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*Research Article*

## Digital Public Infrastructure and Economic Stability in India: Evidence from UPI, Aadhaar and Direct Benefit Transfers

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### Abstract

Digital Public Infrastructure (DPI) has emerged as a critical institutional innovation in India's development strategy, with platforms such as Aadhaar, the Unified Payments Interface (UPI) and Direct Benefit Transfers (DBT) reshaping financial transactions, service delivery and welfare governance. While national-level data highlight the rapid expansion of these systems, there is limited empirical evidence on how DPI contributes to economic stability at the local level. This study examines the role of Digital Public Infrastructure in strengthening economic stability in India, using primary and secondary evidence from Bharuch district in Gujarat. Primary data were collected through a structured survey of 200 respondents from selected urban and semi-urban areas of Bharuch district. The urban sample was drawn from Bharuch city and Ankleshwar, while semi-urban respondents were selected from Jhagadia and Vagra. These locations were chosen due to their varying levels of digital penetration, economic activity and dependence on welfare mechanisms. The survey captured access to Aadhaar, patterns of UPI usage, receipt of DBT benefits and perceptions related to income regularity, transaction reliability and welfare security. Secondary data from RBI, NPCI, UIDAI and government reports were used to support the analysis.

The findings reveal that Digital Public Infrastructure has contributed significantly to economic stability at the district level. Aadhaar has improved access to banking and welfare services by reducing administrative barriers, UPI has enhanced transaction efficiency and income predictability for households and small businesses and DBT has strengthened welfare security by ensuring timely and transparent benefit transfers. However, the benefits of DPI are uneven, with semi-urban areas experiencing constraints due to infrastructure limitations and digital literacy gaps. The study concludes that DPI functions as a stabilising economic mechanism at the grassroots level and that targeted district-level interventions are essential for achieving inclusive and resilient economic growth.

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**KEYWORDS:** Digital Public Infrastructure, Economic Stability, UPI, Aadhaar, Direct Benefit, Transfers, District-level Studies

## 1. INTRODUCTION

Economic stability is a critical prerequisite for sustained growth and social well-being, particularly in developing economies where households and small enterprises are vulnerable to income volatility, welfare uncertainty and transaction inefficiencies. In recent years, India has sought to address these structural challenges through the creation of Digital Public Infrastructure (DPI), a set of interoperable digital platforms designed to improve access, efficiency and transparency in financial and governance systems. Core components of India's DPI architecture include Aadhaar for digital identity, the Unified Payments Interface (UPI) for real-time digital transactions and Direct Benefit Transfers (DBT) for targeted welfare delivery. Together, these platforms form an institutional framework that has the potential not only to enhance financial inclusion but also to strengthen economic stability at the grassroots level. Traditionally, discussions on economic stability in India have focused on macroeconomic indicators such as inflation control, fiscal balance and growth rates. While these indicators remain important, recent policy debates have emphasised the role of institutional mechanisms that reduce uncertainty at the household and micro-enterprise level. Digital platforms that ensure predictable income flows, minimise transaction costs and prevent leakages in welfare delivery can play a stabilising role in everyday economic life. In this context, India's DPI has emerged as a key policy innovation, attracting global attention for its scale, low cost and replicability.

UPI has transformed the payment ecosystem by enabling instant, low-cost and interoperable transactions across banks and applications. For households and small businesses, regular access to digital payments reduces reliance on cash, improves transaction reliability and supports smoother income flows. Aadhaar, by providing a universal digital identity, has streamlined access to banking, welfare schemes and public services, thereby reducing exclusion errors and administrative delays. DBT, by linking Aadhaar with bank accounts, has further strengthened economic security by ensuring timely and transparent transfer of subsidies, pensions and social assistance directly to beneficiaries. Collectively, these systems contribute to reducing economic uncertainty and enhancing resilience among vulnerable groups. Despite the rapid expansion of DPI at the national level, its impact on economic stability is not uniform across regions. Urban areas with better connectivity and digital literacy tend to benefit more than semi-urban and peripheral regions. District-level variations in infrastructure, awareness and dependence on welfare mechanisms influence how effectively DPI translates into economic stability. However, empirical studies examining the combined impact of UPI, Aadhaar and DBT at the district level remain limited.

