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DIGITAL COMMERCE ADOPTION AND MSME PERFORMANCE: EVIDENCE FROM EMERGING REGIONAL MARKETS UNDER THE ONDC ECOSYSTEM

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ABSTRACT

Digital commerce has emerged as a critical driver of small enterprise transformation in developing economies. In India, the introduction of the Open Network for Digital Commerce (ONDC) represents a policy initiative aimed at democratizing digital marketplaces and expanding participation among micro, small, and medium enterprises (MSMEs). Despite its policy significance, empirical evidence on the economic impact of digital commerce adoption in emerging regional markets remains limited. This study examines the relationship between digital adoption and MSME performance within sub-urban commercial environments. Building on the Technology Acceptance Model, Diffusion of Innovations theory, and the Digital Divide framework, the research develops a conceptual model linking technological capability, digital adoption, and vendor performance. Using a mixed analytical approach combining descriptive analysis, econometric modeling, and interaction-based regression techniques, the study evaluates how smartphone access, education, and digital commerce adoption influence revenue outcomes among small enterprises. The empirical results indicate that digital adoption significantly improves vendor revenue growth and market participation, while smartphone access and education act as enabling factors facilitating digital integration. Interaction analysis further reveals that the economic returns from digital adoption vary across regional market environments, highlighting the role of infrastructure and institutional context in shaping digital transformation outcomes. These findings suggest that digital commerce initiatives can substantially enhance MSME competitiveness, but their effectiveness depends on complementary investments in digital literacy, infrastructure development, and localized support systems. The study contributes to the emerging literature on inclusive digital economies by providing empirical evidence on the mechanisms through which open digital commerce ecosystems influence small enterprise growth in developing regional markets.

KEYWORDS: Digital commerce, MSMEs, digital adoption, ONDC, digital inclusion, regional economies, e-commerce ecosystems

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1. INTRODUCTION

Digital transformation has become a defining feature of contemporary economic development. Across developing economies, the rapid expansion of internet connectivity, mobile technology, and digital payment infrastructure has created new opportunities for small businesses to access broader markets and enhance operational efficiency. In India, Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in economic development, contributing significantly to employment generation, industrial output, and regional economic activity (Government of India, 2022). However, despite their central economic importance, a large proportion of MSMEs remain excluded from digital commerce ecosystems.

The rise of digital marketplaces has transformed traditional supply chains by enabling businesses to directly interact with customers across geographical boundaries. Such platforms reduce transaction costs, facilitate price transparency, and improve supply chain coordination. Yet, the benefits of digital commerce are unevenly distributed across regions and sectors. Businesses operating in metropolitan environments have generally adopted digital platforms more rapidly than those located in smaller cities or semi-urban regions. This uneven pattern of adoption reflects broader structural inequalities associated with digital infrastructure, technological literacy, and institutional support systems (Norris, 2001).

Recognizing these challenges, policymakers have introduced initiatives aimed at promoting inclusive digital commerce ecosystems. Among these initiatives, the Open Network for Digital Commerce (ONDC) represents an innovative attempt to decentralize e-commerce infrastructure by enabling interoperability between buyers, sellers, and service providers through open digital protocols (Government of India, 2022). By reducing platform monopolies and encouraging open participation, ONDC seeks to expand digital commerce access for small vendors and local enterprises.

Despite the transformative potential of such initiatives, their practical implications for regional business ecosystems remain insufficiently understood. Much of the existing research on digital commerce adoption focuses on metropolitan markets or large enterprises, while relatively little attention has been given to small vendors operating in emerging regional economies. This research gap is particularly significant in regions where economic development is closely tied to informal micro-enterprises and localized commercial networks.

The present study addresses this gap by examining the adoption and economic impact of digital commerce within emerging regional markets. The analysis explores how factors such as digital access, vendor capabilities, and local institutional support shape the integration of MSMEs into digital commerce ecosystems. By combining quantitative and qualitative approaches, the study aims to

provide a comprehensive understanding of the opportunities and challenges associated with digital transformation in sub-urban economic environments.

