



Digital payments and MSME financial performance in Kerala: Operational efficiency, credit access, and cybersecurity risk

Dr. Sujitha K A

Assistant Professor, Department of Commerce, Sree Vivekananda College, Under University of Calicut, Keralam, India

Corresponding Author: Dr. Sujitha K A

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Abstract

Abstract: The introduction of digital payment facilities like the Unified Payment Interface (UPI) along with the acceptance of QR Codes and point of sale terminals, has transformed the payment methods of MSMEs in India. The cash handling costs associated with transactions have been lowered, which has enhanced collection speed and created a trail that enables lenders to make decisions regarding creditworthiness. The risks incurred through digital payments have offset part of the gains. These include increased frauds, misuse of data, and failures of transactions. This study designs DPA with links to the FP, operational efficiency standard and AFC. The influence exerted by DPA on FP is mediated by PCR. The model is estimated using Partial least squares structural equations modeling (PLS SEM) with over 400 responses from proprietors/managing directors of registered MSME in Kerala. The paper shows that the method works based on one dataset. All the work on technology adoption, resource-based theory and business value of information technology is combining into a single theory for the MSME sector. MSMEs that engage in digital payment methods such as UPI are likely to get improved performance.

Keywords: Digital payments, UPI, msmes, financial performance, operational efficiency, access to credit, cybersecurity risk, PLS SEM

Introduction

A switch from cash payments to phones, real-time payment networks and QR-code acceptance has relocated commercial payments from cash drawers to smartphones; digital finance is today one of the most vibrant areas of research in commerce ^[1, 2]. For a small enterprise, however, this change is not simply a matter of switching from a chequebook to an app every digital receipt provides a record, every immediate payment accelerates the speed of receipt of cash, and fewer cash transactions decrease a whole host of costs and risks in doing business. India serves as a paradigm for this shift; UPI transactions exceeded ten billion monthly transactions in August 2023 ^[27] and RBI's Payments Vision 2025 sets out an ambition of 'E-Payments for All, Always, Everywhere' with especial focus on "small" vendors ^[25]. MSMEs are the cornerstone of RBI's vision because they make up the vast majority of the enterprise sector ^[26] and the great bulk of production output exports and employment.

The thin margins and cash-based operation prevalent in MSMEs result in inadequate formal credit due to absence of collateral and a reliable record of cash flows ^[7]. Empirical evidence for developing countries indicates that better credit access results in increasing business income ^[8] while Mobile Payments reduce transaction costs, increase participation in markets ^[4, 5]. The management information systems literature maintains that technology only improves performance through changes in business processes, new resources and capabilities ^[16, 17, 18]. For MSMEs these can take the form of enhanced operational efficiency digital payments decrease the effort to manage and reconcile cash transactions and formal credit through better provision of an

audit trail of sales. Most Indian studies have examined consumer adoption intentions using TAM or UTAUT ^[9], ^[10]; far fewer have examined the business outcomes of adoption or the mechanisms behind them. This study addresses that gap by developing an integrated model of DPA and FP with OE and AFC as mediators and PCR as a moderator.

Literature Review

Digital finance and payments. Gomber, Koch and Siering ^[1] established a digital finance research agenda by presenting the 'Digital Finance Cube' and emphasizing that there is much still to be learned about its commercial potential. One key role digital finance can play is to bring greater inclusion and stability, both of which hinge on consumers trusting the digital finance institutions that serve them and on institutions being able to defend against cyber threats. Dahlberg *et al.* ^[3] noted that literature in the mobile payment sphere revolves mostly around consumer adoption while largely ignoring merchants' decisions to implement and how payments influence the economics of firms. According to Khando, Islam, and Gao ^[24], the top three digital payment technology challenges are all related to trust: security, privacy, and trust.