This study addresses this gap by examining the role of Digital Public Infrastructure in promoting economic stability in Bharuch district of Gujarat. Primary data were collected from selected urban areas (Bharuch city and Ankleshwar) and semi-urban areas (Jhagadia and Vagra), representing diverse levels of

digital penetration and economic activity. By integrating primary survey evidence with secondary data from official sources, the study provides a microlevel assessment of how DPI affects income regularity, transaction reliability and welfare security. The findings are expected to contribute to policy discussions on strengthening districtlevel economic resilience in line with India's long-term vision of inclusive and stable growth.

## 2. REVIEW OF LITERATURE

The literature on digital infrastructure highlights its transformative role in improving economic outcomes. Demirgüç-Kunt et al. (2018) <sup>[3]</sup> argue that digital financial systems reduce transaction costs, enhance transparency and enable broader participation in formal economic activity. In the Indian context, digitalisation has been closely linked with financial inclusion initiatives, particularly after the introduction of Aadhaar, UPI and Direct Benefit Transfers (DBT). These platforms collectively form what has come to be described as Digital Public Infrastructure (DPI).

Several studies focus on the role of UPI in reshaping payment behaviour. Agarwal and Sengupta (2018) <sup>[1]</sup> observe that UPI has significantly reduced reliance on cash transactions and improved the efficiency of retail payments. Chavan (2020) <sup>[2]</sup> notes that UPI's interoperability and low transaction costs have been particularly beneficial for small traders and self-employed workers. However, concerns regarding transaction failures, digital literacy and network reliability persist, especially outside metropolitan regions.

Aadhaar has been widely examined as a governance reform tool. Khera (2017) <sup>[8]</sup> highlights Aadhaar's potential to reduce exclusion errors by simplifying identity verification in welfare and banking systems. At the same time, scholars such as Ghosh (2019) <sup>[6]</sup> caution that Aadhaarlinked systems may create access challenges for digitally marginalised populations if supporting infrastructure is weak. These studies underline the dual nature of Aadhaar as both an enabler and a constraint, depending on regional conditions.

Research on DBT has largely focused on its role in improving welfare delivery and reducing leakages. Studies by Muralidharan et al. (2016) <sup>[9]</sup> demonstrate that DBT improves the timeliness and predictability of benefit transfers, thereby strengthening household consumption stability. RBI (2023) <sup>[13-14]</sup> reports also indicate that DBT has contributed to better targeting of subsidies and improved fiscal efficiency. Nevertheless, empirical evidence on how DBT affects overall economic stability at the local level remains limited.

While the existing literature provides valuable insights into individual components of DPI, most studies analyse UPI, Aadhaar and DBT in isolation or rely on national-level data. There is limited empirical research examining the combined impact of Digital Public Infrastructure on economic stability at the district level, particularly in semi-urban contexts. This study addresses this gap by offering primary evidence from Bharuch

district, integrating all three DPI components to assess their role in strengthening economic stability at the grassroots level.

### 3. Conceptual Framework: Digital Public Infrastructure and Economic Stability

Digital Public Infrastructure influences economic stability through multiple, interrelated channels that operate at the household, enterprise and institutional levels. Unlike traditional welfare or financial systems that function in isolation, DPI integrates identity, payments and welfare delivery into a unified framework, thereby reducing inefficiencies and uncertainty in economic transactions. This study conceptualises economic stability as a condition characterised by predictable income flows, reliable access to financial services, timely welfare support and reduced vulnerability to shocks. UPI contributes to economic stability primarily through transaction efficiency and income predictability. By enabling instant payments at negligible cost, UPI reduces delays and uncertainties associated with cash-based transactions. For small traders and self-employed individuals, regular digital payments improve cash flow management and reduce dependence on informal credit. At the household level, UPI facilitates timely payments for utilities, education and healthcare, thereby improving financial planning.

