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Barriers of digital transaction in rural areas: an interpretive structural modelling and MICMAC analysis

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Abstract: Digital transaction is the indispensable practice for all the household as well as commercial units in this era of digitalisation that is affected by pandemic too. Digital transaction stills a difficult task in the several rural areas. This study aims to identify the key barriers of digital transaction in rural areas and focus to explain the contextual interrelationship among these barriers. This study primarily focusing over the identification of key barriers of digital transactions in the rural areas from the extensive literature review. Secondly, it emphasises over the establishment of a hierarchical model using interpretive structural modelling (ISM). MICMAC analysis is further used to segregate these key barriers. Result revealed twelve key barriers of digital transactions in rural areas that further established a six-level hierarchical interpretive structural model. This paper provides the insights for the researchers, academicians, industry practitioners and policymakers to fill the theoretical and implication gaps.

Keywords: digital transaction; barriers; rural area; interpretive structural modelling; ISM; MICMAC analysis.

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Biographical notes: Ashulekha Gupta is a Professor and avid researcher in the diverse field of International Business, Economics and Marketing Management. She has more than 21 years of teaching, research and industry rich experience. She has numerous publications in national and international journals of repute and presented more than 30 papers in national and international conferences which includes Bangkok, Thailand and contributed five chapters in edited books. Her recent research interest in the area of environmental economics is published as a book chapter in edited book of Springer Nature, Singapore.

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1 Introduction

In the present regime of the digital economy across the globe, there is a phenomenal growth of internet users. There are 4,574,150,134 internet users as on 30 June 2020 throughout the world (Internet World Stats, 2020). Only Asia contributes about 49.8% of internet users as compared to the rest of the world. This phenomenal growth in internet usage and the penetration rate is about 51.9% of the percentage population. Nowadays mobile phones facilitate the growth of digital transactions and contribute to a cashless economy (Faqih and Jaradat, 2015; Feng et al.; 2006; Ahn, 2020.). There is a scarcity of literature focusing on the barriers of digital payments and move ahead towards a cashless economy. Srivastava (2008) highlighted the lack of literacy, unawareness, lack of resources, insecurity, etc. are the main barriers of online transactions in rural areas.

The number of telephone subscribers in India increased to 1,195.24 million at the end of Sep-19 giving an overall teledensity to 90.52 as on QE Sep-19 (TRAI), 2020. Further, rural telephone subscriptions increased to 517.29 million at the end of Sep-19 giving an effective rural teledensity of 57.59 at the end of Sep-19. The reports from TRAI (2014) indicate a considerable rise in rural teledensity as comparability to urban teledensity. In light of this current growth rate of 0.32% on quarterly basis, mobile banking can be influential to solve the problem of online banking in rural areas. Behl (2013) stated if mobile banking accessible by every person can change the image of financial exclusion in any economy.

Digital payment means transactions through electronic devices like mobile phones, wireless and communication devices, etc. using internet (Halaweh and Al Qaisi, 2016; Alkhowaiter, 2020). Even after so many obstacles, these latest technologies are acceptable (Palmquist, 2020; Mora-Monge et al., 2010).

Earlier various research aspects were conducted (Ho and Ko, 2008; Palacios and Jun, 2020; Pakhale and Pal, 2020.) on digital payment through various modes. This research paper focusing on the barriers to digital payments in rural areas using interpretive structural modelling (ISM) approach and to find out critical barriers for these digital payments.

Objectives of the present research study are as follows:

a to find out the key barriers of digital payment in rural areas

b to develop the contextual interrelationships among the barriers

c to determine the hierarchy among the barriers and to develop a framework.

The present study is categorised into four major sections. Section 1 is the introduction of the research problem which focused on digital payments in the Indian scenario. Section 2 discussed the various literature review studies which are conducted to find out barriers to digital payments. Section 3 comprises the research methodology adopted to conduct this study. Analysis and findings are well defined in Section 4. Sections 5, 6 and 7 mentioned conclusions, limitations, and future perspective of the present study. This paper aims to find out barriers and drivers of digital transactions in rural India.

2 Literature review

This section focuses on related studies of this research theme. After a meticulous study of the literature review (Slade et al., 2013) identified various barriers of digital payment. After identification of these barriers consult experts and discussed the barriers and finally taken 12 barriers in our study. These barriers are as follows:

