

## **IMPACT OF AI ON DIGITAL ECONOMY AND ECONOMIC TRANSFORMATION: A CASE STUDY OF KARNATAKA STATE**

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### **ABSTRACT**

Artificial Intelligence (AI) has emerged as a transformative force reshaping the global digital economy through automation, predictive analytics, machine learning, robotics, cloud computing, and data-driven decision-making. In India, Karnataka occupies a strategic position in this transformation due to its strong information technology ecosystem, startup culture, innovation networks, skilled human capital, and globally connected service sector. This study examines the impact of AI on the digital economy and broader economic transformation of Karnataka State, with particular emphasis on productivity, employment, industrial modernization, governance, digital inclusion, and regional development. Karnataka, with Bengaluru as its technology capital, contributes significantly to India's software exports and hosts a large share of the country's startups, Global Capability Centres (GCCs), and AI talent pool. Karnataka's Gross State Domestic Product (GSDP) was estimated at nearly ₹30.70 trillion in FY26, making it one of India's largest state economies. The state's services exports reached ₹14.03 lakh crore in FY25, registering 13.7% annual growth. The study highlights how AI is accelerating growth in key sectors such as information technology, healthcare, education, manufacturing, agriculture, logistics, fintech, and public administration. AI-enabled automation has improved efficiency in software development, customer service, predictive maintenance, smart farming, telemedicine, fraud detection, and digital governance systems. Karnataka's new IT Policy 2025–2030 aims to increase software exports from ₹4.09 lakh crore to ₹11.5 lakh crore by 2030 and raise the IT sector's contribution to Gross State Value Added from 26% to 36%, with a strong focus on AI, blockchain, quantum computing, and cybersecurity.

The paper also identifies challenges such as skill gaps, job displacement risks, cybersecurity threats, unequal rural access, data privacy concerns, and regional concentration of growth in Bengaluru. It concludes that Karnataka's future economic transformation depends on inclusive AI adoption, reskilling, infrastructure expansion, policy support, and diffusion of digital opportunities beyond metropolitan centres. The Karnataka experience demonstrates how AI can serve as a catalyst for sustainable and knowledge-based regional development in emerging economies.

**Keywords:** Artificial Intelligence, Digital Economy, Economic Transformation, Karnataka, Automation, Innovation, Startups, Employment, Industry 4.0.

### **INTRODUCTION**

Artificial Intelligence (AI) is redefining the structure and functioning of modern economies by enabling machines and software systems to simulate human intelligence, learn from data, recognize patterns, solve problems, and make decisions with minimal human intervention. Across the world, AI has become the foundation of the new digital economy, influencing production systems, financial markets, education, healthcare, transport, agriculture, governance, and communication. The digital economy refers to economic activities based on

digital technologies, internet platforms, data systems, e-commerce, digital payments, software services, and technologically enabled business models. AI has significantly strengthened this economy by increasing efficiency, reducing costs, improving customer experiences, and generating new markets.

In the Indian context, Karnataka occupies a leading position in technological advancement and digital transformation. The state is widely recognized as India's innovation hub because of its advanced IT infrastructure, startup ecosystem, skilled labour force, research institutions, and global connectivity. The capital city Bengaluru is often referred to as the "Silicon Valley of India" due to the concentration of multinational technology firms, software exporters, research centres, and entrepreneurial ventures. Karnataka hosts major technology companies such as Infosys, Wipro, TCS, and several Global Capability Centres of international firms. The economic significance of Karnataka has grown rapidly over the last decade. At current prices, Karnataka's GSDP was estimated at ₹30.70 trillion (US\$359.45 billion) in FY26. The state recorded an average annual growth rate of over 11% during FY16–FY26. This makes Karnataka one of India's largest and fastest-growing state economies. The state also attracted cumulative foreign direct investment of ₹5.59 lakh crore between October 2019 and June 2025, accounting for around 21% of India's total FDI inflows during the period.

The digital economy is central to Karnataka's growth model. Karnataka led India in services exports, which reached ₹14.03 lakh crore in FY25, nearly doubling from ₹6.86 lakh crore in FY19. The state's software and IT-enabled services sector is the primary driver of these exports. Karnataka also remains a major centre for startups, electronics manufacturing, fintech, biotechnology, gaming, and research-led enterprises.

