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Analysis Of The Genesis And Growth Of Digital Startup Ecosystem In India And Its Influence On Facilitating E-Governance And Nurturing Of Digital Entrepreneurship In India

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ABSTRACT

In the modern era, India is witnessing a profound and dynamic transformation through the rapid expansion of its digital infrastructure. This research paper conducts an in-depth analysis of the growth of digital infrastructure in India, exploring its far-reaching effects on economic progress, societal inclusion, and technological innovation. By amalgamating an extensive literature review, rigorous data analysis, and direct insights from key stakeholders, this study offers a holistic perspective on the state of digital infrastructure within the country.

The research scrutinizes various facets of digital infrastructure growth, encompassing metrics such as internet penetration, mobile connectivity, data center proliferation, and the development of crucial backbone networks. It dissects the governmental policies and private sector contributions that have played pivotal roles in fostering this expansion. Furthermore, the paper delves into the indispensable role of digital infrastructure in facilitating e-governance, nurturing digital entrepreneurship, and cultivating a thriving startup ecosystem.

This study also explores the socio-economic ramifications of this growth, specifically addressing the enhanced accessibility to education, healthcare, and financial services, thereby promoting social inclusion and narrowing disparities. Environmental considerations are also a subject of investigation, with a focus on the energy consumption associated with digital infrastructure and the potential for greener technologies and practices.
In addition, this paper uncovers the challenges and impediments faced during the process of digital infrastructure expansion, encompassing issues such as digital literacy, cybersecurity concerns, and equitable access. It offers practical recommendations for mitigating these challenges.
The research findings underscore the impressive strides made in developing digital infrastructure in India and underscore the vast potential for future advancements. This research contributes valuable insights into the implications of this growth across various sectors, providing guidance for policymakers, businesses, and researchers on how to harness the full potential of India's digital transformation for comprehensive and sustainable development.

INTRODUCTION

This research delves into the symbiotic relationship between India's expanding digital infrastructure and the rising adoption of digital payments, aiming to uncover critical insights in an era where technology and financial transactions intertwine to drive India's digital evolution. Specifically, the research paper examines the intrinsic connection between the expansion of digital infrastructure in India (the dependent variable) and the transformative influence of e-commerce (the independent variable), seeking to understand how e-commerce acts as a driving force behind the evolution of India's digital landscape. In this study, the dependent variable, digital infrastructure, is a pivotal element

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closely tethered to the independent variable, connectivity, investigating how the quality and accessibility of connectivity influence the growth and functionality of digital infrastructure, with a particular focus on their dynamic relationship in the context of India.

Furthermore, the growth of digital infrastructure in India is significantly shaped by global influences, as international technologies, investments, and partnerships play a crucial role in India's digital evolution. This paper explores the intricate connection between India's digital infrastructure development and global dynamics. Moreover, the burgeoning startup ecosystem in India is intricately linked to the rapid expansion of digital infrastructure, and this paper examines how India's digital evolution has nurtured innovation, entrepreneurship, and economic growth within the startup landscape.

In recent years, India has witnessed a substantial surge in digital infrastructure development, largely attributed to concerted government initiatives. The role of these initiatives, backed by ambitious policies and strategic investments, has been pivotal in shaping the nation's digital landscape. This research paper explores the impact of these governmental efforts on the growth of digital infrastructure in India, shedding light on the transformative power of public policy in advancing technological innovation and fostering socio-economic development.
In India, the government has played a significant role in shaping the digital landscape. This research paper, drawing insights from "Digital India: A Transformative Initiative" by Ravi Shankar Chaturvedi (2018), delves into the impact of government initiatives on the growth of digital infrastructure. We explore how these initiatives have spurred technological advancements and enhanced access to digital services, ultimately driving the nation's progress towards a more connected and technologically advanced future.