Economic impacts of payments and access to finance. M-PESA has been shown to both lower transaction costs and serve as a smoothing mechanism for consumption by Jack and Suri ^[4]. It has also been demonstrated that this platform enables entrepreneurship by Suri and Jack ^[5]; indeed, the former has led to overall poverty reduction. In 2021, the percentage of the world's population with at least one account was 76 percent, while the Global Findex further

found that these customers often access other products by virtue of a digital payment account ^[6]. Due to issues such as information asymmetry, small and medium enterprises appear to have worse access to finance than their larger counterparts, Beck and Demirgüç-Kunt ^[7]; increased utilization of formal financial institutions has been correlated with higher rates of business ownership, Bruhn and Love ^[8].

Technology adoption and the firm's profitability or performance. TAM ^[9] and UTAUT ^[10] help understand individual adoption using perceived usefulness, perceived ease of use, social influence, and facilitating conditions. The Diffusion of Innovations model ^[11], TOE framework ^[12], and other variables as surveyed by Oliveira and Martins ^[13] help predict adoption in a firm or enterprise setting. Performance by the firm is linked to a valuable and sustainable but not easily duplicable resource according to the resource-based view ^[14]. According to Melville, Kraemer, and Gurbaxani ^[15] IT is likely to positively affect firm performance if there is a concurrent positive effect on business process

performance. This latter has also been shown to have a moderating impact on IT effect on firm profitability by Brynjolfsson and Hitt ^[16]. DeLone and McLean ^[17] links system quality to both usage and net-benefits. Lusardi and Mitchell ^[18] Drexler, Fischer, and Schoar ^[19] demonstrated that the former improves the decision-making skills and business operation of employees with limited understanding of finances, while the latter benefits from simpler accounting.

The topic of perceived risk, security, and adoption. Although much has been studied regarding trust, perceived risk and utilization of e-services (Featherman and Pavlou ^[20]), perceived risk reduces adoption by making e-services less useful and desirable (Pavlou ^[21]); trust and risk influence online transaction intentions Kim *et al.* ^[22] and security and trust are essential for the use of e-payments systems Anderson and Moore) ^[23]. This information provides a rationale for policy, and the existing policy documents from the RBI ^[25], MSME ^[26], and NPCI ^[27] document the Indian context. Table 1 provides an updated summary of key studies relating to the topic of risk, security, and e-business adoption.

Table 1: Summary of Key Literature

Ref.	Author(s) & Year	Key Finding
[1]	Gomber <i>et al.</i> (2017)	Digital Finance Cube; need for research on business consequences
[3]	Dahlberg <i>et al.</i> (2008)	Merchant-side mobile payment research is under-represented
[4, 5]	Jack & Suri (2014); Suri & Jack (2016)	Mobile money lowers transaction costs and encourages business activity
[6]	Demirgüç-Kunt <i>et al.</i> (2022)	Digital payments act as a gateway to other financial services
[7, 8]	Beck & Demirgüç-Kunt (2006); Bruhn & Love (2014)	Access to finance constrains SME growth; better access raises income
[9, 10]	Davis (1989); Venkatesh <i>et al.</i> (2003)	TAM and UTAUT explain technology acceptance and use
[12, 13]	Tornatzky & Fleischer (1990); Oliveira & Martins (2011)	TOE framework explains firm-level adoption
[14]	Barney (1991)	Resource-based view of competitive advantage
[15, 16]	Melville <i>et al.</i> (2004); Brynjolfsson & Hitt (2000)	IT creates value through business processes and complementary resources
[19]	Drexler <i>et al.</i> (2014)	Simple record-keeping improves micro-enterprise outcomes
[20, 22]	Featherman & Pavlou (2003); Pavlou (2003); Kim <i>et al.</i> (2010)	Perceived risk, trust and security shape e-service and e-payment use
[25]	Reserve Bank of India (2022)	Payments Vision 2025: digital acceptance for small merchants and security

Research Gap and Objectives

While some prior research analyzed consumer adoption of digital payment methods, it did not pay much attention to enterprises who are the recipients of such payments ^[3]. The literature linking technology and firm performance typically treated firm performance as a function of the level of technology adoption itself, without examining process-level and financing-level effects implied by the IT business value literature ^[15, 16]. However, perceived risk has mostly been analyzed as an obstacle to adoption ^[20, 22] rather than as a condition constraining the benefits that a firm achieves upon adoption, and the impact of electronic transaction histories on MSME credit has largely been an issue of policy discussion ^[6, 25]. Evidence regarding Kerala, given that it exhibits relatively high levels of both literacy and cell phone penetration, has numerous micro-enterprises, and very high penetration of electronic transaction for large number of MSME is not available.

