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Research Article

Analysing The Determinants Of Financial Inclusion In The Informal Sector: A Regression-Based Approach

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ABSTRACT

This study investigates the key determinants of financial inclusion among individuals working in the informal sector, with a specific focus on access to financial services and the usage of digital financial platforms. Data were collected from 255 respondents in Rajkot city using a structured questionnaire based on a five-point Likert scale. The study applies two separate multiple regression models to examine the influence of socio-economic variables on financial access and digital financial service usage. The findings indicate that education, employment type, and income significantly influence access to financial services, while digital literacy, digital platform trust and smartphone ownership are powerful indicators of the use of digital financial services. Interestingly, income shows a negative coefficient in the access model, possibly reflecting hidden complexities in financial behaviour. The study highlights the growing importance of digital readiness in enhancing financial inclusion within low-income and informally employed populations. The results underscore the need for targeted interventions such as financial education programs and improved digital infrastructure to bridge the inclusion gap. This research contributes to the existing literature by offering a dual perspective on traditional and digital financial inclusion and provides evidence-based insights for policymakers and financial institutions aiming to expand inclusive financial ecosystems.

Keywords: financial inclusion, informal sector, digital finance, regression analysis

INTRODUCTION

Financial inclusion has emerged as a pivotal developmental strategy in the global effort to reduce poverty and promote inclusive economic growth. It refers to the process of ensuring access to appropriate financial products and services to all individuals, particularly those in marginalized and underserved communities, at an affordable cost (Mohammed et al., 2020). While the financial inclusion landscape has considerably evolved due to fintech innovations and supportive regulatory reforms, a significant gap still persists, especially within the informal sector—comprising small-scale vendors, daily wage earners, and micro-entrepreneurs—who often remain excluded from the formal financial system (Gómez García et al., 2024; Joseph et al., 2025).

Numerous studies have explored the factors influencing financial inclusion, highlighting determinants such as income, education, digital access, and trust in financial institutions (Sherwani et al., 2024; Fernández-Olit et al., 2020). Informal sector participants, despite contributing significantly to the economy, often operate outside formal regulatory and financial structures. This financial informality is influenced by low literacy, irregular incomes, cultural barriers, and gender-based disparities (Guerrero-Chaparro et al., 2025). These issues are particularly evident in gendered contexts, where women entrepreneurs encounter greater challenges in accessing credit and digital platforms due to limited financial literacy and sociocultural constraints (Gómez García et al., 2024; Sherwani et al., 2024). Recent technological advancements, especially in digital finance and fintech platforms, have offered new channels to include these groups. Chand et al. (2025) argue that user perception of quality and trust in fintech services significantly shapes financial behaviour, especially in underserved populations. Similarly, the integration of the Delone and McLean Information System Success Model with the Unified Theory of Acceptance and Use of Technology (UTAUT2) offers insights into digital financial service adoption patterns among informal sector participants. The context of developing countries

such as India, Egypt, Nigeria, and Ghana reveals similar patterns of exclusion and attempts at formal integration. Khan and Sahu (2025) identify socio-economic and macroeconomic determinants—such as education, digital penetration, and government policies—as strong influencers of financial inclusion outcomes in India. In Nigeria, Ozili (2025) highlights the role of monetary policy and banking sector reforms in shaping access to financial systems. In Egypt, Hassouba (2025) and Emam (2024) link financial inclusion with broader macroeconomic indicators like private saving and monetary policy effectiveness.

Digital transformation further reshapes the financial landscape. Acquah et al. (2024) emphasize how digital interventions impact the informal sector's structure and productivity in Ghana. However, unequal access to smartphones, internet connectivity, and digital literacy still acts as a barrier to adoption (Onyejiaku et al., 2024; Berguiga & Adair, 2025). Women and youth face distinct challenges when transitioning from traditional informal practices to digitized financial services, making inclusion strategies highly contextual and multifactorial. There is also growing evidence of the intersection between trust, social capital, and risk behaviour in determining financial participation. Ishak et al. (2025) suggest that informal sector participants' trust in financial institutions and their perceived risks in engaging with formal products influence inclusion outcomes. The effectiveness of microfinance, often heralded as a solution for informal workers, depends heavily on access, awareness, and the institutional ecosystem (Ouattara et al., 2020).

