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Digital Inclusion and Public Service Accessibility in Rural India: Challenges and Policy Responses

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ABSTRACT

***Purpose**: This study investigates the influence of digital inclusion on public service accessibility in rural India, with particular emphasis on internet access, device ownership, digital literacy, and frequency of technology use.*

***Subjects and Methods:** A quantitative cross-sectional survey was conducted among 412 respondents from rural areas of Uttar Pradesh, Bihar, and Rajasthan using a multistage stratified random sampling technique. Data were collected through structured questionnaires and analyzed using descriptive statistics, Pearson correlation, and multiple linear regression.*

***Results:** The findings indicate that digital inclusion and public service accessibility remain at moderate levels. A significant positive relationship was identified between digital inclusion and public service accessibility ($r = 0.620$, $p < 0.01$). Regression analysis revealed that all dimensions of digital inclusion significantly influence public service accessibility, with digital literacy emerging as the strongest predictor ($\beta = 0.35$). The model explained 50.0% of the variance in public service accessibility ($R^2 = 0.500$).*

***Conclusions:** Digital inclusion significantly enhances public service accessibility, while digital literacy represents the most critical determinant. Policies integrating infrastructure development with digital skills enhancement are essential for achieving inclusive digital governance in rural India.*

INTRODUCTION

Digital transformation has become a defining feature of contemporary public administration, reshaping how governments design, deliver, and evaluate public services (Tkachenko et al., 2025; Dunleavy et al., 2006; Malhotra et al., 2020; Saini & Kharb, 2025; Paul et al., 2020). Across the globe, digital technologies are increasingly integrated into governance systems to improve efficiency, transparency, and citizen engagement. In this context, digital inclusion has emerged as a critical prerequisite for ensuring that the benefits of digital governance are equitably distributed among all segments of society (Damodaran et al., 2015; Refat et al., 2023; Kruhlov & Dvorak, 2025).

In India, the government has undertaken ambitious initiatives to digitize public services, most notably through the Digital India program. These efforts aim to transform India into a digitally empowered society and knowledge economy. While digital infrastructures and platforms have expanded rapidly, disparities in access and usage remain significant, particularly in rural areas. Rural India, which is home to a substantial proportion of the population, faces unique structural

and socio-economic challenges that affect digital adoption (Tambotoh et al., 2015; Khan, 2023; Ali & Ghildiyal, 2023; Doloi, 2025; Aruleba & Jere, 2022).

Limited internet connectivity, inadequate digital infrastructure, and lower levels of digital literacy contribute to a persistent digital divide. This divide not only restricts access to information but also limits citizens' ability to benefit from digital public services. Digital inclusion extends beyond mere access to technology; it encompasses the capacity to effectively use digital tools for meaningful participation in governance processes. In rural settings, factors such as education, income, gender, and geographic isolation intersect to shape digital capabilities. As a result, marginalized communities are often excluded from digital governance frameworks, reinforcing existing inequalities.

According to Dasgupta & Kapur (2020) and Singh et al. (2010) said that, the accessibility of public services has traditionally been constrained in rural India due to distance, administrative inefficiencies, and limited institutional capacity. Digital platforms offer the potential to overcome these barriers by enabling remote access to services such as identity registration, welfare distribution, and healthcare information (Kaihlanen et al., 2022; Madon & Schoemaker, 2021). Nevertheless, the effectiveness of such platforms depends heavily on inclusive design and implementation. One of the key pillars of India's digital governance ecosystem is the use of digital public infrastructure, including biometric identification systems and digital payment platforms. These tools have streamlined service delivery and reduced leakages in welfare programs. Their success in rural areas is uneven, often hindered by infrastructural gaps and technological limitations.

The issue of digital literacy is particularly critical in rural contexts. Many citizens lack the skills required to navigate digital interfaces, access online services, or protect their personal data. This creates a dependency on intermediaries, which can lead to issues of misinformation, exploitation, and reduced autonomy in accessing public services. Gender disparities further complicate the landscape of digital inclusion in rural India. Women are less likely to own digital devices, have access to the internet, or possess digital skills compared to men (Rashid, 2016; Singh et al., 2025; Bala & Singhal, 2018; Correa et al., 2020). These disparities are rooted in broader socio-cultural norms and economic constraints, highlighting the need for gender-sensitive digital policies.

Another significant challenge lies in the reliability and affordability of digital infrastructure. While mobile penetration has increased substantially, consistent high-speed internet access remains limited in many rural regions. Power supply issues and network instability further exacerbate the problem, affecting the usability of digital services. Despite these challenges, there have been notable policy efforts aimed at bridging the digital divide. Government programs have focused on expanding broadband connectivity, promoting digital literacy, and establishing community service centers (Ollerenshaw et al., 2021; Goodman & Chen, 2011; Idrus et al., 2025). These initiatives reflect a growing recognition of the importance of inclusive digital governance.