The purposes of this paper are

1. Investigate the relationship between Digital Payment Adoption and the financial performance of MSMEs.

2. Investigate the relationship between Digital Payment Adoption and operational efficiency and access to formal credit.
3. Investigate the mediating roles of access to formal credit and operational efficiency.
4. Investigate whether perceived cybersecurity risk moderates the relationship between Digital Payment Adoption and Financial Performance.

Conceptual Framework and Hypotheses

DPA is the extent and depth of use of UPI, QR codes, POS terminals, wallets and net banking for business payments. Following the IT business value model ^[15], DPA is expected to improve FP both directly and through OE (speed, cost and accuracy of collections, cash handling and reconciliation) and AFC (ease of obtaining loans and working capital from formal lenders, supported by reduced information asymmetry ^[7]). Drawing on the perceived risk perspective ^[20, 21], PCR is expected to weaken the DPA–FP relationship, since owners who fear fraud may limit their use of digital channels (Figure 1).

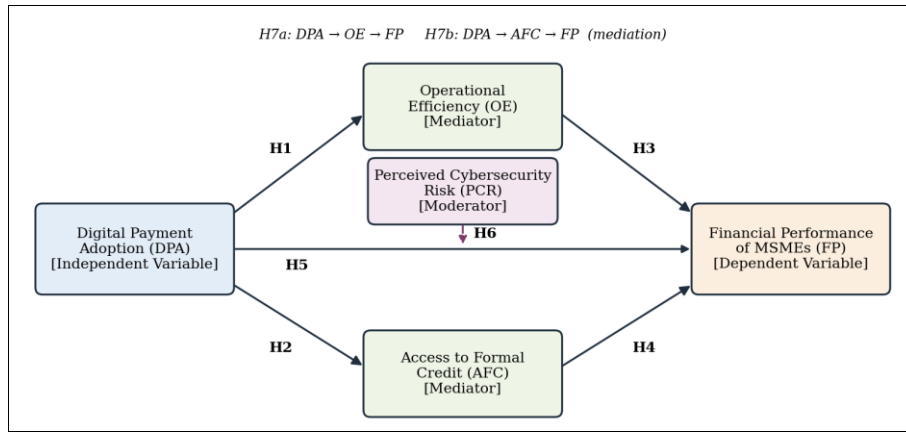


Fig 1: Proposed Conceptual Framework

H1: DPA has a significant positive influence on OE. H2: DPA has a significant positive influence on AFC. H3: OE has a significant positive influence on FP. H4: AFC has a significant positive influence on FP. H5: DPA has a significant positive influence on FP. H6: PCR negatively moderates the DPA–FP relationship. H7a: OE mediates the DPA–FP relationship. H7b: AFC mediates the DPA–FP relationship.

Research Methodology

The study uses a cross-sectional, quantitative approach with the deductive method. The population that this study aims to explore is all owner/managers of Udyam registered MSMEs in the state of Kerala that have used at least one digital payment method for more than one year. The research design selected is multi stage – a three-fold classification of the State as South, North and Central; identification of districts in each region with high MSME concentration in the order of Trivandrum, Ernakulam, Thrissur, Kozhikode and Malappuram; selection of respondents through purposeful sampling from selected districts considering enterprise size and sector in proportion to the state distribution; Cochran's formula to determine a sample size (95% Confidence at 5% margin of error) to get a minimum of 384 samples and which coincides with

the required sample size for PLS-SEM [28].