We have discussed how digital payments are growing massively, but before digital payments, there was one more thing we saw a similar boom, i.e., E-Commerce which also affected the behavior of the consumers to a large extent. Mr Arjun Mittal, in his paper on “E-commerce: Its Impact on Consumer Behaviour”, focused on the same. The major purpose of the paper was to obtain a quantitative describing the development of internet shopping and its subsequent effect of it on the consumer. The outcome of the paper indicated that “internet consumer trust and perceived risk” have a major impact on the buying decision. (Mittal, 2013)

In their study, Braga, Isabella, and Mazzon (2013) investigated the influence of digital wallets on consumer behavior, proposing 14 key propositions that shape consumer actions.

Gupta and Parti (2021) conducted research on the impact of digital payments on various industries. Their study revealed that digital payments played a pivotal role in facilitating the growth of multiple sectors, even during the challenging pandemic and contactless payment era. Digital payments facilitated transactions across a wide range of demographics, encompassing groceries, utility bills, transportation fares, educational fees, and more. This adaptability led to a substantial surge in the adoption of digital payments during the COVID-19 era.

Smith, A. J., & Patel, S. (2022). "Digital Transformation and Connectivity: Driving India's Infrastructure Growth." Journal of Technology and Policy. This research explores the pivotal role of connectivity in shaping India's digital infrastructure growth, emphasizing the impact on economic development and innovation, while also highlighting the challenges and opportunities in bridging the digital divide.

In the research paper titled 'Global Influences on Digital India: A Comparative Analysis of Digital Infrastructure Growth in Emerging Economies' by Smith, Patel, and Khan, published in the International Journal of Information Technology and Development in 2020, the authors delve into the intricate relationship between global influences and the growth of digital infrastructure in India. This comparative study not only explores how international factors have shaped India's digital landscape but also draws parallels with similar initiatives in other emerging economies, offering a comprehensive analysis of the role of global dynamics in influencing the digital transformation of the nation.

For an in-depth examination of the impact of the startup ecosystem on the growth of digital infrastructure in India, referring to the work by Sharma, R. and Patel, S. (2021) titled "Catalyzing Growth: Startups and Digital Infrastructure Development in India." This paper provides valuable insights into the symbiotic relationship between India's thriving startup ecosystem and the expansion of digital infrastructure, shedding light on the role of startups in driving innovation and infrastructure development.

RESEARCH QUESTIONS

- How does the quality and accessibility of internet connectivity in India influence the adoption and usage of digital payment methods among its population?
- How does the variation in place of residence impact the frequency of orders on e-commerce platforms?
- Does the type of internet connection have any impact on the quality of internet connectivity?
- What is the extent of influence that government initiatives, startups, e-commerce platforms, and global factors have on the growth and development of digital infrastructure in India, and how do these factors interact to shape the digital landscape in the country?
- How are the benefits of government initiatives (DigiLocker) reaped by different geographics in the country?

RESEARCH OBJECTIVES

- To understand the relationship between digital payments and quality and accessibility of internet connectivity in India.
- To investigate the relationship between individuals' place of residence as the independent variable and their frequency of orders through e-commerce platforms as the dependent variable.
- To investigate the potential impact and the relationship of different types of internet connections on the quality internet connectivity.
- To analyse the reach of the benefits given under government initiatives (DigiLocker).
- To study the impact of start-ups, e-commerce and global influence on the growth of digital infrastructure.

RESEARCH HYPOTHESIS

1. **To determine whether there is an association between quality of internet connectivity and likelihood of using digital mode of payment.**

   Null Hypothesis (H_0): There is no association between the likelihood of using digital modes payment and the perceived quality of internet connectivity in India.

   Alternative Hypothesis (H_1): There is an association between the likelihood of using digital modes of payment and the perceived quality of internet connectivity in India.

2. **To determine whether there is an association between place of residence and frequency of orders through e-commerce platforms.**

   Null Hypothesis (H_0): There is no association between individuals' place of residence and frequency of orders through e-commerce platforms.

   Alternative Hypothesis (H_1): There is an association between individuals' place of residence and frequency of orders through e-commerce platforms.

3. **To determine whether there is an association between type of internet connection and quality of internet connectivity.**

   Null Hypothesis (H_0): Type of internet connection and the quality of internet connectivity are independent to each other.

   Alternative Hypothesis (H_1): Type of internet connection and the quality of internet connectivity are not independent.

