

Prioritising sustainability factors for public-private partnership (PPP)-based mature telecentres using the 'Akshaya' project as a case

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Abstract

Telecentres are considered an essential information and communication technology (ICT) platform to deliver e-government services and play a vital role in reducing the digital divide, thereby enhancing access to e-government services. This study aimed to identify the factors that financially sustain a PPP-based mature telecentre and explore the hierarchy among these factors. An in-depth review of existing literature was conducted to identify sustainability factors. These factors were subjected to further validation through a qualitative field study. Then, interpretive structural modelling (ISM) was used to understand the interrelationships and identify the hierarchy between the identified factors. Finally, the decision-making trial and evaluation laboratory (DEMATEL) was used to validate the developed hierarchical model. The results indicated that in order of their hierarchy, 'centre resources', 'affordability', 'quality of services', 'quality of operators', and 'convenience' were the influential factors that sustained a mature telecentre. The critical role of village-level entrepreneurs and the importance of integration between public and private entities at each stage of the hierarchy were emphasised. This paper presents theoretical and practical implications for stakeholders to adopt appropriate measures to sustain telecentres.

Keywords: ICT, Telecentre adoption, ISM, e-Governance.

1 Introduction

Technological innovation and using it as a tool for human development have been the focus of discussion among academics, practitioners, and policymakers (Rhodes, 2004). Information and communication technology (ICT) can play an important role in development. e-Government is a term that refers to the application of ICT for conducting governance functions through interactions between government and its citizens for efficient delivery of services (Iyer & Rao, 2017; Joshi, 2018). As an ICT application, telecentres are crucial for governance reform required for the development of communities (Madon, 2005). Telecentres have become an important ICT platform for e-government service delivery (Kiran, 2014).

Telecentres aim to support development among the underprivileged population (Furuholt & Sæbø, 2018). Telecentres serve as single facilitation points for delivering government and business services for rural people. Moreover, they act as multipurpose community centres serving as communication hubs that provide various services. They have a complex, interrelated structure based on the involvement of multiple stakeholders, such as government, citizens, private sector, development organisations, other public organisations, and even

village-level entrepreneurs (VLEs) at the micro-level. The VLEs invest, maintain, and operate the telecentres (Mishra, 2018) and are intermediaries between technology and citizens.

Mobile government (m-government) is being tractioned because of mobile penetration in urban and rural areas. In volume terms in 2018, India was the second-largest smartphone market, with a growth rate of nearly 15% (India Cellular and Electronics Association, 2020). Several factors, such as reduced smartphone prices, affordable mobile data, increase in rural users, rise in vernacular accessibility, and government impetus, including internet banking for payment of bills and managing the Aadhar card (unique identification card issued by the Indian government) by using the mobile application (Aledhari, Aneja, Bashir, Bennett, Bielby, Hicks, Johnson, Mandal, Mantri, Nighot & Wack, 2018; Motiani, 2019), may increase the use of certain m-government services. Moreover, telecentres may become extinct in India because of m-government (Sharma & Ray, 2019).

However, many innovative mobile-based applications in government domains remain in their early stages (Jauhari & Maheshwari, 2014). m-Government should not be viewed as a replacement for e-government but is expected to be used to explore avenues for e-Government integration (Hellström, 2008). Telecentres remain the optimum platform for delivering e-government services in countries, such as India, where factors, including limited Internet access, technology skills, and literacy rate, majorly hinder the progress of m-government. The Government of India data state that in the financial year 2019–2020, the operational telecentres (also referred to as Common Service Centres (CSCs)) increased to 360,873 against 345,246 operational telecentres at the close of the financial year 2018–19¹.

2 Public–Private Partnership (PPP)

Public–private partnership has received considerable interest as cooperative institutional mechanisms between the public and private sectors in areas such as public services and infrastructure. The PPP approach provides an opportunity to overcome the problems of complex policies and public services because of joint development and risk sharing between partners (Wang, Xiong, Wu & Zhu, 2018). In addition, given the opportunities of innovation, efficiency, and finance (Bayliss & Van Waeyenberge, 2018), both the developed and developing economies use PPP as an alternative solution in project design and implementation.

In the literature, PPP has not been defined consistently by practitioners and researchers (Cuttaree & Mandri-Perrott, 2011). World Bank defines PPP as a ‘contractual agreement between a private party and a government agency, for providing a public asset or service, in which the private party bears significant risk and management responsibility’².

In a wider view, Organisation for Economic Co-operation and Development (OECD) (2012), defines PPP as ‘long-term contractual arrangements between the government and a private partner whereby the latter delivers and funds public services using a capital asset, sharing the associated risks’, while emphasising the role of private partners. Similarly, Garvin and Bosso

¹ CSC Annual Report, 2019–20, available on <https://csc.gov.in/assets/events-report/Annual-Report-2019-20.pdf>, accessed on 20/12/2021

² Accessed from <https://ppp.worldbank.org/public-private-partnership/overview/what-are-public-private-partnerships>, accessed on 20/04/2021

(2008) highlight the management, operations, and financial risk aspects of the private party in this long-term agreement primarily set up for mutual benefits.

Despite these differences, the following common elements are present in all the definitions (Hodge & Greve, 2017): a formal partnership contract; objective to meet government's economic or social requirements; substantial risks and management responsibilities of the private entity; remuneration to private entities based on output; and varied forms of undertakings and rewards.

The form of PPPs changes with the nature and duration of the project, purpose, and desired outcomes, and the level of investment involved. To simplify the resulting structures, Cruz and Marques (2013) classify them into two parameters: (a) the stage of the partnership, that is, design, build, and maintenance and (b) ownership of asset, that is, public ownership, lease, rent, and divestiture. For instance, in some popular PPP forms, such as build-own-operate (BOO), the private entity finances, designs, develops, and maintains the public project and retains the ownership. On the other side, the government (public entity) may not have a long-term service purchase agreement, for example, power purchase agreement in a power distribution project. In contrast to BOO, in Design-Build-Operate (DBO), the private entity designs, builds, and operates the public facility but the government retains the ownership. Further, in case of the BOO-Transfer (BOOT) form, the operation of the project is undertaken by the private entity for a specified period of time, after which it is transferred to the government at a previously agreed price or even market price as stated in the contract.

3 PPP in telecentre-based e-government projects

To drive their growth agenda through telecentre-based e-government projects, several countries face constraints such as insufficient funds, lack of technical expertise, and limited execution capabilities. The PPP approach provides an opportunity to address such constraints in e-government and other project implementation. For example, India is a prominent global PPP leader (World Bank, 2018) and has used the PPP alternative in various sectors such as infrastructure, energy, transport, water, sanitation, telecommunication, and e-government (Laksmanan, 2008). Research supports the association between PPP and e-government to propel socioeconomic development (Mkude & Wimmer, 2015). According to Aundhe and Narasimhan (2016), PPP helps the government leverage the private enterprise's operational efficiency to achieve their development goals.

In e-government, PPP is defined as a legally enforceable contract between a private sector entity and government body that requires the private partner to provide a desired electronic public service, for which the private sector is required to invest some of its resources and become responsible for some risks of service delivery (Emilio, 2015). Risk in e-government PPP projects is associated with changing technology and service requirements that must be upgraded constantly (Aundhe & Narasimhan, 2016).

In PPP-based telecentres, the private sector runs the telecentre with the revenue generated from the services provided to citizens, the government, and businesses. The government departments must prepare themselves in backend processes and appropriate systems and with a mindset to deal effectively with the private sector. Telecentres that operate on the PPP model provide services and other necessary support (e.g. rent-free offices). Hence, telecentres mainly follow the BOO type of PPP.

Another pertinent aspect of these telecentres is that stakeholders directly affect the implementation of a project and can influence the system at various stages of project development. Telecentre projects have multi-stakeholder participation and cooperation. De (2005) classifies these stakeholders into supply and demand sides. The supply-side stakeholders are primarily involved in funding, designing, implementing, and maintaining the system, whereas the demand-side stakeholders consume the system's services and help provide revenue for sustaining the system. For instance, the government is not a single entity because it reaches and affects departments, groups, organisations, and citizens (Sealy, 2003).

In the PPP model, the telecentre ecosystem is likely to increase people's participation, reduce government interference, provide service at the doorstep, improve transparency, increase employment opportunities, and nurture entrepreneurs. However, at the ground level, the practitioners face several challenges and difficulties while operating these PPPs (Basílio, 2017). According to Heeks (2003), most telecentre-based e-government projects fail either totally or partially. One of the primary reasons for this failure is the gap between the 'design' and 'reality' of such interventions.

