Analyzing Factors Influencing Digital Technology Adoption among Women in STEM: A UTAUT2 Model Perspective from India

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ABSTRACT:

This study examines gender differences in digitalization adoption in STEM education in Delhi and Tamil Nadu, India, using the UTAUT2 model. It explores key determinants—performance expectancy, social influence, effort expectancy, facilitating conditions, price value, hedonic motivation, habit, and perceived ubiquity—that influence technology adoption among women in STEM. By applying the UTAUT2 model, the research enhances the understanding of the factors shaping women's use of digital technologies. The findings will help establish gender relations within the broader socio-economic context and identify organizational culture aspects that contribute to reinforcing or mitigating gender inequalities. Additionally, the study evaluates the effectiveness of current strategies to reduce these disparities and explores successful practices that could be adapted to different regional settings. Finally, the study provides a theoretical foundation for policy and practice, promoting more vigorous advocacy for women's employment in STEM fields and ensuring equal opportunities in critical sectors.

Keywords: Digitalization Adoption, Gender Differences, STEM Education, UTAUT2 Model, Technology Adoption in Women

1. INTRODUCTION:

The growing use of digital technology in science, engineering, and mathematics (STEM) disciplines has revolutionized professional practices, learning methodologies, and innovation processes. Nonetheless, despite swift technical progress, women in STEM persistently encounter substantial obstacles in utilizing digital tools and platforms. In India, where gender discrepancies in STEM careers endure, comprehending the determinants that affect women's use of digital technology is essential for closing the gender gap and promoting inclusivity. The UTAUT2 model offers a comprehensive framework for examining the factors influencing technology adoption, including performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit.

The digital revolution in STEM disciplines presents significant prospects for career progression, skill enhancement, and professional networking. Nonetheless, several socio-cultural and structural obstacles impede women's capacity to utilize digital tools properly. Restricted access to technology, insufficient institutional support, gender prejudices in professional settings, and cultural expectations hinder women's rapid adoption of digital technology in STEM fields. Furthermore, individual factors such as technological confidence, perceived utility, and motivation significantly influence adoption behaviour. The UTAUT2 model elucidates the relative significance of these aspects, offering a thorough comprehension of the facilitators and impediments influencing digital adoption. Government and institutional initiatives, including digital literacy programs, scholarships for women in STEM, and mentorship opportunities, have been implemented to enhance digital inclusion. Notwithstanding these endeavours, discrepancies persist, underscoring the necessity for focused treatments. Research demonstrates that cultivating an inclusive digital culture in STEM necessitates tackling both external limitations and internal perspectives on technology usage. This study utilizes the UTAUT2 model to empirically examine the factors affecting the digital adoption behaviour of women in STEM in India. The results will aid policymaking, educational measures, and workplace changes, ultimately promoting a more egalitarian and technologically advanced STEM ecosystem.

2. THEORETICAL BACKGROUND

The progression of digital technologies has become more and more rapid which has affected STEM disciplines in terms of performance, innovation, and future cooperation. However, there is one hurdle that women still face, and that is still lagging in the use of technology in their various fields of work. Such inequalities also confine the participation and presence of women in STEM as well as hinder them from fully contributing to those sectors.

Importance of Studying Gender Disparities

It is imperative to establish measures to understand the disparities between genders' capabilities and willingness to adopt digitalization solutions and make the classroom discrimination-free. Barriers and issues that women encounter in access to and use of technology comprise culture, socio-economic level, and biassed environment. Thus, the aforementioned barriers can be seen as the objectives to achieve by providing women with focused actions aimed at making their digital activity and career in STEM more effective. This paper covers issues connected with the main topic in various urban areas in Delhi and the smart cities of Tamil Nadu, thereby giving a plural and random sample coverage to discuss all the aforementioned aspects comprehensively.

