Formal Finance.

3.8 Operationalization of Constructs

3.8.1 Digital Payment Adoption

Digital Payment Adoption refers to the extent to which paratransit operators integrate digital payment mechanisms into routine occupational and income-related transactions. The construct captures the regularity of digital payment use, preference for electronic transactions, perceived convenience, confidence in using payment technologies, and the importance of digital transactions within daily economic activities.

The construct was represented by five indicators assessing the respondent's level of engagement with digital payment mechanisms. Higher scores indicate stronger integration of digital payment systems into routine transaction activities.

3.8.2 Transaction Formalization

Transaction Formalization refers to the extent to which economic transactions become visible, traceable, reviewable, and documentable through digitally mediated payment channels. The construct does not imply complete legal or occupational formalization. Instead, it represents the development of a documented financial footprint resulting from electronically recorded economic exchanges.

The construct was represented by five indicators reflecting transaction recording, income documentation, reviewability of previous transactions, traceability of economic activity, and the ability to understand transaction patterns through digital records. Higher scores indicate greater transaction visibility and documentation.

3.8.3 Financial Inclusion

Financial Inclusion refers to meaningful access to and engagement with regulated financial services that support routine financial management and economic participation. In the present study, the construct extends beyond simple ownership of a financial account and focuses on the accessibility and use of formal banking and financial services.

The construct was represented by five indicators reflecting engagement with formal financial institutions, access to financial services, use of appropriate financial products, and confidence in interacting with regulated financial systems. Higher scores indicate stronger participation in accessible formal financial services.

3.8.4 Transition toward Formal Finance

Transition toward Formal Finance represents a progressive behavioural and financial movement away from dependence on informal financial arrangements toward greater reliance on regulated and institutional financial channels. The construct was conceptually distinguished from Financial Inclusion by emphasizing the direction of

financial transition and the increasing preference for formal financial arrangements rather than merely the availability or use of financial services.

The construct was represented by five indicators assessing increasing reliance on formal institutions, preference for regulated financial channels, movement toward formal financial products, and the strengthening of long-term connections with institutional finance. Higher scores indicate a stronger transition from informal financial practices toward sustained participation in formal financial arrangements.

3.9 Evaluation Criteria for the Measurement Model

The measurement model was evaluated to determine whether the reflective constructs demonstrated satisfactory indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. The assessment criteria were selected in accordance with the analytical procedures specified for the study and were applied consistently in the subsequent empirical analysis.

Indicator reliability was assessed using outer loadings. Higher outer loading values indicate that an observed indicator adequately represents its corresponding latent construct. Outer loadings of approximately 0.708 or above were considered satisfactory.

Internal consistency reliability was assessed using Cronbach's alpha, rho_A, and Composite Reliability (CR). Values of 0.70 or above were considered indicative of acceptable reliability, while Composite Reliability values substantially below 0.70 would indicate inadequate internal consistency.

Convergent validity was evaluated using the Average Variance Extracted (AVE). An AVE value of 0.50 or above indicates that a construct explains at least 50 percent of the variance in its associated indicators and was therefore considered evidence of satisfactory convergent validity.

Discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT). HTMT was used to determine whether the latent constructs were empirically distinct from one another. Values below 0.85 were considered indicative of satisfactory discriminant validity for the constructs examined in the study.

The measurement model evaluation criteria applied in the analysis are summarized in Table.

Measurement Model Evaluation Criteria

Assessment Criterion	Recommended Benchmark
Outer Loading	≥ 0.708
Cronbach's Alpha	≥ 0.70
rho_A	≥ 0.70
Composite Reliability	≥ 0.70
Average Variance Extracted (AVE)	≥ 0.50
Heterotrait–Monotrait Ratio (HTMT)	< 0.85

Only after establishing satisfactory measurement properties were the hypothesized structural relationships examined. The subsequent structural model assessment focused on the standardized path coefficients, bootstrapped t-statistics, p-values, coefficient of determination (R^2), and the specific sequential indirect effect specified in the proposed research framework.

3.10 Data Preparation and Screening

Prior to the structural analysis, the dataset was examined to ensure that the observations and variable coding were suitable for multivariate analysis. The preparation process included verification of respondent records,

examination of variable coding, confirmation of response-scale consistency, and screening for incomplete or irregular observations.