4 Telecentre Sustainability

The telecentre literature discusses mainly five types of sustainability—financial, social, technological, policy (institutional), and environmental. According to Madon (2010), financial sustainability refers to the telecentre's ability to generate adequate revenue from the local community for activities it offers. Social sustainability is related to how compatible the telecentre and its services are with the socio-political context of its location (Masiero, 2011). Technological sustainability involves the ability of telecentres to upgrade computer hardware and software continuously so that services are not affected by degradation/obsolescence of the equipment or network (Kumar & Best, 2006). Policy or institutional sustainability reflects the telecentre's acceptance and institutionalisation by political actors (Faroqi, Siddiquee, & Ullah, 2019). Environmental sustainability entails plans for electronic equipment disposal or reuse when they reach the end of their life (Kumar & Best, 2006).

Attwood, Diga, Braathen, & May (2013) indicate that the sustainability of telecentres depends on countless interconnected factors involving multiple stakeholders. Telecentres require time to evolve and mature institutionally and functionally. PPP-based telecentres usually require three years for financial sustainability or independence (Faroqi & Siddiquee, 2017). After the start-up phase, telecentres have to sustain themselves financially while operating in the free market (Masiero, 2011). According to Hudson (2001), in the long term, because of the realisation of socioeconomic effects and opportunity cost of alternative delivery modes, telecentres may become financially sustainable.

In this study, the financial sustainability of telecentres is specifically focused. We are of the view that financial sustainability is relevant for a PPP-based telecentre supported by an external public entity. In PPP-based telecentres, because VLEs invest, operate, and maintain telecentres, revenue from telecentres is crucial in supporting VLE livelihood. The VLEs would like to receive high returns from their investment. Hence, financial sustainability of telecentres is crucial not only for their operation and maintenance but also for VLEs' livelihood. Telecentres are similar to enterprises, and therefore, financial sustainability is an immediate concern for telecentres (Shadrach & Sharma, 2011).

5 Focus of the study

This study focused on understanding the factors and their interrelationships that financially sustain matured PPP-based telecentres. Previous telecentre literature has mainly explored aspects related to service delivery (Furuholt & Sæbø, 2018; Weerakkody, El-Haddadeh, Sivarajah, Omar, & Molnar, 2019), social impacts (Faroqi & Siddiquee, 2017; Rashid, 2017), usage (Kapondera & Namusanya, 2017; Verkijika & De Wet, 2018), and adoption (AlAwadhi, 2019; Carter, Weerakkody, Phillips, & Dwivedi, 2016; Jaganathan, Ahmad, Ishak, Nafi, & Uthamaputhran, 2018). However, literature on what sustains a matured telecentre in the long-term is scarce.

The authors believe that a mature telecentre may provide better insights into sustainability factors rather than one with a shorter existence. Mature telecentres have been in the community for some time and have reached operational sustainability and stable management (Fuchs, 1998; Lo, Songan, Cheuk, Atang, & Yeo, 2013). The maturity stage of telecentres affects their effectiveness; hence, research on the factors that sustain matured telecentres is recommended (Palaco, Park, Kim, & Rho, 2019). In addition, understanding how the factors that sustain telecentres interact or affect each other given the complexity of their systems is crucial (Nasim, 2011). The identified factors must be ranked so that the stakeholders in the PPP allocate their limited resources to the most critical factors and draw necessary strategies to improve e-government service delivery through telecentres (Gupta, Bhaskar, & Singh, 2017). Lal & Haleem (2009) recommended using graphics and words to portray the complexity of interrelationships among factors in a simplified way. The direct and indirect relationships between the factors picture the situation far more precisely than when considered in isolation (Janssen, Rana, Slade, & Dwivedi, 2018). Thus, with the view to understand the complex interactions of sustainability factors and represent the hierarchy and interactions among the factors simplified, interpretive structural modelling (ISM) is employed. ISM is a method used to transform multifaceted issues into a clear and structured model showing well-defined interrelationships among various elements (Sage, 1977; Warfield, 1974).

Further, the Decision-Making Trial and Evaluation Laboratory (DEMATEL) is used to validate ISM. A combination of ISM and DEMATEL is used to provide a complete and highly comprehensible analysis of sustainability factors associated with PPP-based telecentres. ISM and DEMATEL are similar because both methods attempt to explain complex nodes among factors. Therefore, integrating them to obtain a clear view of variable arrangements is easy (Zhou, Zhang, & Li, 2006).

Warfield first proposed ISM in 1974, and since then, it has been instrumental in providing deep insights into diverse subjects to practitioners and academicians. In ISM, 'I' stands for interpretative because an expert's judgment and practical experience are used to define the relationships among all variables, 'S' denotes the structure, which is developed on the basis of the extracted interrelationship among variables, and 'M' signifies graphical presentation of the overall model depicting the hierarchical relationship among variables.

Since its inception, this methodology has been employed to develop fields such as education programmes (Hawthorne & Sage, 1975), cross-cultural communication (Jedlicka & Mayer, 1980), energy conservation in the cement industry (Saxena & Vrat, 1992), vendor selection (Mandal & Deshmukh, 1994), and waste management (H. D. Sharma & Gupta, 1995). Furthermore, information-technology-driven studies, including information security management (Muktesh Chander, Jain, & Shankar, 2013), e-commerce (Valmohammadi &

Dashti, 2016), and risk considerations in software engineering projects (Samantra, Datta, Mahapatra, & Debata, 2016), have witnessed the rising endorsement of ISM.

DEMATEL is used to validate the model developed through ISM. This comprehensive method originated in Battelle Geneva Institute in the 1970s and provides direct and indirect causal relationships between variables in complex systems (Gabus & Fontela, 1972). The DEMATEL method can be used to validate and reinforce the ISM model.

e-Government services through telecentres may be an emerging field where ISM can convert complex systems with multiple stakeholders into well-defined models. Few researchers have used ISM and DEMATEL in e-government services (Lal & Haleem, 2009; Liu, Wang, Xie, & Zhan, 2020) but not explicitly for telecentre sustainability or a combination of both models. This study, therefore, attempts to develop a mature telecentre model by examining and analysing the factors and interrelationships that financially sustain PPP-based mature telecentres.

Overall, the objectives of the present study are:

1. To identify the factors that financially sustain a PPP-based mature telecentres
2. To identify the hierarchy among sustainability factors using ISM and validate them using DEMATEL

6 Methodology

In this study, first, related literature is reviewed, and based on this review, telecentre sustainability factors were identified. Then, a field study was conducted to verify the identified factors in the field setting using the case of the 'Akshaya' project. ISM was then used to develop a model illustrating the hierarchy and interrelationships among the identified factors. Further, the model was validated using DEMATEL. Finally, the data were analysed using appropriate tools. The following sections describe these steps in detail.

6.1 Literature Review

We focused on the literature mainly on e-government, factors influencing telecentre use and sustainability, the role of PPP in ICT-based projects, adoption of a telecentre, types of sustainability, and telecentre lifecycle (stages of telecentre growth) because they are related to our study objectives. The methodology proposed by Webster & Watson (2002) to enlist factors that influence telecentre sustainability was employed. A literature review is required to ascertain and evaluate the functional know-how to determine the beneficial or ineffective measures for an identified phenomenon. (Knopf, 2006).

We identified the articles using the ISI Web of Science (WoS) library databases. In addition, for inclusivity, as Thapa and Sæbø (2014) suggested, we searched relevant journals and a broader generic literature in e-government, telecentre movement, telecentre sustainability, and PPP, which are essential for this research, focussing mainly on high-rated journals. Table 1 reflects the literature review process. Based on the selection criteria of most relevant articles, 75 articles were identified for the study. According to Thapa and Sæbø (2014), literature reviews are conducted based on a specific selection strategy, and the process runs a high risk of excluding potentially relevant literature from sources that are not included. However, considering these limitations, we assume that the identified articles provided a relevant list of relevant factors of telecentre use.

Particulars	Details
Library used for search	e-Government journals, ICT4D journals, ISI WoS
Search Terms	Telecentres for good governance, telecentre sustainability, ICT4D, PPP in telecentre initiative, PPP in project sustainability, PPP in e-government, telecentre adoption, telecentre project life cycle, mature telecentres, sustainable telecentres
Total search results	187
Selected for review	75
Language	English
Subject Areas	Computer Science, Information Systems, Supply Chain Management, Public Policy, Social Science, ICT and interdisciplinary areas
Criteria for inclusion	Most cited papers, relevance to the research, most cited authors, known authors in the field, published after 2000, excluded articles based on technical/computer concepts

Table 1. Literature Review Process

6.2 Field verification of sustainability factors

The factors derived from the literature review were verified in a contextual setting. The ‘Akshaya’ telecentre project was used as a case for this purpose since it is a mature telecentre project with over ten years of existence. The ‘Akshaya’ project, implemented in Kerala, India, aims to bridge the digital divide through ICT access and is designed to link government and citizens. ‘Akshaya’ telecentres are set up within a maximum of two kilometres for any household and network leveraging entrepreneurship. These centres or access points are visualised as the principal route to the project’s success. According to the project website, currently, there are approximately 2,650 ‘Akshaya’ telecentres. Various government services, including Aadhar (unique ID) enrolment, utility bill payment, ration card applications, motor vehicle license payment, commercial tax filing, and university fee payment, are provided through these centres. At least two telecentres are available in each Panchayat (a local rural administrative unit).