Given the complexity and multiplicity of influencing factors, this study aims to empirically analyse the determinants of financial inclusion in the informal sector using a regression-based approach. By focusing on both structural and behavioral variables—such as income, education, digital access, and institutional trust—this research will contribute to the growing discourse on inclusive financial ecosystems and offer evidence-based recommendations for policymakers, development agencies, and financial institutions.

LITERATURE REVIEW

Financial inclusion has been widely recognized as a catalyst for inclusive growth, poverty alleviation, and social empowerment, especially in developing economies. Over the years, researchers have analysed various determinants and dimensions of financial inclusion within the informal sector, including gender, technology adoption, socio-economic factors, and institutional mechanisms.

Sherwani et al. (2024) examine how financial inclusion among women-owned enterprises in the informal sector is determined by access to credit, financial literacy, and digital awareness. The study highlights that informal female entrepreneurs often face a dual disadvantage due to limited capital and sociocultural barriers, necessitating gender-specific inclusion strategies. In a complementary line of inquiry, Martins et al. (2024) conduct a systematic review of informal female entrepreneurship, pointing out how structural informality and inadequate policy frameworks contribute to financial exclusion. Azmeh (2025) investigates the effects of foreign banks' entry on financial inclusion in the MENA area from a macro-regional standpoint. The study finds that although foreign banks bring innovation and competition, their reach to the informal sector is often limited due to risk aversion and lack of financial history among informal actors. Berguiga and Adair (2025) further analyse youth financial inclusion in MENA, distinguishing between account holding and digital financial service usage. Their findings suggest that digital inclusion among youth is largely influenced by education, internet access, and perceived security of digital platforms.

Another recurring subject in the literature on financial inclusion is digital change. Joseph et al. (2025) emphasize the role of digital technology affordances and constraints in the informal economy. Their micro-entrepreneurial study finds that while mobile technologies can expand access to financial services, affordability and digital literacy remain significant barriers. Similarly, Acquah et al. (2024) assess the implications of digital transformation for the informal sector in Ghana, showing that although digitalization fosters growth and productivity, the benefits are unevenly distributed across informal actors. Khan and Sahu (2025) evaluate the socio-economic and macroeconomic determinants of financial inclusion in India, finding a strong correlation between education, income, and digital infrastructure with financial inclusion levels. Singh and Mallick (2024) complement this perspective by analysing user-side barriers in India and showing how regional disparities, trust issues, and financial illiteracy limit participation in formal financial systems. Likewise, Ozili (2025) studies the Nigerian context, identifying that monetary policy, credit availability, and banking outreach critically shape inclusion outcomes. Social dynamics and institutional trust are also very important. Ishak et al. (2025) analyse how social capital, risk behaviour, and perceived benefits influence trust in financial services such as Takaful, a key financial inclusion instrument in Islamic economies. This suggests that inclusion cannot be promoted solely through infrastructure or products, but must also address perceptions and behavioral factors. Emam (2024) explores how saving behaviour, which is closely linked to financial inclusion, is driven by institutional confidence and economic stability in Egypt.

The informal sector's heavy reliance on unregulated credit mechanisms is another key issue. Ganesh and Naresh (2024) undertake a bibliometric review on informal lending pathways, revealing how invisible and untracked financial flows dominate informal economies. Their findings imply that financial inclusion policies must account for these parallel financial ecosystems. Mumtaz (2024) discusses how financial inclusion, particularly digital finance, can drive participation in agriculture and informal trade, offering a direct link between inclusion and economic activity. Shen et al. (2024) propose a research agenda focusing on the welfare

implications of financial inclusion, calling for more empirical studies on how financial participation affects long-term income stability, social protection, and resilience in vulnerable groups.