All construct indicators were coded using a five-point Likert scale ranging from 1 to 5. The data were subsequently organized according to the four latent constructs and their respective indicators. Descriptive analysis of respondent background characteristics was undertaken to provide a contextual profile of the study sample.

The screening process also considered missing values, out-of-range responses, and inconsistencies in coding. Since the selected analytical technique is variance-based, strict multivariate normality was not considered a prerequisite for model estimation. Nevertheless, the distributional characteristics of the indicators were examined to identify potential irregularities that could affect the interpretation of the results.

3.11 Data Analysis Technique

The data analysis was conducted using a two-stage Partial Least Squares Structural Equation Modeling (PLS-SEM) procedure. PLS-SEM was considered appropriate for the present study because the research aimed to examine multiple simultaneous relationships among latent constructs and to evaluate the proposed pathway linking Digital Payment Adoption, Transaction Formalization, Financial Inclusion, and Transition toward Formal Finance.

The analysis was undertaken in two sequential stages: (1) assessment of the measurement model and (2) assessment of the structural model.

3.11.1 Assessment of the Measurement Model

The measurement model was evaluated to establish the reliability and validity of the reflective constructs included in the study. Indicator reliability was assessed through outer loadings. Internal consistency reliability was examined using Cronbach's alpha, rho_A, and Composite Reliability (CR). Convergent validity was assessed using the Average Variance Extracted (AVE).

The commonly accepted threshold values were considered during interpretation. Outer loadings of approximately 0.70 or above were regarded as satisfactory. Cronbach's alpha, rho_A, and Composite Reliability values above 0.70 were considered indicative of acceptable internal consistency reliability. An AVE value above 0.50 was considered evidence that a construct explained more than half of the variance in its indicators.

Discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT). HTMT values below the recommended threshold were interpreted as evidence that the constructs were empirically distinct from one another.

3.11.2 Assessment of the Structural Model

Following the establishment of satisfactory measurement properties, the structural model was assessed to examine the hypothesized relationships among the study constructs. The assessment focused on standardized path coefficients (β), t-statistics, p-values, and the coefficient of determination (R^2).

The statistical significance of the hypothesized direct relationships was assessed using non-parametric bootstrapping with 5,000 resamples. The bootstrapping procedure generated t-statistics and p-values for evaluating the significance of the structural path coefficients.

The explanatory power of the endogenous constructs was assessed using the coefficient of determination (R^2). The R^2 values were interpreted to determine the proportion of variance in Transaction Formalization, Financial Inclusion, and Transition toward Formal Finance explained by their respective predictor constructs.

3.11.3 Assessment of the Sequential Indirect Effect

The proposed sequential indirect relationship between Digital Payment Adoption and Transition toward Formal Finance through Transaction Formalization and Financial Inclusion was assessed using the bootstrapping procedure. The specific indirect effect was evaluated by examining the estimated indirect coefficient and its bootstrap confidence interval.

The sequential indirect effect was considered statistically significant when the corresponding confidence interval did not include zero. This procedure enabled the study to examine whether Digital Payment Adoption was indirectly associated with Transition toward Formal Finance through the sequential pathway involving Transaction Formalization and Financial Inclusion.

3.12 Structural Model and Hypothesis Testing

The structural model was specified to examine the hypothesized relationships among Digital Payment Adoption (DPA), Transaction Formalization (TF), Financial Inclusion (FI), and Transition toward Formal Finance (TFF).

The proposed model examined the following direct relationships:

Digital Payment Adoption → Transaction Formalization;

Transaction Formalization → Financial Inclusion;

Digital Payment Adoption → Financial Inclusion; and

Financial Inclusion → Transition toward Formal Finance.

In addition to the direct relationships, the study examined the specific sequential indirect pathway:

Digital Payment Adoption → Transaction Formalization → Financial Inclusion → Transition toward Formal Finance.

The significance of the hypothesized direct relationships was assessed using standardized path coefficients, t-statistics, and p-values generated through non-parametric bootstrapping with 5,000 resamples. The explanatory capability of the structural model was evaluated using the coefficient of determination (R^2) for the endogenous constructs.

The sequential indirect effect was assessed separately through bootstrapping and interpreted using the estimated indirect coefficient and its corresponding bootstrap confidence interval. The indirect pathway was considered statistically significant when the confidence interval did not include zero.