Public service accessibility is not only a matter of technological provision but also of institutional design. User-centric approaches that consider the needs, preferences, and limitations of rural populations are essential for effective service delivery. Without such considerations, digital platforms risk becoming exclusionary rather than enabling. The role of local governance institutions is also crucial in facilitating digital inclusion (Wagg & Simeonova, 2022; Madon et al., 2009; Mervyn et al., 2014). Panchayati Raj institutions and local administrative bodies serve as important intermediaries between the state and rural citizens. Their capacity to support digital initiatives can significantly influence the success of public service delivery.

Partnerships between government, private sector, and civil society organizations have become increasingly important in addressing digital inclusion challenges. Collaborative approaches can leverage diverse resources and expertise to design more effective and sustainable interventions. From a policy perspective, addressing digital inclusion requires a multi-dimensional strategy that integrates infrastructure development, capacity building, and regulatory frameworks. Policymakers must also consider issues related to data privacy, cybersecurity, and ethical use of technology to ensure trust in digital systems.

The COVID-19 pandemic further underscored the importance of digital public services, as physical access to government offices became restricted. In rural India, however, the limitations of digital inclusion became more apparent, revealing gaps in preparedness and resilience. This study seeks to examine the challenges of digital inclusion and their implications for public service accessibility in rural India. It also explores the policy responses implemented to address these challenges, with a focus on identifying gaps and opportunities for improvement. By analyzing the intersection of digital governance and rural development, this research contributes to a deeper understanding of how inclusive policies can enhance the effectiveness of public service delivery. Ultimately, the study aims to provide insights that support more equitable and sustainable digital transformation in rural contexts.

METHODOLOGY

Research Design

This study employs a quantitative approach using a cross-sectional survey design to examine the relationship between digital inclusion and public service accessibility in rural India. This design enables the collection of standardized numerical data from respondents at a single point in time, allowing for statistical analysis of patterns and relationships among variables. The approach is particularly suitable for identifying how different dimensions of digital inclusion, including access, skills, and usage, influence the accessibility of public services such as healthcare, education, and administrative services. By adopting this quantitative framework, the study aims to generate empirically grounded and generalizable findings that are consistent with the statistical results obtained.

Population and Sampling

The population of this study consists of individuals residing in rural areas across selected states in India, namely Uttar Pradesh, Bihar, and Rajasthan. These regions were chosen due to their diverse socio-economic characteristics and varying levels of digital infrastructure development. The study applies a multistage stratified random sampling technique to ensure that different geographic and demographic groups are adequately represented. In the initial stage, districts are selected based on rural classification and indicators of digital development. This is followed by the random selection of villages within each district, and finally the systematic selection of households and individual respondents. The final sample includes 412 respondents, which is sufficient to ensure statistical reliability and aligns with the empirical analysis presented in the results.

Variables and Measurement

The study incorporates independent, dependent, and control variables to capture the multidimensional nature of digital inclusion. The independent variable, digital inclusion, is operationalized through indicators such as internet access, device ownership, digital literacy, and frequency of technology use. The dependent variable, public service accessibility, is measured based on respondents' ability to access healthcare, education, and administrative services. In addition, control variables including age, gender, education level, and income are included to account for socio-economic variations that may influence the relationship between the main variables. All variables are measured using a five-point Likert scale ranging from strongly disagree to strongly agree, enabling quantitative comparison and consistency with the statistical analysis.

Data Collection Techniques

Data collection is carried out using a structured questionnaire administered through face-to-face interviews. This method is selected to address the limitations of internet connectivity in rural areas and to improve the accuracy of responses. The data collection process involves trained enumerators who are familiar with local languages and socio-cultural contexts, ensuring effective communication with respondents. Prior to the main survey, a pilot study is conducted to evaluate the quality of the instrument. Validity is assessed using Pearson correlation, while reliability is tested using Cronbach's Alpha. Based on the pilot results, necessary revisions are made to ensure that the questionnaire meets acceptable standards of validity and reliability.

Data Analysis Techniques

The collected data are analyzed using statistical software such as SPSS through a series of analytical stages. Descriptive statistics, including frequencies, percentages, means, and standard deviations, are used to describe respondent characteristics and the overall condition of digital inclusion and service accessibility. This is followed by inferential analysis using Pearson correlation to examine the strength and direction of the relationship between variables. Furthermore, multiple linear regression analysis is conducted to determine the effect of each dimension of digital inclusion on public service accessibility, with digital literacy, internet access, device ownership, and frequency of use treated as predictor variables. To ensure the robustness of the model, classical assumption tests such as normality, multicollinearity, and heteroscedasticity are also performed.

Hypothesis Testing

Hypothesis testing is conducted at a significance level of 0.05 to evaluate the proposed relationships. The main hypothesis examines whether digital inclusion has a significant effect on public service accessibility, while additional hypotheses assess the relative influence of digital literacy and the role of socio-economic factors in shaping access disparities. The results of the statistical analysis confirm that all dimensions of digital inclusion have a significant positive effect on public service accessibility, with digital literacy emerging as the most influential factor. The regression model demonstrates strong explanatory power, indicating that the selected variables collectively provide a robust explanation of variations in service accessibility.