- Resistance to learning digital payment (B1): Several people are not ready to switch in the new digital system. Believe in this system is complicated and restricted to their old conventional system (Kumar and Bose, 2016). As per Sivathanu (2019) before adoption of new technologies consumers show their resistance towards technologies.
- Additional charges (B2): Additional charges are the fee on the usage of the digital transaction as per Gerrard et al. (2006) those customers are using conventional banking services they are disinclined to use internet banking even after offerings due to additional fees. In the studies of Sathye (1999) explained a fact that undue expensive item is the most crucial motive of non-adoption of digital banking among the customers. Azad and Islam (1997) believe and mentioned in their studies that high charges of the online services provided by the banks pose a major obstacle for the adoption of internet banking. Further, Munusamy et al. (2012) mentioned that poor usage of internet banking is correlated with the connection fee. Howcroft et al. (2002) discovered a fact that acceptance of digital payment will increase if customers believe that extra charges paid by them are lesser as compared to the physical mode of transaction. As per Deepa and Lalitha (2020) additional charges effects on cashless transactions.
- Lack of smartphones (B3): Clear display and presentation of data are one of the important aspects of digital payments. High tech and user-friendly phones promote customers for digital banking due to clear display and high resolution (Carlsson and Walden, 2002). Lack of availability of smartphones also played a significant role during online banking, leading to less adoption of digital transactions as users face issues like less storage capacity in the mobile phones, slow internet speed during the transaction (Furnell and Karweni, 1999). Improving some obstacles and critical operational parameters by the manufactures would lead to increase usage of online banking practices by the customers (Vrechopoulos et al., 2002). Palmquist (2020) studies focus on digital transaction depends on lack of smartphones.
- Ineffective redressal mechanism (B4): Any poor experience with digital transactions would conduct demolition of the consumer faith in a digital payment system and create an obstacle in the process of acceptance of electronic payment (Pramod and

Banwet, 2014). This poor experience and grievance redressal mechanism always discourage customers to adopt digital payments (Shiyas, 2020).

- Low literacy rate (B5): It has been observed that lack of knowledge is a crucial obstacle in the digital transaction process according to Qureshi et al. (2014). Due to illiteracy, i.e., how to use online transactions for information users does not feel comfortable using online mode (McKinsey & Company, 2014). Obeida and Saxena (2015) present in their studies lack of compatibility with smartphones and the internet is also one of the reasons for less acceptance of digital transactions. As per the studies of Ouedraogo and Sy (2020) literacy rate plays an important role in the digital transaction adoption.
- Lack of awareness (B6): Lack of online payment information is very important because in a country like India 70% population is residing in a rural area, so they are not using such a convenient mode of a payment system (Ramavhona and Mokwena, 2016). According to Gerrard et al. (2006) findings awareness about online payment services plays a crucial role in the adoption. Salehi and Alipour (2010) in their research work put the views that the online payment services are available but not comfortable for using online payment services. Sathye (1999) also found non-awareness of the online payment system is an obstacle in the adoption of digital services.
- Non-supportive environment for cashless payment (B7): According to Sattar and Rahaman (2013), not enough controlling supports work as an obstacle to online payment transactions. The digital payment system is also influenced by a lack of support in the country. Azad and Islam (1997) also found rules and regulations designed by the government not supportive of the customers, so it acts as an obstacle. Cross-country regulatory check varies a lot could be a barrier for a digital payment system (Suh and Han, 2003).
- Transaction security issues (B8): Customer is more concern about security about personal information and money being sent across the internet browser (Blakesley and Yallop, 2019). Problems come across due to less security during the digital transaction it is reflected in the studies of Compeau and Higgins (1995). As per Shen et al. (2010) even after the great advantage of digital transaction customers are relatively concern for transaction and security.
- Instability of mobile network (B9): The research outcomes by Anckar and Walden (2003) disclose this there is a speed and network coverage act as a barrier. As per Mallat (2007) studies discussed that customers and merchant's acceptability of payments by online or digital mode is purely dependent on their respective network stability.
- Low digital payment (B10): India is becoming a favourite destination for the global investment giants but despite that, the country faces challenges in creating a sustainable environment for making India digital. As per Ligon et al. (2019) digital payment growth is uncertain (Loh et al., 2020) in some developing countries and particularly in India despite lots of substantial hard work to encourage the implementation of digital payment by the government.

- Government low regulations (B11): As per RBI (2009) guidelines digital banking permit only the licensed banks as well as physical existence in India to offer online payment services on the purchase of goods and services. So, government policies (Camilleri, 2019) can regulate the risk-bearing of customers and policy in favour of improvement of financial inclusion (Novachenko et al., 2020; Paul et al., 2020).
- Lack of IT infrastructure (B12): Sattar and Rahaman's (2013) studies reflect for the promotion of digitisation, good fastest data connectivity, good communication infrastructure, and best quality-service plays influential importance for the overall growth of any locality. In India, the lack of infrastructure gap is huge, and to streamline this needs a lot of funding. The mobile service providers have apprehension for the poor adoption of services by consumers and they turned to focus urban customers (Pakhale and Pal, 2020).