Overview of the UTAUT2 Model

The second model for acceptance and use of technology, the UTAUT2 model, was established by Venkatesh et al (2012) which integrates further constructs that include hedonic motivation, price value, and habit. Based on the context, the UTAUT2 model hypotheses that performance expectancy hedonic motivation, (perceived usefulness); (perceived ease of use); social influence (others' opinions); effort expectancy, facilitating condition (resources); (enjoyment); price value; habitus; and perceived ubiquity affect both behavioral intention and actual usage of technology. Hence, this model enables the establishment of a framework of a combination of factors that are used to look at the mechanisms that determine women in STEM about technology adoption.

Application of UTAUT2 in This Study:

Integrating the UTAUT2 model into this research allows for a detailed examination of the numerous and multifaceted factors expected to contribute to the adoption or otherwise of digital technology among women in STEM. This study aims to explore the factors that support or hinder women's adoption of digital tools, focusing on factors such as their expectations of performance, ease of use, social influences, available resources, enjoyment motivation, perceived value for the cost, habitual behaviors, and the perceived availability of these tools.Thus, the proposed UTAUT2 model, which offers a more diverse perspective on the implication of these factors, offers useful implications about how they may differ in socio-technical and cultural constructs.

It also raises questions on gender combined with other factors like race, status, and geography to advance the knowledge of such complex relationships between digitalization implementation and STEM demographics. Moreover, the involvement and contributions of organizational cultures in either the maintenance and/or eradication of gender equality gaps in the labor force are examined with clear recommendations on fostering POS for women.

Gender Disparity in Digital Adoption

Digital divide across genders remains a major concern which is even worse in fields such as STEM, where women are under-represented. It has been portrayed in various research that women are in a disadvantaged position when it approaches to adaptation to innovative technologies and this challenge is normally a result of cultural and societal influences.

Cheryan(et al). noted that gender stereotypes concerning IT and technical disciplines push the female population away from these occupations. These stereotypes contribute to a perception that technology is a male-dominated area, which in turn decreases women's self- efficacy and interest in technology-related careers (Nosek et al., 2009).

Hilbert (2011) also explained that gender inequality in ICT usage and penetration is worsened by the fact that women and girls cannot access the physical ICT infrastructure and education in many developing nations. This not only decreases women's engagement in the digital economy but, indeed, does not allow them to use technology as a tool for self- and professional development. According to the study made by Cooper (2006), early exposure dictates the variances between males and females in the utilization and approval of the technology.

UTAUT2 Model

The UTAUT2 model by Venkatesh, Thong, and Xu (2012) builds upon the main version including the considerations of hedonic motivation, habit, price value. All these additions greatly improve the capacity of the adopted model to account for technology adoption behavior. UTAUT2 has been implemented and tested in numerous domains including, mobile banking (Baptista & Oliveira, 2015.), online learning (Hew et al., 2015), e-health services (Dwivedi et al., 2019), and much more.

The primary variables examined in the UTAUT2 model for this study encompass performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, perceived value relative to cost, and habitual use. Altogether, these variables form a refreshing paradigm to explain the adoption scenario of a particular technology. To better understand the factors influencing digital technology adoption among women in STEM in India, this study incorporates three additional variables into the UTAUT2 model: gender stereotypes, trust, and organizational support.

Gender Stereotypes: Gender stereotypes refer to societal beliefs and perceptions about the roles and capabilities of men and women. Concerning the application of technology, gender norms may greatly affect the capability and interest of women. According to Cheryan et al (2017), it is evidenced that these stereotypic perceptions hinder women's engagement in stem-related disciplines as they are sure that technology is for males only.

Trust: Acceptance of the technology and the organizations that supply such technologies need to be trusted by the users. According to Gefen, Karahanna, and Straub (2003, p. 344), trust plays a part when it comes to users' propensity to use technology. McKnight et al. (2011) also proved that is a direct and positive relationship among the overall level of trust and the actual usage of technology adopted which makes it a critical factor in the use of a technology tool by women sensing a lack of reliability or security in Information Technology.