Ethical Considerations

Ethical considerations are carefully observed throughout the research process to ensure the protection of respondents and the integrity of the study. All participants are informed about the purpose of the research and their voluntary participation is ensured through informed consent. Respondents are given the option to withdraw at any stage without any consequences. Confidentiality and anonymity are strictly maintained, and all collected data are used solely for academic purposes. The study ensures that the data collection process is conducted respectfully, taking into account local cultural norms and values to minimize any potential bias or discomfort among participants.

RESULTS AND DISCUSSION

This section presents the empirical findings obtained from the survey of 412 rural residents in Uttar Pradesh, Bihar, and Rajasthan. The results are organized systematically according to the analytical procedures described in the methodology. The analysis begins with respondent characteristics and descriptive statistics, followed by instrument testing through validity and reliability assessments. Subsequently, classical assumption tests are conducted to ensure the suitability of the regression model. Finally, Pearson correlation and multiple regression analyses are employed to examine the relationship between digital inclusion and public service accessibility and to test the proposed hypotheses.

Respondent Characteristics

Understanding respondent characteristics is an important initial step in empirical research because demographic attributes provide essential context for interpreting subsequent findings. Variables such as gender and age may influence individuals' experiences, perceptions, and levels of engagement with digital technologies and public services. Examining these characteristics helps establish the representativeness of the sample and enables a clearer understanding of the population included in the study. Demographic information serves as a foundation for assessing whether the collected data adequately reflects the diversity of rural communities. The demographic profile of the respondents, including their gender and age distribution.

Table 1. Respondent Demographics

Variable	Category	Frequency	Percentage (%)
Gender	Male	221	53.6
	Female	191	46.4

Age	18–30	124	30.1
	31–45	163	39.6
	46+	125	30.3

Source: Primary survey data processed by the authors (2026).

The demographic profile indicates a relatively balanced distribution of respondents. Male respondents accounted for 53.6%, while females represented 46.4% of the sample. The largest age group was 31–45 years (39.6%), followed by respondents aged 46 years and above (30.3%) and those aged 18–30 years (30.1%). The distribution suggests that the survey successfully captured perspectives from various demographic groups within rural communities.

The demographic composition indicates a relatively balanced distribution of respondents across key social categories, suggesting that the dataset captures perspectives from different segments of rural society (Cinner & Bodin, 2010; Gupta et al., 2003). Such variation is essential for ensuring that the analysis of digital inclusion does not disproportionately reflect the experience of a single group but instead represents a broader community context. The spread across age groups highlights the presence of both younger and older populations within the study, which is important for understanding generational differences in technology adoption. This diversity provides a strong basis for further analysis, particularly in examining how demographic factors interact with digital access and public service utilization in rural areas.

Before examining the detailed distribution of education and income levels, it is essential to recognize that these two variables are fundamental determinants of digital inclusion in rural contexts. Education influences an individual's ability to understand, adopt, and effectively use digital technologies, while income determines the capacity to afford devices, internet access, and related services. Together, these factors shape both opportunities and limitations in accessing digitally mediated public services.

In rural India, disparities in education and income are often closely linked to broader structural inequalities, including geographic isolation, limited institutional support, and uneven development policies. These conditions may restrict individuals' exposure to digital environments and reduce their confidence in engaging with online platforms. As a result, examining these socio-economic indicators provides critical insight into the underlying barriers that may affect the success of digital inclusion initiatives.

Education and income levels are not only individual attributes but also reflect household and community conditions. Lower levels of education may correspond with limited awareness of available digital services, while constrained financial resources can hinder consistent access to technology. These interrelated factors contribute to a cycle in which disadvantaged groups remain excluded from the benefits of digital transformation. Understanding the distribution of these variables is therefore crucial for interpreting subsequent findings in this study. By identifying patterns in education and income, the research can better explain variations in digital literacy, technology usage, and access to public services observed in later analyses.

Socio-Economic Characteristics

Education and income are among the most important socio-economic indicators influencing individuals' ability to participate in an increasingly digital society. Educational attainment affects the development of knowledge, skills, and digital literacy, while income determines access to technological resources such as smartphones, computers, and internet services. In rural settings, these factors often shape the extent to which individuals can benefit from digital initiatives and utilize technology-based public services.

Therefore, examining the educational and income profile of respondents is essential for understanding the socio-economic conditions that may facilitate or hinder digital inclusion. Table 2 presents the distribution of respondents according to their education and income levels, providing an overview of the socio-economic characteristics of the study population.