Table 1 Key barriers and their sources from various literature review

Barriers	*Barriers*	*Sources*
B1	Resistance to learn digital payment	Kumar and Bose (2016), Laukkanen and Cruz (2008), Kumar and Purbey (2018), Kuisma et al. (2007), Sivathanu (2019)
B2	Additional charges	Azad and Islam (1997), Gerrard et al. (2006), Munusamy et al. (2012), Howcroft et al. (2002), Deepa and Lalitha (2020)
B3	Lack of smartphones	Anckar and Walden (2003), Mahatanankoon and Vila-Ruiz (2007), Lee and Benbasat (2003), Venkatesh et al. (2003), Feng et al. (2006), Carlsson and Walden (2002), Palmquist (2020)
B4	Ineffective redressal mechanism	Pramod and Banwet (2014), Verma (2017), Shiyas (2020)
B5	Low literacy rate	Singh (1970), Ouedraogo and Sy (2020)
B6	Lack of awareness	Basu (2016), Digital India (2016)
B7	Non-supportive environment for cashless payment	Azad and Islam (1997), Thulani et al. (1970), Suh and Han (2003)
B8	Transaction security issues	Shen et al. (2010), Compeau and Higgins (1995)
B9	Instability of mobile network	Anckar and Walden (2003), Wen and Mahatanankoon (2004), Lee and Benbasat (2003), Laukkanen and Cruz (2008), Ketkar et al. (2012), Ho and Ko (2008)
B10	Low digital payment	Ligon et al. (2019)
B11	Government low regulations	Rotchanakitumnuai and Speece (2003), RBI (2009), Ahn (2020), Novachenko et al. (2020)
B12	Lack of IT infrastructure	Kuisma et al. (2007), Digital India (2016), Sattar and Rahamn (2013), Pakhale and Pal (2020)