Organizational Support: Organizational support includes the resources, training, and encouragement provided by an organization to its employees. Igbaria et al. (1997) found that such support significantly impacts employees' technology acceptance. For women in STEM, organizational support can help overcome challenges posed by gender stereotypes and perceived risks. Teo et al. (2008) highlighted that perceived organizational support positively influences the goal to use technology, underscoring its importance in the adoption process. By incorporating these additional variables, this study objectives to provide a broad understanding of the factors influencing technology adoption among women in STEM fields in India, offering insights into how to address gender disparities in digital adoption.

3. LITERATURE REVIEW

Sharma, R., & Patel, S. (2025). This study investigates the influence of performance expectancy, effort expectancy, and facilitating environments on women's adoption of digital technologies in STEM fields. Research demonstrates that social impact and hedonic incentives substantially affect adoption behaviour. Research indicates that customised training programs and mentorship initiatives improve technology adoption rates.

Kumar, A., & Reddy, P. (2024). The study identifies significant obstacles, including insufficient institutional support and gender prejudices, that impede women's use of digital technologies in STEM fields. The study uses the UTAUT2 paradigm to reveal that conducive conditions and habits are crucial in technological acceptance. Recommendations entail incorporating digital skills training into STEM curricula to enhance adoption rates.

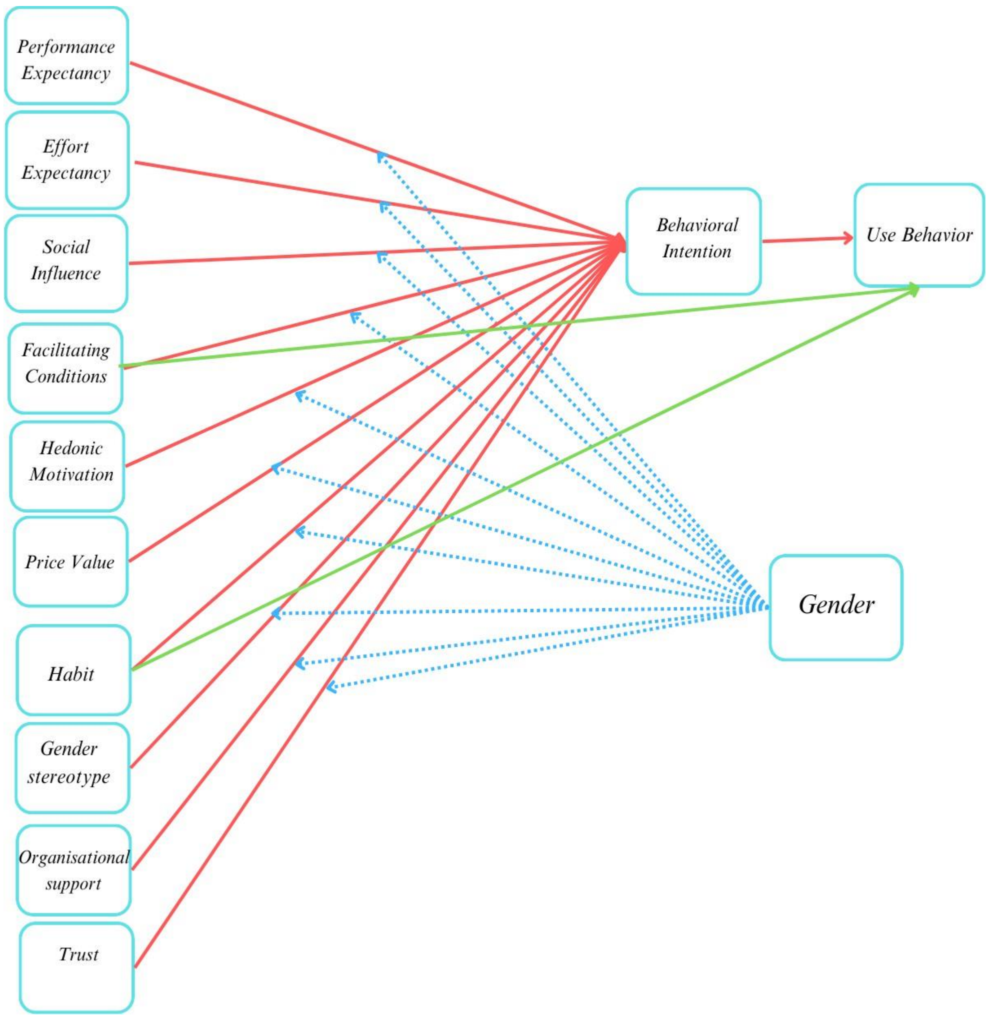
Bose, T., & Mehta, R. (2023). This study investigates gender inequalities in adopting digital technology within STEM disciplines. The findings indicate that effort expectancy and social influence are the primary determinants of adoption. The research highlights the significance of institutional policies in fostering inclusive digital learning environments to promote technology utilisation among women in STEM fields.