6.2.1 Selection of Telecentres and Respondents

Two districts were selected in Kerala, namely Mallapuram and Kollam. These were selected on the basis of project maturity. In Mallapuram and Kollam, the project has been active since 2001 and 2005, respectively. Maturity was an essential criterion for selection because this study relates to the factors that sustain such telecentres. In each district, two centres were selected on the basis of the usage pattern. One centre is used comparatively more than the other (based on the number of transactions in the project records). Nendumgolam (high use) and Thenmala (less use) centres were selected in Kollam, and Kishreri (high use) and Velliyampuram (less use) centres were selected in Mallapuram. Table 2 presents the number of respondents (users) with telecentres. For the study, we randomly selected the users. Every fourth person who visited the telecentre was interviewed. Each interview took 30–45 min. However, convenient sampling was adopted for non-users because it helped us interact with them as VLEs knew them. The interview protocol is available in Appendix 1.

Districts in Kerala	Telecentre location	Respondents-Users	Respondents-Non-users
Kollam	Nendumgolam	34	30
	Thenmala	28	31
Mallapuram	Velliyampuram	36	33
	Kishreri	37	25

Table 2. Number of respondents for each telecentre

During the investigation in the telecentres, data saturation was attained after 25–30 respondents in each of the four telecentres. The number of respondents was based on the generally used qualitative technique of data saturation, that is, nothing new becomes evident beyond a particular stage of interviewing (Fusch & Ness, 2015). We also interacted with approximately 20 VLEs and two senior project officials at the state level to comprehensively understand the context and two officials at the district level.

6.3 Model Development using Interpretive Structural Modelling

Multiple sources and techniques for data collection and analysis such as detailed literature reviews, in-depth interviews, expert's judgement, and brainstorming sessions are recommended to enhance the reliability and validity of ISM (Warfield, 1974). In the present study, all these techniques were used; the factors identified from the literature review and verified through the field study were presented to experts.

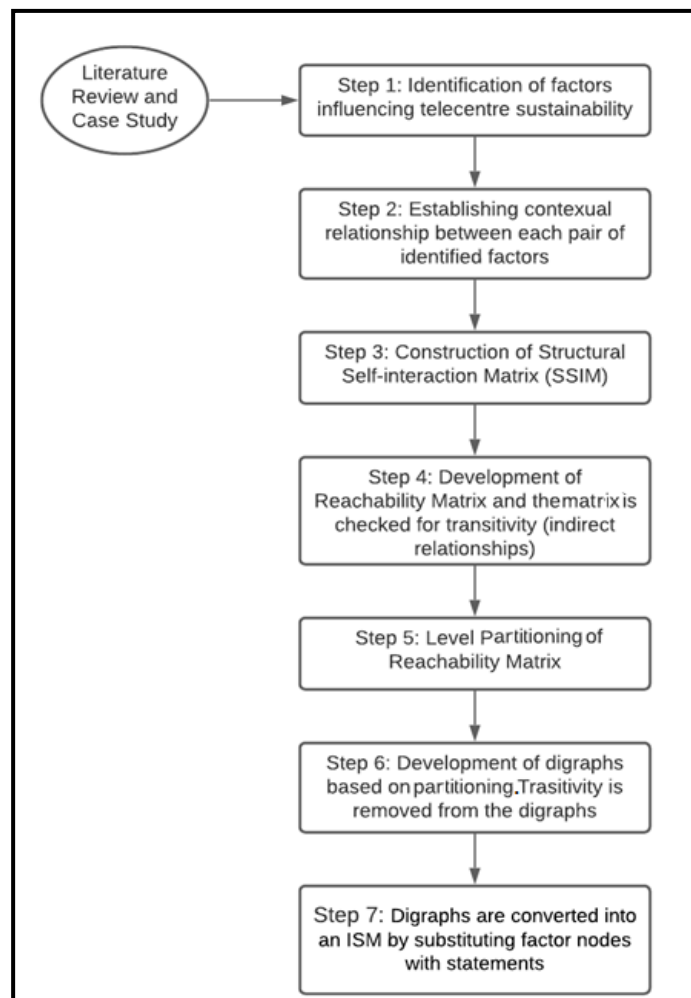


Figure 1. ISM process used in the study

Initially, three academics with more than ten years of research experience and three experts who closely worked with telecentres were provided with the factors, definitions, and explanations. Subsequently, the final list of factors with their description was presented to the experts to establish contextual relationships. In the second brainstorming session, the group

reached a consensus for the final contextual relationship, which was ultimately used for developing the ISM model. The steps in the ISM process are illustrated in Figure 1.

6.4 ISM Model Validation using DEMATEL

This study used DEMATEL to identify the factors that drive sustainability. For DEMATEL analysis, a five-step process was used and analysed in detail; the steps are (a) create a direct relationship matrix with the experts' support, (b) normalise the direct relationship matrix, (c) construct the total relationship matrix, (d) determine the causal parameter, and (e) determine the threshold value.

a. Direct Relationship Matrix

Experts solicited a pair-wise comparison between factors at five levels from 0 to 4: 0—no influence; 1—very low influence; 2—medium influence; 3—high influence, and 4—very high influence. X_{ij} represents that factor i influences factor j . In this analysis, the diagonal influence was considered zero.

b. Normalised Direct Relation Matrix

The normalised matrix was calculated by the following equation:

$$S = \frac{1}{\max_{1 \leq i \leq n} \sum_{aij}} \text{ where } S_{i,j} = 1, \dots, n$$

c. Total Relation Matrix (TRM).

The TRM includes all direct and indirect relations among factors and is obtained as follows:

$$T = N(I - N) - 1$$

where I = identity matrix N = Normalised Direct Relation Matrix

d. Determine the Causal Parameters

In the TRM, R_i represents the summation of all the direct and indirect relations of enabler i , while C_j represents that of the columns of enabler j . $R_i + C_j$ signifies the total effect of i on other factors, and $R_i - C_j$ indicates the net effect of i on the system. The causes or effect relationships were decided through $R_i - C_j$. A positive result indicates a net cause, and a negative result represents a net effect.

e. Determining the Threshold Value

A threshold value is the average entry of the TRM.

6.5 Analysis of Data

Both qualitative and quantitative data were collected at different stages of the study. For quantitative data analysis, we used MS Excel mainly in building ISM and DEMATEL models. We used NVivo software for qualitative data analysis, mainly to identify and contextualise sustainability factors in the field. The corpus of transcripts obtained from in-depth interviews was content analysed, which helped in the systemic coding and categorising of the large pool of texts (Hsieh & Shannon, 2005). An iterative process was then used to familiarise the content by reading, re-reading, and understanding the nature of the content to explore factors.

Broad themes of the factors were initially identified in the literature. Based on this, the software highlighted transcript content and linked to these themes. A new node was created for coding if any new theme was reflected in the identified text. The thematic grouping passed

through several rounds of a recursive process, in which researchers consistently refined and reviewed codes by constantly comparing the codes and themes that emerged. The transcript text was coded with an axial code 'faith on telecentre for transaction services', which is part of the parent theme 'trust', as reflected in Table 3.

Responses	Axial Code	Overarching theme
<i>"The centre is run as a private business. I do not have faith in the services of the centres. I would prefer government offices for utility bill payments. For other services, I may use the centre."</i> [KP16]	Faith on telecentre for transaction services	Trust
<i>"I pay electricity bill here as I do not have time to go to the government offices. There is a long queue in a government office and therefore much time is wasted. I have to spend around 2 hours to pay the bills. When I come to the Akshaya centre, I do not waste time."</i> [KP9]	The benefit of using services- Time and money saved	<ul style="list-style-type: none"> • Time saving • Convenience

Table 3. Coding process of transcripts

7 Results

The results are discussed in four parts, namely literature review, field verification of factors, ISM, and DEMATEL.