Aadhaar functions as the foundational layer of DPI by providing a universally accepted digital identity. Aadhaar-enabled authentication simplifies access to banking services, welfare schemes and public utilities. From the perspective of economic stability, Aadhaar reduces exclusion errors and administrative barriers, ensuring that individuals can consistently access services essential for livelihood security. In semi-urban areas, where documentation gaps often limit access to formal systems, Aadhaar plays a critical stabilising role. Direct Benefit Transfers strengthen economic stability by ensuring the timely and transparent delivery of welfare benefits. By eliminating intermediaries, DBT reduces leakages and delays, thereby increasing the predictability of income support for beneficiaries. Regular receipt of pensions, subsidies and social assistance helps households' smooth consumption and reduces vulnerability during economic shocks. DBT thus acts as an income-stabilising mechanism, particularly for

welfare-dependent and low-income groups. The conceptual framework of this study integrates these three components of DPI and links them to key indicators of economic stability, namely income regularity, transaction reliability, welfare security and reduced financial uncertainty. The framework recognises that the impact of DPI is moderated by factors such as digital literacy, network connectivity and regional infrastructure.

Economic stability has traditionally been examined through macroeconomic indicators such as growth rates, inflation control and fiscal balance. However, recent scholarship increasingly recognises the importance of institutional and technological mechanisms that influence stability at the micro level, particularly for households and small enterprises. Financial access, transaction efficiency and welfare security have emerged as critical determinants of economic resilience in developing economies.

## 4. RESEARCH METHODOLOGY

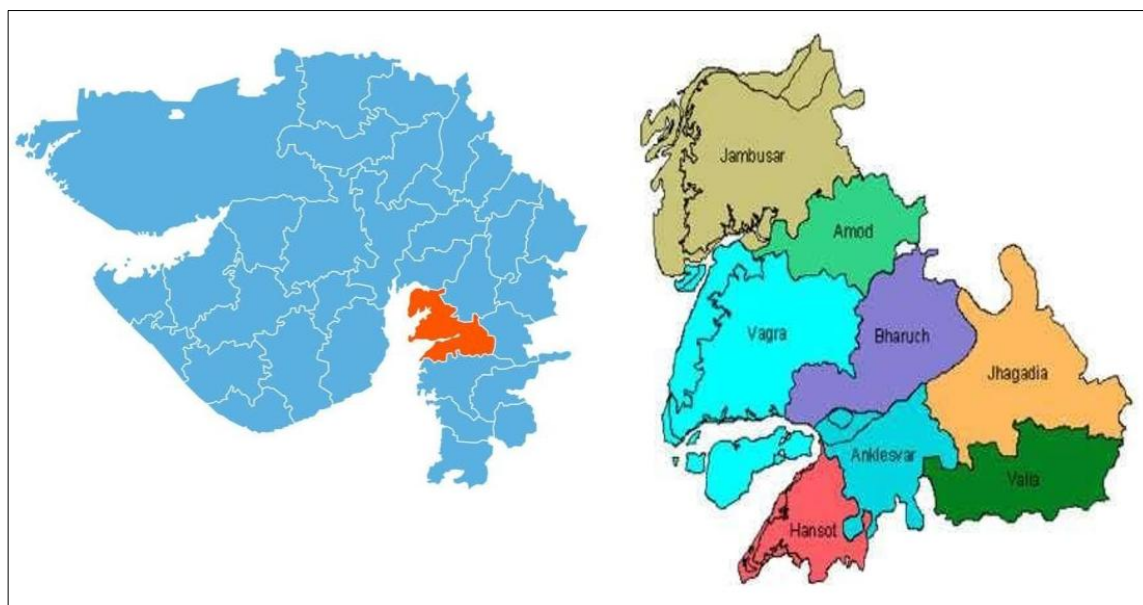
### 4.1 RESEARCH DESIGN

The present study adopts a descriptive and analytical research design to examine the role of Digital Public Infrastructure (DPI) in promoting economic stability at the district level. The study integrates primary survey-based evidence with secondary data from official sources to capture both experiential and institutional dimensions of DPI. A mixed-method approach was considered appropriate, as it allows quantitative assessment of access and usage patterns while also incorporating qualitative perceptions related to income stability, transaction reliability and welfare security.