Singh, P., & Verma, K. (2022). This study indicates that habit and hedonic incentives are crucial elements affecting the adoption of digital technologies. The study highlights the necessity for governmental measures to tackle structural obstacles, such as employment discrimination and insufficient access to digital resources, that impede women's participation in STEM fields.

Nair, S., & Das, M. (2021). The research examines gender disparities in the use of digital technology, pinpointing significant motivational and structural obstacles. Findings demonstrate that performance expectancy and effort expectancy substantially affect adoption decisions. The report advocates for digital upskilling initiatives and mentorship programs in the workplace to address the digital divide for women in STEM fields.

Gupta, L., & Rao, A. (2020). This study investigates the perceptions and adoption of digital technology among women in STEM fields. The findings indicate that enabling situations and habitual behaviour significantly influence adoption. The study advocates for legislative initiatives, including gender-inclusive digital literacy programs and collaborations with industry, to enhance women's involvement in technology-oriented STEM professions.

4. PROPOSED RESEARCH MODEL:



5. RESEARCH OBJECTIVES

1. To assess the level of disparity in digital technology adoption between genders in STEM.
2. To examine the impact of UTAUT2 variables on digital technology adoption among women in STEM.
3. To categorize the barriers and enablers influencing digital technology adoption.

4. To provide recommendations for enhancing digital technology adoption among women in STEM.

6. RESEARCH HYPOTHESES

1. Performance Expectancy has a positive relationship with the acceptance of digital technologies among women in STEM fields.
2. Effort Expectancy has a positive relationship with the adoption of digital technologies among women in STEM fields.
3. Social Influence has a direct impact on the adoption of digital technologies among women in STEM fields.
4. Facilitating Conditions have a positive influence on the adoption of digital technologies among women in STEM fields.
5. Hedonic Motivation positively influences the adoption of digital technologies among women in STEM fields.
6. Price Value has a direct impact on the adoption of digital technologies among women in STEM fields.
7. Habit has a significant positive relationship with the adoption of digital technologies among women in STEM fields.
8. Gender Stereotypes have a negative impact on the adoption of digital technologies among women in STEM fields.
9. Trust in Digital Technologies has a direct influence on the adoption of digital technologies among women in STEM fields.
10. Organizational Support plays a crucial role in promoting the adoption of digital technologies among women in STEM fields.

7. RESEARCH METHODOLOGY

This work purposes to examine the influence of an array of factors on women's use of digital technology in STEM disciplines with a primary interest in equality issues. Performance expectancy (PE), Social influence (SI), Effort expectancy (EE) Facilitating condition (FC), Hedonic motivation (HM), Price value (PV), , Gender stereotype (GS), Trust (TR), Organisational support (OS), Habit (HT) are assumed to be related with the attitudes towards IS use as independent variables. The dependent variable of this study is defined as the Behavioural Intention to adopt digital technologies (BI).

A positivist research approach with the use of quantitative research that deals with the collection of numerical data. Information is gathered with the help of a standardized questionnaire that is based on a 5-point Likert Scale. Convenience sampling is employed. To check the content validity, reliability, and error-free features of the above-developed questionnaire, a 'pilot study' was conducted. Data analysis procedures are performed by means of Statistical Package for Social Science (SPSS) and Smart Partial Least Square (PLS). All these analytical tools are inclusive of descriptive statistics, regression analysis, correlation analysis, factor analysis, discriminant analysis, reiability analysis, and collinearity analysis.