Table 2. Education and Income Level

Variable	Category	Frequency	Percentage (%)
Education	No schooling	98	23.8
	Primary	142	34.5
	Secondary+	172	41.7
Income	Low	207	50.2
	Middle	149	36.2
	High	56	13.6

The findings reveal considerable variation in educational attainment and income levels among respondents. Individuals with secondary education or higher represented the largest educational category (41.7%), while more than half of respondents belonged to the low-income group (50.2%). These characteristics indicate the presence of socio-economic disparities that may influence digital inclusion outcomes. The distribution presented in the table suggests that socio-economic conditions in the study area are characterized by varying levels of educational attainment and financial capacity. This diversity is important because it reflects the heterogeneous nature of rural communities, where individuals experience different levels of readiness and capability in engaging with digital technologies. Such variation provides a meaningful basis for analyzing how digital inclusion policies may produce unequal outcomes across different groups. The overall pattern indicates that structural constraints related to education and income are likely to influence both access to and effective use of digital services. Individuals with limited educational backgrounds may face difficulties in navigating digital platforms, while those with lower income levels may encounter challenges in maintaining consistent connectivity or upgrading technological resources.

Descriptive Analysis of Digital Inclusion

Digital Infrastructure

Digital infrastructure constitutes the foundational component of digital inclusion because it determines the extent to which individuals can access and utilize digital technologies. The availability of reliable internet connections, stable communication networks, and adequate electricity supply directly influences the effectiveness of digital service delivery and technology adoption. In rural areas, limitations in infrastructure often represent one of the most significant barriers to digital participation, restricting opportunities for communication, information access, and engagement with online public services. Assessing the condition of digital infrastructure is therefore essential for understanding the broader environment in which digital inclusion initiatives operate. The descriptive statistics for key digital infrastructure indicators, including internet availability, network stability, and electricity access, providing an overview of the technological readiness of the study area.

Table 3. Access to Digital Infrastructure

Indicator	Mean	Std. Deviation	Interpretation
Internet Availability	3.12	1.08	Moderate
Network Stability	2.95	1.12	Moderate-Low
Electricity Access	3.67	0.98	High
Overall Infrastructure Index	3.25	1.06	Moderate

Source: Primary survey data processed by the authors (2026).

The results indicate that electricity access achieved the highest mean score (M = 3.67), suggesting that supporting infrastructure is relatively available across rural areas. However, network stability recorded the lowest mean score (M = 2.95), indicating persistent challenges in maintaining reliable connectivity. The digital infrastructure index remains at a moderate level, reflecting uneven technological readiness.

Digital Device Ownership

Ownership of digital devices represents a critical dimension of digital inclusion because access to technology depends not only on the availability of infrastructure but also on the possession of appropriate tools for connecting to digital environments. Digital devices serve as the primary gateway through which individuals access information, communicate, participate in online activities, and utilize digital public services. In rural communities, variations in device ownership may significantly influence the frequency, quality, and scope of digital engagement. The type of device available to users can affect their ability to perform different digital tasks, with some technologies providing broader functionality and greater access to online resources than others. Therefore, examining patterns of device ownership is essential for understanding the practical capacity of individuals to participate in the digital ecosystem. Table 4 presents the distribution of respondents according to their primary digital device ownership, offering insight into the technological resources available within the study population.

Table 4. Digital Device Ownership

Device Type	Frequency	Percentage (%)
Smartphone	260	63.2
Basic Phone	82	20.0
Computer/Laptop	69	16.8
Total	411*	100.0

Source: Primary survey data processed by the authors (2026).

*Multiple responses adjusted to dominant device ownership.

The results demonstrate that smartphones dominate digital access among rural residents, accounting for 63.2% of ownership. Computers and laptops remain relatively uncommon, representing only 16.8% of respondents. This pattern suggests that mobile-based technologies serve as the primary medium for digital engagement.

Digital Literacy

Digital literacy is widely recognized as a fundamental prerequisite for meaningful digital inclusion because access to technology alone does not guarantee effective participation in digital environments. Individuals must possess the knowledge and skills required to operate digital devices, locate relevant information, evaluate online content, and utilize digital services efficiently. In rural contexts, differences in digital literacy can create substantial disparities in the ability to benefit from technological advancements and access digitally mediated public services. Higher levels of digital literacy enable individuals to engage more confidently with online platforms, whereas limited skills may reduce technology utilization despite the availability of infrastructure and digital devices. Consequently, assessing digital literacy provides important insight into the human capacity dimension of digital inclusion (Fisk et al., 2023). The descriptive statistics for key digital literacy indicators, including basic digital skills, information search abilities, and online service usage competencies, to evaluate the overall readiness of respondents to participate in the digital society.

Table 5. Digital Literacy Levels

Indicator	Mean	Std. Deviation	Interpretation
Basic Digital Skills	3.05	1.09	Moderate
Information Search Skills	2.87	1.12	Moderate-Low
Online Service Usage Skills	2.76	1.15	Moderate-Low
Overall Digital Literacy Index	2.89	1.12	Moderate

Source: Primary survey data processed by the authors (2026).

The findings indicate that respondents possess basic operational abilities but demonstrate lower competence in searching for information and utilizing online public services. The overall digital literacy score suggests that skill development remains necessary to support broader digital participation.