### 4.2 AREA OF THE STUDY

The study was conducted in Bharuch district of Gujarat, selected due to its diverse economic structure, comprising industrial, service-oriented and welfare-dependent populations. Primary data were collected from selected urban and semi-urban areas to capture variations in digital penetration and economic dependence.

- Urban areas: Bharuch City and Ankleshwar
- Semi-urban areas: Jhagadia and Vagra



These locations were chosen because they exhibit differing levels of access to digital infrastructure, banking facilities and welfare schemes. Bharuch city and Ankleshwar represent relatively advanced urban centres with higher digital adoption, while Jhagadia and Vagra reflect semi-urban contexts where infrastructure constraints and digital literacy gaps are more visible.

This spatial variation makes the district suitable for analysing the stabilising impact of DPI.

### 4.3 SOURCES OF DATA

#### 4.3.1 Primary Data:

In this paper, primary data were collected through a structured questionnaire using a personal survey method during November–December 2025. The questionnaire was administered through face-to-face interactions with respondents across selected urban and semi-urban areas of Bharuch district, Gujarat to ensure clarity of responses and inclusiveness. The questionnaire captured information on respondents' socio-economic characteristics, access to Aadhaar, patterns of UPI usage, receipt of Direct Benefit Transfers and perceptions related to economic stability.

#### 4.3.2 Secondary Data:

Secondary data were sourced from:

- Reserve Bank of India (RBI) reports on digital payments and financial stability
- National Payments Corporation of India (NPCI) statistics on UPI transactions
- UIDAI reports on Aadhaar coverage
- Ministry of Finance publications on Direct Benefit Transfers
- Gujarat Economic Review and district-level reports

- These sources were used to contextualise primary findings and support interpretation.

### 4.4 Sampling Design and Sample Size

Table 1 shows that the total sample size for the study was 200 respondents, selected using a purposive and convenience sampling technique to ensure representation of digitally active and welfare-dependent groups.

**Table 1:** Distribution of Respondents by Area and Type

Area/Taluka	Type	Sample Size
Bharuch City	Urban	60
Ankleshwar	Urban	50
Jhagadia	Semi-Urban	45
Vagra	Semi-Urban	45
Total	-	200

*Source:* Primary Survey, November–December 2025.

Respondents included households, small business owners, self-employed individuals and beneficiaries of government welfare schemes.

### 4.5 Variables Used in the Study

Independent Variables (DPI Components):

- Frequency of UPI usage
- Aadhaar linkage with bank and welfare services
- Regularity of DBT receipts

Dependent Variables (Economic Stability Indicators):

- Income regularity
- Transaction reliability
- Ability to meet routine expenses
- Perceived reduction in financial uncertainty
- Welfare security

#### 4.6 TOOLS OF ANALYSIS

The collected data were analysed using descriptive statistical techniques, including percentages and cross-tabulation. The results are presented through tables, bar diagrams and pie charts to highlight patterns across urban and semi-urban areas. Qualitative responses were thematically interpreted to supplement quantitative findings.

#### 4.7 Ethical Considerations

Participation in the survey was voluntary. Respondents were informed about the purpose of the study and confidentiality of responses was assured. No personal identifiers were disclosed and data were used strictly for academic analysis.

### 5. DATA ANALYSIS AND INTERPRETATION

This section analyses the primary data collected from 200 respondents across selected urban and semi-urban areas of Bharuch district to examine the role of Digital Public Infrastructure (DPI) in promoting economic stability. The analysis focuses on access to DPI, usage patterns of UPI, Aadhaar-enabled services, Direct Benefit Transfers and their perceived impact on income regularity, transaction reliability

and welfare security. The results are presented through the following tables and supported by graphical representations.

**Table 2:** Socio-Economic Profile of the Respondents

Particulars	Category	Number	Percentage
Gender	Male	118	59.0
	Female	82	41.0
Age Group	Below 25	32	16.0
	25-40	74	37.0
	40-55	61	30.5
	Above 55	33	16.5
Occupation	Salaried	52	26.0
	Self-employed/Business	78	39.0
	Agricultural/Allied	34	17.0
	Welfare-dependent	36	18.0

Source: Primary Survey, November–December 2025.