3.13 Ethical Considerations

The study was conducted with due consideration for research ethics and respondent confidentiality. Participation was voluntary, and respondents were informed about the academic purpose of the study before providing their responses. Informed consent was obtained prior to participation.

Respondents were assured that their individual responses would be treated confidentially and used exclusively for academic and research purposes. No personally identifiable information was included in the analytical reporting of the findings. Participants retained the right to decline participation or discontinue their involvement without any adverse consequences.

The collected information was handled in a manner intended to preserve privacy, confidentiality, and responsible research practice throughout the data collection and analytical process.

3.14 Summary of the Methodological Framework

The study employed a quantitative explanatory framework to investigate the relationship between digital payment adoption and the transition toward formal finance among paratransit operators. The analytical model comprised four latent constructs measured through 20 indicators. Digital Payment Adoption was positioned as the initiating construct, Transaction Formalization and Financial Inclusion functioned as intervening constructs, and Transition toward Formal Finance represented the principal outcome.

PLS-SEM was employed to evaluate both the measurement properties of the constructs and the hypothesized structural relationships. The methodological framework enabled examination of whether digital payment engagement is associated not only with transactional convenience but also with enhanced transaction visibility, greater engagement with formal financial services, and a progressive movement toward sustained participation in regulated financial arrangements.

4. Data Analysis And Results

This section presents the empirical results obtained from the analytical dataset comprising 350 observations. In accordance with the methodological procedure described in Section 3, the analysis was undertaken using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results are presented in two principal stages. First, the reliability and validity of the reflective measurement model were assessed. Second, the structural model was evaluated to examine the hypothesized direct relationships, explanatory power, and sequential indirect effect.

4.1 Profile of the Analytical Sample

The analytical dataset comprised 350 observations representing paratransit operators. Respondent characteristics were examined to provide contextual information regarding the composition of the study sample.

The respondents ranged in age from 21 to 65 years, with a mean age of 40.50 years and a median age of 41 years. The sample was predominantly male, comprising 328 respondents (93.7%), while 22 respondents (6.3%) were female.

With respect to educational attainment, the largest proportion of respondents had completed higher secondary education (33.1%), followed by those educated up to the secondary level (28.9%). Undergraduate-level respondents accounted for 19.4% of the sample, whereas Diploma or ITI holders represented 15.1%. Postgraduate respondents constituted 3.4% of the analytical sample.

Regarding the type of transport operation, auto-rickshaw operators represented the largest occupational category (45.4%). Taxi operators accounted for 23.1% of the respondents, followed by shared taxi or van operators (20.6%) and e-rickshaw operators (10.9%).

Table 1. Demographic and Occupational Profile of the Analytical Sample (N = 350)

Characteristic	Category	Frequency	Percentage
Gender	Male	328	93.7
	Female	22	6.3
Education	Up to Secondary	101	28.9
	Higher Secondary	116	33.1
	Diploma/ITI	53	15.1
	Undergraduate	68	19.4
	Postgraduate	12	3.4
Operator Type	Auto-rickshaw	159	45.4
	Taxi	81	23.1
	Shared taxi/van	72	20.6
	E-rickshaw	38	10.9

The mean duration of experience with digital payment mechanisms was 4.33 years. Overall, the sample demonstrated variation in demographic characteristics, educational background, occupational category, and

familiarity with digital payment systems, providing an appropriate analytical context for examining the proposed relationships.

4.2 Descriptive Statistics of the Study Constructs

Descriptive statistics were calculated to examine the central tendency and dispersion of the four principal constructs included in the proposed model. Each construct was represented by five indicators measured on a five-point Likert scale.

Table 2. Descriptive Statistics of the Principal Constructs

Construct	Mean	Standard Deviation	Minimum	Maximum
Digital Payment Adoption (DPA)	3.148	0.655	1.20	5.00
Transaction Formalization (TF)	3.180	0.683	1.00	5.00
Financial Inclusion (FI)	3.190	0.732	1.00	5.00
Transition toward Formal Finance (TFF)	3.189	0.720	1.00	5.00

The construct means ranged from 3.148 to 3.190. Financial Inclusion recorded the highest mean value ($M = 3.190$), closely followed by Transition toward Formal Finance ($M = 3.189$) and Transaction Formalization ($M = 3.180$). Digital Payment Adoption recorded a mean score of 3.148.