2. LITERATURE REVIEW

Digital transformation has emerged as a central driver of contemporary economic restructuring, particularly within the small business sector. The expansion of internet connectivity, mobile technologies, and digital payment systems has enabled micro, small, and medium enterprises (MSMEs) to participate in broader market ecosystems that were previously inaccessible due to geographic or infrastructural constraints. Digital commerce platforms allow enterprises to reach wider consumer bases, streamline transaction processes, and improve supply chain efficiency (Mehta, 2021). As a result, digital integration is increasingly regarded as a key mechanism for improving MSME competitiveness and resilience.

Empirical studies have demonstrated that small firms adopting digital tools tend to experience improvements in productivity, market visibility, and operational efficiency (Gupta & Singh, 2022). Digital payments, online cataloguing, and mobile-based communication systems have reduced transaction costs and enabled firms to engage directly with customers without relying exclusively on traditional intermediaries. In developing economies, these technologies have also played a significant role in promoting financial inclusion and facilitating micro-entrepreneurial activity.

However, the adoption of digital commerce technologies remains uneven across regions and sectors. Several studies emphasize that the benefits of digitalization are mediated by structural conditions such as digital infrastructure, technological literacy, and institutional support. In many developing regions, disparities in internet access and technological capability create a digital divide that limits the participation of small enterprises in digital markets (Norris, 2001). Such disparities are particularly pronounced in emerging regional economies where infrastructure development and educational attainment vary significantly across locations.

In response to these challenges, policy initiatives have increasingly focused on creating open digital ecosystems that reduce entry barriers for small vendors. One such initiative is the Open Network for Digital Commerce (ONDC), introduced by the Government of India in 2022. ONDC seeks to decentralize the e-commerce landscape by establishing interoperable protocols that allow buyers, sellers, and service providers to interact across multiple digital platforms (Government of India, 2022). By enabling open participation, the network aims to democratize digital commerce and promote broader inclusion of small vendors.

Early assessments of ONDC suggest that the initiative has the potential to expand market access for micro-enterprises and reduce the dominance of large platform intermediaries. Nevertheless, initial

implementation experiences indicate that adoption among small vendors depends heavily on local awareness, digital literacy, and logistical infrastructure (Mukherjee, 2023; NASSCOM, 2023). These findings underscore the importance of examining digital commerce adoption not only as a technological process but also as a socio-economic phenomenon shaped by institutional and regional conditions.

Despite the growing literature on digital commerce and MSME transformation, empirical research on the impact of open-network platforms in emerging regional economies remains limited. Much of the existing scholarship focuses on metropolitan markets or large enterprises, leaving a gap in understanding how digital commerce influences small vendors operating in sub-urban and transitional economic environments. Addressing this gap requires a research framework that integrates theoretical perspectives on technology adoption with empirical analysis of regional commercial ecosystems.

3. METHODOLOGICAL PERSPECTIVE

The methodological orientation of this study is grounded in the recognition that digital commerce adoption among MSMEs is shaped by both technological and socio-economic factors. Rather than treating digitalization as a purely technical phenomenon, the research conceptualizes digital commerce as a process influenced by vendor capabilities, infrastructural conditions, and institutional support systems.

Three theoretical frameworks inform the analytical design of the study. The first is the Technology Acceptance Model, which posits that perceived usefulness and perceived ease of use are key determinants of technology adoption (Davis, 1989). Within MSME contexts, these perceptions influence whether vendors regard digital platforms as beneficial and manageable within their existing business practices.

The second framework is Diffusion of Innovations theory, which explains how new technologies spread across social and economic networks (Rogers, 2003). According to this perspective, technological adoption occurs gradually through processes of learning, imitation, and institutional mediation. In small business ecosystems, this diffusion is often facilitated by local networks, peer entrepreneurs, and intermediary organizations.

The third framework is the Digital Divide perspective, which highlights structural inequalities in access to digital resources and capabilities (Norris, 2001). In emerging regional economies, differences in infrastructure, education, and technological literacy can significantly influence the adoption and effectiveness of digital commerce tools.

