International Journal of Accounting and Economics Studies, 12 (8) (2025) 388-397

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/x9by9t43
Research paper

Assessing The Role of Digital India Initiatives in Empowering Rural Women: An Analysis through The UTAUT Model

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Received: October 18, 2025, Accepted: October 25, 2025, Published: December 14, 2025

Abstract

Background: To examine the impacts of the Digital India scheme on the economic empowerment of rural women in India, the study has adopted Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and Empowerment Theory as a theoretical foundation.
Methods: Conceptualizing the research process is based on a cross-sectional study; data were collected from 570 women in rural India in three states (Uttar Pradesh, Rajasthan, and Tamil Nadu) who had participated in state-funded digital literacy and capacity building initiatives. "Structural equation modeling (SEM)" was conducted on the relationship between performance expectancy, effort expectancy, social influence, facilitating condition, behavioral intention, and actual usage of digital services using SmartPLS.
Result: All proposed relationships were significant, confirmed, and found that the perceived usefulness, ease of use, social encouragement, and infrastructures positively influence women's behavioral intention to adopt digital platforms, which results in actual usage and economic empowerment. The results encourage the use of UTAUT2 in a gendered rural context and extend Empowerment Theory by making links between technology and behavior engagement and concrete empowerment outcomes. The study is theoretically constructive as it integrates two theoretical paradigms, technology adoption and empowerment, and practically constructive in that the study offers recommendations to policymakers in the design of inclusive digital strategies. It recommends surmounting digital infrastructure capabilities, growing vernacular digital education, and facilitating community-based learning for sustainable empowerment.
Conclusion: This research emphasizes that through evidence-based interventions and effective community engagement in digital interventions would bring about a change in the social and economic agency of rural women with the role of Digital India being an enabler to the process of inclusive and technologically enabled rural development.

Keywords: *Rural Women Empowerment; Digital India; Technology Adoption; UTAUT2; Smart PLS.*

1. Introduction

In the modern world, digital transformation has become a pillar for achieving inclusive growth and sustainable development, especially in developing countries such as India (Gupta & Thomas, 2020; Gupta & Arora, 2021). In 2015, the Government of India launched the Digital India initiative, aiming to transform the nation into a digitally empowered society and a knowledge-driven economy, under the guidance of the Ministry of Electronics and Information Technology. The vision of the program was developed on the three pillars specifically, digital infrastructure as a basic utility, governance and services accessible on demand, and the digital empowerment of citizens (NITI Aayog, 2018).While many great steps have been made in urban and semi-urban India, the outreach of this program in rural areas has been limited (Bansal & Aggarwal, 2022). The role of digitalization in the economic empowerment of rural women is especially important because women make up almost half of India's rural population and act as the backbone of agricultural and microenterprise activities (Chaudhary and Verma, 2019). The economic opportunities provided by the digital tools, such as mobile banking, e-commerce and online government services, are likely to increase participation in income-generating activities (Singh & Naidu, 2021).However, digital inclusion is more than just access to technology, and also includes digital literacy and affordability, as well as effective use of digital tools (World Bank, 2022). Women in rural India often struggle with structural barriers (limited mobility, low education levels, limited financial autonomy, and socio-cultural norms) that can impede their capacity to interact effectively with digital platformss (Kumar & Dey, 2020;). Therefore, the transformational potential of the Digital India initiatives in promoting women's economic empowerment is yet to be realized (Bhattacharya & Sharma, 2023).
Despite the government's extensive investments in digital infrastructure and literacy programs, the gendered digital divide remains a persistent issue in rural India (OECD, 2022; Ghosh, 2021). National surveys show that rural women are much less likely than men to have smartphones, to use the internet or to have access to digital financial services (National Sample Survey Office [NSSO], 2021). The digital

divide is not just technological, but rather behavioural and cultural - due to gender norms, lack of awareness and fear of being digitally defrauded or misused (Mehra et al., 2020; Sahoo & Patel, 2022). Existing literature is mainly centered on infrastructural access or basic digital literacy (Kaur & Raj, 2020; World Economic Forum, 2023). However, there is little empirical insight on behavioural intention and actual usage patterns of rural women in accessing Digital India schemes (Reddy & Bhatnagar, 2021). The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework serves as a valuable perspective for examining how performance expectancy, effort expectancy, social influence, and facilitating conditions relate to behavioral intentions and the actual use of digital tools (Venkatesh, Thong, & Xu, 2012). Consequently, there exists a research gap in evaluating how these UTAUT2 constructs affect rural women's engagement in digital initiatives and the transition of their behavioral intentions into real digital usage, particularly in terms of their influence on economic empowerment. (Sarkar, 2022; Banerjee & Das, 2023).

The study is critically significant at several levels - theoretical, policy-oriented and developmental. Theoretically, it adds to the body of literature on digital empowerment by the application of UTAUT2 model to a particular under-researched demographic: rural women in India (Dwivedi et al., 2020). It also incorporates Empowerment Theory (Zimmerman, 1995), which stresses the importance of empowerment as a process of gaining control, awareness and active participation in decision-making. From a policy perspective, the knowledge of the behavioural and contextual factors affecting digital adoption can be used to guide focused interventions under the ambit of the Digital India mission (Ministry of Rural Development, 2022). The findings might help policymakers, technologists and development practitioners in framing inclusive digital strategies which will extend beyond the provision of infrastructure and focus on capacity building, affordability and safety (World Bank, 2022; NITI Aayog, 2021). At the societal level, the purpose of the research is to shed light on the nexus of gender, technology and empowerment(United Nations, 2020). The outcomes of the study may further help in framing of digital literacy programs designed for women's socio-cultural context to ensure that the outcomes of digital inclusion are actualized in terms of empowerment such as entrepreneurship, financial independence, and better livelihood opportunities (Agarwal & Singh, 2021; Desai & Patel, 2022).