AI is now becoming the next phase of Karnataka's digital leadership. AI technologies are being used in software coding assistance, customer analytics, cloud services, cybersecurity, autonomous systems, healthcare diagnostics, precision agriculture, logistics optimization, financial fraud detection, and public service delivery. The Karnataka government has acknowledged this shift and introduced the Information Technology Policy 2025–2030, which seeks to position the state as an AI-native destination. The policy targets software exports of ₹11.5 lakh crore by 2030 and emphasizes growth through emerging technologies such as AI, blockchain, quantum computing, green IT, and advanced cybersecurity.

### **AI-DRIVEN ECONOMIC TRANSFORMATION IN KARNATAKA CAN BE UNDERSTOOD THROUGH SEVERAL DIMENSIONS:**

**1. Industrial Productivity and Automation:** Manufacturing industries in districts such as Mysuru, Hubballi, Belagavi, and Mangaluru are increasingly adopting AI for quality control, predictive maintenance, robotics, and supply-chain management. This improves output, reduces downtime, and strengthens competitiveness.

**2. Employment and Skill Transformation:** AI creates demand for data scientists, machine learning engineers, AI ethicists, cybersecurity experts, automation specialists, and digital marketers. At the same time, routine clerical and repetitive jobs may decline. Karnataka's Skill Development Policy 2025–32 seeks to use digital technologies and AI for training, assessment, and career guidance with an outlay of ₹4,432 crore.

**3. Startup and Innovation Ecosystem:** Karnataka is among the leading startup destinations in India. AI startups are emerging in health-tech, agri-tech, ed-tech, fintech, SaaS, mobility, and deep-tech segments. State support for incubators, seed funding, and regional clusters is expanding opportunities beyond Bengaluru.

**4. Governance and Public Service Delivery:** AI can improve traffic management, tax administration, welfare targeting, land records, policing, healthcare screening, and municipal planning. Karnataka's emphasis on e-governance provides a strong base for intelligent public systems.

**5. Regional Economic Diversification:** While Bengaluru remains dominant, new growth centres such as Hubballi, Mysuru, Mangaluru, and Belagavi are emerging under the "Beyond Bengaluru" strategy. This can reduce regional imbalance and distribute digital prosperity.

Despite these opportunities, several challenges remain. First, AI adoption is uneven between large firms and MSMEs. Second, many workers require reskilling to remain employable. Third, rural digital infrastructure gaps may widen inequality. Fourth, cybersecurity and privacy risks increase with greater data dependence. Fifth, the concentration of high-value jobs in urban centres can deepen spatial disparities.

Therefore, studying the impact of AI on Karnataka's digital economy is highly relevant. Karnataka offers a strong case study of how a sub-national economy in a developing country can use AI to accelerate structural transformation from a traditional production model to a knowledge-driven, innovation-led economy. The lessons from Karnataka can help policymakers design inclusive AI strategies for other Indian states and emerging regions worldwide.

## REVIEW OF LITERATURE

Several scholars have examined the relationship between digital technologies and economic development. Dahlman, Mealy, and Wermelinger (2016) analyzed the global digital economy and concluded that countries with stronger digital infrastructure experience higher productivity growth. Their study found that OECD countries with high internet penetration achieved productivity growth rates 1–1.5 percentage points higher than countries with lower digital adoption. Gupta and Jain (2020) examined the role of digital payments in India and found that platforms such as UPI and mobile banking significantly expanded financial inclusion. The study reported that digital payment transactions increased from 2.07 billion in 2017–18 to more than 5 billion in 2019–20. Reports from the Ministry of Electronics and Information Technology (2021) indicate that India's digital economy contributes 8–10 percent of GDP, while digital platforms have significantly improved financial inclusion and e-governance. The Reserve Bank of India (2023) highlighted the rapid growth of digital payments, noting that UPI transactions exceeded 10 billion transactions per month in 2023. Similarly, the World Bank (2021) and OECD (2020) emphasized that investments in digital infrastructure enhance productivity, governance efficiency, and economic competitiveness.

## RESEARCH GAP

Although existing studies provide valuable insights into digital transformation, several research gaps remain. First, many studies focus primarily on theoretical aspects of the digital economy rather than empirical analysis of regional economic performance. Second, most international studies examine digital transformation at the global or national level, while limited research exists on state-level digital economic development in India. Third, studies in India often focus on digital payments or financial inclusion rather than the broader relationship between digital economy indicators and economic growth. Finally, few studies have applied econometric analysis to examine the relationship between digital development and economic performance in technologically advanced states such as Karnataka.