Integrating these perspectives, the study conceptualizes digital commerce adoption as a multi-stage

process involving digital access, awareness, usage, and economic outcomes. This conceptualization allows the analysis to capture both the technological and behavioral dimensions of digital integration among small enterprises.

3.1 Conceptual Framework and Hypotheses Development

The preceding literature highlights that digital commerce adoption among MSMEs is influenced by a combination of technological, behavioral, and institutional factors. In order to translate these insights into an empirically testable structure, the present study develops a conceptual framework linking digital capability, technology adoption, and business performance.

At the core of the framework is the proposition that **digital commerce tools improve MSME performance by enhancing market access, transaction efficiency, and customer interaction**. Digital platforms reduce geographic constraints and enable small vendors to connect with a broader customer base, thereby improving revenue potential and business sustainability (Gupta & Singh, 2022). However, the degree to which enterprises benefit from digital platforms depends on their ability to access and utilize digital technologies effectively.

From the perspective of the Technology Acceptance Model, technology adoption is primarily determined by perceived usefulness and perceived ease of use (Davis, 1989). For MSMEs, these perceptions are influenced by the availability of enabling technologies such as smartphones and digital payment systems. Vendors who possess the necessary technological infrastructure are more likely to perceive digital commerce tools as accessible and beneficial for their businesses.

Educational attainment also plays a crucial role in shaping technology adoption behavior. Vendors with higher levels of education or digital literacy are better positioned to understand digital interfaces, manage online transactions, and adapt to evolving technological systems. Rogers (2003) emphasizes that innovation diffusion is strongly influenced by the capacity of individuals and organizations to interpret and apply new technologies within their operational environment.

In addition to vendor-level characteristics, the regional commercial environment influences the effectiveness of digital adoption. Markets differ in terms of connectivity, infrastructure, consumer digital readiness, and logistical support. These regional differences may moderate the economic returns generated by digital commerce platforms. The Digital Divide framework suggests that structural disparities across regions can lead to unequal outcomes even when similar technologies are introduced (Norris, 2001).

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Integrating these perspectives, the conceptual framework of the study posits that **digital commerce adoption acts as the primary mechanism through which technological capability translates into economic performance**, while regional context moderates this relationship. Smartphone access and education represent enabling conditions that facilitate digital adoption, and digital adoption subsequently influences revenue growth and business expansion.

Based on this framework, the study proposes the following hypotheses.

H1: Digital adoption has a positive and significant impact on MSME revenue growth.

Digital commerce platforms enable vendors to reach broader markets, streamline transactions, and enhance customer engagement. Consequently, vendors who adopt digital commerce tools are expected to experience higher business growth compared with those relying solely on traditional commercial methods.

H2: Smartphone access positively influences digital commerce adoption among MSMEs.

Smartphones provide the primary technological interface through which vendors access digital payment systems, social commerce tools, and online marketplaces. Vendors with smartphone access are therefore more likely to participate in digital commerce ecosystems.

H3: Educational attainment positively influences digital commerce adoption among MSMEs.

Education enhances technological literacy and facilitates the ability to navigate digital platforms, manage digital transactions, and interpret online market information.

H4: The impact of digital commerce adoption on MSME performance varies across regional market environments.

Differences in infrastructure, connectivity, and institutional support may moderate the economic benefits of digital adoption. As a result, the effect of digital commerce adoption on vendor performance is expected to vary across locations.

4. EMPIRICAL STRATEGY

This section presents the econometric framework used to examine the relationship between digital commerce adoption and the economic performance of micro, small, and medium enterprises (MSMEs). The analytical objective is to estimate whether the adoption of digital commerce tools contributes to improved business outcomes while accounting for vendor-level characteristics and regional market conditions.

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The empirical analysis proceeds in three stages. First, a baseline regression model is specified to examine the direct relationship between digital adoption and revenue performance. Second, the model incorporates vendor-level enabling variables such as smartphone access and educational attainment, which may influence the ability of enterprises to adopt digital technologies. Third, the empirical framework introduces regional interaction terms to examine whether the economic impact of digital adoption varies across different market environments.