From the overview stated above, the following research questions are the key aspects of the current study:

RQ1: How do the UTAUT2 constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions influence the behavioral intention of rural women to use Digital India schemes for economic empowerment?

RQ2: To what extent does behavioral intention mediate the relationship between UTAUT2 constructs and the actual utilization of Digital India schemes in fostering rural women's economic empowerment?

To address these questions, the study combines the UTAUT2 model and Empowerment Theory (Zimmerman, 1995) to develop an evidence-based model for understanding the behavioral, social and infrastructural dynamics that govern the economic empowerment of rural women through digital initiatives.

2. Literature Review and Hypotheses Development

Recent studies in other developing economies substantiate the purpose of gender-sensitive policies in digital inclusion in empowering rural women. Venkatesh (2012), discovered that digital literacy programs in sub-Saharan Africa enhanced access to financial instruments and independence by women. In the same manner, Ali and Khan (2024) reported that entrepreneurship programs conducted via the mobile platform in rural Pakistan played a significant role in boosting women participation in the market. Comparative observations by Nguyen and Pham (2025) and de Souza and Silva (2024) indicate that community-based learning and perceived autonomy are crucial empowerment agents in line with the Empowerment Theory framework that is applicable in the current study.

2.1. Underpinning theories

2.1.1. UTAUT2: unified theory of acceptance and use of technology version 2

Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), proposed by Venkatesh (2012), which is further an extension of the original UTAUT model to incorporate consumer technology use and behavioral outcomes. The theory provides for user adoption in terms of important constructs like performance expectancy, effort expectancy, social influence and facilitating conditions. In addition, it also contains hedonic motivation, price value and habit, so it can be used for the study of how people make behavioral intentions toward technology. In the aspect of rural India, this theory generates a strong basis for understanding women's experiences and perceptions of technology as a driving factor in their participation in digital interventions through the Digital India initiative. Digitalisation has redefined the way service delivery works in rural areas and empowers women. The UTAUT2 model enables researchers to determine how cognitive beliefs and contextual factors result in actual usage behavior of rural women. By looking at these constructs, the current study will seek to understand how women's behavioral intentions are influenced by technological expectancy and social conditions, which consequently influence empowerment outcomes.

2.1.2. Empowerment theory

The Empowerment theory by Zimmerman (1995), explained empowerment as a multidimensional construct and it has intrapersonal, interactional and behavioral dimensions. Intrapersonal empowerment is concerned with a person's sense of self-efficacy and agency, interactional empowerment relates to how people understand social systems, and behavioural empowerment is concerned with action taken in order to influence events. In general digitalization context of rural areas, the participatory use of the technology is the form of behavioral empowerment of women. Claiming welfare, engaging in financial transactions, and engaging in e-learning are all acts of active agency, of taking control of one's socio-economic destiny through the digital means. As such, the theory offers a complementary basis to UTAUT2 by relating technological adoption to empowerment outcomes. By integrating these two viewpoints, the research conceptualises the generation of concrete empowerment through what the digital engagement of rural women under Digital India looks like.

2.2. Theoretical background and hypotheses formulation

2.2.1. Performance expectancy and behavioral intention

Performance expectancy is defined as a belief that technology use would enhance task performance or quality of life (Venkatesh, 2012). In rural India, women's perceived utility from digital services - whether it is accessing government entitlements, increased business opportunities, or increased household income - is strongly linked to their intent to use digital platforms. Rural women have a preference for

technologies that increase economic productivity and social mobility (Mishra, 2019). Kumar (2020) agrees that when women view digital interventions as a tool for empowerment and efficiency, their motivation to engage is enhanced. For example, digital agricultural platforms are giving women farmer's real-time prices which enhances decision making and productivity (Tripathi, 2021). Similarly, e-governance portals are making welfare schemes easily accessible thus reducing the dependence on middlemen (Singh, 2022). Therefore, the higher the projected performance advantage, the higher the intention to use digital technologies.
H1: Performance expectancy has a positive effect on rural women's behavioral intention towards Digital India.

2.2.2. Effort expectancy and behavioral intention

Effort expectancy is the level of easiness in using technology (Venkatesh, 2012). In this regard, simplicity and ease of use are very important factors for the acceptance of technology, especially in rural areas, where digital literacy is still limited. Women in rural India have challenges in using sophisticated interfaces or applications built in English, which hampers adoption (Sharma, 2021). Studies have shown that when platforms provide culturally appropriate local-language interfaces, voice-based support, and community training, women adoption rates go up (Nayak, 2020). Inclusive digital literacy initiatives which have guided demonstrations like the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) have proved to be having a profound effect on the participation of rural women (Rani, 2022). Using such devices is not only user-friendly, so as to alleviate fear of technology, but also has positive effects on users' level of confidence and continuity of use (Banu, 2018). Therefore, the degree to which rural women have a perception of technology as being easy to use has a direct influence on the behavioral intention.
H2: Effort expectancy has a positive effect on rural women's behavioural intention to embrace Digital India initiatives.

2.2.3. Social influence and behavioral intention

Social influence refers to the extent to which individuals feel that important others - family, peers or community leaders - believe that they should use a given technology (Venkatesh, 2012). In collectivistic societies like India, social approval plays a huge role in influencing behavioural decisions. Patnaik (2022) states that the use of digital platforms is endorsed by the community and therefore more women engage in technology-based programs. And in promoting digital adoption, rural self-help groups and women's cooperatives increase confidence and decrease cultural reluctance (Rizvi, 2021). Furthermore, being exposed to positive digital entrepreneurs in the community can be a social catalyst for involvement (Gond, 2020).In addition, the data shows that male family members play a significant role in women being provided with a digital device, supporting the understanding that household support must play a direct role in adoption (Chatterjee, 2021). Therefore, positive social reinforcement improves women's intention to use technology.
H3: Social influence has a positive effect on rural women's behavioral intention of Digital India initiatives.