The standard deviations ranged from 0.655 to 0.732, indicating observable variation in respondents' perceptions across the four constructs. The distribution of responses therefore demonstrated sufficient variability for subsequent latent-variable analysis.

4.3 Assessment of the Reflective Measurement Model

Prior to examining the hypothesized structural relationships, the reflective measurement model was assessed to establish the reliability and convergent validity of the four latent constructs. In accordance with the analytical procedure described in Section 3, indicator reliability was evaluated using standardized outer loadings, while internal consistency reliability was assessed using Cronbach's alpha, ρ_A , and composite reliability. Convergent validity was evaluated using the Average Variance Extracted (AVE).

Table 3. Measurement Model Reliability and Convergent Validity

Construct	Indicator Loading Range	Cronbach's Alpha	ρ_A	Composite Reliability	AVE
Digital Payment Adoption	0.782–0.813	0.863	0.882	0.901	0.647
Transaction Formalization	0.782–0.821	0.867	0.886	0.904	0.654
Financial Inclusion	0.813–0.837	0.882	0.898	0.914	0.681
Transition toward Formal Finance	0.792–0.833	0.873	0.891	0.908	0.664

All indicator loadings exceeded the recommended threshold of 0.708, ranging from 0.782 to 0.837, thereby confirming satisfactory indicator reliability across all measurement items.

The internal consistency measures also demonstrated satisfactory reliability. Cronbach's alpha values ranged from 0.863 to 0.882, rho_A values ranged from 0.882 to 0.898, and composite reliability values ranged from 0.901 to 0.914. All values exceeded the recommended minimum threshold of 0.70, indicating strong internal consistency among the indicators representing each construct.

The AVE values ranged from 0.647 to 0.681 and exceeded the recommended minimum threshold of 0.50. This indicates that each latent construct explained more than half of the variance in its respective indicators, thereby supporting convergent validity.

Overall, the results confirm satisfactory indicator reliability, internal consistency reliability, and convergent validity for Digital Payment Adoption, Transaction Formalization, Financial Inclusion, and Transition toward Formal Finance. The measurement model was therefore considered adequate for subsequent assessment of discriminant validity and structural relationships.

4.4 Assessment of Discriminant Validity

Discriminant validity was examined to determine whether the four latent constructs were empirically distinguishable from one another. The Heterotrait-Monotrait ratio (HTMT) was used as the principal criterion for this assessment.

Table 4. Heterotrait-Monotrait Ratio (HTMT)

Construct	DPA	TF	FI	TFF
Digital Payment Adoption (DPA)	—	0.564	0.571	0.375
Transaction Formalization (TF)	0.564	—	0.625	0.435
Financial Inclusion (FI)	0.571	0.625	—	0.698
Transition toward Formal Finance (TFF)	0.375	0.435	0.698	—

All HTMT values were below the conservative threshold of 0.85. The highest HTMT value was observed between Financial Inclusion and Transition toward Formal Finance (HTMT = 0.698), which remained below the recommended threshold.

The findings therefore demonstrate adequate discriminant validity among the four constructs. Although Financial Inclusion and Transition toward Formal Finance are conceptually related, the HTMT results indicate that they represent empirically distinguishable dimensions within the proposed model.

Based on the combined results of reliability, convergent validity, and discriminant validity assessment, the measurement model demonstrated adequate quality for interpretation of the structural relationships.

4.5 Association among the Study Constructs

The relationships among the principal constructs were further examined to provide an overview of the observed associations.

Table 5. Construct Correlation Matrix

Construct	DPA	TF	FI	TFF
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Digital Payment Adoption (DPA)	1.000			
Transaction Formalization (TF)	0.488	1.000		
Financial Inclusion (FI)	0.500	0.546	1.000	
Transition toward Formal Finance (TFF)	0.325	0.378	0.612	1.000

Digital Payment Adoption demonstrated positive associations with Transaction Formalization ($r = 0.488$) and Financial Inclusion ($r = 0.500$). Transaction Formalization was also positively associated with Financial Inclusion ($r = 0.546$).

The strongest association was observed between Financial Inclusion and Transition toward Formal Finance ($r = 0.612$). Digital Payment Adoption demonstrated a comparatively lower but positive association with Transition toward Formal Finance ($r = 0.325$).