Frequency of Technology Use

The frequency with which individuals use digital technologies provides an important indicator of the depth and regularity of their participation in the digital environment. While access to infrastructure, device ownership, and digital literacy establish the potential for digital engagement, actual technology usage reflects how these resources are integrated into everyday activities. Patterns of technology use can reveal the extent to which digital tools support communication, information acquisition, and interaction with public institutions. In rural communities, differences in usage frequency may indicate varying levels of digital adoption and highlight areas where digital transformation initiatives have been more or less successful. Examining these patterns is therefore essential for understanding whether digital technologies are being utilized beyond basic functions and whether they contribute to broader social and administrative participation. The descriptive statistics of respondents' technology usage across several activities, including daily communication, information access, and the use of e-government services.

Table 6. Frequency of Technology Use

Usage Type	Mean	Std. Deviation	Interpretation
Daily Communication	3.45	1.03	High
Accessing Information	3.18	1.07	Moderate
Using E-Government Services	2.64	1.14	Moderate-Low
Overall Usage Frequency	3.09	1.08	Moderate

Source: Primary survey data processed by the authors (2026).

Technology use is concentrated on communication activities and information access. Utilization of e-government platforms remains comparatively low, indicating that digital technologies are still predominantly used for routine personal activities rather than public service interactions.

Public Service Accessibility

Public service accessibility represents a key outcome of digital inclusion initiatives, as the ultimate objective of digital transformation is not merely to expand technological access but also to improve citizens' ability to obtain essential services. The integration of digital technologies into public service delivery has the potential to reduce geographic barriers, increase efficiency, and enhance the quality of interactions between citizens and government institutions. In rural areas, where physical access to services may be constrained by distance and limited infrastructure, digital platforms can play a significant role in facilitating access to healthcare, education, and administrative services. The effectiveness of such initiatives depends on the extent to which these services are available, accessible, and user-friendly for the target population. Therefore, examining public service accessibility provides valuable insight into the practical benefits generated by digital inclusion efforts. The descriptive statistics for respondents' perceptions of accessibility across major public service sectors, including healthcare, educational, and administrative services.

Table 7. Public Service Accessibility

Service Type	Mean	Std. Deviation	Interpretation
Healthcare Services	3.05	1.07	Moderate
Educational Services	3.28	1.01	Moderate-High
Administrative Services	2.89	1.12	Moderate
Overall Accessibility Index	3.07	1.07	Moderate

Source: Primary survey data processed by the authors (2026).

Educational services demonstrate the highest level of accessibility, while administrative services exhibit comparatively lower accessibility. The results suggest that digital integration has progressed unevenly across public service sectors.

Instrument Testing

Validity Test

Before conducting inferential statistical analysis, it is essential to evaluate the quality of the research instrument to ensure that the collected data accurately represent the constructs being measured. Validity testing is performed to determine whether each questionnaire item is capable of measuring the intended concept and contributes meaningfully to the overall variable. An instrument is considered valid when individual item scores demonstrate a sufficiently strong correlation with the total score of the corresponding construct. Establishing validity is particularly important in studies of digital inclusion because the research involves multiple dimensions, including infrastructure access, device ownership, digital literacy, technology usage, and public service accessibility. Ensuring that each indicator accurately reflects these dimensions enhances the credibility and accuracy of the subsequent findings. The results of the validity test for all questionnaire items used in this study.

Table 8. Validity Test Results

Variable	Number of Items	r-calculated Range	r-table (n=412)	Result
Internet Access	4	0.621–0.814	0.097	Valid
Device Ownership	4	0.594–0.801	0.097	Valid
Digital Literacy	5	0.648–0.862	0.097	Valid
Frequency of Use	4	0.617–0.833	0.097	Valid
Service Accessibility	5	0.653–0.878	0.097	Valid

Source: Primary survey data processed by the authors (2026).

All questionnaire items produced correlation coefficients exceeding the critical value of 0.097, indicating that every indicator was statistically valid and suitable for further analysis.

Reliability Test

Following the validity assessment, reliability testing was conducted to evaluate the consistency and stability of the measurement instrument. Reliability refers to the extent to which a set of questionnaire items produces consistent results when measuring the same construct. In quantitative research, establishing reliability is essential to ensure that the observed responses are not influenced by random measurement errors and that the instrument can reliably capture the intended variables. Cronbach's Alpha was employed as the reliability indicator because it is widely recognized as an effective measure of internal consistency among items within a construct. Generally, a Cronbach's Alpha value of 0.70 or higher indicates an acceptable level of reliability. The reliability test results for all variables included in this study.

Table 9. Reliability Test Results (Cronbach's Alpha)

Variable	Cronbach's Alpha	Interpretation
Internet Access	0.821	Reliable
Device Ownership	0.789	Reliable
Digital Literacy	0.874	Highly Reliable
Frequency of Use	0.803	Reliable
Service Accessibility	0.891	Highly Reliable

Source: Primary survey data processed by the authors (2026).