2.2.4. Facilitating conditions and intention to behave

Facilitating conditions are the availability of technical infrastructure, resources and organizational support that facilitate the use of technology (Venkatesh, 2012). In rural areas, connectivity, device availability and local technical support are critical to adopting digital (Dwivedi 2020). Government programs like BharatNet and Digital Village have upgraded rural broadband infrastructure and closed the digital divide (Behera, 2021). Furthermore, government sponsored training initiatives, local service centres and public Wi-Fi access points are enablers of participation (Kamath, 2021).
According to the study, women who have access to smartphones and training are more confident in using digital financial platforms (Nedungadi, 2018). In contrast, limited access to electricity, poor network connectivity, and no local support are still major deterrents (Burman, 2021).Hence, if rural women can feel that the environment is supportive enough, their behavior intention is fortified.
H4: Facilitating Conditions Positive effect on rural women's behavioral intention of Digital India initiatives.

2.2.5. Intended behavior and actual behavior

Behavioral intention is the cognitive preparation to act in a certain manner, which comes before the actual usage (Ajzen, 1991). In technology adoption context, it refers to the behavioral intention to use a system and actual usage refers to the actual behavior. In the context of rural India, digital activities leading to behavioral intention are online banking, participation in e-governance and e-learning (Singh, 2023). Jani (2015) argues that when women have a positive intention towards digital platforms, they are more likely to use them in a more meaningful and repetitive manner. Training interventions which reinforce digital confidence increase intention and behavior (Vij, 2018). Also, community-level advocacy and local champions encourage long-term engagement (Nugroho, 2021). The intention to use relationship illustrates empowerment through measurable behavioral change.
H5: behavioral intention positively impact on actual usage of Digital India initiatives by rural women.
Actual usage is a measure of frequency and depth of digital application. When women are actively using digital tools for financial management, education or entrepreneurship, it results in behavioral empowerment (Zimmerman, 1995).Empirical research shows that constant digital use increases decision-making agency, opportunities to access market opportunities and social involvement (Bhasin, 2016). The digital literacy not only closes the gender gap but also imbues socio-economic freedom (Nayak, 2018). Eventually, such participation shifts women's positions from passive beneficiaries to active participants in the digital ecosystem (Iivari, 2020). Thus, actual digital usage may be considered a quantifiable measure of empowerment outcomes.

2.3. Identified literature gap

Although rural digitalization has been a major investing area, current research is largely confined to infrastructural and technological dimensions of digitalization and largely overlooks the behavioral and empowerment dimensions of women's digital inclusion. Empirical studies on how the constructs of UTAUT2 namely performance expectancy, effort expectancy, social influence and facilitating conditions impact on rural women's behavioral intentions and actual use of digital interventions are scarce. Further, socio-cultural and psychological barriers, such as control over devices by gender, restrictions of mobility, low levels of literacy, and privacy concerns, are not well explored. The causality between digital adoption and tangible empowerment outcomes - such as income increase, decision-making power, social inclusion - is not well tackled yet. The present study addresses these gaps by combining UTAUT2 and Empowerment Theory to formulate a comprehensive conceptual framework that not only explains technology adoption, but also how actual use leads to empowerment results. This dual theoretical framework makes a contribution to the fields of information systems and development studies by locating the

phenomenon of digital adoption within the socio-economic contexts of India.

2.4. Conceptual framework

The proposed conceptual model links UTAUT2 constructs, namely, performance expectancy, effort expectancy, social influence, and facilitating conditions, to behavioral intention and actual use, which further results in empowerment outcomes for rural women under the Digital India initiative. In this model, behavioral intention acts as an intermediate step between technological determinants and actual use, where empowerment is defined as the final result of the process of continuous digital participation.

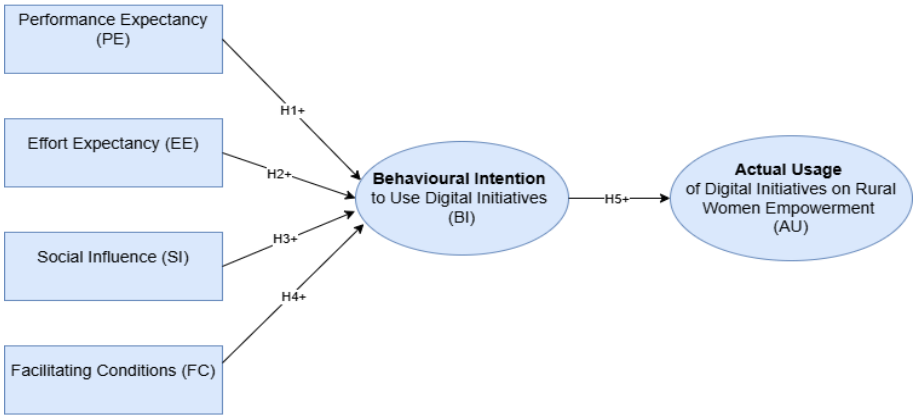

Fig. 1: Conceptual Framework.

Figure 1. Conceptual Framework illustrates the association between digital adoption variables (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions) and the results of women's empowerment on the UTAUT2 and Empowerment Theory frameworks. This diagram serves to point out the supposed causal directions that are being tested in the research.

3. Research Methodology

3.1. Research design

The present study relies on a quantitative research design based on the cross-sectional and explanatory research design, in order to identify the impact of the Digital India projects on the economic empowerment of rural women. The cross-sectional design is appropriate given that it enables the information to be gathered on a specific group of people at a single time, or on a single point in time, on their intentions of behaving in a certain way and the actual engagement on digital platforms (Creswell, 2014). The study aims to test the correlations of the variables empirically as they were described in the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and the Empowerment Theory frameworks. It is a deductive research, and in this, the researchers are testing a set of hypotheses that are based on the established theories using the information that is gathered in a survey (Sekaran et al., 2016). The quantitative study method will ensure objectivity, reproducibility, as well as generalisability of results in a range of rural contexts in India. Moreover, structured questionnaires would enable the systematic measurement of the constructs that would be consistent with UTAUT2 dimensions (Hair et al., 2020).