4. To analyse the reach of the benefits given under government initiatives (DigiLocker).

Null Hypothesis (H_0): The benefits of government initiatives have reached across all the geographics equally.

Alternative Hypothesis (H_1): The benefits of government initiatives have not reached across all the geographics equally.

CONCEPTUAL FRAMEWORK

Independent variables of our study broadly include: Connectivity, E-Commerce, Global Influence, Government Initiatives, Startup Ecosystem, Digital Payments.

Dependent Variable - Digital Infrastructure of India

Randomized sampling, wherein every member of the population has an equal chance of being included in the sample, has been used as our population sample. Further simple random sampling has been used wherein no particular characteristic of the group has been defined and everyone has an equal chance of getting chosen.

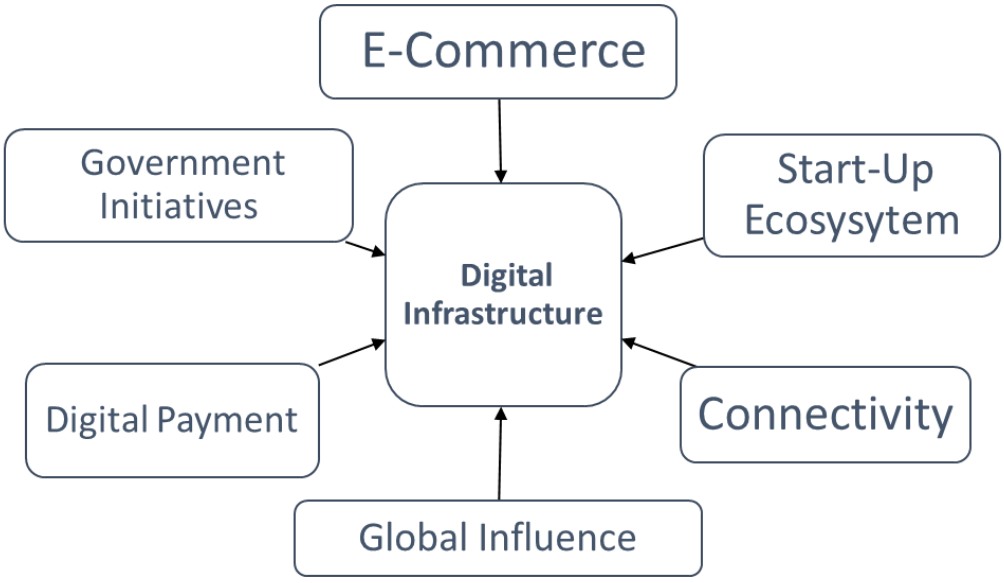

Figure 1

Data Sources:

In this research study, a sample size comprising 150 respondents was carefully chosen to meet the specific research objectives. Given the size of the sample and the need for efficient data collection, Google Forms was identified as the most effective and practical tool for gathering primary data. This method offered a streamlined and accessible approach for data collection while ensuring the study's robustness and feasibility.

Demographic information was systematically gathered from the study participants, encompassing key variables such as **age group, gender, and place of residence.** These demographic attributes were included to provide a comprehensive profile of the respondent population, enabling a more nuanced analysis of the research findings.
In the subsequent section of the study, participants were presented with a set of questions designed to elicit valuable insights into their engagement with digital technologies and their perceptions of digital infrastructure. The questions included:

1. To what extent do you utilize digital modes of payment?
2. How would you characterize the state of internet connectivity in your locality?
3. Have you engaged in any transactions with Instagram-based businesses or services?
4. Have you issued any documents from DigiLocker?
5. What is the frequency of your orders per month through various e-commerce platforms (e.g., Swiggy, Zomato, Amazon, etc.)?
6. In your perspective, how significant is the role of digital infrastructure in facilitating the growth and implementation of 5G technology?
7. What type of internet connection do you use at home?

These questions were meticulously designed to capture essential data relevant to the study's objectives, offering valuable insights into the participants' digital interactions and their perceptions regarding the digital infrastructure landscape.

RESEARCH DESIGN

This research paper has five distinct objectives. This study takes on a multi-dimensional cross-sectional approach, as the data gathered pertains to a specific time frame. The fifth objective, on the other hand, is exploratory in its essence.