7.1 Literature Review: Factors influencing telecentre's financial sustainability

This section focuses on the relevant literature related to factors that may sustain telecentres financially operating under a PPP model. Based on the literature review, we identify the following factors that affect the sustainability of telecentres:

- a. **Cost of Services:** The service cost is crucial for sustainability (Verdegem & Verleye, 2009). According to Attwood et al. (2013), the financial costs of using a telecentre are a major demand-side factor influencing the use of telecentre. Telecentres' reduced service costs may influence its use and enhance social inclusion (Gilbert, Balestrini, & Littleboy, 2004; Mayanja, 2006).
- b. **Money and Time-saving:** Telecentres assist users to save money because they reduce trips to cities to seek government services (Mbangala & Samzugui, 2014). If the telecentres are available in a community, it helps citizens save money with the availability of the services at a nearer location (Hudson, 2001; Kapondera & Namusanya, 2017). Perceptions about inconvenient locations might result in the telecentres not being used (Gollakota & Pick, 2020). Telecentres provide efficiency in terms of time (Hudson, 2001; Kumar & Best, 2006). Citizens save time because they do not have to travel considerably far to use government services (Chander Mahesh, Rathod, & Balaraju, 2014; Mbangala & Samzugui, 2014).
- c. **Reliability:** Here, reliability is related to the availability of services whenever citizens need them. For e-government, reliable services hold importance for citizens (Verdegem & Verleye, 2009). According to Elliman (2006), citizens are unlikely to use e-government services if there is a lack of reliable information and data about services. Telecentres may be a reliable point of contact for citizens to access information and download and send applications (Naik, Chitre, Bhalla, & Rajan, 2016).

- d. **Skillsets of Operator:** A VLE or an operator runs the operation of a telecentre. According to Attwood et al. (2013), a telecentre manager (operator) is found to be an essential driver of telecentre development. Poor entrepreneurship among operators contributes to non-functional telecentres (Faroqi, 2019). According to Oestmann & Dymond (2001), telecentre resources may remain underutilised because of operators' lack of ability to utilise them. The skillset of operators remains an important consideration for the smooth functioning of telecentres (Hudson, 2001).
- e. **Trust:** Trust of citizens in the services through telecentres is vital for its sustained use (AlAwadhi, 2019; Carter et al., 2016; Schaupp, Carter, & McBride, 2010). Trust among different stakeholders is crucial for a sustainable telecentre (Foko, 2018). Trust in the telecentres may be one of the linkages between financial viability and broader goals in terms of social development (Masiero, 2011).
- f. **Satisfaction:** Verdegem and Verleye (2009) reported that satisfaction is a factor that affects people's intention to use telecentres. Unless users are satisfied with the services, they may not continue using telecentres and maintain the status quo (Gollakota & Pick, 2020). Haddad & Oliveira (2019) showed that satisfaction in using telecentres encourages empowerment, autonomy, and solidarity among users.
- g. **Social Influence:** Here, social influence refers to someone's perception that he/she should use services of a telecentre that people in their social circle may suggest (Brown, Dennis, & Venkatesh, 2010). Social influence may affect telecentre use where people are mostly illiterate and usually pass information verbally (Omogor, 2013). The literature confirms the importance of social influence in using e-government services through telecentres (Almajali, Maqableh, & Moh'd Taisir Masa, 2015; Kapondera & Hart, 2016).
- h. **Media Influence:** In rural areas, propagation through media plays a significant role in creating awareness about innovations (Roman, 2003). Media may be a means to make people aware of telecentres and their services. Media provides new information that may influence people to accept new norms (Arias, 2019). This factor focuses on the role of media in influencing telecentre use. Here, media relates to both printed and digital media.
- i. **Digital Divide:** Access to a telecentre may be affected by a person's gender, caste, and education (Hill, 2016; Naik et al., 2016; Ndiku & Mwai, 2016). Here, the digital divide is related to citizens' perceptions of equality/inequality in services through telecentres. Citizens may feel deprived of the telecentre services due to their gender, caste, or education.
- j. **Centre Infrastructure:** A combination of resources in telecentres are necessary for financial and operational sustainability (Faroqi & Siddiquee, 2017). These include vital ICT infrastructure, including the Internet, computers, printers, and photostat machine (Faroqi et al., 2019).
- k. **Complexity and Compatibility:** Complexity refers to the extent to which people perceive technology as challenging to understand and use (Kante, Oboko, & Chepken, 2019). Lack of proper knowledge about how the technologies work is a vital barrier in telecentre adoption. Contrary to this, the dimension of compatibility suggests the degree to which the information given in telecentres matches with the

information generated via traditional sources and past experiences (Gollakota, Pick, & Sathyapriya, 2012; Rogers, 2004). Consequently, the use of telecentres increases when there is better compatibility with the users' prevailing economic, social, and value systems.

1. **Relative Advantage:** Relative advantage refers to how people perceive any product or service as better than the previous idea, product, or program it replaces (Venkatesh, Morris, Davis, & Davis, 2003). What constitutes a relative advantage depends upon the needs and perception of the actual users. In the case of e-government, the greater the perceived relative benefit of the user, because of the use of computers to access current information in comparison to previous conventional information, the more rapid will be the rate of adoption of telecentres (Samuel, Doctor, Christian, & Baradi, 2020).
- m. **Observability:** Observability relates to the degree to which results are tangible and visible to others (Rogers, 2004). High demonstrability reduces ambiguity and helps the telecentre user give concrete feedback to other community members interested in knowing about the user's experience. Thus, easier observability of results increases the likelihood of telecentres' adoption (Luo & Chea, 2018).
- n. **Trialability:** Trialability is the extent to which the user can try a product or service on a limited basis before committing to adopt it (Rogers, 2004). It is an essential factor, specifically in the case of services where a user needs to experience to perceive its value. The trialability of the telecentres would reduce the users' uncertainty and experimentation without any cost attached is likely to increase the chances of its adoption (Chigona & Licker, 2008).

7.2 Field verification of factors

On the basis of literature review and thematic analysis, ten factors were finalised—affordability (includes direct cost and indirect savings), awareness (overall information about availability of services), convenience (denotes ease of access and use), time saving (relatively less time consumed in accessing the services), quality of operators (reflects the competency and entrepreneurial ability of the operator), quality of services (general effectiveness and efficiency of the services), social influence (recommendation by friends or relatives), media influence (impact of mass media communication about the centre), centre resources (availability of operational resources for regular functioning), satisfaction (overall satisfaction with the services), and trust (the faith placed in the operator).

The factors digital divide, complexity, and compatibility, relative advantage, observability, and trialability, derived from the literature, were dropped from subsequent analysis because these factors were not validated in the field study. Detailed description of the factors with their implied meanings are shown in Appendix 2.

7.3 ISM Results

The discussed steps of ISM were followed, and the resulting model is described below:

7.3.1 Structural Self-Interaction Matrix (SSIM)

The ISM methodology recommends the use of the following four symbols (Warfield, 1974):

- V: parameter i will lead to parameter j (one direction);

- A: parameter j will lead to parameter i (one direction);
- X: parameters i and j will lead to each other (both directions);
- O: parameters i and j are unrelated.

The developed SSIM is depicted in Table 4 with a pair-wise comparison between the eleven telecentre factors affecting sustainability.

Code	Factors	11	10	9	8	7	6	5	4	3	2	1
1	Affordability	0	V	A	0	0	V	V	0	A	0	X
2	Awareness about centre and services	0	0	0	A	A	0	A	0	A	X	
3	Convenience	V	V	X	0	0	V	0	V	X		
4	Time saving	V	V	A	0	0	V	A	X			
5	Quality of operator	V	V	A	0	0	V	X				
6	Quality of services	V	V	A	0	V	X					
7	Social influence	X	A	A	A	X						
8	Media influence	V	0	0	X							
9	Centre resources	V	V	X								
10	Satisfaction	V	X									
11	Trust	X										

Table 4. Structural Self Interaction Matrix

Note: 'i' represents the row parameter,s while 'j' represents the column parameters

7.3.2 Reachability Matrix and Transitivity Check

The SSIM was converted into a binary relationship matrix called the initial reachability matrix (IRM) by replacing V, A, X, and O in the range from 1 to 0 based on the following rules:

If the (i, j) entry in the SSIM is V, then the (i, j) entry in the IRM becomes 1 and (j, i) entry becomes 0.

If the (i, j) entry in the SSIM is A, then the (i, j) entry in the IRM becomes 0, and the (j, i) entry becomes 1.

If the (i, j) entry in the SSIM is X, then the (i, j) entry in the IRM becomes 1, and the (j, i) entry also becomes 1.

If the (i, j) entry in the SSIM is O, then the (i, j) entry in the IRM becomes 0, and the (j, i) entry also becomes 0.

In addition, the relationship between nature and its strength was considered to improve the analysis further. The strength of the relationship is the measure of i 's impact on j 's probability of occurrence. The relationship strength was measured as 0.25 (low strength), 0.50 (medium strength), 0.75 (high strength), and 1 (highest strength). The values were assigned after the third round of discussions with the experts (Appendix 3). The relationships with low or medium strength were omitted. Those with high strength of occurrence, i.e. relationships ≥ 0.75 , were retained and converted to 1 and were finally superimposed in the IRM.