Table 2 presents the sample that reflects a balanced representation of economically active groups. A significant proportion of respondents are self-employed or small business owners, indicating the relevance of digital payments and welfare mechanisms for daily economic stability. The presence of welfare-dependent households allows assessment of DBT effectiveness.

**Table 3:** Access to Digital Public Infrastructure

DPI Component	Respondents (No.)	Percentage
Aadhaar Possession	196	98.0
Aadhaar Linked with Bank Account	182	91.0
Aadhaar Linked with Welfare Schemes	168	84.0
Access to UPI-Enabled Mobile Apps	154	77.0
Receipt of DBT Benefits	121	60.5

Source: Primary Survey, November–December 2025.

Table 3 reveals that access to Aadhaar is nearly universal among respondents, reflecting the successful penetration of digital identity. Aadhaar-bank linkage is also high, enabling

smoother access to financial and welfare services. However, UPI access and DBT coverage show moderate variation, particularly across semi-urban areas, indicating infrastructural and awareness gaps.

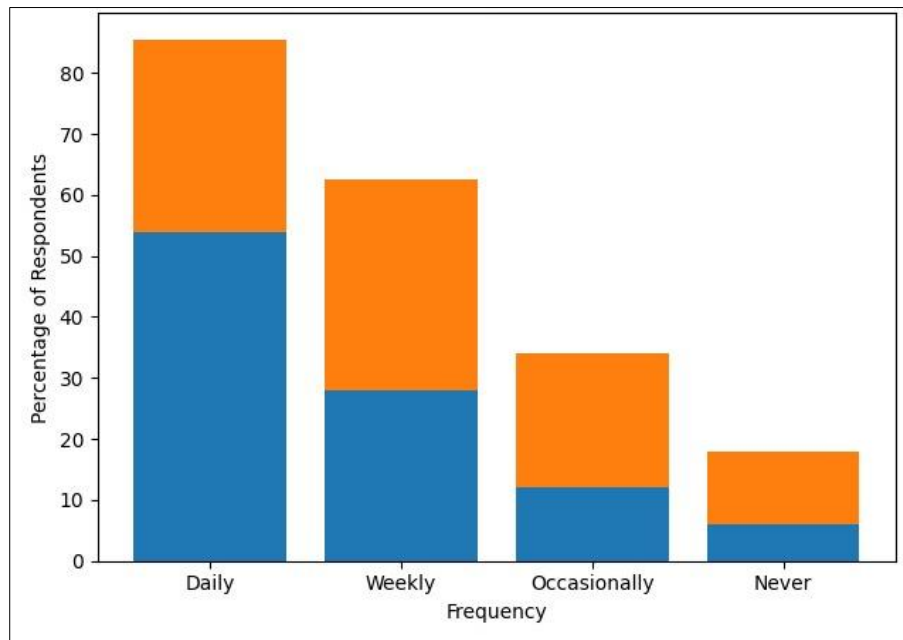
**Table 4:** Frequency of UPI Usage (Urban vs Semi-Urban)

Frequency	Urban (Percentage)	Semi-Urban (Percentage)
Daily	54.0	31.5
Weekly	28.0	34.5
Occasionally	12.0	22.0
Never	6.0	12.0

Source: Primary Survey, November–December 2025.

The above table 4 shows that UPI usage is significantly higher in urban areas, with more than half of urban respondents using UPI daily. In semi-urban areas, weekly and occasional usage

dominate. This indicates that while digital payments have expanded across regions, intensity of usage remains uneven, affecting the extent of economic stability benefits.



Source: Computed from Table 4 (Primary Survey, 2025)

Graph 1: Frequency of UPI Usage (Urban vs Semi-Urban Areas)

Table 5: Aadhaar-Enabled Service Accessibility

Service Type	Respondents (Percentage)
Banking Services	88.0
Welfare Scheme Enrolment	81.5
Subsidy Access	76.0
Pension/Scholarship Services	64.0

Source: Primary Survey, November–December 2025.