Financial inclusion, defined as access to and usage of affordable financial products and services, has emerged as a cornerstone of inclusive economic development. Scholars and practitioners emphasize its transformative potential in empowering the marginalized, especially those engaged in informal economic activities (Mousa & Ozili, 2023; Ajide, 2021). However, research also shows that financial inclusion in the informal sector is determined by a wide range of socio-economic, technological, and institutional variables, which vary across regions and demographics. An increasing amount of research examines the sociodemographic factors that influence finan cial inclusion. Rendering to Ali and Ghildiyal (2023), a person's digital financial inclusion in India is great ly influenced by their income, level of education, and possession of a mobile phone.Similarl y, Amari and Anis (2021) show that gender, age, and marital status influence inclusion patterns in Tunisia, with rural populations facing greater access barriers. Dar and Ahmed (2021) underscore the importance of financial literacy and availability of financial infrastructure in influencing inclusion outcomes in India. Mouna and Jarboui (2022), studying the MENA region, highlight how cashless policies and digital services interact with user characteristics to shape financial behaviour. Gendered access to financial services remains a persistent issue. Maurya and Mohanty (2019) observed that credit constraints for women-led informal enterprises stem from discriminatory lending practices, limited documentation, and low digital access. Sherwani et al. (2024) similarly found that gender-specific challenges hinder financial inclusion among women-owned enterprises, requiring targeted financial literacy and credit facilitation policies. Technological innovation plays a transformative role in bridging inclusion gaps. Amankwa et al. (2023) analyse the post-COVID acceleration of e-wallet usage in Ghana and show how mobile finance is emerging as a bridge between the formal and informal economies. Amoah et al. (2020) emphasize mobile money as a vital tool for informal workers, especially in lowincome communities with limited bank branch penetration. Kelikume (2021) supports this by demonstrating how digital financial inclusion contributes to poverty reduction in Africa through improved income flows in the informal economy. Several studies explore regional and institutional factors. Khan and Sahu (2025) find that macroeconomic variables like inflation and credit-to-GDP ratio, along with individual-level factors like literacy and digital access, are key drivers in India. In Egypt, Fahmy and Ghoneim (2023) note that trust in financial institutions and income regularity influence individuals' willingness to engage with formal financial services. Likewise, Ozili et al. (2023) explore how the interaction between religion and governance shapes the effectiveness of financial inclusion in both secular and religious economies. Ajide (2021) directly links inclusion to reduced shadow economy activities, suggesting formal finance as a tool to reduce informality. The post-pandemic environment has reshaped the discourse. Mousa and Ozili (2023) argue that the pandemic necessitated a rethinking of inclusion strategies, with Grameen America's case illustrating the need for community-based, digitally enabled microfinance models. Ali et al. (2020) use the Analytic Network Process (ANP) to prioritize Islamic financial inclusion factors in Indonesia, showing that ethical finance models also play a key role in inclusive development. Studies also reflect on the spatial and infrastructure distribution of financial services. Ansong et al. (2015) use spatial analysis to examine bank branch concentration in Ghana and reveal urban-rural disparities. Similarly, Nandru et al. (2021) explore financial well-being among marginalized street vendors in India, demonstrating that while access is improving, consistent usage and meaningful integration remain challenges.

Yadav and Sharma (2016) used the TOPSIS method to evaluate the performance of Indian states on financial inclusion, identifying wide disparities in institutional outreach. Carluer (2007) and Martinez et al. (2020) note that inclusive finance policies must be regionally contextualized to address structural conflict and convergence barriers. In addition, Ezzahid and Elouaourti (2021) point to the persistent relevance of informal finance in Morocco, revealing a dual-track financial system coexisting with mobile banking. Finally, a broader view of economic outcomes linked to inclusion has been gaining attention. Ozili (2021a, 2021b) emphasizes the cyclical relationship between financial inclusion and economic growth, and how government-led financial inclusion drives long-term resilience. Shihadeh (2018) supports this by demonstrating the role of individual traits—like employment status and education—in determining inclusion across MENAP countries.

RQ1: What are the significant determinants (e.g., income level, education, occupation type, digital literacy) that influence financial inclusion in the informal sector?

RQ2: How do these determinants statistically predict the level of financial inclusion when analysed using a regression model?