7.3.3 Final Reachability Matrix

The final reachability matrix was obtained by checking and removing the transitivity if any present in the IRM. Transitivity check is the process of searching 0 in the initial matrix, that is, if X leads to Y and Y leads to Z, it implies that X leads to Z, and finally replacing 0 with 1* (Appendix 4).

7.3.4 Level Partitioning

In this stage, the final reachability was degenerated into different hierarchical ordering to create the structural model (Warfield, 1978). The final reachability matrix grouped factors into different levels based on the interrelationships between factors. The reachability set comprised the factor itself and other factors in the row that may assist in achieving it. As depicted in the factor column, an antecedent set comprised the factor itself and other factors that help attain it. An intersection set comprised the factors present in the reachability and the antecedent set. The factor(s) with the same intersection and reachability was assigned the top-level position in the ISM hierarchy. Once the factor(s) has achieved the top level, it is discarded from all sets. Repeated iterations were conducted for each factor until the hierarchy's bottom-most levels were achieved (Appendix 5). Appendix 6 presents the levels of all factors at the end of the eight iterations.

The level partition helped construct the digraph, based on which the final ISM model was constructed. After transitivity removal, the digraph was transformed into ISM (Figure 2).

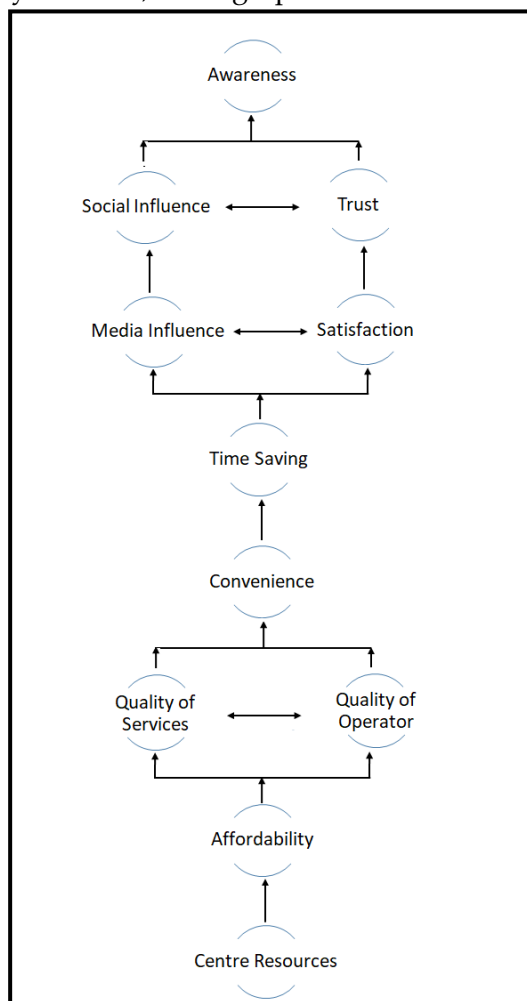


Figure 2. ISM Model

The relative importance of factors is from bottom to top in the hierarchy. For example, ‘centre resources’ are more important than ‘affordability’. Similarly, the model’s relatively most minor factor is ‘awareness’. A horizontal bi-directional arrow represents the factors at the same level. For example, ‘quality of service’ and the ‘quality of operator’ are at the same level and have bidirectional interaction.

7.4 DEMATEL Results

The cause-and-effect relationship obtained on the basis of the DEMATEL steps enlisted in section 6.4 is exhibited in Table 5. The threshold value for this study was 0.0562. Influential factors are factors that influence other factors. Based on $R_i - C_j$ values, a causal diagram depicted in Figure 3 classifies factors into influential or influenced factors. Seven factors were grouped as influential and four as influenced.

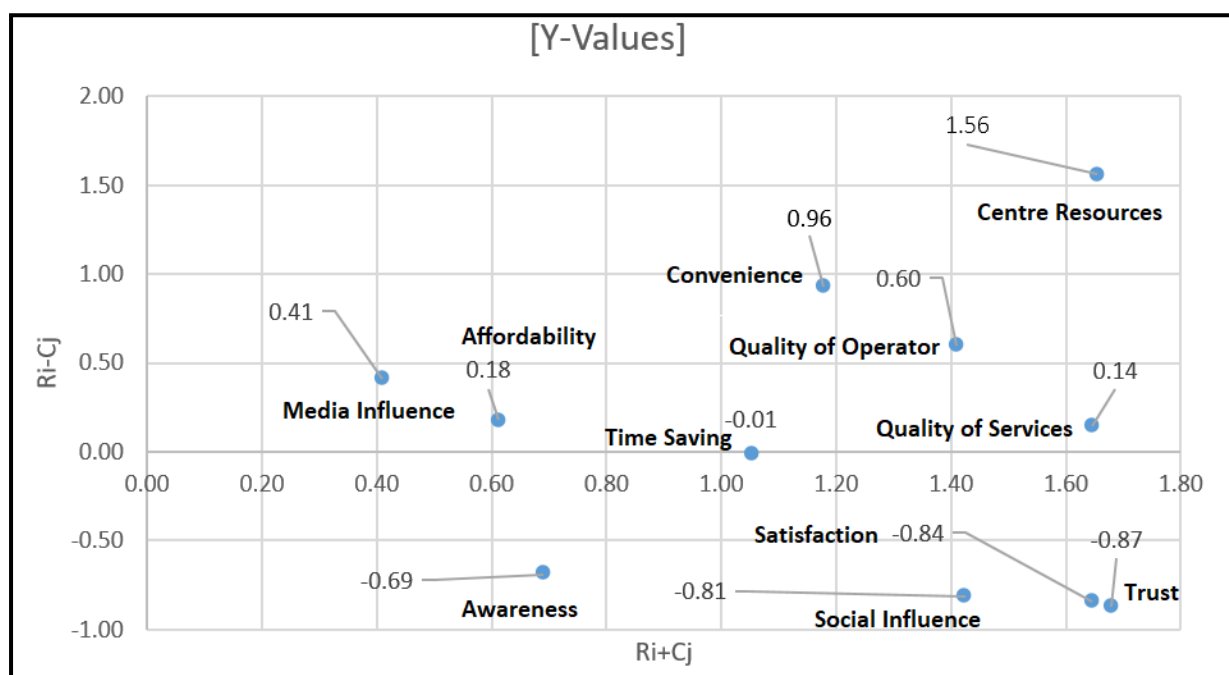


Figure 3. Causal diagram based on $R_i - C_j$ values

Sr No	Factors	R_i	C_i	$R_i + C_i$	$R_i - C_i$	Cause/Effect
1	Affordability	0.3957	0.2154	0.6111	0.1802	Cause
2	Awareness	0.0000	0.6904	0.6904	-0.6904	Effect
3	Convenience	1.0521	0.1254	1.1775	0.9267	Cause
4	Time saving	0.5210	0.5303	1.0514	-0.0093	Effect
5	Quality of operator	1.0043	0.4055	1.4098	0.5989	Cause
6	Quality of services	0.8951	0.7504	1.6455	0.1447	Cause
7	Social influence	0.3051	1.1194	1.4244	-0.8143	Effect
8	Media influence	0.4095	0.0000	0.4095	0.4095	Cause
9	Centre resources	1.6100	0.0450	1.6550	1.5649	Cause
10	Satisfaction	0.4022	1.2429	1.6451	-0.8407	Effect
11	Trust	0.2088	1.0800	1.6790	-0.8712	Effect

Table 5. Cause and effect influence

The influential factors identified using DEMATEL are 'centre resources', 'affordability', 'quality of services', 'quality of operator', and 'convenience'. These factors influence other factors 'time saving', 'satisfaction', 'social influence', 'trust', and 'awareness'. 'Media influence' is identified as an autonomous factor, i.e. it is not influenced and does not influence other factors. Hence, media influence plays an insignificant role in the sustainability of PPP-based telecentres.

8 Discussion

The study's first objective was to identify factors that sustain mature PPP-based telecentres financially. The literature review identified fourteen factors influencing the financial sustainability of telecentres. We conducted field verification using 'Akshaya' as a case to ascertain whether the identified factors hold in the context, i.e. a PPP-based mature telecentre. The field verification helped us identify eleven key factors and define them in the contextual setting. The field verification revealed a new factor, 'awareness', which is about citizens being aware that the telecentre services are that of government and that they are run by private entities that provide government-related services. 'Awareness' as a direct linkage between individual users, government, and private entities has not been highlighted as an independent factor in previous studies. Contrary to this, the factors complexity, compatibility, relative advantage, observability, trialability, and digital divide often cited in the literature did not resonate in the field study.