Figure 1 Flow diagram for preparing ISM

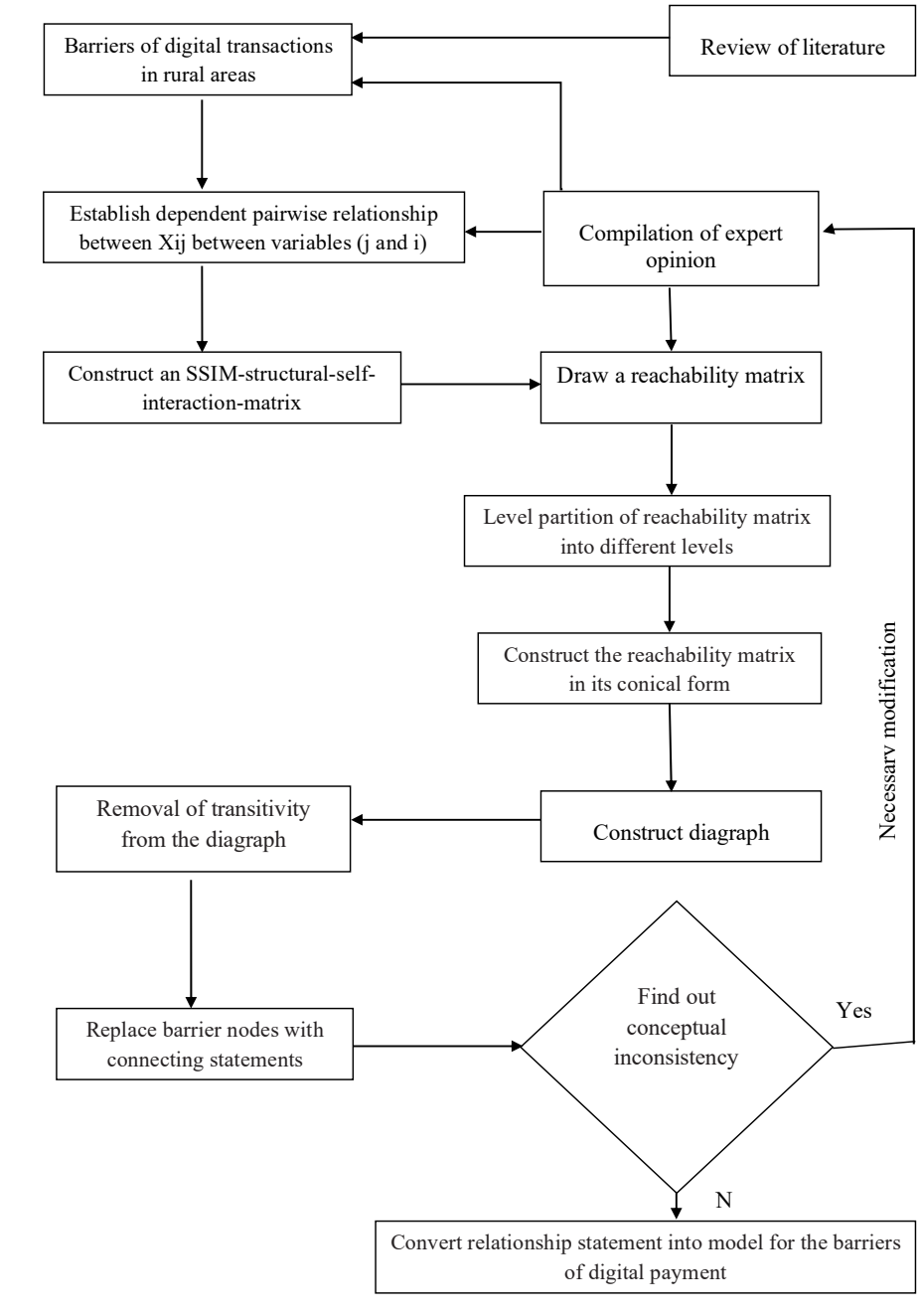


Table 2 Structural self-interaction matrix

	Barriers to digital transactions in rural areas	*Lack of IT infrastructure in hilly areas*	*Govt. low regulations*	*Low digital payment*	*Instability of mobile network*	*Transaction security issues*	*Non-supportive environment for cashless payment*	*Lack of awareness*	*Low literacy rate*	*Ineffective redressal mechanism*	*Lack of smartphones*	*Additional charges*
1	Resistance to learn digital payment	A	A	V	A	A	X	A	A	A	A	A
2	Additional charges	O	O	V	A	X	V	V	V	X	A	
3	Lack of smartphones	X	A	V	X	V	V	V	V	V		
4	Ineffective redressal mechanism	A	A	O	A	X	O	V	V			
5	Low literacy rate	O	A	V	A	A	V	X				
6	Lack of awareness	A	A	O	O	A	V					
7	Non-supportive environment for cashless payment	A	O	V	A	A						
8	Transaction security issues	A	A	V	A							
9	Instability of mobile network	X	A	V								
10	Low digital payment	A	A									
11	Govt. low regulations	V										

3 Research methodology

The research objectives indicate the implementation of a research technique or tool that provides a profound insight of a complex problem by digging the contextual interrelationships among the barriers by developing a hierarchical framework. There are many other useful techniques that may provide a hierarchical paradigm based on ranking, but they are unable to enlighten the contextual interrelationships. That is why to accomplish the research objectives of this study, ISM has been applied. The ISM technique was developed by Warfield (1978), for solving complex issues and identifies association among the definite items. This technique is used in various areas to solve complex issues (Sindhwani and Malhotra, 2017, 2018; Sindhwani et al., 2019; Raut et al., 2018, 2019). The list of barriers for digital payment is identified based on the literature review and discussed with a panel of experts to correlate this study and relevance in the current scenario. After a brainstorming session with all experts established an interrelationship among the barriers. This paper applies an ISM approach, it is a method which categorises relationship amid the quantified items (Attri et al., 2013, 2020). The sequential movement diagram of the ISM technique as represented in Figure 1. This flow diagram shown in the figure represents a synchronised accomplished procedure for this technique.

- Interpretative structural modelling: This ISM technique (Ahuja et al., 2009; Diabat et al., 2013; Bamel and Dhir, 2019; Ajmera and Jain, 2019; Liu et al., 2020; Bux et al., 2020) helps to classify affiliation among the specified variables and is originally given by Warfield (1974). This method focuses on ill-defined models to fine clearly explained models. As per Mishra et al. (2012) ISM model helps to give direction and rank on the difficulty of a relationship amongst the variables (Warfield, 1974). ISM was used to identify the inter relationship between the criteria. Inter-relationship of criteria obtained from ISM will serve as an input for analytic network process (ANP). A few features of the ISM method include incorporating the subjective judgments and the knowledge base of experts systematically, provide ample opportunity for revision of judgments, and computational efforts involved are far less for criteria ranging from 10 to 15 numbers as well as used as a handy tool for real-life applications. The ISM model comprises a set of interrelated relationships and establishes the leads to the relationship among the variables and pick-up the real-life problems and higher ability for established dynamic difficulty (Warfield, 1974; Thakkar et al., 2006; Sage, 1977).

The various steps involved in the ISM technique (Verma and Singh, 2018; Shukla et al., 2018; Kumar and Purbey, 2018; Tooranloo and Shahamabad, 2020; Singh and Gupta, 2020; Singh et al., 2020; Kadam and Bandyopadhyay, 2020) for the barriers influencing the digital transactions are as per sequence:

a the sequence of the barriers influencing the digital transaction through extensive study of literature review and discussion method used to recognise these barriers

b establishment of a suitable relationship among the barriers

c development of structural self-interaction matrix (SSIM) from the barriers and data collection

d develop initial reachability matrix (IRM)

e after checking transitivity develop final reachability matrix (FRM)

f level partition is done to find out the hierarchy of each barrier

g the conical matrix is developed from the level partitioned reachability matrix by clubbing barriers as per the positioning

h conversion of digraph proceeds to the interpretive structural model (ISM)

i development of four-quadrant driving and dependence power diagram – MICMAC analysis

j finally result, discussion, and conclusion for the ISM of barriers affecting the digital transaction.

3.1 Questionnaire development

To identify the barriers affecting the digital transaction in rural areas insights have been taken from the literature. Further, a thinking session was conducted with 12 expert academicians and practitioners with involvement more than ten years in their fields. After these identified barriers were discussed with the expert panel to study the relevance of these barriers. After taking experts' opinions finally 12 barriers were finalised out of the 17 that affect the digital transaction in rural areas. Then experts in their field were inquired to establish the association among the 12 barriers by using the criteria 'leads to' after developing a questionnaire. As mentioned, these most significant 12 barriers in Table 2.