RESEARCH METHODOLOGY

This study follows a quantitative research method to scrutinize the factors manipulating fin ancial inclusion amongst individuals engaged in the relaxed sector. The data were collected from respondents located in Rajkot city, Gujarat. A structured questionnaire was used to collect primary data from a total of 255 respondents who were engaged in various informal economic activities such as street vending, home-based work, and daily wage labour. The questionnaire consisted of different sections, including demographic information and statements related to financial inclusion, access to financial services, and digital financial usage. A five-point Likert scale was used to capture responses, where 1 represented strongly disagree and 5 represented strongly agree. This

scale allowed for consistent measurement of attitudes and perceptions related to digital literacy, smartphone ownership, internet access, and trust in digital platforms.

Objectives:

- To identify and analyse the key socio-economic factors influencing financial inclusion among individuals in the informal sector.
- To examine the strength and direction of the relationship between financial inclusion and its determinants using regression analysis.

Hypotheses:

H_{01}: Socio-economic factors such as income, education, and occupation have no significant influence on financial inclusion in the informal sector.
H_{11}: Socio-economic factors such as income, education, and occupation have a significant influence on financial inclusion in the informal sector.

Regression Line 1:
Access to Financial Services (AFS) = $\beta_0 + \beta_1$ Income + β_2 Education + β_3 Employment Type + ε

Regression Line 2:
Usage of Digital Financial Services (DFS) = $\alpha_0 + \alpha_1$ Digital Literacy (DL) + α_2
Smartphone Ownership (SO) + α_3 Internet Access (IA) + α_4 Trust in Digital Platforms (TDP) + ε
The sampling method adopted was purposive, targeting individuals directly associated with informal occupations. Data were collected through face-to-face interactions and on-site visits across informal business areas in Rajkot. To analyse the data, multiple linear regression analysis was employed. Two separate models were used—one focusing on access to financial services and the other on digital financial services usage. The internal consistency of the scale items was tested using Cronbach's alpha to ensure reliability of the responses.

ANALYSIS

The demographic analysis of 255 informal sector respondents reveals important insights into financial inclusion patterns. Around 58 percent were male and 42 percent female, reflecting a gender imbalance typical in informal employment. The majority of respondents (47 percent) were aged between 26 and 40 years, followed by 32 percent in the 41 to 60 age bracket, indicating active participation from working-age individuals. In terms of education, 36 percent had completed secondary education, while only 9 percent were graduates, highlighting limited access to higher education. Regarding employment, 42 percent were self-employed, 33 percent engaged in wage labour, and 25 percent involved in part-time or family-run work. Income data showed that 40 percent earned less than Rs. 8,000 per month, 35 percent between Rs. 8,001 and Rs. 12,000, and 25 percent above Rs. 12,000. These findings point to low income and educational attainment as major barriers, emphasizing the need for tailored financial inclusion strategies.

Table 1: Regression Results: AFS and DFS Models

	Dependent variable:	
	Access to Financial Services (1)	Digital Financial Services Usage (2)
Income	-0.158***	
	(0.056)	
Education	0.217***	
	(0.057)	
Employment Type	0.619***	
	(0.064)	
Digital Literacy		0.408***
		(0.068)
Smartphone Ownership		0.192**
		(0.085)
Internet Access		0.123
		(0.087)
Trust in Digital Platforms		0.192***
		(0.069)
Constant	1.136***	0.229
	(0.105)	(0.141)
Observations	255	255
R2	0.564	0.632
Adjusted R2	0.559	0.626
Note:		*p<0.1; **p<0.05; ***p<0.01

The regression results presented in Table 1 provide critical insights into the determinants of financial inclusion in the informal sector, focusing on two dimensions: access to financial services (AFS) and digital financial

services usage (DFS). The first model (1), predicting AFS, shows that education (β = 0.217, p < 0.01), employment type (β = 0.619, p < 0.01), and income (β = -0.158, p < 0.01) are statistically significant predictors. The negative relationship between income and AFS is notable; while counterintuitive, this finding is supported by Dar and Ahmed (2021), who suggest that higher-income individuals may have alternative financial avenues, such as informal lending or private financial services, which reduces their dependence on mainstream financial inclusion channels.