For the study's second objective, we developed the ISM model to identify the factors' hierarchy and interrelationships. For ISM, the interrelationships were enriched through anecdotal evidence in the field and brainstorming with experts. Finally, we used DEMATEL to identify the most influential factors and relate them with the findings of the ISM model. The hierarchy of the factors derived from ISM (Figure 2) illustrates that 'centre resources' is the foundational factor for sustaining a PPP-based mature telecentre. Any other factor does not influence this factor because it is present at the model's base. 'Centre resources' include internet connection, continuous electricity, seating facility, operational hardware (including computer system, printers, photocopying machine, and camera) and software, and availability of services to provide e-government services. These resources are the VLE's responsibility, and thus in a PPP model, the private entity is the prime driver for the telecentre's financial sustainability.

The next important factor is the 'affordability' of services. Here, 'affordability' is not limited to the cost of services, as reported in the literature. The data from the field also shows that it includes the expenses saved in travel, food, and daily wages while using a telecentre. Hence, the factor reflects the VLE's role in keeping the cost of services appropriate to attract a high number of users. In addition, the telecentre is to be operated from a strategic location to help citizens save expenses they would otherwise incur while using government offices.

At this point, it is worth noting that 'centre resources' influence 'affordability'. With time, the cost of services become less (Chen & Gant, 2001). Hence, the services are less costly for mature telecentres because the VLEs can provide more services by using the same resources. Moreover, the public entity, i.e. the state government, encourages citizens to use services by paying a part of the service cost. For example, the telecentres supported the e-literacy programme during the initial years. The government telecentres envisaged providing basic computer literacy to at least one family member. The beneficiary had to pay only 12.5% of the total fees, and the state government paid the remaining fees. In addition, VLEs made

additional efforts to include services on their own, such as linkages with banks for bank account-related services and mobile phone companies to provide services related to mobile phone connection. In addition, some telecentres were located in the rent-free campuses of Panchayats. Hence, the public entity may provide the necessary support to the VLEs through subsidies towards operational costs such as the Internet, rent-free space, and others to make services affordable in the long run.

At the next level are the factors 'quality of services' and 'quality of operator'. When services become affordable in the long run due to an increase in the number of services and optimum utilisation of resources, the quality of services and operator influence telecentres' sustainability. Quality of services for customers is how quickly and proactively services are delivered, issues resolved, and questions responded to. The quality of service would improve when both public and private entities learn from each other about e-government applications and their capability (Chen & Gant, 2001). The same was evident in the case of 'Akshaya', where VLEs, operators, and the state government work together during workshops towards improved quality of services. The government trains VLEs and operators on e-government applications and keeps them educated on the latest services, processes, and computer hardware and software requirements. Such capacity-enhancing activities helps in maintaining the necessary quality of services and the quality of operators.

Thus, 'quality of services' and 'quality of operators' make telecentres more convenient to use than government offices because 'convenience' comes at the next level in ISM. This finding is in line with Gollakota et al. (2012) that capable management of telecentres improves the convenience of services and stimulates improved access. Therefore, the chances of financial sustainability may increase due to enough users willing to pay for the services over a long period (Furuholt & Sæbø, 2018).

'Convenience' leads to 'time saving'. Owing to various aspects of convenience, there is time saving, citizens can access services locally with flexible timings, and service delivery is faster and hassle free.

At the next level of the ISM model, 'satisfaction' reflects the overall contentment with the ease of access, quality of service, and service delivery. We observe that the overall satisfaction with the telecentre is propagated through word of mouth, resulting in 'social influence', i.e. people tend to use the services because their social contacts have used them or VLEs have influenced them to use the telecentres. People are also influenced by television advertisements and printed materials circulated by VLEs and the government. People influenced by media pass the information to their other social contacts. 'Social influence' leads to the overall trust in a telecentre and its services and vice-versa.

'Awareness' is the last level in the ISM model. If citizens trust services, they are likely to tell other people to use those services. A personal account is vital in creating social influence about the telecentre and its services. Hence, VLEs should put efforts at the local level to promote services, which would strengthen trust and generate confidence in people to use telecentre services.

Lastly, the ISM model was reinforced by using the DEMATEL analysis. In the DEMATEL findings, five factors, namely 'centre resources', 'affordability', 'convenience', 'quality of operator', and 'quality of services', were established as influential factors that indicated strong driving power in telecentre sustainability. Meanwhile, factors such as 'satisfaction', 'trust',

'awareness', 'social influence', and 'time-saving' are seen as influenced factors because they strongly rely on the influential factors to drive them. Finally, 'media influence' is an autonomous factor that is relatively disconnected from the other factors, and it illustrates that 'social influence' as a factor influences mature telecentre sustainability more than 'media influence'. The following table 6 shows the factors obtained through ISM and DEMATEL. The factors marked 'driving factors' are essential for telecentres' financial sustainability.

ISM	DEMATEL
Centre resources-Level 8 (at the base of the model)	Driving factor
Affordability-Level 7	Driving factor
Quality of services and quality of operator-Level 6	Driving factors
Convenience- Level 6	Driving factor
Time saving-Level 4	Dependent factor
Satisfaction and media influence-Level 3	Satisfaction-Dependent factor Media influence- Autonomous factor
Trust and social influence-Level 2	Dependent factor
Awareness-Level 1 (at the top of the model)	Dependent factor

Table 6. Comparison of relationships obtained using ISM and DEMATEL

9 Study Implications

The research study has a novel contribution to the literature on telecentre sustainability, focusing on PPP-based e-government projects. One of the theoretical implications is that some factors established to be valid in literature have not been relevant in mature PPP-based telecentres in our study. Second, a new factor, 'awareness', is not only about being aware of telecentre and its services but it also emphasises the separate roles of public and private entities. The study provides valuable insight into the complementarity roles of both public and private entities for financially sustaining telecentres. The study may be a benchmark for less mature telecentres. The study has methodological implications too. We employ two methods, ISM and DEMATEL, for this study, a combination which past researchers have not used much to solve complex problems involving PPP-based telecentre sustainability.

This research has implications that are notable for practitioners too. First, ranking sustainability factors will help decision-makers formulate strategies to use their limited resources for improved telecentre sustainability. The study reveals that the initial focus of the telecentre entrepreneurs should be on centre resources. Next, both the public and private entities should work together to make the services affordable to the citizens. Affordability enhances telecentre use. In addition, affordability of services comes as the centres mature.

'Quality of services' and 'quality of operators' must be maintained by PPP stakeholders. There needs to be constant engagement between the public and private entities to learn from each other and enhance service quality and the quality of operators. 'Convenience' in terms of proactive service delivery, location, and telecentre operating time is crucial at the next level. The aforementioned five factors are critical because they are influencing factors. Being influential, they drive other factors in the hierarchy: time saving, satisfaction, trust, social influence, and awareness. If the stakeholders utilise their limited resources for the five factors, PPP-based telecentres may have financial sustainability.

10 Limitations and Scope for Future Research

A significant constraint of this study is the lack of focus on m-government services. In the view of emerging m-government initiatives, in future, a study can be undertaken to check how m-government services are flourishing in specific areas, which are the factors that influence them, and how telecentres complement m-government services and vice versa. Further, study could be conducted on the effect of literacy on the adoption of telecentre services. To the best of our knowledge, because ISM was applied in telecentre-related research for the first time, future studies based on this model in a different context or a new ISM with innovative factors are likely to provide more clarity about its generic applicability. Furthermore, future studies can statistically substantiate this model. For instance, structured equation modelling may be used to verify the already developed theoretical model. Other approaches such as the analytical network process and fuzzy ISM could be used for model validation. This study could also be used as a benchmark for assessing less-mature telecentres. Further, the two applied methods (ISM and DEMATEL) can be used and reviewed by the experts to justify their use in future benchmarking studies.

11 Conclusion

Telecentre-related studies have highlighted the complexity in the system on account of multiple stakeholders with diverse objectives and interdependencies in a PPP-based context. This study addresses the call for a robust and integrated framework by providing a simple yet comprehensive understanding of the telecentre model and processes by studying actual users and operators rather than the literature. The study included a large group of factors derived from the literature review. Few contextual factors were added based on the results of the field study.

The ISM model representing the hierarchy of sustainability factors for mature PPP-based telecentres was developed based on the identified factors. The proposed model is likely to have universal applicability with contextual differences. On account of this, the interrelationships between factors in the derived framework may vary with different socioeconomic and cultural contexts.