The pattern of associations was consistent with the proposed conceptual framework and provided preliminary support for the hypothesized progression from digital payment engagement to transaction formalization, financial inclusion, and transition toward formal financial arrangements.

4.6 Structural Model Assessment

Following the establishment of satisfactory measurement properties, the structural model was evaluated to examine the hypothesized relationships among the latent constructs. The assessment focused on the standardized path coefficients (β), bootstrapped t-statistics, significance levels, and explanatory power of the endogenous constructs.

The statistical significance of the structural relationships was assessed using non-parametric bootstrapping with 5,000 resamples.

4.6.1 Effect of Digital Payment Adoption on Transaction Formalization

Digital Payment Adoption demonstrated a positive and statistically significant relationship with Transaction Formalization.

$$\beta = 0.488, t = 10.420, p < 0.001$$

The result indicates that greater engagement with digital payment mechanisms was associated with higher levels of transaction visibility, documentation, and traceability.

Digital Payment Adoption explained 23.8% of the variance in Transaction Formalization ($R^2 = 0.238$).

Therefore, **H1 was supported**.

4.6.2 Effect of Transaction Formalization on Financial Inclusion

Transaction Formalization demonstrated a positive and statistically significant relationship with Financial Inclusion.

$$\beta = 0.396, t = 8.115, p < 0.001$$

The result indicates that greater transaction documentation and visibility were associated with stronger engagement with formal financial services.

Therefore, **H2 was supported**.

4.6.3 Effect of Digital Payment Adoption on Financial Inclusion

Digital Payment Adoption also demonstrated a positive and statistically significant direct relationship with Financial Inclusion.

$$\beta = 0.306, t = 6.273, p < 0.001$$

The combined influence of Digital Payment Adoption and Transaction Formalization explained 36.9% of the variance in Financial Inclusion ($R^2 = 0.369$).

The finding indicates that digital payment engagement was directly associated with Financial Inclusion while Transaction Formalization simultaneously contributed to explaining Financial Inclusion.

Therefore, **H3 was supported**.

4.6.4 Effect of Financial Inclusion on Transition toward Formal Finance

Financial Inclusion demonstrated a strong positive and statistically significant relationship with Transition toward Formal Finance.

$$\beta = 0.612, t = 14.454, p < 0.001$$

Financial Inclusion explained 37.5% of the variance in Transition toward Formal Finance ($R^2 = 0.375$).

The result indicates that stronger engagement with regulated financial services was associated with a greater orientation toward formal financial arrangements.

Therefore, **H4 was supported**.

4.7 Summary of Direct Hypothesis Testing

Table 6. Structural Path Results and Hypothesis Decisions

Hypothesis	Structural Relationship	β	t-value	p-value	Decision
H1	DPA $\rightarrow$ TF	0.488	10.420	<0.001	Supported
H2	TF $\rightarrow$ FI	0.396	8.115	<0.001	Supported
H3	DPA $\rightarrow$ FI	0.306	6.273	<0.001	Supported
H4	FI $\rightarrow$ TFF	0.612	14.454	<0.001	Supported

All four direct structural relationships were positive and statistically significant.

Digital Payment Adoption demonstrated significant positive effects on both Transaction Formalization and Financial Inclusion. Transaction Formalization further contributed positively to Financial Inclusion. The strongest direct structural relationship was observed between Financial Inclusion and Transition toward Formal Finance.

The results collectively support the proposed progression from digital payment engagement toward broader participation in formal financial systems.

4.8 Explanatory Power of the Structural Model

The explanatory capability of the structural model was assessed using the coefficient of determination (R^2).

Table 7. Explanatory Power of the Endogenous Constructs

Endogenous Construct	R^2	Variance Explained
Transaction Formalization	0.238	23.8%
Financial Inclusion	0.369	36.9%

Transition toward Formal Finance	0.375	37.5%
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Digital Payment Adoption explained 23.8% of the variance in Transaction Formalization. The combined influence of Digital Payment Adoption and Transaction Formalization explained 36.9% of the variance in Financial Inclusion.

Financial Inclusion explained 37.5% of the variance in Transition toward Formal Finance.

Overall, the model demonstrated meaningful explanatory capability across the endogenous constructs, with the highest proportion of explained variance observed for Transition toward Formal Finance.

4.9 Sequential Indirect Effect Analysis

The final hypothesis examined whether Transaction Formalization and Financial Inclusion sequentially transmitted the relationship between Digital Payment Adoption and Transition toward Formal Finance.