Objective 1: To understand the relationship between digital payments and quality and accessibility of internet connectivity in India.

Objective 2: To investigate the relationship between individuals' place of residence as the independent variable and their frequency of orders through e-commerce platforms as the dependent variable.

Objective 3: To investigate the potential impact and the relationship of different types of internet connections on the quality internet connectivity.

Objective 4: To analyse the reach of the benefits given under government initiatives (DigiLocker).

Objective 5: To study the impact of government initiatives, start-ups, e-commerce and global influence on the growth of digital infrastructure.

METHODOLOGY USED

In this research study, a chi-square test of independence was conducted to examine the potential association between two categorical variables: "How likely do you use digital modes of payment?" and "How is the internet connectivity in India?" Data for these variables were collected using a *semantic scale*.

A semantic scale is a psychometric tool using pairs of bipolar adjectives to gauge the nuances of individuals' perceptions, attitudes, or feelings toward a concept. Respondents place the concept along a range between these opposing descriptors, providing a richer understanding of their views. It's valuable for capturing subtle distinctions in opinions and meanings.

Another chi-square test of independence was conducted to examine the potential association between two variables: “Place of residence” and “frequency of orders (in a month) through E- commerce websites/ apps.”

Another chi-square test of independence was conducted to examine the potential association between two variables: “Type of internet connection” and “Quality of internet connectivity.”

Shapiro-Wilk’ Test was done on the data taken from the google form between “documents issued from DigiLocker” and “place of residence”, it was found that the data was normal. Further, Z-test was done.

SAMPLE AND DATA COLLECTION

A sample of participants was selected to represent the broader population, with data collected through a structured questionnaire distributed via a google form. Respondents were asked to provide their responses regarding all the variables associated with the study.

Variables:

1. **Independent Variable**: "How likely do you use digital modes of payment?" was considered as the independent variable. It was categorized based on ***semantic scale*** responses, from "Very Likely" to "Very Unlikely."

   Dependent Variable: "How is the internet connectivity in India?" served as the dependent variable, categorized similarly on a ***semantic scale*** from "Poor" to "Excellent."

2. **Independent Variable**: "What is your place of residence?" was considered as the independent variable. It was categorized based on ***nominal scale*** responses, namely: Urban, Rural and Metropolitan.

   Dependent Variable: "What is the frequency of your orders (in a month) through E- commerce websites/ apps?" served as the dependent variable, categorized through an ***interval scale***: "Less than 10", "10-15 Orders" and "More than 15 Orders" (in a month).

3. **Independent Variable**: "What type of internet connection do you use at home?" was considered as the independent variable. It was categorized based on ***nominal scale*** responses, namely: Mobile data (3G, 4G, 5G) and Broadband (DSL, cable, fiber).

4. **Dependent Variable**: "How is the internet connectivity in India?" served as the dependent variable, categorized similarly on a ***semantic scale*** from "Poor" to "Excellent."

5. **Independent Variable**: "Place of Residence" is independent variable. It was categorized based on ***nominal scale*** responses, namely: Urban, Rural and Metropolitan.

6. **Dependent Variable**: "Have you issued any documents from DigiLocker?" is the dependent variable.

Hypothesis:

1. Null Hypothesis (H_0): There is no association between the likelihood of using digital modes of payment and the perceived quality of internet connectivity in India.

Alternative Hypothesis (H_1): There is an association between the likelihood of using digital modes of payment and the perceived quality of internet connectivity in India.

2. Null Hypothesis (H_0): There is no association between individuals' place of residence and frequency of orders through e-commerce platforms.

Alternative Hypothesis (H_1): There is an association between individuals' place of residence and frequency of orders through e-commerce platforms.

3. Null Hypothesis (H_0): Type of internet connection and the quality of internet connectivity are independent.

Alternative Hypothesis (H_1): Type of internet connection and the quality of internet connectivity are not independent.

4. **Null Hypothesis (H_0)**: The benefits of government initiatives have reached across all the demographics equally.

Alternative Hypothesis (H_1): The benefits of government initiatives have not reached across all the demographics equally.