3.2. Data collection methods

The primary data have been collected among the rural women under various Digital India-sponsored digital empowerment initiatives such as Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), Digital Sakhi Program, and Common Service Centres (CSCs). The research was carried out on women who were trained on various aspects such as e-commerce, online banking, digital marketing, and e-learning that directly relate to their economic empowerment (Kumar & Patnaik, 2022). The data collection was based on structured questionnaires that were distributed through the use of a face-to-face method and an aided self-completion method to accommodate respondents with varying levels of literacy (Bryman, 2016). The designation of the tool is a pilot study of 40 rural women previously conducted before the main survey to pilot the question items in terms of reliability and clarity (Venkatesh et al., 2012). There were minor adjustments to words and design, based on the feedback, to make the language and layout easier to comprehend (Bell et al., 2019). The research instrument was also pretested by a team of five academic experts and practitioners in the field of digital literacy and rural development to ensure that the research instrument is contextually relevant and that the content validity is present. It took into consideration their feedback to eliminate the wording of questions and make them clearer. In order to increase the transparency level, all the questionnaire items were pre-tested to be readable and translated into local languages with back-translation of the translated statements to make them semantically equal. Moreover, enumerators were provided with detailed field protocols, which described standardized enumerator instructions on data collection, approach to the respondent, and consent procedures to reduce the bias of the interviewer and to be able to reproduce the data collection conditions.

The institutional review board in question gave ethical approval, and informed consent was obtained before the participation. The questionnaire has been translated into local languages in order to make sure that it is understood: Hindi (in Uttar Pradesh), Tamil (in Tamil Nadu), and Rajasthani (in Rajasthan). The survey was anonymous and of a voluntary nature in accordance with ethical standards of research (Israel, 2014). To achieve semantic equivalence, the process of back translation was adopted in translating it (Brislin, 1970). To prevent miscommunication and to achieve inclusiveness, procedural remedies of common method bias (CMB) were applied, such as randomisation of the questions, maintaining anonymity of the respondents, and simple wording based on the context. Furthermore, the lack of bias was ensured by conducting the subsequent statistical tests, including the Harman single-factor test (Jordan and Troth, 2020).

3.3. Sampling methodology and sample size

The study employed a multi-stage purposive and random sampling method to enable them to obtain a satisfactory number of cases in various socio-economic and geographical backgrounds. The first phase has selected 3 states, namely, Uttar Pradesh, Rajasthan, and Tamil Nadu, because they are considered to be among the top states in implementing digital empowerment programs as part of the Digital India initiative (MeitY, 2023). The second stage involved random selection of respondents on the lists supplied by the partnering community-based organisations (CBOs), non-governmental organisations (NGOs), and local-level development agencies that are delivering Digital India literacy schemes in the rural districts of these states (NITI Aayog, 2022). We followed this approach to make sure that we were accessing the actual beneficiaries and the data collected in an ethical way (Patton, 2015).

In the first place, 2000 women were approached to participate in the survey. Among these 650 agreed, and when the screening of the data and removal of incomplete or inconsistent answers was done, only 570 valid questionnaires were retained to do the ultimate analysis. The required minimum of the recommended standards of structural equation modeling (SEM) of at least 10 respondents per observed variable was satisfied by providing minimal non-monetary incentives in the form of tokens of gratitude, mobile data vouchers, or local community goods (Hair et al., 2020). This will help achieve a greater response rate and trust with the participants and ensure that external validity and reliability of the findings in other rural areas within India (Dillman et al., 2014). Lastly, the sample will be diversified in terms of age, education, occupation, income, etc., to attain external validity and reliability of the results in other rural areas within India (Etikan and Bala, 2017).

Table 1 displays the Sample descriptive information of the despondence. This information was gathered to ensure that socio-economic and cultural factors didn't have an effect on the results.

Table 1: Demographic Details

Variable (Sample Size n=570)	Category	Frequency	Percentage (%)
Age	18–30 years	180	31.58%
	31–45 years	230	40.35%
	46 years and above	160	28.07%
Marital Status	Married	390	68.42%
	Unmarried	180	31.58%
Education Level	No formal education	100	17.54%
	Primary education	160	28.07%
	Secondary education	180	31.58%
	Higher secondary	90	15.79%
	Graduate and above	40	7.02%
Occupation	Homemaker	300	52.63%
	Self-employed (micro-business)	150	26.32%
	Agricultural worker	80	14.04%
	Other	40	7.02%
Region	Uttar Pradesh	200	35.09%
	Tamil Nadu	180	31.58%
	Rajasthan	190	33.33%
Access to the Internet	Yes	420	73.68%
	No	150	26.32%