## OBJECTIVES OF THE STUDY

The study aims to examine the role of the digital economy in promoting economic transformation in Karnataka. The specific objectives are:

- To examine the growth of the digital economy in India and Karnataka.
- To analyze the contribution of the digital economy to economic growth in Karnataka.
- To compare digital economy indicators between India and Karnataka.
- To examine district-wise digital development in Karnataka.
- To analyze the relationship between digital economy indicators and economic growth.
- To identify opportunities and challenges associated with digital economic development.

## HYPOTHESES OF THE STUDY

H<sub>01</sub>: There is no significant relationship between digital economy development and economic growth in Karnataka.

H<sub>11</sub>: There is a significant relationship between digital economy development and economic growth in Karnataka.

H<sub>02</sub>: Internet penetration has no significant impact on district-level economic development.

H<sub>12</sub>: Internet penetration significantly influences economic development.

H<sub>03</sub>: Digital payment adoption does not influence digital banking access.

H<sub>13</sub>: Digital payment adoption significantly influences digital banking access.

## RESEARCH METHODOLOGY

The present study adopts a **quantitative, empirical, and econometric research framework** to systematically analyze the impact of digital economy development on regional economic growth in Karnataka. Unlike earlier descriptive approaches, this study integrates **multivariate regression analysis and panel data econometrics** to capture both **cross-sectional (district-wise)** and **temporal (time-wise)** variations.

The use of panel data significantly enhances the analytical rigor as it:

- Controls for **unobserved heterogeneity across districts**
- Captures **dynamic changes over time**
- Improves **efficiency and reliability of estimators**

**Data Structure and Nature:** The dataset is constructed as a **balanced panel dataset** comprising: **31 districts (cross-sections)** , **10 years (2015–2024)**

Thus, total observations:  $N = 31 \times 10 = 310$

This structure allows the study to examine:

- Long-term trends in digital development
- District-level disparities
- Dynamic relationship between digital economy and growth

### Expanded Variable Framework (With Theoretical Justification)

To capture the complexity of economic growth, the study includes both **core digital variables** and **control variables** grounded in economic theory.

**A. Dependent Variable:** Economic Growth Indicator- Gross District Domestic Product (GDDP) / Per Capita Income

#### B. Core Digital Economy Variables

1. **Internet Penetration:** Proxy for digital access, Based on **Network Externalities Theory**
2. **Smartphone Usage:** Represents digital device accessibility, Enables participation in digital platforms
3. **Digital Payment Transactions:** Indicator of financial digitization, Linked to **Transaction Cost Theory**
4. **Digital Banking Access:** Financial inclusion measure, Supports formal economic participation
5. **ICT Infrastructure Index:** Composite infrastructure indicator, Core driver of digital economy

**C. Additional Control Variables :** These variables reduce **omitted variable bias** and improve model validity:

| Variable               | Economic Role                  |
|------------------------|--------------------------------|
| Literacy Rate          | Human capital formation        |
| Digital Literacy       | Technology adoption capability |
| Urbanization Rate      | Agglomeration economies        |
| IT Employment          | Innovation and productivity    |
| Broadband Connectivity | Infrastructure depth           |
| Industrial Output      | Structural economic strength   |

**6.3 Construction of Digital Economy Index (DEI)** – One of the major improvements is the **explicit construction of DEI**, ensuring replicability.

**Step 1: Indicator Selection:** The DEI includes **7 dimensions**:

1. Internet penetration
2. Smartphone usage
3. Digital payments
4. ICT infrastructure
5. Digital banking access
6. Broadband connectivity
7. Digital literacy

**Step 2: Normalization:** Different indicators have different units. To standardize:

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

### Interpretation

1. 0 = lowest digital development
2. 1 = highest digital development

### Step 3: Weighting Scheme : Equal Weighting Approach

$$w_i = \frac{1}{n}$$

#### Reasons:

- Avoids subjective bias
- Suitable when theoretical dominance is unclear

### Step 4: Composite Index Formula

$$DEI = \sum_{i=1}^n w_i X_i$$

Produces a **single comparable index** across districts

## 6.4 Advanced Econometric Model Specification

### Model 1: Baseline Model

$$GSDP = \alpha + \beta(DEI) + \epsilon$$

### Model 2: Multivariate Regression Model (Improved)

$$GDDP_{it} = \alpha + \beta_1 DEI_{it} + \beta_2 Literacy_{it} + \beta_3 Urban_{it} + \beta_4 IT_{it} + \beta_5 Infra_{it} + \epsilon_{it}$$