Each measure is operationalized by five items, taken from prior studies [9, 10, 15, 20, 22], on a five-point Likert scale (1 = 1 = Strongly Disagree to 5 = 5 = Strongly Agree); these measures are presented in Appendix A. Financial performance is measured subjectively, because most SMEs lack audited financial statements. To validate the measure, reliability and convergent validity are evaluated via the criteria for indicator loading (all loadings .708 or higher), Cronbach's alpha and composite reliability (both .7 or higher), and AVE (at least .5) [28], [29]; discriminant validity via the Fornell–Larcker criterion [29] and HTMT (< 0.85) [30]; and common method variance via procedural remedies, Harman's single-factor test, and full collinearity VIF's [31]. The structural model is estimated via SmartPLS with 5,000 resamples in the bootstrapping procedure, the bootstrapped indirect effects to test mediation [32], and the two-stage moderating interaction using interaction term.

Data. To report the complete analysis procedure of the proposed model, 400 responses are produced in Section 6, with results of Tables 2 through 6 presenting a glimpse of how the findings should be reported and interpreted. Table results do not come from field data of Kerala MSMEs but, instead, are replaced by the outcomes of real data when employed as empirical proof.

Data Analysis (Illustrative, Simulated Data)

Table 2: Profile of Respondents (simulated data, n = 400)

Variable	Category	Frequency	Per cent
Gender	Male; Female	225; 175	56.2; 43.8
Age	Below 30; 31–40; 41–50; Above 50	72; 156; 111; 61	18.0; 39.0; 27.8; 15.2
Type of enterprise	Micro; Small; Medium	250; 110; 40	62.5; 27.5; 10.0
Sector	Manufacturing; Trading; Services	86; 171; 143	21.5; 42.8; 35.8
Years in business	Below 5; 5–10; Above 10	90; 168; 142	22.5; 42.0; 35.5
Main digital channel	UPI-QR; POS; Wallet; Net banking	243; 75; 32; 50	60.8; 18.8; 8.0; 12.5

Table 3: Descriptive Statistics, Reliability and Convergent Validity (simulated data)

Construct	Mean	SD	Loadings	α / CR	AVE
Digital Payment Adoption	3.545	0.660	0.854–0.866	0.912 / 0.935	0.741
Operational Efficiency	3.490	0.654	0.830–0.857	0.895 / 0.923	0.705
Access to Formal Credit	3.294	0.659	0.831–0.878	0.905 / 0.929	0.724
Perceived Cybersecurity Risk	2.763	0.677	0.842–0.869	0.910 / 0.933	0.735
Financial Performance	3.438	0.633	0.808–0.853	0.883 / 0.915	0.683

Although some measures fit the patterns as previously mentioned, the scores for DPA, OE and FP are clustered at the midpoint with DPA at 3.55, OE 3.49, FP 3.44, and AFC

below midpoint at 3.29. When reflecting on online threats, concerns develop, and precaution ratings average 2.76 on the four-point scale. All loadings across indicators are above

0.708. The reliability statistics further show a good footing as the findings regarding Cronbach's alpha lies between 0.883 and 0.912 while the values of composite reliability lie between 0.915 and 0.935 which is well above the threshold value of 0.70. Support for discriminant validity is provided by the AVE values, which are between 0.683 and 0.741 and all above 0.50. Everything

remains where it is with no weakness spotted. A cross-load inspection confirms that there is no threshold violated under 0.85, and the upper bounds are 0.708 for DPA to FP link, 0.682 for DPA to OE and 0.656 for OE to FP. All in all, the conditions of Fornell-Larcker are fulfilled with the overall convergence. Evidence indicates different constructs functioning independently.

Table 4: Structural Model, Mediation and Moderation Results (simulated data; 5,000 bootstrap subsamples)

Path	β	t	p	f ²	Decision
H1: DPA $\rightarrow$ OE	0.617	17.14	<0.001	0.613	Supported
H2: DPA $\rightarrow$ AFC	0.457	10.09	<0.001	0.264	Supported
H3: OE $\rightarrow$ FP	0.326	7.68	<0.001	0.142	Supported
H4: AFC $\rightarrow$ FP	0.273	7.00	<0.001	0.126	Supported
H5: DPA $\rightarrow$ FP	0.313	7.37	<0.001	0.110	Supported
H6: DPA $\times$ PCR $\rightarrow$ FP	-0.104	-3.09	<0.01	0.022	Supported
H7a: DPA $\rightarrow$ OE $\rightarrow$ FP	0.201	6.77	CI [0.145, 0.261]	—	Partial mediation
H7b: DPA $\rightarrow$ AFC $\rightarrow$ FP	0.125	5.86	CI [0.085, 0.169]	—	Partial mediation