3.4. Measurements

Measurement scales in the current study have been validated as rigorous scales in past research to bring the highest reliability. The performance Expectancy (PE) was measured using three items based on Venkatesh et al. (2012), which evaluated the degree to which the implementation of the Digital India schemes helps to enhance the daily performance, the efficiency of work, and the overall quality of life. The participants were requested to answer the questions in all the items using a five-point Likert scale, i.e., strongly disagree, strongly agree. All the constructs and items were based on validated scales in accordance with the UTAUT2 model and the Empowerment Theory. A comprehensive construct matrix was drawn showing wording of items, theoretical basis, and probable orientation of the relationship to enhance measurement transparency and reproducibility. Moreover, the translation and back-translation procedure was done in a way that maintained linguistic and conceptual equivalence of measurement items in Hindi, Tamil, and Rajasthani versions, which can be replicated in the future within the same settings. Effort Expectancy (EE) was measured using three items that were provided by Venkatesh et al (2012). They involved the products that were based on the convenience of learning and the utilization of Digital India platforms. Social Influence (SI) was measured by three items from the same source to investigate the extent to which peers, the community, and key people can motivate individuals to use digital India schemes. Facilitating Conditions (FC) was measured by three items to consider the ease of getting the resources, knowledge, and support required to use the Digital India schemes. The Behavioural Intention (BI) was obtained using three items, which were adapted from the ones by Kim et al. (2008), concerned with the intention of respondents to remain and keep using, actively involved and supportive of Digital India platforms. Actual Usage (AU) was measured using half a dozen items developed based on Goodhue and Thompson (1995) and Zimmerman (1995), and measures the frequency, reliance, confidence, and empowerment with regard to the utilisation of digital services. A team of researchers, the authors of the instrument, reviewed the questionnaire to establish that the items were clear, relevant, and useful. Depending on the feedback received by the experts, slight changes were made to it in regard to wording, grammar, and order of items in a bid to reduce the possibility of common method bias. A pilot test was provided to 40 students and 10 research scholars to define the extent to which the questionnaire could be understood and helpful. The comments received by the pilots were used to make more changes to make the text understandable and easy to read. The final questionnaire was in two parts. The first section explored construct issues of PE, EE, SI, FC, BI, and AU around the adoption of Digital India. The first one was a demand for demographic data. The respondents were requested to evaluate individual items in accordance with their perceptions, experiences, and interactions with Digital India initiatives.

Table 2: Operationalization of the Constructs

Construct	Measurement Items	Source
Performance Expectancy (PE)	PE1: Using Digital India schemes improves my performance in daily activities. PE2: Digital services help me accomplish tasks more efficiently. PE3: Using Digital India platforms enhances the quality of my life.	Venkatesh et al. (2012)
Effort Expectancy (EE)	EE1: Learning to use Digital India schemes is easy for me. EE2: My interaction with Digital India services is clear and understandable. EE3: It is easy for me to become skillful at using digital platforms.	Venkatesh et al. (2012)
Social Influence (SI)	SI1: People who are important to me think I should use Digital India schemes. SI2: People who influence my behavior encourage me to use digital services. SI3: My community and peers support my use of Digital India programs.	Venkatesh et al. (2012)
Facilitating Conditions (FC)	FC1: I have the resources necessary to use Digital India schemes. FC2: I have the knowledge required to use digital platforms. FC3: Help is available when I face difficulties using Digital India services.	Venkatesh et al. (2012)
Behavioral Intention (BI)	BI1: I intend to continue using Digital India schemes in the future. BI2: I plan to use Digital India platforms frequently. BI3: I will recommend the use of Digital India services to others.	Kim et al. (2008)
Actual Usage (AU)	AU1: I frequently use Digital India services for my regular needs. AU2: I use digital platforms to access various government or financial services. AU3: I depend on Digital India schemes for important tasks. AU4: Using Digital India services makes me feel more confident and capable. AU5: I can make independent decisions using digital tools. AU6: Digital platforms have improved my access to opportunities and resources.	Goodhue & Thompson (1995) Zimmerman (1995)

Table 2 presents the measurement model that will display factor loadings and construct validity of the UTAUT2 variables and constructs of empowerment. The picture confirms the reliability and discriminant validity of the scale items that were applied in this research. The UTAUT2 model includes five additional constructs, such as Hedonic Motivation, Price Value, and Habit, but these constructs were excluded from the present research for contextual relevance and theoretical consistency with the topic under study. Hedonic Motivation (HM), which reflects the enjoyment or pleasure from using technology, was excluded as the Digital India programs were more about getting things done than having fun. The initiatives do not aim at providing entertainment or leisure; they aim at improving access to services, financial inclusion, and employment opportunities. In this context, cost-benefit perceptions do not contribute significantly to rural women's technology usage decisions, implying that, for the time being, there is no established pattern of usage among rural women because the digital adoption process in rural areas is at an early stage of development. Thus, at this stage of digital empowerment, habit could not be a useful predictor. In general, in terms of providing clear documentation of the questionnaire design, construct measurement sources, translation and pilot-testing protocols, and conventionalized methods of data collection, this study guarantees high methodological transparency, reliability, and reproducibility of a study in a future similar rural setting.

4. Analysis and Results

The data analysis was done with SmartPLS 4 software using the Partial Least Squares Structural Equation Modelling (PLS-SEM) method. We chose PLS-SEM over traditional covariance-based SEM procedures because PLS-SEM is more suitable for exploratory research, complex models with more than one construct, and smaller to medium sample sizes. All these things are in line with the goals and structure of this study.

The PLS-SEM approach tries to maximise the variance explained of dependent constructs. This is especially beneficial in research on new and emerging constructs, such as digital empowerment and behavioral utilization in rural areas. In addition to this, PLS supports both formative and reflective measurement models, providing flexibility in modeling mechanisms of the UTAUT2 independent variables, the mediating effect of behavioral use, and the outcome construct of rural women's empowerment. Given the relatively heterogeneous rural sample, and that the different latent variables, that is, performance expectancy, social influence, facilitating conditions, behavioral use, and actual empowerment outcomes were introduced, PLS-SEM was determined to be the most suitable analytical tool for this study (Hair & Alamer, 2022). This method has been widely used in recent social science research, including studies regarding technology adoption, digital inclusion, and women's empowerment under the developmental framework (e.g., Mishra et al., 2021).

The analysis was performed in two main stages: Measurement Model Assessment - the assessment of the reliability and validity of the constructs (both convergent and discriminant validity), Structural Model Assessment - the application of the model and the testing of the relationships between the constructs and their significance and explanatory power. This approach provided us with a powerful way to analyze the impact of digital initiatives on the behavior of their practitioners and how this translates into tangible empowering outcomes for women in rural regions.