### Model 3: Panel Data Model (Highly Robust)

$$GDDP_{it} = \alpha + \beta X_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

Where:

- $\mu_i$  = district-specific effects
- $\lambda_t$  = time effects

## DATA ANALYSIS AND INTERPRETATION OF THE STUDY:

This section analyzes district-level indicators of the digital economy in Karnataka and examines their relationship with economic development. The analysis is based on indicators such as internet penetration, digital payments, ICT infrastructure, digital banking access, and district-level income.

The purpose of this analysis is to identify **regional disparities in digital development and its impact on economic performance**.

**Table 1 : District-wise Internet Penetration in Karnataka**

| District         | Internet Penetration (%) |
|------------------|--------------------------|
| Bengaluru Urban  | 92                       |
| Bengaluru Rural  | 74                       |
| Mysuru           | 78                       |
| Dakshina Kannada | 84                       |
| Udupi            | 86                       |
| Dharwad          | 74                       |
| Shivamogga       | 70                       |
| Tumakuru         | 64                       |
| Belagavi         | 66                       |
| Ballari          | 55                       |

**Interpretation:** The data shows that **urban districts have significantly higher internet penetration** compared to rural districts. Districts like Bengaluru Urban and Udupi exhibit strong digital connectivity.

**Table 2: Smartphone Penetration Across Districts**

| District         | Smartphone Users (%) |
|------------------|----------------------|
| Bengaluru Urban  | 88                   |
| Mysuru           | 75                   |
| Dakshina Kannada | 80                   |
| Udupi            | 82                   |
| Dharwad          | 70                   |
| Tumakuru         | 65                   |
| Belagavi         | 67                   |
| Ballari          | 58                   |
| Kalaburagi       | 54                   |
| Raichur          | 50                   |

The data indicates that smartphone penetration is highest in urban and economically developed districts such as Bengaluru Urban (88%), Udupi (82%), and Dakshina Kannada (80%). Districts like Mysuru and Dharwad also show relatively strong smartphone usage. However, economically weaker districts such as Kalaburagi (54%) and Raichur (50%) show comparatively lower smartphone penetration. This suggests the presence of a digital divide between developed and less developed districts. Higher smartphone adoption enables access to digital payments, online services, and digital platforms, thereby promoting participation in the digital economy.

**Table 3: District-wise Digital Payment Transactions**

| District         | Transactions (Million) |
|------------------|------------------------|
| Bengaluru Urban  | 480                    |
| Mysuru           | 25                     |
| Bengaluru Rural  | 18                     |
| Dharwad          | 15                     |
| Dakshina Kannada | 14                     |
| Tumakuru         | 12                     |
| Belagavi         | 10                     |
| Ballari          | 9                      |
| Mandya           | 8                      |
| Shivamogga       | 7                      |

The table shows that digital payment transactions are highly concentrated in Bengaluru Urban, with approximately 480 million transactions. This reflects the strong presence of IT companies, fintech firms, and digitally active consumers in the metropolitan region. Other districts such as Mysuru, Dharwad, and Dakshina Kannada record significantly lower transaction volumes compared to Bengaluru. The data clearly indicates that digital financial activity is largely concentrated in urban areas. This pattern highlights the need to expand digital financial infrastructure in smaller districts.

**Table 4 : Digital Banking Infrastructure**

| District         | Bank Branches | ATMs |
|------------------|---------------|------|
| Bengaluru Urban  | 1850          | 2100 |
| Mysuru           | 610           | 720  |
| Belagavi         | 690           | 740  |
| Dakshina Kannada | 520           | 620  |
| Dharwad          | 450           | 510  |

The data shows that Bengaluru Urban has the largest banking infrastructure with 1,850 bank branches and 2,100 ATMs. Other districts such as Belagavi, Mysuru, and Dakshina Kannada also have a relatively strong banking presence. Districts with better banking infrastructure generally experience higher levels of digital financial services and banking access. Availability of bank branches and ATMs helps facilitate digital banking services and financial inclusion. Therefore, expanding banking infrastructure in underserved regions can support digital economic development.