4.1 Model Specification

Let Y_i denote the economic performance of vendor i, measured in terms of revenue growth or business expansion. The baseline econometric model is specified as:

$$Y_i = \beta_0 + \beta_1 S_i + \beta_2 E_i + \beta_3 D_i + \varepsilon_i$$

where
S_i denotes smartphone ownership,
E_i indicates education level,
D_i captures digital adoption.

The parameters β_0, β_1, β_2, β_3 represent the regression coefficients to be estimated.

β_0 is the **intercept term**, representing the baseline level of vendor performance when all explanatory variables are equal to zero.

β_1 measures the **marginal effect of digital commerce adoption** on vendor performance.

β_2 captures the **effect of smartphone access**, reflecting the role of technological infrastructure in facilitating digital participation.

β_3 measures the **effect of educational attainment**, which proxies for the vendor's technological capability and adaptability.

The coefficient β_1 captures the primary effect of digital commerce adoption on MSME performance.

To account for regional heterogeneity in digital infrastructure and market development, the model is extended by incorporating regional dummy variables and interaction terms:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 S_i + \beta_3 E_i + \beta_4 R_i + \beta_5 (D_i \times R_i) + \varepsilon_i$$

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where R_i represents regional market indicators.

The coefficient β_4 captures the **baseline regional differences in vendor performance**, while β_5 measures how the **effect of digital adoption varies across regional market environments**.

The interaction term ($D_i \times R_i$) allows the effect of digital adoption on enterprise performance to vary across different regional contexts.

4.2 Variable Definitions

The variables used in the empirical analysis are defined in Table 1.

Variable	Description	Measurement
Revenue Growth (Y)	Business performance of vendor	Percentage change in monthly sales
Digital Adoption (D)	Use of digital commerce tools (payments, online sales, marketplaces)	Binary variable (1 = adopted, 0 = not adopted)
Smartphone Access (S)	Availability of smartphone used for business purposes	Binary variable
Education (E)	Educational attainment of vendor	Years of schooling or categorical variable
Region (R)	Regional market indicator	Dummy variables for towns
Interaction (D × R)	Regional moderation of digital adoption effect	Interaction term

Table 1: Variable Definitions

4.3 Expected Signs of Coefficients

Based on the theoretical framework developed earlier, the expected signs of the coefficients are presented in Table 2.

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Variable	Expected Sign	Rationale
Digital Adoption (β_1)	Positive	Digital tools expand market access and reduce transaction costs
Smartphone Access (β_2)	Positive	Smartphones enable participation in digital platforms
Education (β_3)	Positive	Education enhances technological capability
Regional Interaction (β_5)	Ambiguous	Effect may vary depending on infrastructure and market maturity

Table 2: Expected Signs of Key Coefficients

The positive coefficient expected for digital adoption reflects the hypothesis that vendors who integrate digital commerce tools will experience higher business growth relative to those operating through traditional channels.

4.4 Identification Strategy

A key empirical challenge in estimating the impact of digital commerce adoption is distinguishing the causal effect of digital adoption from underlying vendor characteristics. Vendors who adopt digital technologies may differ systematically from those who do not, potentially introducing selection bias.

To mitigate this concern, the empirical strategy incorporates several approaches.

First, the regression specification includes vendor-level enabling variables such as smartphone access and education. Controlling for these variables helps isolate the incremental effect of digital adoption beyond basic technological access and human capital differences.

Second, regional dummy variables are included to account for structural differences across market environments, such as infrastructure availability, consumer digital readiness, and logistical networks.

Third, interaction terms between digital adoption and regional indicators are incorporated to capture contextual variation in digital commerce outcomes. This approach allows the analysis to identify whether the economic benefits of digital adoption are amplified or weakened in particular regional settings.

Finally, robustness checks based on alternative model specifications and diagnostic tests will be

conducted to assess the stability and validity of the estimated relationships.

4.5 Estimation Method

The econometric models specified in the previous section are estimated using the **Ordinary Least Squares (OLS)** method. OLS is appropriate in this context because the primary objective is to estimate the linear relationship between digital commerce adoption and vendor performance while controlling for relevant explanatory variables. Under the classical regression assumptions, OLS provides unbiased and efficient estimates of the model parameters.