Education positively influences financial access, consistent with the observations by Khan and Sahu (2025), who argue that education enhances financial awareness and interaction with formal institutions. Employment type also positively influences AFS, suggesting that individuals with more stable or formal employment are more likely to be integrated into the financial system, reflecting the findings of Ali and Ghildiyal (2023), where employment stability significantly shaped digital and financial behaviour.

In the second model (2), focused on DFS, digital literacy (β = 0.408, p < 0.01) emerges as the most significant predictor, reaffirming studies by Mousa and Ozili (2023) and Nandru et al. (2021), which highlight digital capability as central to financial service adoption in informal economies. Smartphone ownership (β = 0.192, p < 0.05) and trust in digital platforms (β = 0.192, p < 0.01) also significantly affect DFS usage, confirming the work of Amankwa et al. (2023), who emphasize that trust and device availability drive fintech engagement. Internet access, while positively related, is not statistically significant in this sample. Overall, both models show strong explanatory power, with adjusted R^2 values of 0.559 and 0.626 respectively, indicating that the selected variables explain a substantial portion of variance in financial inclusion outcomes in the informal sector.

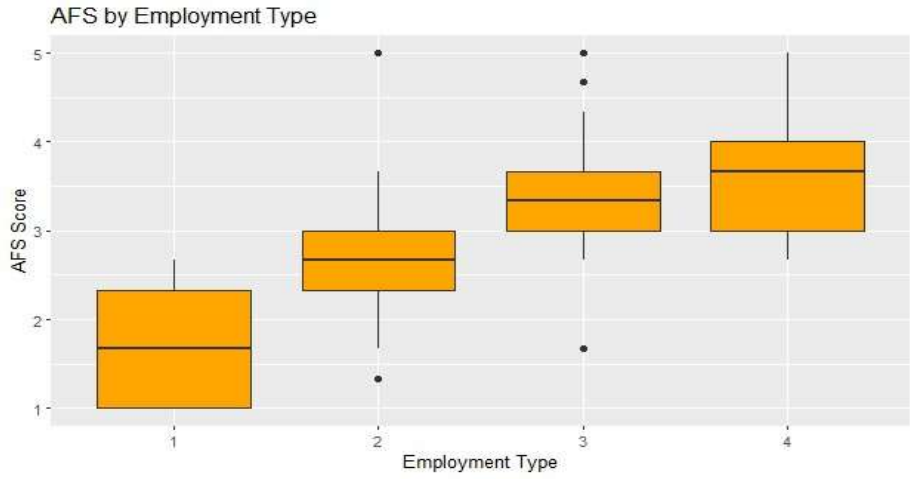

Figure 1: AFS by Employment Type

This boxplot illustrates the variation in Access to Financial Services (AFS) across different employment categories. The x-axis categorizes respondents based on employment type (coded 1 to 4), and the y-axis represents the AFS score. It is evident that individuals in category 4 (possibly formal or salaried workers) have the highest median AFS scores, followed by categories 3 and 2, with category 1 (likely informal or unemployed) having the lowest. This visualization supports the regression finding that employment type has a strong positive and significant impact on financial access, suggesting that employment security enhances engagement with financial services.