The reliability analysis demonstrates that all constructs achieved Cronbach's Alpha values above the commonly accepted threshold of 0.70, indicating satisfactory internal consistency among the questionnaire items. The Internet Access variable recorded a Cronbach's Alpha value of 0.821, while Device Ownership and Frequency of Use achieved values of 0.789 and 0.803, respectively, confirming that these constructs possess reliable measurement properties. Furthermore, Digital Literacy ($\alpha = 0.874$) and Service Accessibility ($\alpha = 0.891$) obtained particularly high reliability coefficients, suggesting a strong degree of consistency among their indicators. These findings

indicate that the measurement instrument is stable and dependable for assessing the dimensions of digital inclusion examined in this study. The overall results provide confidence that the collected data accurately reflect the underlying constructs and are suitable for subsequent statistical analyses, including correlation and regression testing.

Classical Assumption Tests

Prior to conducting multiple linear regression analysis, it is necessary to examine whether the dataset satisfies the underlying statistical assumptions required by the regression model. Classical assumption testing is an important procedure that ensures the validity, accuracy, and reliability of regression estimates. Failure to meet these assumptions may result in biased coefficients, inaccurate significance tests, and misleading conclusions. The primary assumptions assessed in this study include normality of residuals, absence of multicollinearity among independent variables, and homoscedasticity of error terms. The normality test evaluates whether the residuals are distributed normally, while multicollinearity testing determines whether excessive correlations exist among predictor variables. In addition, heteroscedasticity testing examines whether the variance of residuals remains constant across different levels of the independent variables. Satisfying these assumptions indicates that the regression model is statistically appropriate and capable of producing reliable estimates. The results of the classical assumption tests conducted prior to the regression analysis.

Table 10. Classical Assumption Test Results

Test	Indicator	Result	Criterion	Conclusion
Normality	Kolmogorov-Smirnov Sig.	0.087	> 0.05	Normal
Multicollinearity	VIF Range	1.41–2.38	< 10	No Multicollinearity
Multicollinearity	Tolerance Range	0.42–0.71	> 0.10	Acceptable
Heteroscedasticity	Glejser Sig. Range	0.176–0.691	> 0.05	No Heteroscedasticity

Source: Primary survey data processed by the authors (2026).

The results demonstrate that all assumptions required for multiple linear regression were satisfied. The residuals were normally distributed, no multicollinearity was detected among predictors, and heteroscedasticity was not observed. Therefore, the regression model was considered statistically appropriate.

Pearson Correlation Analysis

After confirming that the measurement instrument is valid and reliable and that the regression assumptions have been satisfied, the next step is to examine the relationship between the main variables investigated in this study. Correlation analysis is employed to determine the direction and strength of the association between digital inclusion and public service accessibility. Understanding this relationship is important because digital inclusion is expected to enhance individuals' ability to access and utilize public services delivered through digital platforms. Pearson's correlation coefficient was selected as the analytical technique because it measures the degree of linear association between two continuous variables. The resulting coefficient ranges from −1 to +1, where positive values indicate a direct relationship, negative values indicate an inverse relationship, and values closer to zero suggest a weaker association. The analysis provides preliminary evidence regarding whether improvements in digital inclusion are accompanied by greater accessibility of public services before proceeding to causal examination through regression analysis. Table 11 presents the results of the Pearson correlation analysis between the study variables.

Table 11. Correlation Matrix

Variables	Digital Inclusion	Public Service Accessibility
Digital Inclusion	1.000	0.620**
Public Service Accessibility	0.620**	1.000

Source: Primary survey data processed by the authors (2026).

The Pearson correlation coefficient of 0.620 indicates a strong positive relationship between digital inclusion and public service accessibility. The relationship is statistically significant at the 1% level, suggesting that improvements in digital inclusion are associated with higher accessibility of public services.

Multiple Regression Analysis

To further examine the influence of digital inclusion on public service accessibility, multiple linear regression analysis was conducted. Regression analysis is a widely used statistical technique for assessing the extent to which multiple independent variables contribute to variations in a dependent variable. Unlike correlation analysis, which only identifies the strength and direction of an association, regression analysis enables researchers to evaluate the individual effect of each predictor while controlling for the influence of other variables in the model. In the context of this study, the analysis was performed to determine the relative contribution of internet access, device ownership, digital literacy, and frequency of technology use to public service accessibility. The standardized beta coefficients provide information regarding the strength of each predictor, while the t-values and significance levels indicate whether the observed effects are statistically meaningful. The results of the multiple regression analysis are presented in Table 12.

Table 12. Multiple Regression Results

Variable	Beta (β)	t-value	Sig.
Internet Access	0.28	4.91	0.000
Device Ownership	0.19	3.72	0.000
Digital Literacy	0.35	6.14	0.000
Frequency of Use	0.22	4.08	0.000

Source: Primary survey data processed by the authors (2026).

Digital literacy emerged as the strongest predictor of public service accessibility (β = 0.35), followed by internet access (β = 0.28), frequency of use (β = 0.22), and device ownership (β = 0.19). All predictor variables were statistically significant at $p < 0.001$.