- SSIM: Experts responded to the initial questionnaire as per the above options. Finally, the responses have been converted to a single response sheet i.e., SSIM by considering the response for each cell with majority. After rigors exercise conducted with the help of experts to develop a contextual relationship between the barriers a 'leads to a' relationship between two barriers (i and j). It means one barrier influence on another barrier. To establish a relationship between two barriers these symbols are used as follows-

  1 'V' = I barrier dominating to j 'barrier i leads to barrier j'.

  2 'A' = j barrier dominating to i 'barrier j leads to barrier i'.

  3 'X' = Influencing to each other 'barrier i and barrier j both leads to each other'.

  4 'O' = No influence 'barrier i and barrier j are unrelated to each other'.

  The above said barriers hindering the digital transactions in rural areas are shown in the SSIM Table 3. The matrix displays the connection between barrier i and j.

- Creation of IRM: IRM denotes the dual procedure (0, 1) of all the entries in the compartments of SSIM (Warfield, 1973). An IRM is built on SSIM established by adapting the SSIM into the dual procedure (1 and 0) for each compartment, showing the connection between barrier i and barrier j discovered in Table 4. A systematic process could be adopted to change the entrants of SSIM convert into binary form, Rules as follows:

Rule 1 Value place in the compartment (i, j) is V, reflects (i, j) compartment reading as 1 but (j, i) compartment reading 0 in the IRM.

Rule 2 Value place in the compartment (i, j) is A reflects (i, j) compartment becomes 0 and (j, i) compartment reading 1 in the IRM.

Rule 3 Value place in the compartment (i, j) is X reflects, (i, j), and (j, i) compartments both reading 1 in the IRM.

Rule 4 Value place in the compartment (i, j) is O reflects, (i, j), and (j, i) compartments both reading 0 in the IRM.

Table 3 Initial reachability matrix

Barriers	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*	*B8*	*B9*	*B10*	*B11*	*B12*
B1	1	0	0	0	0	0	1	0	0	1	0	0
B2	1	1	0	1	1	1	1	1	0	1	0	0
B3	1	1	1	1	1	1	1	1	1	1	0	1
B4	1	1	0	1	1	1	0	1	0	0	0	0
B5	1	0	0	0	1	1	1	0	0	1	0	0
B6	1	0	0	0	1	1	1	0	0	0	0	0
B7	1	0	0	0	0	0	1	0	0	1	0	0
B8	1	1	0	1	1	1	1	1	0	1	0	0
B9	1	1	1	1	1	0	1	1	1	1	0	1
B10	0	0	0	0	0	0	0	0	0	1	0	0
B11	1	0	1	1	1	1	0	1	1	1	1	1
B12	1	0	1	1	0	1	1	1	1	1	0	1

Table 4 Final reachability matrix

Barriers	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*	*B8*	*B9*	*B10*	*B11*	*B12*
B1	1	0	0	0	0	0	1	0	0	1	0	0
B2	1	1	0	1	1	1	1	1	0	1	0	0
B3	1	1	1	1	1	1	1	1	1	1	0	1
B4	1	1	0	1	1	1	1*	1	0	1*	0	0
B5	1	0	0	0	1	1	1	0	0	1	0	0
B6	1	0	0	0	1	1	1	0	0	1*	0	0
B7	1	0	0	0	0	0	1	0	0	1	0	0
B8	1	1	0	1	1	1	1	1	0	1	0	0
B9	1	1	1	1	1	1*	1	1	1	1	0	1
B10	0	0	0	0	0	0	0	0	0	1	0	0
B11	1	1	1	1	1	1	1	1	1	1	1	1
B12	1	1*	1	1	1*	1	1	1	1	1	0	1

Table 5 Barrier level iterations (I-VI)

Barriers	*Reachability set*	*Antecedent set*	*Intersection set*	*Level*
Iteration 1				
B1	1, 7, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	1, 7	
B2	1, 2, 4, 5, 6, 7, 8, 10	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12	3, 9, 11, 12	3, 9, 12	
B4	1, 2, 4, 5, 6, 7, 8, 10	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B5	1, 5, 6, 7, 10	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6	
B6	1, 5, 6, 7, 10	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6,	
B7	1, 7, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	1, 7	
B8	1, 2, 4, 5, 6, 7, 8, 10	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12	3, 9, 11, 12	3, 9, 12	
B10	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	10	I
B11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	11	11	
B12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12	3, 9, 11, 12	3, 9, 12	
Iteration II				
B1	1, 7	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	1, 7	II
B2	1, 2, 4, 5, 6, 7, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B3	1, 2, 3, 4, 5, 6, 7, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B4	1, 2, 4, 5, 6, 7, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B5	1, 5, 6, 7	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6	
B6	1, 5, 6, 7	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6,	
B7	1, 7	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	1, 7	II
B8	1, 2, 4, 5, 6, 7, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B9	1, 2, 3, 4, 5, 6, 7, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B11	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	11	11	
B12	1, 2, 3, 4, 5, 6, 7, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
Iteration III				
B2	2, 4, 5, 6, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B3	2, 3, 4, 5, 6, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B4	2, 4, 5, 6, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B5	5, 6	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6	III
B6	5, 6	2, 3, 4, 5, 6, 8, 9, 11, 12	5, 6,	III
B8	2, 4, 5, 6, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	
B9	2, 3, 4, 5, 6, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B11	2, 3, 4, 5, 6, 8, 9, 11, 12	11	11	
B12	2, 3, 4, 5, 6, 8, 9, 12	3, 9, 11, 12	3, 9, 12	