Table 3: Construct Validity and Factor Loadings

Constructs	Item Label	Factor loadings	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Actual Usage (AU)	AU1	0.765	0.791	0.793	0.852	0.791
	AU2	0.77				
	AU3	0.701				
	AU4	0.631				
	AU5	0.658				
	AU6	0.669				
Behavioral Intention (BI)	BI1	0.845	0.81	0.81	0.888	0.726
	BI2	0.888				
	BI3	0.822				
Effort Expectancy (EE)	EE1	0.864	0.834	0.834	0.9	0.75
	EE2	0.87				
	EE3	0.865				
Facilitating Conditions (FC)	FC1	0.808	0.741	0.744	0.852	0.657
	FC2	0.818				
	FC3	0.806				

	PE1	0.878				
Performance Expectancy (PE)	PE2	0.9	0.84	0.841	0.904	0.758
	PE3	0.834				
	SI1	0.874				
Social Influence (SI)	SI2	0.868	0.844	0.846	0.906	0.762
	SI3	0.876				

From Table 3, the measurement model depicts the reliability and validity of all constructs in the study. To test the internal consistency and convergent validity, it involved several statistical variables, namely, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). Table 2 indicates that all factor loadings were above the acceptable threshold of 0.60 (Hair et al., 2019), and this fact means that items were highly reliable. The values of the composite reliability (rho c) of all constructs, 0.852 to 0.906, are higher than the acceptable standard of 0.70. It means that the constructs are internally consistent (Henseler et al., 2015). Similarly, the AVE values were all greater than 0.50, and this means that there was good convergent validity of the constructs.

Table 4: Discriminant Validity

Constructs	AU	BI	EE	FC	PE	SI
Actual Usage (AU)	0.701					
Behavioral Intention (BI)	0.385	0.852				
Effort Expectancy (EE)	0.409	0.371	0.866			
Facilitating Conditions (FC)	0.285	0.318	0.325	0.811		
Performance Expectancy (PE)	0.353	0.355	0.431	0.195	0.871	
Social Influence (SI)	0.445	0.295	0.268	0.155	0.377	0.873

Table 4 Discriminant validity helps to determine the Heterotrait-Monotrait (HTMT) ratio of Hair et al. (2019). The results are provided in Table 3, and it is possible to note that all the values of HTMT were less than the conservative level of 0.85. This means that all the constructs of the model have an empirical difference among themselves. Table 4 also indicated that the square roots of AVE (diagonal elements) had higher values compared to inter-construction correlations (off-diagonal elements) by the Fornell-Larcker criterion. This also demonstrated that discriminant validity was right, and the combination of these results demonstrates that the measurement model is valid and reliable, and the constructs used were appropriate to determine the behavioral intentions and actual use of Digital India initiatives to empower rural women.

Table 5: Path Estimates

Hypothesis	Dimensions	Original sample (O)	T statistics (|O/STDEV|)	P values	Result
H5	BI -> AU	0.385	8.148	0.000	Significant
H2	EE -> BI	0.190	2.731	0.006	Significant
H4	FC -> BI	0.198	4.073	0.000	Significant
H1	PE -> BI	0.180	3.365	0.001	Significant
H3	SI -> BI	0.145	2.560	0.001	Significant

Table 5, the path values illustrate the Structural Equation Modelling (SEM) to measure Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Behavioural Intention (BI), and Actual Usage (AU) of Digital India schemes were related to each other. The measurement model showed commendable reliability and validity, with all constructs showing adequate composite reliability and convergent validity. The structural model indicated a significant positive link between BI and AU (b = 0.385, t = 8.148, p < 0.001), i.e., people who want to use digital services more actually use them more. The significant predictors of BI are EE (b=0.19, t=2.731, p=0.006), FC (b=0.198, t=4.073, p<0.001), PE (b=0.18, t=3.365, p=0.001) and SI (b=0.145, t=2.56, p=0.01), which have significant positive effects. This shows that ease of use, availability of resources, usefulness perceived, and social support all work together to make users more likely to adopt Digital India schemes. These results also show that BI is the link between these factors and AU. The outcomes of structural models are standardized path coefficients. Figure 2 illustrates the magnitude and direction of relationships between the important variables that test the hypothesis formulated on digital adoption and empowerment.

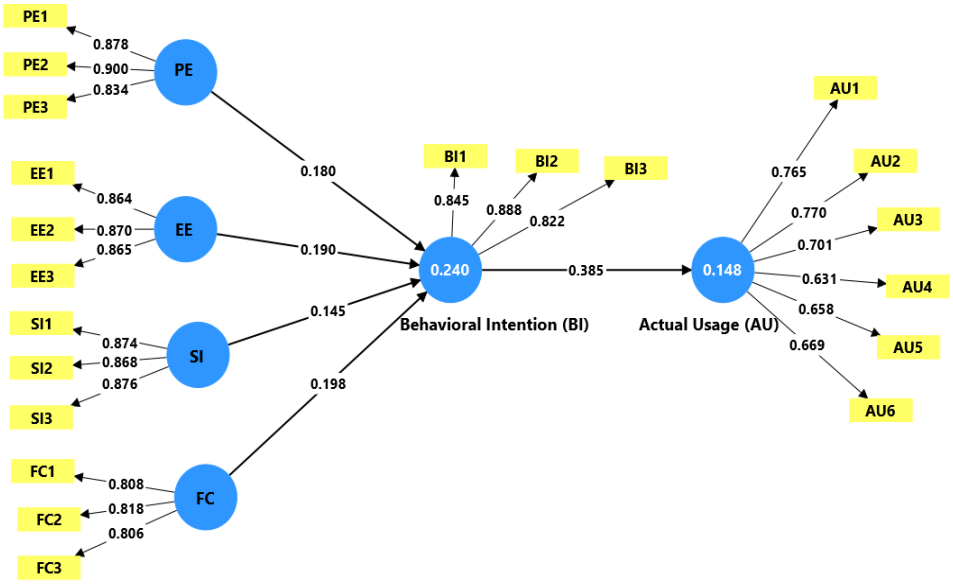

Fig. 2: Standard Path Coefficients of the Constructs.