DATA ANALYSIS

The chi-square test of independence was employed to determine whether there is a statistically significant association between the two categorical variables. This analysis assessed whether the observed frequencies in the contingency table significantly differed from what would be expected if there were no association between the variables. The results of the chi-square test were interpreted to determine whether the null hypothesis was rejected.

The Shapiro-Wilk' test was done to determine if the normality of the data. Null hypothesis is data is normal and alternate hypothesis is data is not normal. If the p-value is lower than alpha we reject null and accept the alternate hypothesis and proceed with non-parametric test if data is not normal. After concluding that the data is normal, we proceeded to perform T-test.

Significance Level:

A predetermined significance level (e.g., $\alpha = 0.05$) was chosen to determine the threshold for statistical significance.

Ethical Considerations:

Ethical guidelines for conducting surveys and research involving human participants were followed. Informed consent was obtained from participants, and data privacy and confidentiality were maintained. This research methodology allowed for the rigorous examination of the relationship between digital payment usage and internet connectivity perceptions in India, contributing valuable insights to the broader field of digital infrastructure and technology adoption.

SALIENT FINDINGS

Hypothesis test 1

Upon analyzing the responses of the questionnaire, we were able to create a hypothesis. The hypothesis will further help us to analyze the relation between the independent and dependent variable. The association between Internet connectivity (independent variable) and digital payments (dependent variable) has been summarized in *Table 1*. Using the chi-square test, the null hypothesis will be either accepted or rejected. When we ran the chi-square test between the variables it was found that the value of alpha is greater than p-value. This means that the null hypothesis will be rejected. We can see from *Table 2* that the p-value is 4.93154E-10 while level of significance i.e., alpha is 0.05. Thus, we conclude that internet connectivity and digital payments are dependent on each other.

Count of How is the internet connectivity in your area?	Column Labels					
Row Labels	1	2	3	4	5	Grand Total
1	3	2	1	1	3	10
2	1	7	10	2	2	22
3	2	9	13	7	3	34
4	5	3	8	10	6	32
5	1	2	4	7	38	52
Grand Total	12	23	36	27	52	150

Table 1

Chi-Square Test					
SUMMARY		Alpha	0.05		
Count	*Rows*	*Cols*	*df*		
131	4	4	9		
CHI-SQUARE					
	chi-sq	*p-value*	*x-crit*	*sig*	*Cramer V*
Pearson's	62.249	4.93154E-10	16.919	yes	0.39799
Max likelihc	64.9301	1.48861E-10	16.919	yes	0.40647

Table 2

Hypothesis Test 2

Upon analyzing the responses of the questionnaire, we were able to create a hypothesis. The hypothesis will further help us to analyze the relation between the independent and dependent variable. The association between place of residence (independent variable) and frequency of orders through e-commerce platforms (dependent variable) has been summarized in *table 3* . Using the chi-square test, the null hypothesis will be either accepted or rejected. As seen in *Table 4* that the p value is less than the significance level (i.e., 0.05), therefore we reject the null hypothesis and conclude that there is a significant association between the two variables. Place of residence and frequency of orders through e-commerce platforms are dependent variables.

Count of What is the frequency of your orders (Column Labels				
Row Labels	**10 - 15 orders**	**15 and more**	**Less than 10**	**Grand Total**
Metropolitan	8	19	4	31
Rural	7	2	55	64
Urban	35	10	10	55
Grand Total	**50**	**31**	**69**	**150**

Table 3

Chi Value	98.582
Degree of Freedom	4
p value of chi square distribution	1.9708E-20

Table 4

Hypothesis test 3

Upon analyzing the responses of the questionnaire, we were able to create a hypothesis. The hypothesis will further help us to analyze the relation between the independent and dependent variable. The association between type of internet connection (independent variable) and quality of internet connectivity (dependent variable) has been summarized in *Table 5*. Using the chi-square test, the null hypothesis will be either accepted or rejected. As seen in *Table 6*, the p value is more than the significance level (i.e., 0.05), therefore we fail to reject the null hypothesis and conclude that there is no significant association between the two variables. Type of internet connection and quality of internet connection are independent variables.