Table 5 Barrier level iterations (I-VI) (continued)

Barriers	*Reachability set*	*Antecedent set*	*Intersection set*	*Level*
Iteration IV				
B2	2, 4, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	IV
B3	2, 3, 4, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B4	2, 4, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	IV
B8	2, 4, 8	2, 3, 4, 8, 9, 11, 12	2, 4, 8	IV
B9	2, 3, 4, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
B11	2, 3, 4, 8, 9, 11, 12	11	11	
B12	2, 3, 4, 8, 9, 12	3, 9, 11, 12	3, 9, 12	
Iteration V				
B3	3, 9, 12	3, 9, 11, 12	3, 9, 12	V
B9	3, 9, 12	3, 9, 11, 12	3, 9, 12	V
B11	3, 9, 11, 12	11	11	
B12	3, 9, 12	3, 9, 11, 12	3, 9, 12	V
Iteration VI				
B11	3, 9, 11, 12	11	11	VI

- Development of FRM: IRM transformed into FRM which familiarising the transitivity concept. As demonstrated if A is leading to B and B is leading to C then A must also lead C. Further, the readings of the compartment (i, j) for A and C will be 1* to reflect the transitivity and to reflect the final relationship between A and C. This FRM reflects the concluding pull out connection between barrier i and barrier j by using dual digits 0 and 1 (Table 5).
- Reachability matrix partition: After finishing this FRM now in the next step prepare partition to find out various levels of barriers. To obtain this reachability set, an antecedent set is collected from the FRM. The intersection set is also developed by taking the common barriers from reachability and antecedent set for each barrier. After the fifth iteration, VI levels are achieved to find out hierarchical structure and will be used for digraph and interpretative structural model (ISM) in this present study.
- Conical form of FRM: Table 6 shows the levels of barriers. FRM is transformed into a conical-form after banging up the barriers at an equal level and can be evaluated easily also interrelationships can be checked. This conical form reflects driving-power and dependence-power for each barrier affecting digital transactions in rural areas, which is next to allocate dependence power and driving power diagram.

Table 6 Conical form of identified barriers

Barriers	*B10*	*B7*	*B1*	*B6*	*B5*	*B4*	*B8*	*B2*	*B9*	*B12*	*B3*	*B11*	*Driving power*
B10	1	0	0	0	0	0	0	0	0	0	0	0	1
B7	1	1	1	0	0	0	0	0	0	0	0	0	3
B1	1	1	1	0	0	0	0	0	0	0	0	0	3
B6	1	1	1	1*	1	0	0	0	0	0	0	0	5
B5	1	1	1	1	1	0	0	0	0	0	0	0	5
B4	1*	1*	1	1	1	1	1	1	0	0	0	0	8
B8	1	1	1	1	1	1	1	1	0	0	0	0	8
B2	1	1	1	1	1	1	1	1	0	0	0	0	8
B9	1	1	1	1*	1	1	1	1	1	1	1	0	11
B12	1	1	1	1	1*	1	1	1*	1	1	1	0	11
B3	1	1	1	1	1	1	1	1	1	1	1	0	11
B11	1	1	1	1	1	1	1	1	1	1	1	1	12
Dependence power	12	11	11	9	9	7	7	7	4	4	4	1	

- Diagraph development: The reachability matrix based on conical form as shown in the digraph figure shows transitivity links, generated through lines and lumps of the boundaries. An arrow connecting one barrier to another barrier reflects the relationship between the two barriers. Likewise, barrier j acts on barrier i an arrow will be directed from j barrier to i barrier. Through this relationship process, a complete diagram is achieved. Finally, a digraph (Figure 2) comes out by this interaction. The barriers found in the preliminary iteration level are pushing up at the top of the diagram and the next iteration one will be putting up at the next to base level and so on until the last iteration level is putting up at the base of the digraph.
- Construction of the ISM model: The obtained digraph is transformed into ISM-based model which reflects the linkages, dependencies, and interdependencies among various barriers at six levels. It shows low regulations are the most crucial barrier in digital transactions appearing at the lowest position in the hierarchy of ISM. A non-supportive environment for cashless payment, the dominance of cash, resistance to learn digital payment, and fear of being cheated placed at the topmost position which shows very small influencing barriers in the total process.
- MICMAC analysis: Matriced impacts croises multiplication applique classment MICMAC (cross impact matrix multiplication applied to classification MICMAC) is applied to know multiplication properties of matrices to analyse the dependencies among the barriers, Faisal et al. (2006). All the barriers are clustered into four quadrants in MICMAC analysis (Figure 4).
- Autonomous barriers: Autonomous barriers are identified by weak-driving-power and weak-dependence-powers and come in the first quadrant and are known as autonomous barriers. They are comparatively separated from the system may or may not be linkages with other barriers.