The specific indirect pathway examined was:

Digital Payment Adoption → Transaction Formalization → Financial Inclusion → Transition toward Formal Finance

The significance of the sequential indirect relationship was assessed using the bootstrapping procedure with 5,000 resamples. The specific indirect effect and its confidence interval were examined directly.

Table 8. Sequential Indirect Effect Results

Indirect Relationship	Indirect Effect	95% Confidence Interval	Result
DPA → TF → FI → TFF	0.118	[0.081, 0.161]	Significant

The sequential indirect effect was positive ($\beta = 0.118$). The bootstrap confidence interval ranged from 0.081 to 0.161 and did not include zero, indicating that the indirect relationship was statistically significant.

The finding demonstrates that the relationship between Digital Payment Adoption and Transition toward Formal Finance operated through a sequential mechanism involving Transaction Formalization and Financial Inclusion.

Specifically, greater engagement with digital payment mechanisms was associated with higher levels of transaction formalization. Greater transaction formalization was subsequently associated with stronger financial inclusion, which in turn was positively associated with Transition toward Formal Finance.

Therefore, **H5 was supported.**

4.10 Integrated Interpretation of the Structural Model

The structural results reveal a progressive pattern among the four constructs included in the proposed Digital-to-Formal Finance Transition Framework.

First, Digital Payment Adoption demonstrated a significant positive relationship with Transaction Formalization. This finding indicates that greater use of digitally mediated payment mechanisms was associated with increased visibility, traceability, and documentation of economic transactions.

Second, Transaction Formalization demonstrated a significant positive effect on Financial Inclusion. This relationship suggests that a more visible and documented transaction history was associated with stronger engagement with regulated financial services.

Third, Digital Payment Adoption also maintained a direct positive relationship with Financial Inclusion. This result indicates that engagement with digital payment infrastructure was independently associated with broader participation in formal financial systems.

The strongest direct structural relationship was observed between Financial Inclusion and Transition toward Formal Finance. This finding highlights the central role of meaningful engagement with regulated financial services in the broader movement toward sustained reliance on formal financial arrangements.

The significant sequential indirect effect provides further support for the process-oriented nature of the proposed framework. The results suggest that the relationship between digital payment engagement and formal financial transition is not limited to a single direct association. Instead, the observed pattern follows a progressive sequence:

Digital Payment Adoption → Transaction Formalization → Financial Inclusion → Transition toward Formal Finance

This sequence supports the conceptual distinction between simple adoption of digital payment technology and deeper integration into formal financial systems.

4.11 Summary of Findings

The analysis produced five principal findings.

First, Digital Payment Adoption demonstrated a significant positive relationship with Transaction Formalization, indicating that greater engagement with digital payment mechanisms was associated with enhanced transaction visibility and documentation.

Second, Transaction Formalization was positively associated with Financial Inclusion, suggesting that more traceable and documented economic activity was associated with stronger engagement with formal financial services.

Third, Digital Payment Adoption demonstrated an additional significant direct relationship with Financial Inclusion, indicating that participation in digital payment infrastructure was independently associated with broader formal financial engagement.

Fourth, Financial Inclusion demonstrated the strongest direct relationship with Transition toward Formal Finance, emphasizing the importance of engagement with regulated financial services in the movement toward sustained formal financial participation.

Finally, the sequential indirect pathway linking Digital Payment Adoption with Transition toward Formal Finance through Transaction Formalization and Financial Inclusion was statistically significant.

Overall, all five hypothesized relationships were supported. The findings provide empirical support for the proposed Digital-to-Formal Finance Transition Framework and establish a foundation for the subsequent discussion of the theoretical and practical implications of digital payment engagement among paratransit operators.

5. Discussion

This study examined the relationships among Digital Payment Adoption (DPA), Transaction Formalization (TF), Financial Inclusion (FI), and the Transition towards Formal Finance (TFF) among paratransit operators. The findings support the proposed process-oriented framework and suggest that the significance of digital payments extends beyond transaction convenience. Digital engagement appears to be associated with greater transaction visibility, broader financial participation, and ultimately stronger integration with formal financial arrangements. This perspective aligns with evidence that digital payments can provide an entry point to wider financial service use (Demirgüç-Kunt et al., 2022).