Count of How is the internet connectivity in your area?	Colum					
Row Labels	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Broadband (DSL, cable, fiber)	4	12	21	15	26	78
Mobile data (3G, 4G, 5G)	6	10	13	17	26	72
Grand Total	**10**	**22**	**34**	**32**	**52**	**150**

Table 5

Chi Value	2.3529
Degree of freedom	4
p value of Chi Square distribution	0.6711

Table 6

Hypothesis 4

When we ran the Shapiro-Wilk' Test for normality (Table 7) it was concluded that the data is normal. Further we did the T-test to determine if we should accept or reject the null hypothesis.

Shapiro-Wilk Test		
	Group 1	*Group 2*
W-stat	0.93557	0.93557
p-value	0.50984	0.50984
alpha	0.05	0.05
normal	yes	yes

Table 7

Count of Have you issued any documents through DigiLocker'	Column Labels		
Row Labels	**No**	**Yes**	**Grand Total**
Metropolitan	3	28	31
Rural	14	50	64
Urban	11	44	55
Grand Total	**28**	**122**	**150**
Variance	21.55555556	86	

Table 8

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	9.333333333	40.66666667
Variance	32.33333333	129.3333333
Observations	3	3
Hypothesized Mean Difference	0	
df	3	
t Stat	-4.26832013	
P(T<=t) one-tail	0.011799959	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.023599917	
t Critical two-tail	3.182446305	

Table 9

From the Table 9, we will reject the null hypothesis if t_{cal} is more than $t_{alpha/2}$. In this case the alpha becomes 0.025 and the t_{cal} is 0.011799. Thus, we accept the null hypothesis. Thus, we can say that the benefits of the government initiatives have been equally reaped by the different geographics.

POLICY RECOMMENDATIONS

The government should have its focus mainly on the following points.

1. Strategic Incentives - The government should increase the incentives given by it towards the usage of digital currency, at the same time reducing the costs associated with digital payments. India can also restrict the use of cash above a particular level - A policy being considered by the EU right now. The government can also follow Thailand's footsteps which had launched PromptPay, an e-payment service, which removed all the charges for online banking.

2. Data Security Measures - People are a bit apprehensive about security concerns related to digital payments such as fraudulent misuse of payment networks and data theft. Hence, to gain the confidence of citizens, cyber security protocols need to be strengthened for securing digital payments. The number of cyber-attacks has been on an increasing trend in the world as well as in India. India had witnessed about 9 million brute force attacks in 2021. These cyber-attacks and security breaches are a major hurdle in promoting digitalization in India as they make people reluctant to keep a lot of digital money. (Dr. Shilpa Bagdare, 2018)

3. Building a Proper Digital Infrastructure – There are still a lot of places in India where there is an absence of ATM facilities. There are only 13 commercial bank branches for every 100,000 people. Therefore, India should take measures towards increasing the number of banks and ATMs, especially in the rural areas. Another important requirement for the transition towards a digital economy is the penetration of smartphones and the internet. Now that money transactions can be done with the click of a button, the more people use smartphones, the more people will come under the purview of digital payments interface.

4. Increasing Financial Literacy – Given the low literacy rates in India, it becomes obvious that the financial literacy in the country would also be very low. The government should include courses related to financial literacy in the education system and make sure that the process of digital transactions is also taught to the students at yearly age.

DISCUSSION

According to research, digital payments offer significant advantages over traditional paper currency. They are available 24/7 and provide internet users with the convenience of making transactions without the need to wait in long lines or visit physical banks. The primary benefits of digital payment systems include time-saving and increased security, as they eliminate the need for exact change. This efficiency contributes to a seamless payment experience and avoids potential issues related to the exchange of small change. Research, often based on data from customers, businesses, and organizations, indicates that the ease of use, rewards, and speed associated with digital payments are key drivers behind their widespread adoption. Notably, in India, a substantial portion of the population transitioned to digital payments after the demonetization move, largely motivated by a shortage of paper currency and the time-saving aspect. The government's initiative to transform India into a cashless society has likely had positive effects. To further investigate this trend and its implications, researchers are exploring independent variables such as global influence, digital payment adoption rates, and the startup ecosystem.