Figure 2 Diagraph – barriers of digital payment

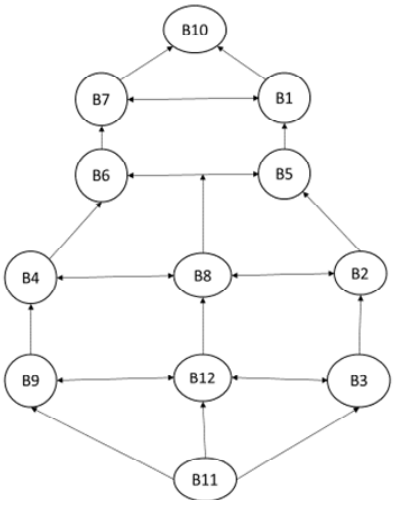
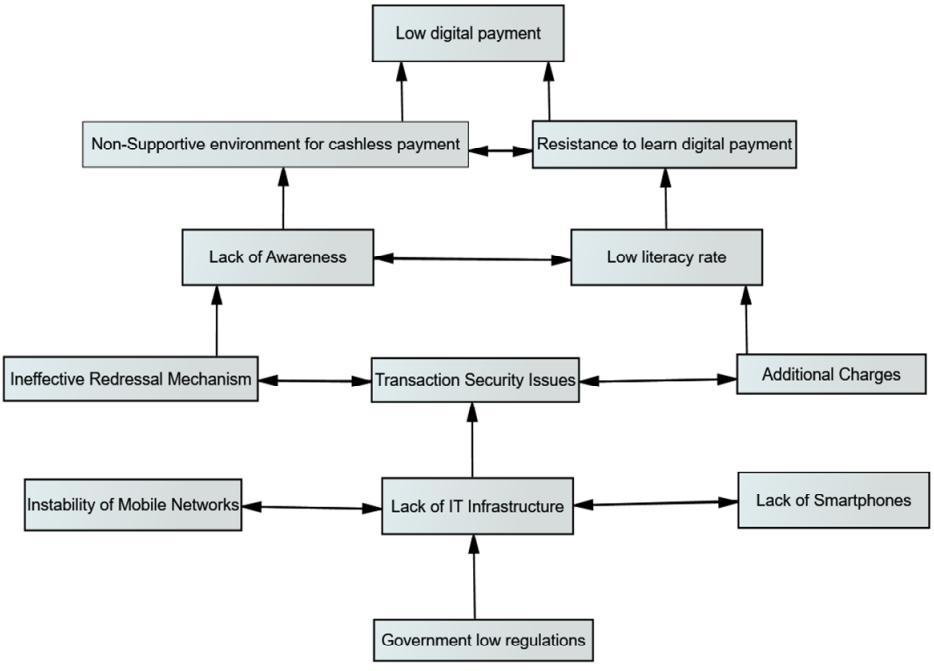


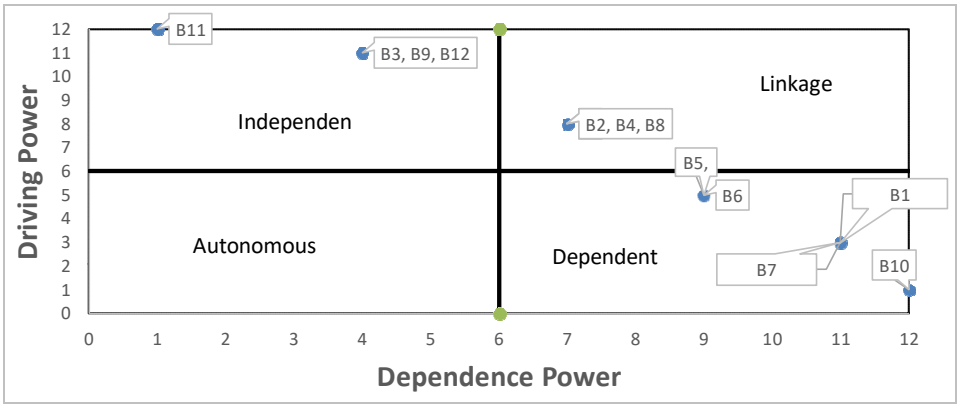
Figure 3 Barriers of digital payment by ISM model approach



- Dependent barriers: This is the second quadrant taking strong-dependence-power and weak-driving-power so barriers act as a dependent barrier in the system.
- Linkage barriers: This is the third quadrant and having strong-dependence-power and strong-driving-power and turn as linkages between two barriers. Any action on them will affect others and revert effect also.

- Independent barriers: In the fourth quadrant variables having weak dependence and strong driving power.