5.1 Digital Payment Adoption and Transaction Formalization

The findings supported H1, demonstrating a significant positive relationship between DPA and TF ($\beta = 0.488$, $p < 0.001$). This suggests that greater use of digital payments is associated with increased visibility and traceability of

everyday transactions. For paratransit operators, whose earnings often arise from frequent small-value transactions, digital payments may create records that are more systematic than conventional cash exchanges.

This finding supports the view that payment digitization can contribute to the documentation of economic activity. However, transaction formalization should not be equated with complete legal or regulatory formalization. Rather, the present findings indicate that digital payments may represent an initial stage through which previously less visible transactions become electronically traceable (Demirgüç-Kunt et al., 2022).

5.2 Transaction Formalization and Financial Inclusion

H2 was also supported, with TF positively associated with FI ($\beta = 0.396$, $p < 0.001$). The result indicates that greater transaction visibility is associated with stronger engagement with formal financial services. This finding suggests that digitally documented economic activity may serve as an intermediate link between payment behaviour and broader financial participation.

Financial inclusion involves more than possessing a financial account; it also concerns meaningful access to and use of financial services (Demirgüç-Kunt et al., 2022). Accordingly, the findings suggest that transaction formalization may help create a pathway through which routine economic activity becomes increasingly connected with formal financial channels.

5.3 Digital Payment Adoption and Financial Inclusion

The results supported H3, showing a significant positive relationship between DPA and FI ($\beta = 0.306$, $p < 0.001$). This indicates that digital payment adoption is directly associated with broader financial inclusion, even alongside the role of transaction formalization.

Regular engagement with digital payment systems may increase familiarity with account-based financial infrastructure and encourage interaction with formal financial services. Nevertheless, the moderate magnitude of this relationship indicates that payment adoption alone is unlikely to guarantee comprehensive financial inclusion. The broader benefits of digital payments depend on whether users can access appropriate and usable financial services (Demirgüç-Kunt et al., 2022; Annan et al., 2024).

5.4 Financial Inclusion and Transition towards Formal Finance

The strongest relationship in the model was observed between FI and TFF ($\beta = 0.612$, $p < 0.001$), supporting H4. This finding indicates that broader participation in formal financial services is strongly associated with movement towards sustained engagement with formal financial arrangements.

The result highlights the distinction between merely accessing digital payment technologies and becoming meaningfully integrated into formal finance. Digital payment use may initiate engagement, but financial inclusion appears to represent the more important mechanism associated with continued participation in formal financial systems. This is consistent with the multidimensional understanding of financial inclusion, which emphasizes both access and effective use of financial services (Demirgüç-Kunt et al., 2022).

5.5 Sequential Pathway from Digital Payments to Formal Finance

H5 was supported through a positive sequential indirect effect ($\beta = 0.118$). The findings indicate that DPA is associated with TFF through the sequential pathway of TF and FI. This result represents an important contribution because it demonstrates that digital payment adoption, transaction formalization, financial inclusion, and formal financial participation should not be treated as identical outcomes.

Instead, the findings support a progressive pathway in which digital payment engagement is associated with more visible transactions, greater financial inclusion, and subsequently stronger participation in formal financial arrangements. This interpretation is consistent with research emphasizing that digital financial technologies can

expand opportunities for financial inclusion but do not automatically eliminate structural barriers to formal financial participation (Annan et al., 2024; Demirgüç-Kunt et al., 2022).

5.6 Overall Interpretation

Overall, the findings support the proposed Digital-to-Formal Finance Transition Framework. The model explained 23.8% of the variance in TF, 36.9% in FI, and 37.5% in TFF, demonstrating meaningful explanatory capability. The results suggest that the transition towards formal finance is not simply a consequence of adopting digital payment technology. Instead, it appears to involve a broader progression from payment digitization to transaction visibility, financial inclusion, and sustained formal financial participation.

The findings therefore suggest that initiatives targeting economically informal workers should move beyond encouraging digital payment adoption alone. Greater attention should be directed towards converting digital transaction activity into meaningful financial access and sustained participation in appropriate formal financial services.

6. Theoretical And Practical Implications

6.1 Theoretical Implications

This study contributes to the literature by presenting digital payment adoption as part of a broader transition process rather than as an isolated technological outcome. The findings distinguish among Digital Payment Adoption, Transaction Formalization, Financial Inclusion, and the Transition towards Formal Finance, demonstrating that these constructs represent related but conceptually distinct stages.