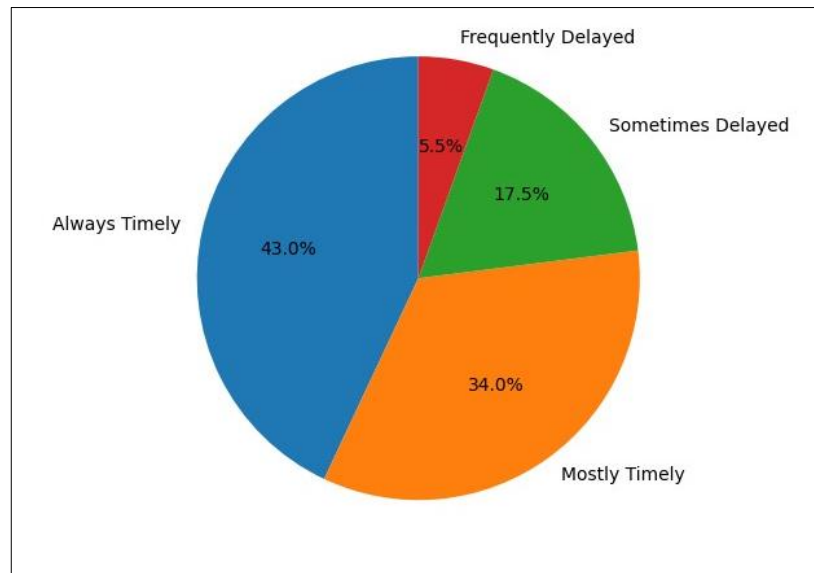
Aadhaar has played a significant role in improving access to essential services. Higher accessibility to banking and welfare enrolment indicates reduced administrative barriers. However, relatively lower access to pensions and scholarships highlights the need for improved awareness and facilitation, particularly in semi-urban locations (Table 5).

Table 6: Regularity and Reliability of DBT Payments

Response	Number	Percentage
Always Timely	52	43.0
Mostly Timely	41	34.0
Sometimes Delayed	21	17.5
Frequently Delayed	7	5.5
Total DBT Recipients	121	100

Source: Primary Survey, November–December 2025. (Income Regularity, Transaction Reliability, Welfare Security)

Table 6 reveals that the majority of DBT beneficiaries report timely or mostly timely receipt of benefits, indicating improved predictability of welfare income. Regular DBT payments contribute to consumption smoothing and reduce short-term financial stress, thereby enhancing household-level economic stability.



Source: Computed from Table 6 (Primary Survey, 2025)