Figure 4 Driving power and dependence power (see online version for colours)



4 Result and discussion

The present study shows the barriers which are critical and poses challenges to curb for the policymakers of the Indian digital payment sectors and government. The government should also keep consideration for better implementation of digital payment and its adoption by society. Encouragement for online payments, digital transactions by the Government will increase the cashless economy and curb the flow of black money, and other corruption laying in the parallel economy. Through this initiative, payment can be transferred at a rapid pace in a fraction of seconds in intercity, across the state, and intercountry without many efforts. This will put a check on long queues and chaos outside payment windows across the country besides, enjoying the convenience of sitting at home and without disturbing office routine.

This study provides all the most important barricades in digital transactions, especially in the Indian scenario. Based on the literature review, in the beginning, 18 barriers were recognised but after a brainstorming session with the experts, these barriers were reduced to 12 barriers.

The digraph reflects at level VI government low regulations (B11) have the highest driving power. Further at level V includes three barriers instability of mobile network (B9), lack of IT infrastructure (B12), and lack of smartphones (B3), all three barriers influence each other at the same level. Level IV contains three factors ineffective redressal mechanism (B4), transaction security issues (B8), and additional charges (B2). At the same level, all three barriers influence each other. Level III includes two barriers lack of awareness (B6) and low literacy rate (B5) influencing each other at this level. Level II comprising two barriers known as resistance to learning digital payment (B1) and a non-supportive environment for cashless (B7). At level, I on the other side low digital payment have high dependence power which depends on other barriers. Further to analyse driving power and dependence power of the barriers. The barriers are classified into four clusters through MICMAC analysis (Figure 4).

Figure 4 reflects in cluster IV includes the barriers (B1), (B4), (B3), (B7), (B11), and (B12) have strong driving power. Resistance to learning digital payment (B1), ineffective redressal mechanism (B4), non-supportive environment for cashless (B7), government low regulations (B11), and lack of IT infrastructure (B12) are an independent barrier having high driving power. We can say these five barriers are leading to other barriers affecting the digital payments.

Cluster III correspondingly, shows barriers (B2), (B5) and (B6) identified as linkages. Linkage barriers are reflected only which creates linkages between independent and dependent barriers. These barriers comprise strong driving-power and dependence-power. Additional charges (B2), low literacy rate (B5), and lack of awareness (B6) are reflecting the characteristics of this cluster.

Weak barriers include (B8), (B9), and (B10) however they depend upon other barriers. Transaction security issues (B8), instability of mobile network (B9), and low digital payment (B10) are four barriers fall under the cluster II that shows dependent barriers. The above four barriers have shown dependence power with low driving power.

In cluster I barriers are found weak drivers and weak dependent. These barriers are known as autonomous barriers and no straight impact on other barriers. Out of 12 barriers, not a single barrier is falls in this cluster.

5 Implications

Theoretical implications: This study contributes significantly to the field of research and academics by filling the gap. Researchers and academician may utilise the comprehensive knowledge given this study about the barriers obstructing the digital transactions in rural areas. Researchers may take these insights to strengthen their future research studies to develop better theories and concepts.

Practical implications: The insights may be used by the industry practitioners and policy makers to understand the barriers hindering the facilitation of digital transactions across rural areas. They may strategies some exclusive action plans to eradicate these barriers and enabling the rural areas to fit for the digital transactions. The policymaker may focus on resistance to learn digital payment (B1), Ineffective redressal mechanism (B4), non-supportive environment for cashless (B7), government low regulations (B11), and lack of IT infrastructure (B12) because they are the root cause and can grasp robust attention on behalf of digital transaction adoption effectively and efficiently. Further, the government may take initiatives or pay more attention to nullify these barriers for better implementation of digitalisation in the economy.

6 Limitations and future scope

The proposed ISM model was not validated statistically. The quantitative analysis and confirmation of the results through any statistical tool or technique may deliver robustness to this study. This model can be further confirmed by using structural equation modelling (SEM) approach. The fuzzy analytic network or analytic hierarchy process can also be applied for analysis. However, in the present study, ISM and MICMAC approach was applied for analysis. The ISM model represents the only hierarchy of the variables but ignores the association of weights with every variable as per Kannan et al. (2008).

These weights could be assigned by ANP (Saaty, 2001). Moreover, this study was conducted for a specific geographical territory and identified barriers as per that only. It may be further extended to other areas and some more barriers may be added to get a deeper knowledge in different economic setup.

7 Conclusions

Digital payments are the most important process and biggest challenge to the government to achieve a dream of a digital economy campaign in the current scenario. In the modern system, digital payment is beneficial to both governments as well as customers. The paper suggests a valuable framework for implementing the digitisation across India by overcoming the barriers hindering the digital transactions in rural areas specifically. The originality of this paper is that an entire set of barriers recognised and considered based on vast and extensive literature available. This study concluded a hierarchical framework for the identified 12 barriers of digital transactions in rural areas. The useful insights of this study may create a deeper understanding of these barriers. This will strengthen and enable us to realise the dream of attaining the objective of Digital India and laying emphasis on promoting the online transactions, saving time, curb black money and corruption in the economy.

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