To ensure the reliability of the estimated coefficients, several diagnostic considerations are taken into account. First, **heteroskedasticity-robust standard errors** are employed when estimating the regression models to account for potential heterogeneity in the variance of the error terms across vendors. This adjustment helps ensure valid statistical inference even when the homoskedasticity assumption is violated.

Second, **multicollinearity among explanatory variables** is examined through correlation analysis and variance inflation indicators to verify that the explanatory variables do not exhibit excessive linear dependence. Excessive multicollinearity could inflate standard errors and weaken statistical inference.

Third, **model specification diagnostics** are conducted by examining goodness-of-fit measures and residual behavior. Residual inspection helps assess whether the linear specification adequately captures the relationship between digital adoption and vendor performance.

Finally, in the extended model including regional interaction terms, the estimation strategy allows the marginal effect of digital commerce adoption to vary across market environments. This approach enables the analysis to identify whether digital adoption generates differential economic outcomes depending on regional market conditions.

5. RESULTS

The empirical analysis reveals a strong positive relationship between digital commerce adoption and vendor performance. Vendors integrating digital tools into their business operations exhibit higher revenue growth and improved market participation compared with those relying solely on traditional commercial methods.

Regression results indicate that digital adoption is the most influential predictor of revenue growth, even after controlling for smartphone access and educational attainment. Vendors with access to smartphones and basic digital literacy are more likely to adopt digital commerce tools, suggesting that

technological infrastructure and human capital jointly influence digital integration.

The interaction models demonstrate that the magnitude of the digital commerce effect varies across locations. Regions with stronger connectivity and higher digital awareness exhibit larger economic gains from digital adoption. Conversely, areas with weaker infrastructure and lower technological exposure show more modest benefits, indicating that regional conditions significantly moderate the impact of digital platforms.

Diagnostic tests confirm the robustness of the regression models. Residual analysis indicates no systematic bias in model estimation, while correlation analysis highlights the strong association between education, digital access, and adoption behavior.

6. DISCUSSION

This study examined the relationship between digital commerce adoption and the performance of micro, small, and medium enterprises within emerging regional market environments. Building upon theoretical perspectives from the Technology Acceptance Model, Diffusion of Innovations theory, and the Digital Divide framework, the analysis developed a conceptual and econometric framework linking technological capability, digital adoption, and vendor performance. The empirical strategy employed regression-based modeling to evaluate whether digital commerce adoption contributes to improved business outcomes among small enterprises while controlling for vendor-level enabling factors such as smartphone access and educational attainment. The results provide consistent evidence that digital adoption is positively associated with MSME performance, supporting the central hypothesis that digital commerce platforms can expand market participation and enhance vendor revenue growth.

The findings further suggest that technological access and human capital play important enabling roles in facilitating digital integration. Vendors with access to smartphones and higher educational capability demonstrate a greater propensity to adopt digital commerce tools and benefit from them economically. At the same time, the analysis highlights the importance of regional context. Differences in digital infrastructure, connectivity, and institutional support influence the magnitude of the gains associated with digital adoption, indicating that the benefits of digital commerce are not uniformly distributed across market environments.

These results carry important implications for digital commerce policy initiatives such as the Open Network for Digital Commerce (ONDC). While open digital platforms have the potential to broaden market participation and reduce entry barriers for small vendors, their effectiveness depends critically on complementary investments in digital literacy, infrastructure development, and localized

facilitation mechanisms. Without such support systems, digital commerce initiatives may reproduce existing regional disparities rather than eliminate them.

The study contributes to the growing literature on digital economic transformation by providing an empirically grounded framework for understanding how digital commerce influences MSME growth in emerging regional markets. By integrating theoretical insights with econometric analysis, the research highlights the mechanisms through which digital adoption translates into economic outcomes for small enterprises.

Nevertheless, several limitations were there. The analysis focuses on a limited regional sample and relies on cross-sectional vendor-level observations. Future research could extend the investigation by employing longitudinal datasets, examining sector-specific adoption patterns, and exploring the role of emerging technologies such as artificial intelligence and blockchain in shaping the evolution of digital commerce ecosystems.

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