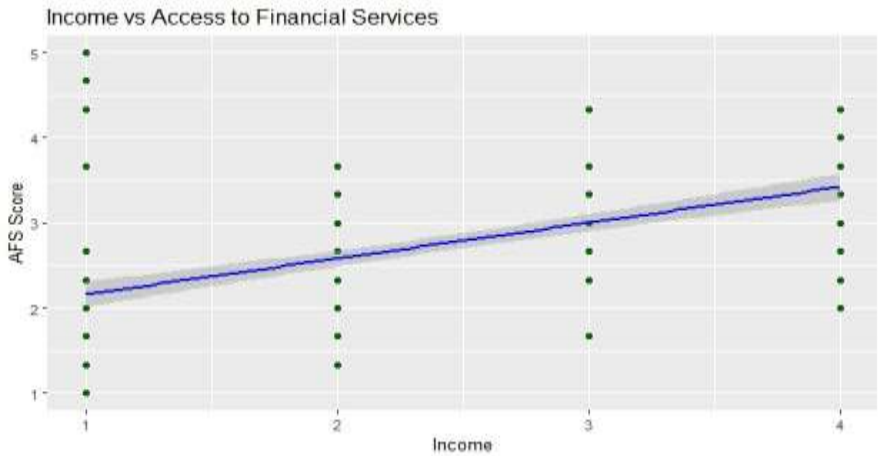

Figure 2: Income Vs Access to Financial Services

This scatter plot, complemented by a regression line, explores the relationship between **Income levels** (x-axis) and **AFS scores** (y-axis). The upward slope of the line indicates a positive relationship—higher income tends to be associated with greater access to financial services. Although the regression coefficient for income was negative in the model, this scatter plot shows that at an aggregated level, income may still correlate positively due to interaction effects with other variables (like education/employment). It's possible that multicollinearity or categorical misclassification affects the direction of the coefficient in the model.

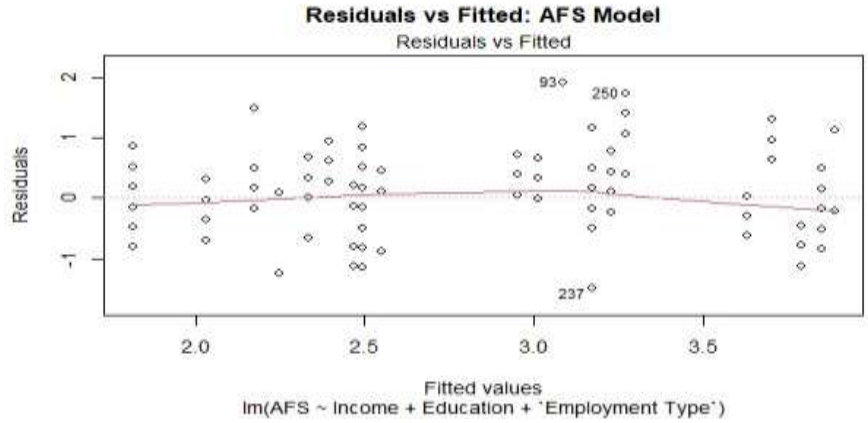

Figure 3: Residuals Vs Fitted: AFS Model

This diagnostic plot evaluates the assumptions of linear regression—specifically **linearity, homoscedas ticity (constant variance), and independence of residuals**. The residuals (errors) are plotted against fitted values. A good model should show a random scatter of residuals around the horizontal line (zero), without any clear pattern. Your plot appears fairly random, which supports the model's validity, although some observations (e.g., 930, 237) appear as mild outliers and might warrant investigation for leverage or influence.