CONCLUSION

The growth of digital payments in India has been nothing short of remarkable, revolutionizing the country's financial landscape and driving financial inclusion. This conclusion draws from a selection of key research papers and findings that underscore the significance and implications of this digital payment evolution.

Research by Reddy and Geetha (2018) highlighted the role of government initiatives, such as Digital India and Jan Dhan Yojana, in promoting digital payments. These programs have played a pivotal role in expanding financial access, especially in rural areas.

Furthermore, Chaturvedi and Chakravarty (2017) emphasized the impact of demonetization in 2016, which acted as a catalyst for the surge in digital payments, encouraging the adoption of various payment platforms like UPI, mobile wallets, and Aadhar-enabled payments.

Studies by Muralidharan et al. (2019) and Majumdar and Kapoor (2018) elucidated the effects of digital payments on financial inclusion and the reduction of the informal cash economy. These digital mechanisms have allowed previously excluded segments of the population to access financial services and participate in the formal economy.

Moreover, research by Gupta and Sharma (2020) highlighted the ongoing challenges, such as cybersecurity and digital literacy, that must be addressed to sustain the growth of digital payments securely and inclusively.

In conclusion, India's journey towards digital payments, as demonstrated by the above-mentioned research, has not only transformed the way financial transactions are conducted but has also paved the way for financial empowerment, economic growth, and greater financial inclusion. While challenges remain, the nation's progression in this domain serves as a model for other economies embarking on a similar transformative path. The continued synergy between technology, policy, and innovation will be instrumental in shaping the future of digital payments in India.