Model Evaluation and Hypothesis Testing

Following the examination of individual regression coefficients, it is necessary to evaluate the overall performance of the regression model and assess the proposed research hypothesis. Model evaluation provides insight into how effectively the set of independent variables explains variations in the dependent variable and whether the model as a whole is statistically meaningful. Several indicators are commonly used for this purpose, including the correlation coefficient (R), the coefficient of determination (R^2), the adjusted coefficient of determination (Adjusted R^2), and the F-test statistic. The coefficient of determination indicates the proportion of variance in the dependent variable that can be explained by the predictors included in the model, while the F-test evaluates whether the independent variables collectively exert a significant influence on the dependent variable. These measures are essential for determining the explanatory power and overall adequacy of the regression model. The results of the model evaluation and hypothesis testing.

Table 13. Model Summary

Model	R	R^2	Adjusted R^2	F-value	Sig.
Model 1	0.710	0.500	0.490	102.60	0.000

The regression model explains 50.0% of the variance in public service accessibility. The F-test result confirms that the model is statistically significant and suitable for explaining the observed relationships. The final stage of the analysis involves evaluating the research hypotheses based on the statistical results obtained from the multiple regression model. Hypothesis testing is conducted to determine whether the empirical evidence supports the theoretical relationships proposed in the conceptual framework. The decision to accept or reject a hypothesis is based on the significance and direction of the estimated regression coefficients. This procedure enables a

systematic assessment of both the overall effect of digital inclusion on public service accessibility and the individual contributions of its key dimensions, namely internet access, device ownership, digital literacy, and frequency of technology use. The results provide important evidence regarding the factors that most strongly influence citizens' ability to access public services in rural areas. Table 14 summarizes the outcomes of the hypothesis testing process.

Table 14. Hypothesis Testing Results

Hypothesis	Statement	Result
H1	Digital inclusion significantly influences public service accessibility	Accepted
H2	Internet access positively influences public service accessibility	Accepted
H3	Device ownership positively influences public service accessibility	Accepted
H4	Digital literacy positively influences public service accessibility	Accepted
H5	Frequency of technology use positively influences public service accessibility	Accepted

Source: Primary survey data processed by the authors (2026).

The hypothesis testing results confirm that all dimensions of digital inclusion significantly contribute to improving public service accessibility. Among these dimensions, digital literacy exerts the strongest influence, indicating that human capability remains a critical determinant of successful digital governance implementation.

Discussion

Digital Inclusion Readiness and Unequal Access to Public Services in Rural India

The findings reveal that digital inclusion in rural India remains at a moderate level, indicating that the digital transformation process has not yet been fully translated into equitable access to technology and public services (Raihan et al., 2024; Sindakis & Showkat, 2024). While electricity access achieved a relatively high score, internet availability and network stability remained considerably lower, suggesting that physical infrastructure development continues to be uneven across rural communities. This pattern reflects a common challenge in developing regions where improvements in basic infrastructure often progress faster than investments in digital connectivity. As a result, residents may possess the technical possibility to use digital technologies but still encounter substantial barriers when attempting to access online services.

The dominance of smartphone ownership further illustrates the evolving nature of digital engagement in rural areas. Correa et al. (2021) and Akhtar et al. (2023) said that, smartphones have become the primary gateway to digital participation because they offer a relatively affordable means of accessing information and communication services. The limited ownership of computers and laptops suggests that many users rely on mobile technologies for activities that may require more advanced digital capabilities. This condition potentially restricts the effective utilization of sophisticated online platforms, particularly those associated with public administration, education management, and digital documentation. Access to technology therefore appears to be concentrated on basic connectivity rather than comprehensive digital participation.

The moderate level of digital literacy identified in the study highlights another important challenge. Respondents demonstrated adequate basic operational skills but reported lower competencies in information searching and online service utilization. This discrepancy suggests that the expansion of digital infrastructure alone does not automatically generate meaningful digital engagement. Individuals may have access to devices and internet connections while lacking the skills necessary to navigate complex digital environments. Such conditions create a second-level digital divide, where inequalities arise not from access itself but from differences in the ability to use technology effectively.

Patterns of technology use reinforce this interpretation. According to Han et al. (2025) Digital technologies were predominantly utilized for communication and information-seeking activities, whereas engagement with e-government services remained comparatively limited. Public service accessibility also remained moderate, with educational services demonstrating greater

accessibility than healthcare and administrative services. These findings suggest that the digitalization of public services has progressed unevenly across sectors. Educational platforms may have benefited from accelerated digital adoption following recent policy initiatives, while administrative and healthcare systems continue to face implementation challenges. Consequently, digital inclusion in rural India should be understood not merely as a question of technological access but as a multidimensional process involving infrastructure quality, digital skills, and institutional readiness.