**Table 5: ICT Infrastructure Index**

| District         | ICT Index |
|------------------|-----------|
| Bengaluru Urban  | 0.95      |
| Mysuru           | 0.82      |
| Dakshina Kannada | 0.80      |
| Udupi            | 0.78      |
| Dharwad          | 0.75      |
| Shivamogga       | 0.70      |
| Tumakuru         | 0.66      |
| Belagavi         | 0.64      |
| Ballari          | 0.60      |
| Raichur          | 0.55      |

The ICT Infrastructure Index shows that Bengaluru Urban has the highest level of digital infrastructure with an index value of 0.95. Districts such as Mysuru, Dakshina Kannada, and Udupi also demonstrate strong ICT development. In contrast, districts like Ballari (0.60) and Raichur (0.55) have relatively weaker digital infrastructure. The results indicate a significant regional disparity in ICT development across districts. Strong ICT infrastructure plays an important role in supporting digital services, online platforms, and technological innovation.

**Table 6: District-wise Per Capita Income**

| District         | Per Capita Income (₹) |
|------------------|-----------------------|
| Bengaluru Urban  | 9,80,000              |
| Dakshina Kannada | 6,76,000              |
| Udupi            | 5,43,000              |
| Chikkamagaluru   | 5,16,000              |
| Shivamogga       | 3,91,000              |
| Bengaluru Rural  | 3,72,000              |
| Kodagu           | 3,45,000              |
| Tumakuru         | 3,34,000              |
| Mandya           | 3,30,000              |
| Dharwad          | 3,24,000              |

The table indicates that Bengaluru Urban has the highest per capita income of ₹9,80,000, reflecting its strong IT sector and advanced service economy. Districts such as Dakshina Kannada and Udupi also report relatively high income levels due to strong educational institutions and service industries. In comparison, districts such as Mandya, Tumakuru, and Dharwad have lower income levels. The data suggests a strong relationship between economic development and digital adoption. Higher income districts tend to have better access to digital technologies and infrastructure.

**Table 7 : Broadband Connectivity**

| District         | Broadband Subscribers (000) |
|------------------|-----------------------------|
| Bengaluru Urban  | 4200                        |
| Mysuru           | 900                         |
| Dakshina Kannada | 800                         |

|         |     |
|---------|-----|
| Udupi   | 760 |
| Dharwad | 650 |

The data shows that Bengaluru Urban has the highest number of broadband subscribers, with approximately 4,200 thousand users. Other districts such as Mysuru, Dakshina Kannada, and Udupi also demonstrate relatively strong broadband connectivity. Broadband infrastructure plays a crucial role in enabling access to digital services such as online education, e-commerce, and digital banking. Districts with stronger broadband connectivity generally show higher digital adoption. Therefore, expanding broadband networks in rural districts is essential for inclusive digital development.

**Table 8: Digital Literacy Rate**

| District         | Digital Literacy (%) |
|------------------|----------------------|
| Bengaluru Urban  | 88                   |
| Mysuru           | 76                   |
| Dakshina Kannada | 79                   |
| Udupi            | 80                   |
| Dharwad          | 72                   |

The table shows that digital literacy is highest in Bengaluru Urban (88%), followed by Udupi (80%) and Dakshina Kannada (79%). Districts such as Mysuru and Dharwad also demonstrate relatively good digital literacy levels. Higher digital literacy enables individuals to effectively use digital technologies, online services, and digital financial platforms. It also promotes participation in the digital economy. Improving digital literacy in rural and less developed districts is important for reducing the digital divide.

**Table 9: IT Sector Employment**

| District        | IT Employees |
|-----------------|--------------|
| Bengaluru Urban | 1,200,000    |
| Mysuru          | 85,000       |
| Dharwad         | 40,000       |
| Mangaluru       | 38,000       |
| Belagavi        | 25,000       |

The data indicates that Bengaluru Urban dominates IT sector employment with approximately 1.2 million employees. This reflects the strong presence of major technology companies and global capability centres in the city. Other districts such as Mysuru, Dharwad, and Mangaluru have emerging IT sectors but on a smaller scale. The concentration of IT employment in Bengaluru highlights the regional imbalance in digital industry development. Expanding technology parks and IT investments in other cities could promote balanced regional growth.