APPENDIX

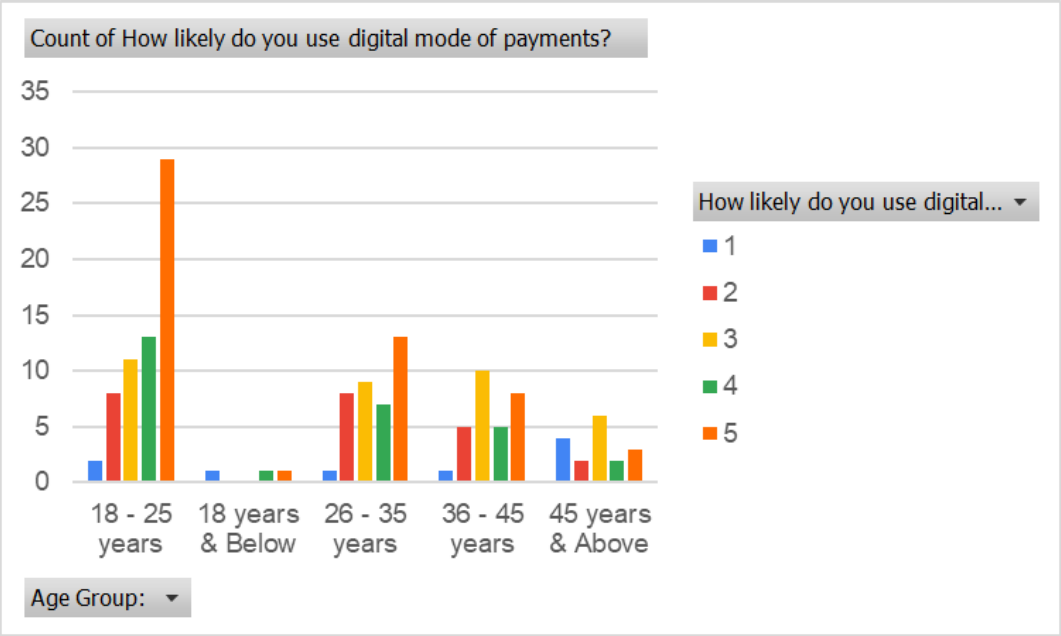

Table 3

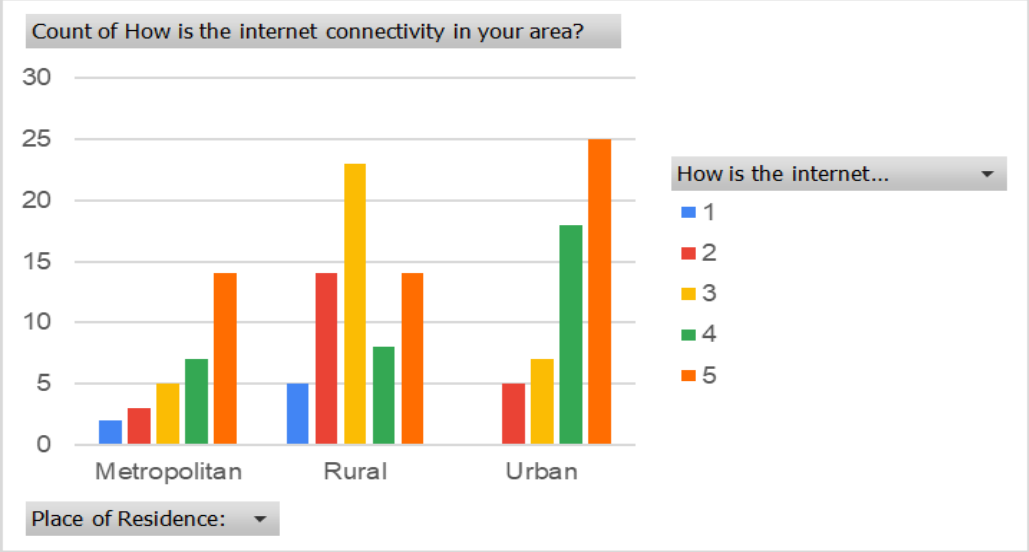

Table 4

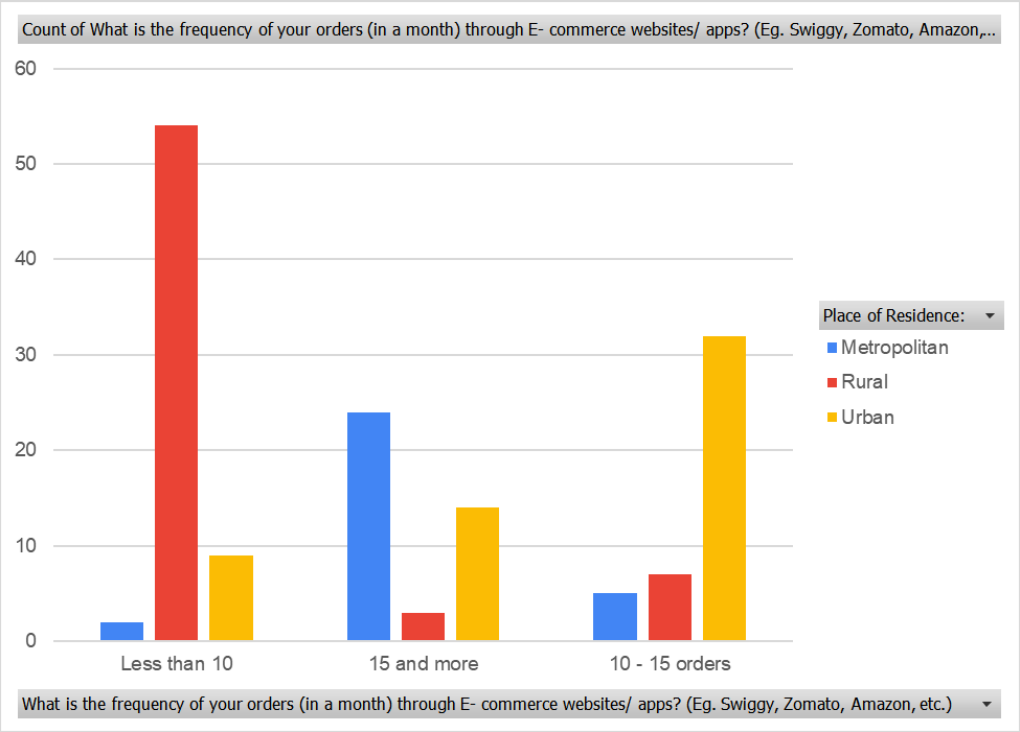

Table 5

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