The study found that the factors 'centre resources', 'affordability', 'quality of services', 'quality of operators', and 'convenience' are the most important for mature telecentre sustainability because they are at the first five levels in the ISM model and are influential factors in DEMATEL. For a successful PPP-based mature centre, the private entity (VLEs) role is crucial for better centre resources. For affordability, both the public and private entities should work together. The private entity has to utilise centre resources to provide affordable services to citizens optimally. The public entity (the government) has to provide more e-government services for financial sustainability. For 'quality of services', 'quality of operator', and 'convenience', both private and public entities must create an environment to learn from each other. A public entity should conduct capacity-building exercises for VLEs and operators to keep them abreast of current e-government services and skills for using them. In addition, the VLEs should strive for efficient and proactive service delivery. Thus, in PPP-based telecentres, both the public and private entities play a crucial role at each stage in the hierarchy of the ISM model.

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Appendices

Appendix 1. Interview protocol

Interview guide for the users

Q1. Gender: Age:

Education.....Profession.....Religion.....

Caste..... Income (Rs/month).....

Disability (if any)Distance from Akshaya centre (km).....

Q2. Have you heard of e-government services (like e-payment, e-filing, etc.) at Akshaya centre: Y/N

Q3. Whether you go to Akshaya service centre Y/N

Q4: How often do you normally visit Akshaya centre: Daily/Twice a week/Weekly/Monthly/Quarterly /Other.....

Q5: How much time do you spend there: 0-20 min/20-40 min/40-1 hr/more than 1 hr.

Q6: Why do you go to the Akshaya service centre (You can choose more than one)

- a. To get information about government
- b. To get information on government schemes
- c. Avail education service provided by the government
- d. To get information on health issues

- e. To get information on agriculture
- f. Getting contact details of government officials
- g. Birth/death certificate
- h. For land registration
- i. To complain against government officials/delay in work etc.
- j. Pay tax
- k. Pay utility bills
- l. Other.....

Q7: Which of the following you have in your home (You can choose more than one):

- a. Television
- b. Radio
- c. Video player
- d. Landline
- e. Mobile phone
- f. Computer
- g. Internet

Q8. How did you hear about Akshaya services?

Q9. Are you aware of Akshaya service centres, and can you receive government service from these centres? If yes, how did you come to know about it?

Q10. If you are not aware of the e-government service centre, will you use them if you know about services available and why?

Q11. What is the purpose for which you use the Akshaya service centres?

Q12. Will you continue to use the services, and if not, why?

Q13. What reasons make you use Akshaya service centres instead of a traditional government department?

Q14. Do you use the services due to your need? Has someone asked you to use the services?

Q15. Do you think that the services are available to all the sections of the society in your locality?

Q16. Are there any problems you have come across while using these centres concerning:

- a. Services available
- b. Time taken
- c. Mediator's response
- d. Accessibility
- e. Others.....

Q17. With the introduction of government service at Akshaya service centre, what change have you observed in the way you:

- a. Communicate
- b. Gather information
- c. Organise meetings
- d. Use for welfare
- e. Education
- f. Health

- g. Agriculture
- h. Others

Q18. What is your opinion on Akshaya service centres, i.e. do you feel they are useful or not? Should the government not invest in these projects and focus on other development problems?

Q19. Do you think e-government services have given you the opportunity for development, and if yes do you use them and reasons for using or not using them:

- Skills and training: Personal development, livelihood generation etc. or any other skill enhancement programmes.
- Education: Has Akshaya service centres helped in increasing access to education
- Health and safety programmes: Have you accessed health and safety-related programmes.
- Basic amenities: Has Akshaya service centres fulfilled the need for basic amenities like food, housing, land etc.
- Participation in decision making
- Participation in project implementation
- Participation in policy-making at the local level
- Representation
- Making government accountable
- Making your voice heard by higher authority
- Employment: Has Akshaya service centres given any employment opportunities, information related to employment
- Wages: Has Akshaya service centres helped in increasing wages, information on better-earning opportunities
- Credit: Has the e-government given access to the bank for credit needs.
- Market: Has e-government given access to better market

Interview guide for nonusers

Q1. Gender: Age:

Education.....Profession.....Religion.....

Caste..... Income (Rs/month).....

Disability (if any)Distance from Akshaya centre (km).....

Q2. Have you heard of e-government services (like e-payment, e-filing, etc.) at Akshaya centre? If yes, what do you know about it?

Q3: Where do you go and pay utility bills?

Q4: Do you have trust in the centres?

Q5: How much far is your home from the nearest centres? Where are the government departments for paying bills or getting information?

Q6: What are the reasons for the non-use of the centre if you are aware of Akshaya centres? Other questions were asked based on the responses given.

Interview guide for entrepreneurs

Q1. Gender: Age:

Education.....Religion.....

Caste..... Income.....

Q2. Name of the centre.....Place.....

Q3. Date of opening.....

Q4. Why did you open the Akshaya centre?

Q5. Which services does your centre offer to the people (Select the appropriate)

- E-literacy
- E-payment
- IGNOU Courses
- Antegramam
- Malayalam computing
- E-Krishi
- Others..... (Please mention)

Q6. Does your husband/father/mother/wife/ help in running the centre?

Q7. Are you satisfied with the way your centre is working and delivering services? Please mention reasons.

Q8. Approximately how many households does your centre provide services to?

Q9. How have you created awareness about the services at your centre to the people? How do you create trust in people to use Akshaya services?

Q10. Are you satisfied by how the government is extending support to you for services? Give reasons.

Q11. What role does government play in running of Akshaya centre? Do you think the success of the Akshaya centre depends on the government?

Q12. How much trust do you have in government for the support of services?

Q13. What are the main reasons you were selected to open the Akshaya centre? Which things made you stand out from other applicants (maybe your qualification, age, experience, infrastructure, political contact etc.)?

Q14. Do you run another business (like computer centre etc.) along with Akshaya centre? If yes, then who takes care of your second business? Which business gives you more income?

Q15. Is your centre providing sufficient income to run the centre? Have you recovered the amount you invested? Please give the amount you invested and the average monthly income through e-centre?

Q16. Please tell problems you are facing concerning services, infrastructure, running etc. of your centre?

Q17. What are the things you need or expect from the government?

Q18. Can you tell your concern/problems to government authorities about your centre and services? How do they receive your requisition, complaint etc.?

Q19. How many people visit your centre on a day? How are the citizens reacting towards your e-centre?

Q20. Are you able to provide all the services which a citizen asks you? If no, which services you are not able to provide?

Q21. Which services are used maximum by the people, and why do you think they are used the most?

Q22. Can you specify which category of people is using most of the services? (like high income, poor people, women, children, disabled, caste, religion etc.). Why some people are using, and others are not using?

Q23. What changes has Akshaya's e-payment, e-literacy, e-filing services brought in the life of people?

Q22. Do you think Akshaya centre is benefitting people? Give reasons, examples?

Q24. Do you want to tell anything else about your experience with centre usage?

Interview guide for project officials

1. What is your view on e-government services? How do you perceive them making an impact in society?
2. What are the policies government implementing to make these services reach the most disadvantaged sections of society?
3. What specific problems did you see in using these services in villages?
4. What is your opinion on using other delivery channels (like mobile, call centre etc.) for e-government services? What opportunities or issues do you see in using them?
5. Do you think e-government has served the purpose?
6. How government plans the service to be delivered?
7. In your opinion, has e-government tackled the issue of social inequality?

The services concerning empowerment are handled in which way. How much support does the government give to these services, i.e. are people given a chance to participate in decision making, do their complaints get cleared in optimum time etc.?

Appendix 2. Factors used for the study after field verification

Factors	Example quotes of respondents	Total references to the overarching theme	Remarks	Implied meaning in the contextual setting
Affordability	<i>"In cities, the cost of doing Medical transcription course is Rs. 35,000, but at this centre, it is only Rs 17,000 plus some tax, but it is far less than what I have to pay in the city."</i> [KT16]	97	Variable retained from literature and validated in the field.	Cost of services, money saved in travel and food, no loss of daily wage
Awareness	<i>"I am aware of the Akshaya project because, in the beginning, Mammooty promoted the project, but at present, I do</i>	39	This is a new variable observed	Linking services of telecentres to government through efforts of entrepreneurs,