The supported sequential pathway suggests that the relationship between digital technology and formal financial participation may operate through intermediate mechanisms. Digital payment adoption was associated with greater transaction formalization, which was subsequently associated with financial inclusion and, ultimately, the transition towards formal finance. This perspective extends conventional discussions of financial inclusion by emphasizing the importance of transaction visibility as a connecting mechanism between digital payment behaviour and broader financial participation.

The findings also reinforce the multidimensional nature of financial inclusion. The strong relationship between Financial Inclusion and the Transition towards Formal Finance indicates that access to digital payment infrastructure alone may not represent meaningful integration into formal financial systems. Instead, sustained engagement with formal financial services appears to be a critical component of the transition process.

6.2 Practical and Policy Implications

The findings suggest that initiatives promoting digital payments among paratransit operators should extend beyond increasing the availability of QR codes or payment applications. Policies should focus on helping operators translate digitally recorded transactions into meaningful financial opportunities, including access to suitable savings, credit, insurance, and other formal financial services.

Financial institutions may also consider developing products appropriate for workers with frequent but variable income streams. Digitally traceable transaction histories could potentially provide additional information for assessing financial behaviour where conventional income documentation is limited.

For policymakers, the findings highlight the importance of integrating payment digitization with broader financial inclusion strategies. Digital infrastructure, financial literacy, consumer protection, and accessible financial products should operate together to support sustained participation in formal financial systems. Such an integrated approach may be particularly valuable for workers operating within economically informal sectors.

Overall, the study indicates that the policy value of digital payment adoption lies not only in reducing dependence on cash but also in its potential to support a broader progression towards transaction visibility, financial inclusion, and deeper participation in formal finance.

7. Limitations And Future Research

Despite its contributions, this study has certain limitations that should be considered when interpreting the findings. First, the analysis was based on a cross-sectional dataset of 350 respondents. Consequently, the reported relationships represent statistical associations and should not be interpreted as definitive evidence of causality. Future research may employ longitudinal designs to examine how digital payment behaviour and formal financial participation evolve over time.

Second, the study focused specifically on paratransit operators. Although this occupational group provides an appropriate context for examining the relationship between digital payments and financial formalization, the findings may not be directly generalizable to other informal-sector workers or geographical settings. Comparative studies involving different occupational groups and regions could provide broader evidence regarding the applicability of the proposed framework.

Third, the model examined four principal constructs and may not capture all factors influencing the transition towards formal finance. Future studies could incorporate additional variables such as digital literacy, financial capability, institutional trust, perceived risk, financial infrastructure, income stability, and access to appropriate financial products.

Finally, future research could examine whether digitally recorded transaction histories translate into measurable improvements in access to formal savings, credit, insurance, or other financial services. Such investigations would provide deeper insight into the long-term capacity of digital payment systems to support meaningful financial inclusion and sustained integration into formal financial ecosystems.

8. Conclusion

This study examined the relationship between digital payment adoption and the transition towards formal finance among paratransit operators through the intervening roles of transaction formalization and financial inclusion. The findings support the proposed framework and demonstrate that digital payment adoption is positively associated with both transaction formalization and financial inclusion. Transaction formalization was also positively associated with financial inclusion, while financial inclusion emerged as the strongest predictor of the transition towards formal finance.

The supported sequential indirect relationship further indicates that the potential contribution of digital payments to formal financial participation may operate through a progressive pathway. Digital payment adoption may increase the visibility and traceability of economic transactions, which can be associated with broader engagement with formal financial services and, subsequently, a stronger transition towards formal finance.

The study therefore demonstrates that payment digitization alone should not be considered equivalent to financial inclusion or formal financial integration. Its broader significance depends on whether digital transaction activity can be translated into meaningful access to and sustained use of appropriate formal financial services.

Overall, the findings provide empirical support for a process-oriented understanding of the Digital-to-Formal Finance Transition Framework. For policymakers and financial service providers, the results suggest that strategies targeting economically informal workers should combine digital payment infrastructure with measures that strengthen transaction visibility, financial access, financial capability, and sustained engagement with formal financial institutions. Such an integrated approach may contribute more effectively to the long-term financial inclusion of workers operating in economically informal sectors.

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