Table 5: Model Goodness-of-Fit Summary

Goodness-of-Fit Index	Value	Recommended Threshold	Status
Chi-Square/df (CMIN/DF)	2.346	< 3.00	Acceptable
Root Mean Square Error of Approximation (RMSEA)	0.062	< 0.08	Good Fit
Comparative Fit Index (CFI)	0.952	> 0.90	Good Fit
Tucker–Lewis Index (TLI)	0.927	> 0.90	Good Fit
Standardized Root Mean Square Residual (SRMR)	0.053	< 0.08	Good Fit

The results of goodness of fit of the structural equation model in Table 5 indicate that the structural equation model fits the data items well (good to satisfactory). The calculated Chi-square/df (2.346) is lower than the suggested value (3.0) 3.0 which shows that the model used to fit is satisfactory (Marsh and Hocevar, 1985). The RMSEA is 0.062, which is below 0.08, and the model fit is reasonable (Browne and Cudeck, 1993). Similarly, both Comparative Fit Index (CFI = 0.952) and Tucker-Lewis Index (TLI = 0.927) are greater than the traditional cut-off point of 0.90, and therefore, they suggest that the hypothesised model is an acceptable fit of the data as compared to an independent model (Hu and Bentler, 1999; Bentler and Bonett, 1980). Besides, the value of SRMR is 0.053, which is lower than 0.08; this once again indicates that the estimated correlation is almost identical to the actual correlation (Hu and Bentler, 1999). Overall, these indices suggest that the model has a sufficient representation of the correlation between constructs and that the measurement and structural aspects are well-operationalized and the hypothesized framework is an effective representation of the dynamics of digital empowerment in rural women in India (Hair et al., 2020; Kline, 2016; Byrne, 2013).

5. Discussion

5.1. Interpretation of findings

The findings of the present research validated and assisted in confirming that the relationships between all the relationships which were posited in the model were statistically significant. UTAUT2 model constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions have a positive, statistically significant effect on behavioural intention to use Digital India schemes. In addition, the behavioural intention influenced the actual utilisation of these digital services significantly, which was subsequently explained as the economic empowerment of the rural women. These findings highlight the importance of women's perception of utility, ease of use, social encouragement, and enabling conditions of digital platforms to their intention and subsequent participation in digital initiatives. This confirms that access and motivation can actually ensure that the economic participation of rural women is indeed taking place through the digital inclusion programs.

The findings are consistent with the past research that advocated the application of UTAUT2 constructs in predicting digital adoption behaviour. Indicatively, Venkatesh et al. (2012) demonstrated the high predictive value of these variables in acceptance of technology, and this is in line with the current findings. Like the findings of Dwivedi et al. (2019) and Gupta et al. (2021), the research confirms the fact that the most notable variables to the behavioural intention are performance expectancy and effort expectancy, especially in digital financial inclusion and e-governance domains. Social influence is also positively involved in the work of Sharma and Lal (2020), who have mentioned that peer and family support are essential in encouraging women in rural India to pursue online learning and entrepreneurship. In addition, the connection between facilitating conditions and actual use is also strong, as reported by Chauhan (2022), and indicates that infrastructural support and training facilities play a significant role in the continuation of digital engagement. Lastly, the established correlation between factual utilization and economic empowerment endorses the theoretical standpoint of Zimmerman (1995) about empowerment, that the target of the digital instruments is practically based, which gives women a sense of confidence, decision-making, and income-generating potential. Therefore, the current research contributes to the existing body of literature that has shown that the application of digitalisation (when applied in an inclusively practiced way) directly results in the economic empowerment of women in developing economies.

5.2. Implications of the findings

The study has important theoretical and practical implications. Theoretically, it provides evidence of the applicability of the UTAUT2 framework in the present study in terms of the digital empowerment of rural women involving the behavioural intention and the actual usage as a mediating mechanism between the technological perception and the digital empowerment outcome. This integration is rich and a way to further the discourse about the gendered digital adoption by connecting psychological determinants to socio-economic outcomes. Practically, the results give policymakers and development practitioners actionable takeaways. They suggest that just providing the digital infrastructure is not sufficient and there needs to be a continued empowerment by improving usability, trust, and confidence through digital literacy and hands-on training. Programmes under the Digital India initiative are to be made more women-centric in the form of awareness campaigns, peer learning networks, and local mentorship models, in order to facilitate greater social influence and self-efficacy. NGOs and local governance bodies should come together to ensure that supportive conditions such as reliable internet access, inexpensive devices, and multilingual digital platforms are strengthened. These measures can work together to turn digital access into actual empowerment for rural women.

5.3. Limitations of the study

To improve the validity and visibility of the research, the possible limitations in the methodology have been addressed. Despite the valuable contribution of this study, there are some limitations. First of all, the cross-sectional design reduces the ability to draw long-term implications of causality between digital adoption and empowerment outcomes. Since a self-administered questionnaire was used to collect data, participants might be reluctant to share negative opinions, which has led to response bias. A longitudinal approach would allow more of a sense of the fluidity of digital engagement. Second, the data were collected from selected states (Uttar Pradesh, Rajasthan, and Tamil Nadu) that, although diverse, may not reflect the full range of socio-cultural contexts of rural India. Third, the study was based on self-reported data, which could have introduced social desirability or recall bias. Finally, whilst the UTAUT2 model gave a strong framework, it did not consider contextual variables such as cultural norms, spousal control, and privacy that could further affect women's digital behaviour. These factors should be taken into consideration as they enhance the credibility of the study and focus on how the study should be structured for future research directions.