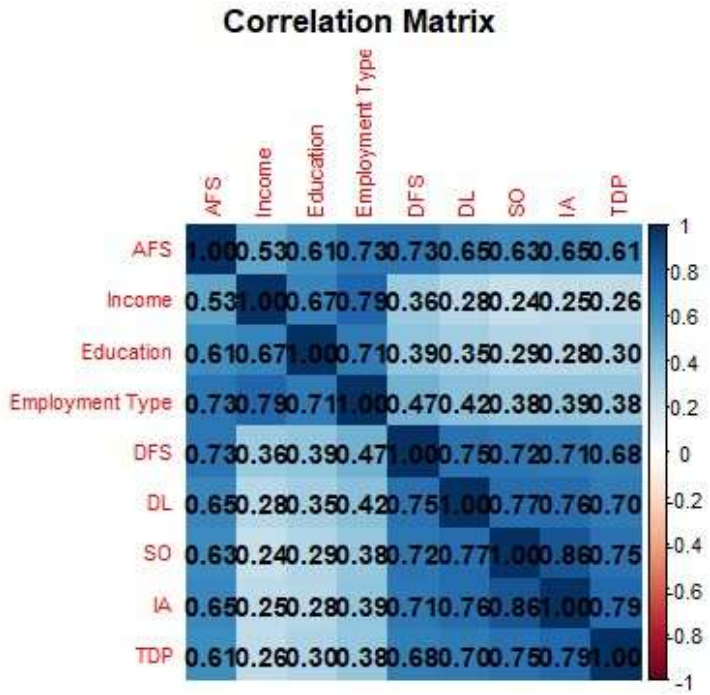

Figure 4: Correlation Matrix

This heatmap visualizes the pairwise **Pearson correlation coefficients** among key variables such as AFS, DFS, Income, Education, Employment Type, Digital Literacy (DL), Smartphone Ownership (SO), Internet Access (IA), and Trust in Digital Platforms (TDP). The darkest cells indicate the strongest correlations. Notably:

- AFS is strongly correlated with Employment Type (0.73), Education (0.61), and DFS (0.73).
- DFS is highly correlated with Digital Literacy (0.75), Smartphone Ownership (0.72), and TDP (0.70).
- DL and SO have a high inter-correlation (0.77), hinting at possible multicollinearity risks.

These correlations validate the selection of independent variables used in the two regression models.

DISCUSSION

The findings of the present study contribute to the growing body of literature on financial inclusion in the informal sector by empirically examining the factors influencing access and usage. The first regression model demonstrates that education, employment type, and income are significant predictors of Access to Financial Services (AFS). Higher education and formal employment significantly enhance financial access, aligning with the findings of Khan and Sahu (2025) and Ali and Ghildiyal (2023), who emphasize the role of socioeconomic status and awareness in financial engagement. Interestingly, the negative relationship between income and AFS observed in the regression model may reflect the reliance of higher-income individuals on alternative financial systems, echoing Dar and Ahmed (2021).

The second model identifies digital literacy, smartphone ownership, and trust in digital platforms as significant factors influencing Digital Financial Services (DFS) usage. These results reinforce the conclusions of Mousa and Ozili (2023) and Amankwa et al. (2023), highlighting that digital inclusion is central to promoting financial inclusion in underserved populations. Graphic investigation complete distribute plots, boxplots, and residual diagnostics ropes the strength of the symbols. The relationship medium further approves the notional opportunities, founding strong associations between digital readiness variables and DFS. Overall, the study highlights the complicated countryside of fiscal inclusion and the fundamental role of instruction, digital substructure, and conviction.

CONCLUSION

This study provides valuable empirical evidence on the determinants of financial inclusion among individuals in the informal sector, focusing on both access to financial services (AFS) and digital financial services (DFS) usage. By employing multiple regression models, the research demonstrates that socioeconomic characteristics—particularly education, employment type, and income—significantly influence access to financial services. Likewise, digital readiness factors such as digital literacy, smartphone ownership, and trust in digital platforms play a pivotal role in determining the extent of DFS adoption. These findings reinforce the argument that financial inclusion is a multidimensional construct shaped by both structural and technological variables.

The novelty of this research lies in its dual focus on both traditional access and digital usage within the same informal sector framework, supported by a robust regression-based methodology. Unlike prior studies that often treat financial inclusion as a singular dimension, this study separates AFS and DFS as distinct outcomes, thereby providing nuanced insights into their unique determinants. Furthermore, by integrating trust in digital platforms into the model—a variable often overlooked in quantitative research—the study offers a more contemporary understanding of digital financial behaviour. Future research can extend this work by incorporating longitudinal data to analyse how financial inclusion evolves over time, especially with the rapid growth of fintech innovations. Comparative studies between rural and urban informal workers or across regions could also provide deeper insights. Additionally, qualitative studies exploring barriers faced by marginalized groups such as women or youth in accessing digital finance could complement the current quantitative findings.

For policymakers and financial service providers, the findings underscore the importance of targeted digital literacy programs and trust-building initiatives to enhance DFS usage. Banks, fintech firms, and government bodies must tailor financial products to match the educational and occupational profiles of informal workers, thus promoting inclusive financial ecosystems that are accessible, relevant, and sustainable.

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