	<p>not know whether the project is running or not." [KN22]</p> <p>"The government supports Akshaya centres as the government has advertised about it and the services like tax-filing in newspapers" [ND19]</p>		in the field study.	advertisement by the government
Convenience	<p>"As a woman, it is difficult for me to go to the government departments to pay the bills. There are different types of government departments and have many counters. It is confusing; hence I find it difficult to go there. When the Akshaya centre was available, I started paying here. It is effortless to use; I do not feel any fear in using the centre." [KT17]</p> <p>"It is quick and simple to get work done at the Akshaya centres. If I have any doubt, I can ask them. In government offices, they do not care about our requirements. They only do their duty like a robot." [KN8]</p>	73	The reliability factor from the literature review is subsumed in this factor as convenience is due to the reliability and simplicity of services.	Simple to use telecentre, ease of access due to location and working hours, availability of necessary services
Time-Saving	<p>"The government office takes more time in delivering services, and they do not give satisfactory services. I have to stand in a queue, but it takes only 5 minutes at the Akshaya centre, and they provide a good service. Because of this, I have an interest to come here again." [KK24]</p>	80	Variable retained from literature, validated in the field.	Time-saving while accessing services near home Time saved while accessing services
Quality of Operator	<p>"The operator is not very friendly. Therefore, I do not prefer to use this centre. I look first at the behaviour of a person; if it is good, then I continue a relationship with him." [KN4].</p> <p>"The government officers go out anywhere without informing anyone about their absence. We cannot ask them any questions. They are not friendly; 'Akshaya' centre is different and very friendly." [KN21]</p>	66	Variable retained from literature and validated in the field.	Competency of operator/VLE to use ICT, the entrepreneurial ability of operator, i.e. how they create awareness, receive and serve customer, and manage and maintain required resources to run centre, promote customer-oriented services, unbiased nature of the operator
Quality of services	<p>"The government office takes more time to deliver services, and they do not give satisfactory services. I have to stand in a queue, but it takes only 5 minutes at the Akshaya centre, and they provide a good service. Because of this, I have an interest to come here again." [KK24]</p>	73	In literature, not much is available on this about the use of telecentre. However, this variable	Overall effectiveness and efficiency with which services are delivered through telecentres.

			emerged prominently in the field.	
Social Influence	<p>"My friend told me that he pays electricity bill in Akshaya centre. I enquired more about it and then started using." [KK9]</p> <p>"I read about the Akshaya project in the newspaper. However, when Mr Gopal (the VLE) visited us and told us about the services, I started using the centre." [KN7]</p>	84	Retained from literature and validated in the field.	Visit by entrepreneurs, the influence of friends or relatives in using services
Media Influence	"The government advertised about the Akshaya centres in the newspapers and television. Since then, I have been aware of the centre and its services." [KK26]	45	Retained from literature and validated in the field.	People are influenced by media (newspaper, TV advertisement, radio broadcast, print materials by VLEs) in using the services.
Centre resources	"My place Akshaya Centre does not have a good internet connection. I am not able to download government job applications. Much time is wasted because of slow speed." [KT18]	93	Retained from literature and validated in the field.	Availability of quality internet connection, apt number of staff services, technical equipment, sitting space (for a minimum of 5-7 people), and necessary software
Satisfaction	"I am happy and satisfied with the services and the centre as there is more interaction with the centre staff. I come for interaction in the centre. People do not answer a query in a satisfied manner." [KK21]	89	Retained from literature and validated in the field.	Overall satisfaction with access, customer service, services delivery
Trust	<p>"I use the government office to pay bills. The Akshaya centre does not put any seal, but they put a seal in the government office. I have been paying in the government office for ages, and I do not want to change the way now. Akshaya centre cannot tell me how to fill an application form, but the government officials can." [KK19]</p> <p>"When I go and pay in Akshaya centre, then they will collect all bills and pay in the government office. Therefore, it will be late. It is better to pay in the government Office directly." [AMR146]</p>	47	Variable retained from literature and validated in the field.	Trust in using services, perceived risk associated in using the services and trust in the intermediary, i.e. VLE or Operator, giving the services.

Digital Divide (10), Complexity and Compatibility (12), Relative Advantage (16), Observability (8) and Trialability (10)	The factors were not evident in the field as the number of references to these codes was below the specified limit of 30 references to the overarching theme.
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Appendix 3. Initial Reachability Matrix

Factors	1	2	3	4	5	6	7	8	9	10	11
1	1	0	0	0	0	0.75	0	0	0	0.75	0
2	0	1	0	0	0	0	0	0	0	0	0
3	0.5	0.75	1	1	0	0.50	0	0	0.25	1	0.50
4	0	0	0	1	0	0.50	0	0	0	1	0.75
5	0	0.25	0	1	1	1	0	0	0	1	1
6	0	0	0	0	1	1	0.75	0	0	1	1
7	0	1	0	0	0	0	1	0	0	0	0.75
8	0	1	0	0	0	0	0.50	1	0	0	0.75
9	0.75	0	0.75	0.75	0.75	1	0.25	0	1	1	1
10	0	0	0	0	0	0	1	0	0	1	1
11	0	0	0	0	0	0	1	0	0	0	1

Appendix 4. Final Reachability Matrix

Note 1* denotes Transitivity Relationship

Factors	1	2	3	4	5	6	7	8	9	10	11	Driving Power
1	1	0	0	0	1*	1	1*	0	0	1	1*	6
2	0	1	0	0	0	0	0	0	0	0	0	1
3	0	1	1	1	0	0	1*	0	0	1	1*	6
4	0	0	0	1	0	0	1*	0	0	1	1	4
5	0	0	0	1	1	1	1*	0	0	1	1	6
6	0	1*	0	1*	1	1	1	0	0	1	1	7
7	0	1	0	0	0	0	1	0	0	0	1	3
8	0	1	0	0	0	0	1*	1	0	0	1	4
9	1	1*	1	1	1	1	1*	0	1	1	1	10
10	0	1*	0	0	0	0	1	0	0	1	1	4
11	0	1*	0	0	0	0	1	0	0	0	1	3
Dependence Power	2	8	2	5	4	4	10	1	1	7	10	

Appendix 5: Level Partitioning

Iteration 1				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1,9	1	
2	2	2, 3, 6, 7,8, 9, 10, 11	2	I

3	2, 3, 4, 7, 10, 11	3, 9	3	
4	4, 7, 10, 11	3, 4, 5, 6, 9	4	
5	4, 5, 6, 7, 10, 11	1, 5, 6, 9	5, 6	
6	2, 4, 5, 6, 7, 10, 11	1, 5, 6, 9	5, 6	
7	2, 7, 11	1, 4, 5, 6, 7, 8, 9, 10, 11	7, 11	
8	2, 7, 8, 11	8	8	
9	1, 2, 3, 4, 5, 6, 7, 9, 10, 11	9	9	
10	2, 7, 10, 11	1, 3, 4, 5, 6, 9, 10	10	
11	2, 7, 11	1, 3, 4, 5, 6, 7, 8, 9, 10, 11	7, 11	
Iteration 2				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1,9	1	
3	2, 3, 4, 7, 10, 11	3, 9	3	
4	4, 7, 10, 11	3, 4, 5, 6, 9	4	
5	4, 5, 6, 7, 10, 11	1, 5, 6, 9	5, 6	
6	4, 5, 6, 7, 10, 11	1, 5, 6, 9	5, 6	
7	7, 11	1, 4, 5, 6, 7, 8, 9, 10, 11	7, 11	II
8	7, 8, 11	8	8	
9	1, 3, 4, 5, 6, 7, 9, 10, 11	9	9	
10	7, 10, 11	1, 3, 4, 5, 6, 9, 10	10	
11	7, 11	1, 3, 4, 5, 6, 7, 8, 9, 10, 11	7, 11	II
Iteration 3				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1, 9	1	
3	3, 4, 10	3, 9	3	
4	4, 10	3, 4, 5, 6, 9	4	
5	4, 5, 6, 10	1, 5, 6, 9	5, 6	
6	4, 5, 6, 10	1, 5, 6, 9	5, 6	
8	8	8	8	III
9	1, 3, 4, 5, 6, 9, 10	9	9	
10	10	1, 3, 4, 5, 6, 9, 10	10	III
Iteration 4				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1, 9	1	
3	3, 4	3, 9	3	
4	4	3, 4, 5, 6, 9	4	IV
5	4, 5, 6	1, 5, 6, 9	5, 6	
6	4, 5, 6	1, 5, 6, 9	5, 6	
9	1, 3, 4, 5, 6, 9	9	9	
Iteration 5				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1,9	1	
3	3	3, 9	3	V
5	5, 6	1, 5, 6, 9	5, 6	
6	5, 6	1, 5, 6, 9	5, 6	
9	1, 3, 5, 6, 9	9	9	
Iteration 6				

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1, 9	1	
5	5, 6	1, 5, 6, 9	5, 6	VI
6	5, 6	1, 5, 6, 9	5, 6	VI
9	1, 5, 6, 9	9	9	
Iteration 7				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1, 9	1	VII
9	1, 5	9	9	
Iteration 8				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 5, 6, 7, 10, 11	1, 9	1	VIII

Appendix 6. Factors and Levels

Sr. No.	Factor Name	Factor Code	Levels
1	Awareness	2	I
2	Social Influence	7	II
3	Trust	11	II
4	Media Influence	8	III
5	Satisfaction	10	III
6	Time Saving	4	IV
7	Convenience	3	V
8	Quality of Operator	5	VI
9	Quality of Services	6	VI
10	Affordability	1	VII
11	Centre Resources	9	VIII

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