5.4. Recommendations for further studies

Future studies can overcome these limitations by adopting mixed-methods or longitudinal designs to assess the change in behaviour and empowerment over time. Comparative studies on the rural and semi-urban areas may show different levels of digital adoption and empowerment achievements. The model could also be extended by incorporating constructs such as trust in technology, perceived risk of technology, or cultural attitude towards gender and technology. Additionally, examining the mediating role of digital self-efficacy and the moderating effects of age, education, and income could help to understand digital empowerment dynamics in a more nuanced way. Finally, participatory research with community-based interventions could provide more qualitative information about the ways in which women experience empowerment in digital inclusion initiatives.

6. Conclusion

This study focused on the contribution of Digital India initiatives in the economic empowerment of rural women using the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and Empowerment Theory. The result showed that performance expectancy, effort expectancy, social influence, and facilitating conditions have a significant impact on behavioural intention to use digital platforms, which in turn have a positive effect on actual usage. Furthermore, actual use of digital services emerged as a pragmatic proxy of the empowerment of women, representing enhanced access to financial services, education, and entrepreneurial activities. These findings confirm that when digital technologies are perceived as useful, easy to use, socially endorsed, and supported adequately, rural women are more likely to incorporate digital technologies into their daily lives and economic activities. The empirical results thus validate the structural model robustness to state that the Digital India mission has been instrumental in narrowing down the Gendered Digital divide and also in capturing the inculcation of inclusive development over rural India (Venkatesh et al., 2012; Zimmerman, 1995).

Theoretically, this research extends research by combining the concepts of technology adoption and empowerment frameworks in a rural Indian context where empirical evidence is limited. By extending UTAUT2 using Empowerment Theory, this study offers a multidimensional understanding of digital empowerment -- one that includes behavioural intention, actual usage, and empowerment outcomes. In line with the call to investigate inclusive digital transformation (Dwivedi et al., 2019; Gupta & Arora, 2021), it contributes to the technology acceptance literature by contextualising it in a gendered, socio-economic context. It also validates that empowerment is not a mere perceptual construct but a behavioural outcome demonstrated in the actual utilisation of digital services. This conceptual integration provides a new empirical approach to the study of technology empowerment in developing economies. Policy-wise, the results reflect the significance of the sustainable funding mechanisms and joint implementation frameworks to ensure the digital empowerment process in rural India. The further presence of digital literacy, infrastructure, and women-led innovation investment can be guaranteed with the introduction of the so-called public-private partnerships (PPP) and the models based on CSR. Making the data transparent and easily monitored, consistent with ethical standards of publication and governance like those prioritized by IJAES and COPE, would also support more accountability and effective policies. These policy measures will make sure that the results of Digital India are inclusive and sustainable, in that the academic wisdom will be merged with the adjustments in the real-world policy development.

6.1. Implications of the practice and theory

The study reveals the importance of reinforcing the digital engagement drivers for women in rural areas. An important role of enabling conditions indicates that infrastructural investments - such as affordable internet, stable electricity, and local digital service centres - continue to play an important role. The findings further indicated that interventions should be structured so as to be easy to use, to be in local languages, and to have culturally relevant training modules so as to overcome literacy limitations. Social influence emerged as a significant determinant, showing that one of the means to speed up digital inclusion for women is women digital champions and peer educators, which has been supported by Kumar (2022) and Sharma (2020).

Theoretically, this study both supports the validity of UTAUT2 in a non-urban context and for females, by empirically linking technology adoption to empowerment outcomes. It is an extension of Zimmerman's (1995) model of empowerment in the digital age, and shows how behavioural and interactional empowerment is attained through women's active use of digital platforms to manage resources, transact, and learn. Hence, the findings add to an emerging theoretical discourse integrating technology adoption theory with the gendered empowerment literature, especially in the case of emerging economies.

6.2. Recommendations to practice and policy

Targeted Training Schemes: Tailored training schemes in local languages on topics such as e-governance, money literacy, and online safety need to be created by policymakers. Government and NGOs can collaborate to build cultural and educational diversity, region-specific content (Nayak, 2018).Infrastructure Development: Investments should focus on adequate internet connectivity, mobile connectivity, and community digital infrastructure, such as community service centres in rural areas (Chatterjee & Nath, 2021). Moreover, the government may consider sustainable funding approaches, such as public-private partnerships (PPP), Corporate Social Responsibility (CSR), and funding, in order to secure further investment in the rural digital infrastructure in the future. By balancing these kinds of models with the principles of ethical governance and open mechanisms of accountability, it would follow the IJAES vision of equitable and responsible policy-making. Community-Based Empowerment Models: Promoting women-led digital groups or self-help collectives can help to amplify social influence, promote peer education and learning, and ensure long-term engagement (Tripathi, 2020).Inclusive Digital Policy Design: Government initiatives should incorporate gender-sensitive digital policy design to have women's inclusion in decision-making bodies pertaining to ICT and rural development (Burman, 2021).Monitoring and Evaluation Mechanisms: For any future digital empowerment policies, the introduction of data-driven evaluation frameworks, gauging not just participation but consequences in terms of income, autonomy, and self-efficacy, must be made (Iivari, 2020).In conclusion, the study presented empirical evidence that the Digital India initiative, based on the inclusion of technology policies and skills development initiatives, is slowly and steadily changing the socio-economic position of rural women. The combination of UTAUT2 and Empowerment Theory provides a strong background to understand the mechanisms by which technology promotes empowerment. As India continues to advance on its road to a digital economy, the long-term success of these programs will hinge on sustained infrastructural support, participatory design, and policy alignment with the goals of gender inclusivity. It is the ability and the confidence of the rural women to utilize the technology in a meaningful manner, not just access to technology, that is the real measure of digital empowerment.

Acknowledgement

The authors are thankful to the **Indian Council of Social Science Research (ICSSR**) for funding the publication of this article through the project fund.

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