Ethics aspects help to preserve the anonymity of the participants, as well as their inclination to contribute in the study. The rationale of this methodology was to fill the gap in understanding the factors that prompt women in STEM to adopt or shun digital technology.

Table No. 1: Demographic Profile of the Respondents

S.No	Demography Variable	Category	Frequency	Percentage (%)
1	**Gender**	Male	67	59.82
		Female	45	40.18
2	**Age**	18-25	21	18.75
		26-35	30	26.79
		36-45	28	25.00
		45-55	21	18.75
		56 and above	12	10.71
4	**Education**	Diploma	51	45.54
		Under Graduation	41	36.61
		Post Graduation	20	17.86
5	**Type of organization**	Private	46	41.07
		Public	33	29.46
		Other	33	29.46
		Total	**112**	**100.00**

***** Source: Primary Source**

The demographic data presents a detailed breakdown of participants across several categories: gender, age, education, and type of organization. In relations of gender, the sample is collected of 67 males (59.82%) and 45 females (40.18%), indicating a male- dominant population. Age distribution reveals a diverse range of participants with the majority falling between 26- 35 years (30 participants, 26.79%). This is followed by the 36-45 age group with 28 participants (25.00%), and both the 18-25 and 45-55 age groups each with 21 participants. (18.75%). The smallest group is those aged 56 and above, comprising 12 participants (10.71%). Educational background shows that the largest portion of the sample holds a diploma (51 participants, 45.54%), while those with an undergraduate degree make up 41 participants (36.61%). Participants with a postgraduate degree are the least represented, with 20 individuals (17.86%). Regarding the type of organization, the private sector has the highest representation with 46 participants (41.07%). The public sector follows closely with 33 participants (29.46%), and Other 33 participants (29.46%) did not specify their type of organization, leading to a total of 112 participants (100%). This analysis indicates a well-rounded demographic representation with a slight male predominance, a significant portion of participants in the early to mid-career age range, and a notable variety in educational qualifications and employment sectors.

Table No. 2: Constructs Reliability

Variable	**Factor**
Performance Expectancy (PE)	**.700**
Effort Expectancy(EE)	**.703**
Social Influence(SI)	**.726**
Facilitating Conditions (FC)	**.782**
Hedonic Motivation (HM)	**.743**
Price Value(PV)	**.683**
Habit (HA)	**.728**
Gender Stereotype(GS)	**.725**
Trust(TR)	**.732**
Behavioral Intention(BI)	**.753**
Use Behaviour (UB)	**.744**

The construct reliability analysis for the given variables demonstrates robust internal consistency across all measured constructs. Each construct's Cronbach's alpha value is above the generally accepted threshold of 0.70, indicating that the items inside each construct are reliably computing the same underlying concept.

Performance Expectancy (PE) has a Cronbach's alpha of 0.700, which is at the threshold, suggesting adequate reliability. Effort Expectancy (EE) is slightly higher with a value of 0.703, also indicating acceptable reliability. Social Influence (SI) has a Cronbach's alpha of 0.726, showing good core consistency among its items.

Facilitating Conditions (FC) stands out with the highest reliability score of 0.782, indicating strong consistency within this construct. Hedonic Motivation (HM) follows with a value of 0.743, reflecting good reliability. Price Value (PV) has a somewhat lower, yet acceptable, alpha of 0.683, which is slightly below the threshold but still considered reasonable in some contexts.

Habit (HA) and Gender Stereotype (GS) both have high reliability with scores of 0.728 and 0.725, respectively. Trust (TR) exhibits a solid reliability score of 0.732, further supporting the internal consistency of its items. Behavioral Intention (BI) has a strong alpha value of 0.753, indicating good reliability, while Use Behavior (UB) also shows good reliability with a value of 0.744. Overall, the constructs demonstrate satisfactory to excellent internal consistency, affirming the reliability of the measurements and suggesting that the objects within each construct are cohesively capturing the planned dimensions.