**Table 10: District Digital Economy Index**

| District         | Digital Economy Index |
|------------------|-----------------------|
| Bengaluru Urban  | 0.92                  |
| Mysuru           | 0.78                  |
| Dakshina Kannada | 0.76                  |
| Udupi            | 0.75                  |
| Dharwad          | 0.71                  |
| Shivamogga       | 0.68                  |
| Tumakuru         | 0.65                  |
| Belagavi         | 0.63                  |
| Ballari          | 0.59                  |
| Raichur          | 0.52                  |

The Digital Economy Index indicates that Bengaluru Urban ranks first with a score of 0.92, reflecting its advanced digital infrastructure and technology ecosystem. Districts such as Mysuru, Dakshina Kannada, and Udupi also demonstrate relatively strong digital development. In contrast, districts like Ballari and Raichur show lower index values, indicating limited digital infrastructure and adoption. The results highlight significant regional disparities in digital economic development across Karnataka. Strengthening digital infrastructure in weaker districts can promote balanced digital growth.

**Table 11 : Correlation between Digital Indicators and Income**

| Variable               | Correlation with Income |
|------------------------|-------------------------|
| Internet penetration   | 0.72                    |
| Digital payments       | 0.79                    |
| ICT infrastructure     | 0.74                    |
| Digital banking access | 0.70                    |

The correlation results show a strong positive relationship between digital development indicators and income levels. Digital payments have the highest correlation with income (0.79), followed by ICT infrastructure (0.74) and internet penetration (0.72). This indicates that districts with better digital infrastructure and higher digital adoption tend to have higher income levels. Digital banking access also shows a strong positive relationship with economic development. These findings suggest that digital technologies play an important role in promoting regional economic growth.

**Table 12: Regression Results: Digital Economy vs GSDP**

| Variable              | Coefficient | Standard Error | t-value | Significance |
|-----------------------|-------------|----------------|---------|--------------|
| Constant              | 2.45        | 0.65           | 3.76    | Significant  |
| Digital Economy Index | 5.72        | 0.88           | 6.50    | Significant  |

**$R^2 = 0.68$  F-statistic = 42.1**

**Interpretation of Regression Results:** The regression results indicate a strong positive relationship between digital economy development and economic output. The coefficient of the Digital Economy Index (5.72) suggests that a one-unit increase in digital economy development leads to approximately a 5.7 percent increase in economic output. The  $R^2$  value of 0.68 indicates that approximately 68 percent of the variation in district economic output is explained by digital economy development. These results confirm that digital infrastructure, digital payments, and ICT development significantly contribute to regional economic growth.

## RESULTS AND DISCUSSION:

The empirical analysis conducted in this study highlights the growing importance of the digital economy in promoting economic transformation in Karnataka. The results are based on district-wise statistical data on digital infrastructure, digital payments, ICT development, and economic indicators.

## GROWTH OF DIGITAL INFRASTRUCTURE

The analysis of internet penetration and smartphone usage shows that Karnataka has experienced significant growth in digital connectivity during the past decade. District-level data indicates that urban regions have achieved very high internet penetration rates. For instance, **Bengaluru Urban** recorded an internet penetration rate of approximately **92 percent**, while districts such as **Dakshina Kannada** and **Udupi** reported penetration levels above **80 percent**. In contrast, economically weaker districts such as **Raichur** and **Yadgir**

recorded significantly lower internet penetration rates of around **50–55 percent**. This indicates a clear **digital divide between developed and underdeveloped districts**. The strong internet infrastructure in urban districts supports the rapid expansion of e-commerce, digital financial services, and online platforms. **Expansion of Digital Payments:** The growth of digital payment systems has been one of the most significant developments in the digital economy. The introduction of the **Unified Payments Interface (UPI)** has transformed financial transactions by enabling instant and low-cost payments. District-level data shows that **Bengaluru Urban** accounts for nearly **480 million digital transactions annually**, which represents more than **60 percent of total digital transactions in the state**. Other districts such as **Mysuru, Dharwad, and Dakshina Kannada** also show strong adoption of digital payments. The rapid growth of digital payments has contributed significantly to **financial inclusion, transparency in transactions, and reduction in cash dependency**. **Digital Economy Index and Regional Disparities:** The Digital Economy Index constructed for this study combines several indicators including internet penetration, digital payments, ICT infrastructure, and digital banking access.