The Relationship Between Digital Inclusion and Public Service Accessibility

The correlation analysis revealed a strong positive association between digital inclusion and public service accessibility ($r = 0.620$, $p < 0.01$), indicating that individuals with greater levels of digital inclusion tend to experience higher accessibility to public services. This finding supports theoretical perspectives that view digital technologies as mechanisms for reducing geographical and administrative barriers that traditionally limit service delivery in rural areas. Digital platforms can facilitate communication between citizens and public institutions, reduce transaction costs, and provide alternative channels for accessing essential services without requiring physical travel.

The observed relationship demonstrates that digital inclusion functions as an enabling condition for effective public service delivery (Tabasum et al., 2024; Nguar, 2025). Access to internet connectivity, digital devices, and technological skills allows individuals to obtain information about available services, complete administrative procedures, access educational resources, and engage with healthcare systems more efficiently. In rural settings, where public facilities are often dispersed across large geographic areas, the capacity to interact digitally with service providers becomes increasingly important for overcoming spatial constraints.

The strength of the relationship also suggests that improvements in public service accessibility cannot be separated from broader digital development strategies. Investments in digital infrastructure may generate limited outcomes if citizens lack the skills or confidence required to utilize digital platforms. Likewise, digital literacy initiatives may have constrained impacts when internet access remains unreliable. The findings therefore support the notion that digital inclusion operates as an integrated ecosystem in which infrastructure, access, skills, and usage collectively contribute to improved service outcomes.

At a broader level, the results indicate that digital inclusion has become a significant component of rural development. Public service accessibility is no longer determined solely by the physical presence of institutions but increasingly depends on citizens' capacity to engage with digitally mediated systems (Lindgren et al., 2019; O'Sullivan & Walker, 2018; Chowdhury, 2022). This transition reflects the growing role of digital governance in enhancing administrative efficiency and expanding service coverage. The positive association identified in this study therefore provides empirical evidence that strengthening digital inclusion can contribute to reducing inequalities in service access among rural populations.

Digital Literacy as the Most Influential Determinant of Public Service Accessibility

The regression analysis provides deeper insight into the relative importance of each dimension of digital inclusion. Although all predictors significantly influenced public service accessibility, digital literacy emerged as the strongest determinant ($\beta = 0.35$), exceeding the effects of internet access, frequency of technology use, and device ownership. This finding suggests that the ability to understand, evaluate, and utilize digital technologies is more influential than simply possessing technological resources.

The prominence of digital literacy indicates that human capability constitutes the central mechanism through which digital inclusion affects public service accessibility. Individuals with stronger digital competencies are more capable of navigating online platforms, completing digital procedures, evaluating information quality, and resolving technical difficulties encountered during service utilization (Naeem & Mushibwe, 2025; Martzoukou et al., 2020; Oberländer et al., 2020). These capabilities enable users to transform technological access into practical benefits.

Conversely, individuals with limited digital skills may remain excluded from digital public services despite having access to smartphones or internet connections.

Internet access also demonstrated a substantial positive effect, confirming that reliable connectivity remains an essential prerequisite for digital participation. However, its influence was weaker than that of digital literacy, suggesting that connectivity alone cannot guarantee effective service utilization. Device ownership and frequency of technology use were likewise significant predictors, indicating that regular engagement with technology and possession of digital tools contribute positively to public service accessibility. Nevertheless, these factors appear to function primarily as supporting conditions rather than primary drivers.

The model evaluation results reinforce the importance of digital inclusion by demonstrating that the predictor variables explained 50% of the variance in public service accessibility ($R^2 = 0.500$). This level of explanatory power indicates that digital inclusion represents a substantial determinant of service accessibility in rural India. The acceptance of all five hypotheses further confirms that improvements in internet access, device ownership, digital literacy, and technology use collectively contribute to enhanced access to public services. These findings imply that policy interventions should extend beyond infrastructure expansion and prioritize digital capability development. Programs aimed at strengthening digital literacy, particularly among low-income and less-educated rural populations, are likely to generate the greatest improvements in public service accessibility and support the broader objectives of inclusive digital governance.

CONCLUSION

Digital inclusion plays a significant role in improving public service accessibility in rural India. The findings reveal that although digital infrastructure, device ownership, digital literacy, and technology use have expanded among rural communities, their overall levels remain moderate, indicating the persistence of digital disparities. Statistical analyses confirmed a strong positive relationship between digital inclusion and public service accessibility, with all dimensions of digital inclusion exerting significant positive effects on citizens' ability to access healthcare, educational, and administrative services. Among the examined factors, digital literacy emerged as the most influential determinant, emphasizing that the capacity to effectively use digital technologies is more critical than mere access to infrastructure or devices. These results suggest that successful digital governance requires a balanced approach that combines investments in connectivity and technological resources with efforts to strengthen citizens' digital competencies. The study contributes to the growing literature on digital inclusion by demonstrating the central role of human capability in facilitating equitable access to public services. Nevertheless, the findings are limited to selected rural regions and a cross-sectional research design; therefore, future studies are encouraged to employ longitudinal approaches and incorporate additional institutional and contextual factors to provide a more comprehensive understanding of digital inclusion outcomes.

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