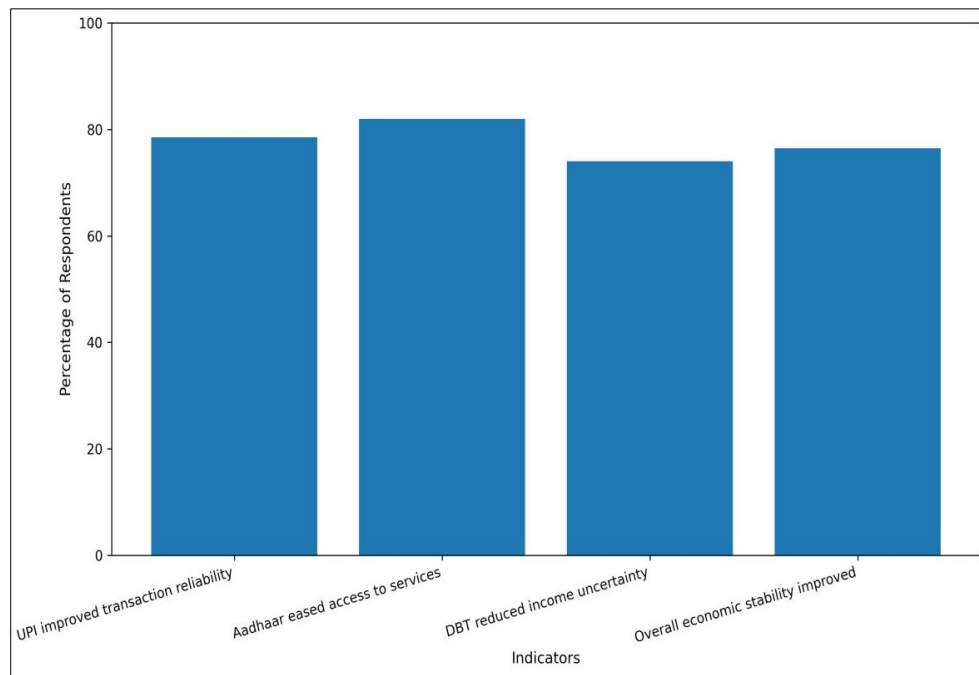
Graph 2: Regularity of DBT payment

Table 7: DPI and Perceived Economic Stability

Indicators	Agree/Strongly Agree (Percentage)
UPI Improved Transaction Reliability	78.5
Aadhaar Eased Access to Services	82.0
DBT Reduced Income Uncertainty	74.0
DPI Improved Overall Economic Stability	76.5

Source: Primary Survey, November–December 2025.

Table 7 shows that perception-based indicators strongly suggest that DPI has positively influenced economic stability. Aadhaar emerges as a key facilitator of service access, UPI enhances transaction reliability and DBT plays a crucial role in reducing income uncertainty among welfare-dependent households.



Source: Computed from Table 7 (Primary Survey, 2025)

Graph 3: Perceived Impact of Digital Public Infrastructure on Economic Stability in Bharuch District

The above analysis reveals that Digital Public Infrastructure has contributed meaningfully to economic stability in Bharuch district by improving transaction efficiency, welfare security and service accessibility. Urban respondents benefit more due to better infrastructure and digital literacy, while semi-urban areas experience partial gains. Nevertheless, the presence of measurable benefits across both contexts confirms DPI's role as a stabilising economic institution at the district level.

## 6. FINDINGS OF THE STUDY

The empirical analysis of primary data collected from urban and semi-urban areas of Bharuch district reveals several important findings regarding the role of Digital Public Infrastructure (DPI) in strengthening economic stability at the local level. The findings are organised around access to DPI, usage patterns and perceived economic outcomes.

First, the study finds near-universal penetration of Aadhaar among respondents, with a high level of linkage to bank accounts and welfare schemes. This indicates that digital identity has become a foundational enabler of access to financial and public services in the district. Aadhaar has significantly reduced procedural barriers and facilitated smoother enrolment in banking and welfare programs, particularly for welfare-dependent households and informal sector workers.

Second, the findings highlight substantial adoption of UPI, especially in urban areas such as Bharuch city and Ankleshwar. Daily usage of UPI is notably higher among urban respondents, reflecting better digital infrastructure and higher digital literacy. In semi-urban areas like Jhagadia and Vagra, UPI usage is more moderate, with weekly and occasional transactions dominating. Despite this variation, respondents across all locations reported improved transaction reliability and reduced dependence on cash, indicating that UPI has contributed positively to transaction stability and day-to-day economic functioning.

Third, the study finds that Direct Benefit Transfers have enhanced income predictability and welfare security. A majority of DBT beneficiaries reported timely or mostly timely receipt of benefits, reducing uncertainty related to subsidies, pensions and social assistance. Regular DBT payments were found to support consumption smoothing and reduce short-term financial stress, particularly among low-income households and elderly beneficiaries. Fourth, perception-based indicators suggest that DPI has positively influenced economic stability in the district. A significant proportion of respondents agreed that UPI improved transaction efficiency, Aadhaar eased access to services and DBT reduced income uncertainty. Overall, more than three-fourths of the respondents perceived DPI as contributing to improved economic stability, reflecting a broad-based positive assessment across socio-economic groups.

Finally, the findings reveal clear urban–semi-urban disparities in the intensity of DPI usage and benefits. While the stabilising effects of DPI are evident across all study areas, infrastructural limitations, network reliability issues and lower digital literacy

constrain the full realisation of benefits in semi-urban regions. These findings underscore the need for targeted policy interventions to bridge regional gaps and strengthen the stabilising role of DPI at the grassroots level.