Table 5: Explanatory Power and Predictive Relevance (simulated data)

Endogenous Construct	R ²	Adjusted R ²	Q ²
Operational Efficiency	0.380	0.378	0.375
Access to Formal Credit	0.209	0.207	0.197
Financial Performance	0.534	0.530	0.525

In the illustrative model, DPA explains 38.0 per cent of the variance in OE and 20.9 per cent in AFC, and the full model explains 53.4 per cent of the variance in FP; all Q² values are positive. Both indirect effects are significant, as their confidence intervals exclude zero, and because the direct DPA $\rightarrow$ FP path remains significant, mediation is partial in both cases, with the OE pathway stronger than the AFC pathway. The DPA $\times$ PCR interaction is negative and significant: the simple slope of DPA on FP is 0.414 at low PCR (-1 SD), 0.311 at mean PCR and 0.208 at high PCR (+1 SD), all p < 0.001, showing that higher perceived risk weakens the DPA-FP relationship.

Discussion

The illustrative results show how the proposed mechanisms would appear in the data. A strong DPA $\rightarrow$ OE path is consistent with the IT business value model, in which technology improves performance mainly by improving business processes^[15, 16]: digital payments remove the effort of counting, depositing and reconciling cash and create an automatic sales record. A positive DPA $\rightarrow$ AFC path reflects the argument that a consistent record of digital receipts reduces information asymmetry between small firms and lenders^[6, 7], while the AFC $\rightarrow$ FP path is consistent with evidence that access to finance raises small-business income^[8]. Partial mediation through both OE and AFC supports the view that technology creates value through complementary resources and process changes rather than through adoption alone^[14, 16]. The negative moderation by PCR is consistent with the perceived risk literature^[20, 22] and suggests that security concerns continue to limit benefits after adoption. Whether these patterns hold for Kerala MSMEs must be established with field data.

Theoretical contribution. The framework moves digital payment research from consumer adoption intentions to the business outcomes of adoption, responding to the call for merchant-side research^[3]; integrates the technology adoption, resource-based and IT business value perspectives

by specifying OE and AFC as parallel mechanisms; and extends the perceived risk perspective beyond the adoption decision.

Conclusion and Implications

This study built a theoretical framework to examine whether better financial performance might be realized by businesses when they shift to using a digital payment system as often such systems may lead to easier workflows and borrowing. Using PLS-sem numerical analysis and data manufactured for this purpose, the ideas received some support. While real results do vary, there is a general pattern that is fairly clear: once trust is formed, entrepreneurs tend to rely more upon platforms that can record transactions. The ownership choices of systems that generate useful insights matter a lot, specifically if the institutions think about what they mean. What is my first challenge?

Business heads, especially those for small and emerging businesses, need to link payment systems. However, it may not be enough as businesses should deploy invoicing tools, automated money matching, and an online bill settlement system. Moreover, having a separate pool of funds will ease transactions and improve working capital cycle. Instead of demanding assurances, banks could utilize electronic records reflecting steady income. The payment network must allow merchants to quickly receive successful payment messages, easily manage chargebacks, as well as educate them on common scams. Training programs module developed jointly by official institutions and craft-business entities may deal with safe digital handling and online defence.

Restrictions and Future Perspectives

A single-shot study is the main limitation of the research. It also depends on self-reporting experiences whilst excluding any impacts like cash perceiving, company size, buyer need and government assistance. To gain in-depth insights, the collection of primary information should involve real money or payment data. Measuring the same businesses over the

years may reveal something less obvious, according to research. You could compare whether there are differences across geographical areas, industries or sexes of owners. The use of fintech innovations such as UPI transactions and ONDC or Account Aggregator platforms is missing. We may underestimate the impact of these factors in shaping outcomes.

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