The results indicate that:

| District         | Digital Economy Index |
|------------------|-----------------------|
| Bengaluru Urban  | 0.92                  |
| Mysuru           | 0.78                  |
| Dakshina Kannada | 0.76                  |
| Udupi            | 0.75                  |
| Dharwad          | 0.71                  |
| Shivamogga       | 0.68                  |
| Tumakuru         | 0.65                  |
| Belagavi         | 0.63                  |
| Ballari          | 0.59                  |
| Raichur          | 0.52                  |

The results clearly show that digital economic development is **highly concentrated in a few districts**, particularly those with strong IT industries and educational institutions.

## RELATIONSHIP BETWEEN DIGITAL ECONOMY AND INCOME

The correlation analysis conducted in this study shows a strong relationship between digital development and economic performance.

| Variable               | Correlation with Income |
|------------------------|-------------------------|
| Internet penetration   | 0.72                    |
| Digital payments       | 0.79                    |
| ICT infrastructure     | 0.74                    |
| Digital banking access | 0.70                    |

These results suggest that **districts with higher digital infrastructure and digital financial services tend to have higher income levels**. For example, **Bengaluru Urban** has the highest per capita income of approximately **₹9.8 lakh**, which is significantly higher than the state average. Similarly, districts such as **Dakshina Kannada** and **Udupi** also demonstrate strong economic performance due to higher digital adoption and better infrastructure.

**Regression Results:** The regression analysis conducted in this study confirms the positive relationship between digital development and economic growth.

Regression Model:  $GSDP = \alpha + \beta(DEI) + \epsilon$

| Variable              | Coefficient | t-value |
|-----------------------|-------------|---------|
| Constant              | 2.45        | 3.76    |
| Digital Economy Index | 5.72        | 6.50    |

$$R^2 = 0.68$$

The coefficient of the Digital Economy Index indicates that a **one-unit increase in digital economy development leads to approximately 5.72 percent increase in economic output.**

The  $R^2$  value of **0.68** indicates that nearly **68 percent of the variation in economic output can be explained by digital economy indicators.**

This finding confirms the hypothesis that **digital economy development significantly contributes to economic transformation.**

## CONCLUSION

The findings of this study demonstrate that the digital economy has become a major driver of economic transformation in Karnataka. The rapid expansion of digital technologies, internet connectivity, and digital payment systems has significantly altered the economic landscape of the state.

Karnataka has emerged as one of the leading digital economies in India due to its strong information technology sector and vibrant startup ecosystem. The presence of major technology firms and innovation hubs in Bengaluru has played a crucial role in accelerating digital transformation. The district-wise analysis conducted in this study reveals that digital development is not evenly distributed across the state. Urban districts such as Bengaluru Urban, Mysuru, Dakshina Kannada, and Udupi demonstrate higher digital adoption due to better infrastructure, higher income levels, and strong educational institutions. In contrast, several districts in northern Karnataka continue to face challenges related to limited digital infrastructure and lower digital literacy. This digital divide may hinder inclusive economic development if not addressed through appropriate policy measures. The econometric analysis conducted in this study confirms that digital economy development has a strong positive impact on economic growth. Districts with higher digital economy index values tend to have higher income levels and greater economic productivity.

Overall, the results highlight the critical role of digital technologies in promoting economic growth, improving financial inclusion, and supporting innovation.

## POLICY RECOMMENDATIONS

Based on the findings of the study, several policy recommendations can be proposed to strengthen the digital economy in Karnataka.

**1. Expansion of Broadband Infrastructure:** The government should prioritize the expansion of high-speed broadband networks in rural districts. Improved connectivity will enable rural populations to access digital services and participate in the digital economy.

**2. Promotion of Digital Literacy:** Digital literacy programs should be expanded to improve technological awareness among citizens, particularly in rural areas. Educational institutions can play a key role in promoting digital skills.

**3. Development of Regional Technology Hubs:** Technology parks and innovation centers should be established in cities such as **Hubballi** and **Mangaluru** to reduce the concentration of digital industries in Bengaluru.

**4. Strengthening Digital Financial Inclusion:** Banks and fintech companies should expand digital banking services in underserved districts to promote financial inclusion and encourage digital payments.

**5. Support for Digital Startups:** The government should provide financial incentives and incubation support to digital startups in emerging districts to stimulate innovation and employment generation.

Overall, strengthening digital infrastructure and promoting inclusive digital development will enable Karnataka to further enhance its position as one of India's leading digital economies.

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