## 7. POLICY RECOMMENDATIONS

The findings of the study underline the critical role of Digital Public Infrastructure (DPI) in enhancing economic stability at the district level. However, the uneven intensity of benefits across urban and semi-urban areas of Bharuch district highlights the need for targeted and context-specific policy interventions. Strengthening DPI should therefore be viewed not merely as a digitalisation initiative, but as an economic stabilisation strategy. First, digital infrastructure in semi-urban areas requires focused strengthening. While Aadhaar coverage is widespread, the effectiveness of UPI and DBT depends heavily on reliable network connectivity and access to digital devices. Policymakers should prioritise improving internet connectivity, mobile network coverage and power reliability in semi-urban locations such as Jhagadia and Vagra. Without addressing these infrastructural gaps, the stabilising benefits of digital platforms will remain uneven. Second, the study points to the importance of digital literacy and user capacity-building. Many respondents in semi-urban areas reported limited familiarity with digital applications, which restricts the regular use of UPI and other services. District-level digital literacy programs, delivered through local institutions such as panchayats, self-help groups and community centres, can enhance confidence and sustained usage. Special attention should be given to elderly beneficiaries and welfare-dependent households to prevent exclusion. Third, strengthening grievance redressal and transaction reliability mechanisms is essential for sustaining trust in digital systems. Although UPI usage has improved transaction efficiency, occasional transaction failures and delays were reported. Establishing responsive, district-level support systems for resolving payment failures and DBT-related issues can reduce uncertainty and reinforce the perception of DPI as a reliable economic platform.

Fourth, DBT delivery mechanisms can be further refined to enhance income predictability. While most beneficiaries receive payments on time, instances of delay undermine welfare security. Regular monitoring of DBT disbursement schedules and proactive communication regarding payment timelines can help households plan expenditures more effectively, thereby strengthening economic stability.

Finally, policymakers should adopt a district-centric approach to DPI expansion. The findings suggest that district-level data and feedback can provide valuable insights into local challenges and usage patterns. Integrating such evidence into planning and implementation will enable DPI to function as a more effective instrument for inclusive and resilient economic growth, aligned with India's broader development objectives.

## 8. CONCLUSION

This study examined the role of Digital Public Infrastructure (DPI) in promoting economic stability in India, using primary and secondary evidence from selected urban and semi-urban areas of Bharuch district in Gujarat. By integrating Aadhaar, Unified Payments Interface (UPI) and Direct Benefit Transfers (DBT) within a single analytical framework, the study moved beyond conventional discussions of digitalisation and financial inclusion to assess the stabilising effects of DPI on everyday economic life. The empirical findings indicate that DPI has contributed meaningfully to economic stability at the district level. Near-universal Aadhaar coverage has eased access to banking and welfare services, reducing administrative barriers and exclusion risks. UPI has enhanced transaction reliability and efficiency, particularly for households and small businesses, by lowering dependence on cash and enabling smoother income flows. DBT has strengthened welfare security by ensuring more predictable and transparent income support, thereby helping households manage consumption and reduce financial uncertainty. Together, these platforms function as an interconnected institutional mechanism that supports income regularity and economic resilience.

However, the study also reveals notable disparities between urban and semi-urban areas in the intensity of DPI usage and the extent of its benefits. Infrastructure limitations, network reliability issues and gaps in digital literacy constrain the full realisation of DPI's stabilising potential in semi-urban regions. These findings suggest that while the architecture of DPI is robust, its outcomes are shaped by local conditions and implementation quality. The study contributes to the existing literature by providing district-level primary evidence on the combined impact of Digital Public Infrastructure on economic stability, an area that has received limited empirical attention. The findings underscore the importance of adopting a district-centric approach to digital policy, where infrastructure development, capacity-building and service delivery are aligned with local needs. Strengthening DPI at the grassroots level can play a crucial role in advancing inclusive and resilient economic growth, consistent with India's long-term development vision.

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