Table No. 3: Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	0.847	0.718	0.693	2.02116	0.718	28.852	9	102	0

From the table, the regression model results is seen. R Squared value is 0.718 which literally explains that almost 752% of the variance was explained by Use behaviour. Adjusted R Square value comes to 0.693 with a standard error approximation of 2.021. Since the significance of P value (0.000) is less than the alpha value (0.05), thus proving the significance of model.

Table No. 4: Correlation analysis

	PE	EE	SI	FC	HM	PV	HA	GS	TR	BI	UB
PE	1	.709	.706	.779	.669	.737	.679	.691	.689	.650	.716
EE	.709	1	.751	.738	.772	.741	.744	.701	.720	.727	.728
SI	.706	.751	1	.709	.733	.774	.742	.801	.733	.745	.768
FC	.779	.738	.709	1	.698	.801	.749	.714	.781	.755	.765
HM	.669	.772	.733	.698	1	.735	.702	.757	.690	.704	.722
PV	.737	.741	.774	.801	.735	1	.731	.761	.750	.762	.743
HA	.679	.744	.742	.749	.702	.731	1	.731	.752	.703	.731
GS	.691	.701	.801	.714	.757	.761	.731	1	.739	.709	.707
TR	.689	.720	.733	.781	.690	.750	.752	.739	1	.791	.728
BI	.650	.727	.745	.755	.704	.762	.703	.709	.791	1	.770
UB	.716	.728	.768	.765	.722	.743	.731	.707	.728	.770	1

The correlation analysis reveals significant relationships among the variables, highlighting the interconnectedness of various factors influencing user behavior and intentions.

Performance Expectancy (PE) shows strong positive correlations with all other variables, particularly with Facilitating Conditions (FC) (r = .779), indicating that as users find the conditions supporting the use of technology more favorable, their performance expectancy also increases. Effort Expectancy (EE) (r = .709) and Price Value (PV) (r = .737) also exhibit substantial correlations with PE, suggesting that easier and more cost-effective use enhances performance expectations.

Effort Expectancy (EE) itself is highly correlated with Hedonic Motivation (HM) (r = .772) and Social Influence (SI) (r = .751), implying that both enjoyment and social factors significantly contribute to the perceived ease of use. The high correlation with Facilitating Conditions (FC) (r = .738) further emphasizes the importance of supportive conditions in reducing effort expectations.

Social Influence (SI) has strong correlations with Price Value (PV) (r = .774) and Habit (HA) (r = .742), suggesting that social factors heavily influence perceived value and habitual behavior. Facilitating Conditions (FC) also strongly correlate with Price Value (PV) (r = .801) and Habit (HA) (r = .749), underlining the role of supportive conditions in perceived value and habitual use.

Hedonic Motivation (HM) exhibits strong relationships with Effort Expectancy (EE) (r = .772) and Social Influence (SI) (r = .733), indicating that enjoyment is closely tied to ease of use and social factors. Price Value (PV) (r = .735) and Habit (HA) (r = .702) are also significantly related to HM, suggesting that enjoyment influences perceived value and habitual behavior.

Price Value (PV) has significant correlations with all other variables, notably Facilitating Conditions (FC) (r = .801) and Social Influence (SI) (r = .774), highlighting the importance of supportive conditions and social influence in perceived value. Habit (HA) (r = .731) is also strongly correlated with PV, suggesting that perceived value contributes to habitual use.

Habit (HA) shows robust correlations with Effort Expectancy (EE) (r = .744) and Social Influence (SI) (r = .742), indicating that habitual use is influenced by ease of use and social factors. Facilitating Conditions (FC) (r = .749) and Price Value (PV) (r = .731) also exhibit strong relationships with Habit, emphasizing the importance of supportive conditions and perceived value in developing habitual behavior.

Gender Stereotype (GS) is strongly correlated with Social Influence (SI) (r = .801) and Hedonic Motivation (HM) (r = .757), indicating that gender stereotypes are influenced by social factors and enjoyment. Trust (TR) (r = .739) and Habit (HA) (r = .731) also show significant relationships with GS, suggesting that trust and habitual behavior are affected by gender stereotypes.

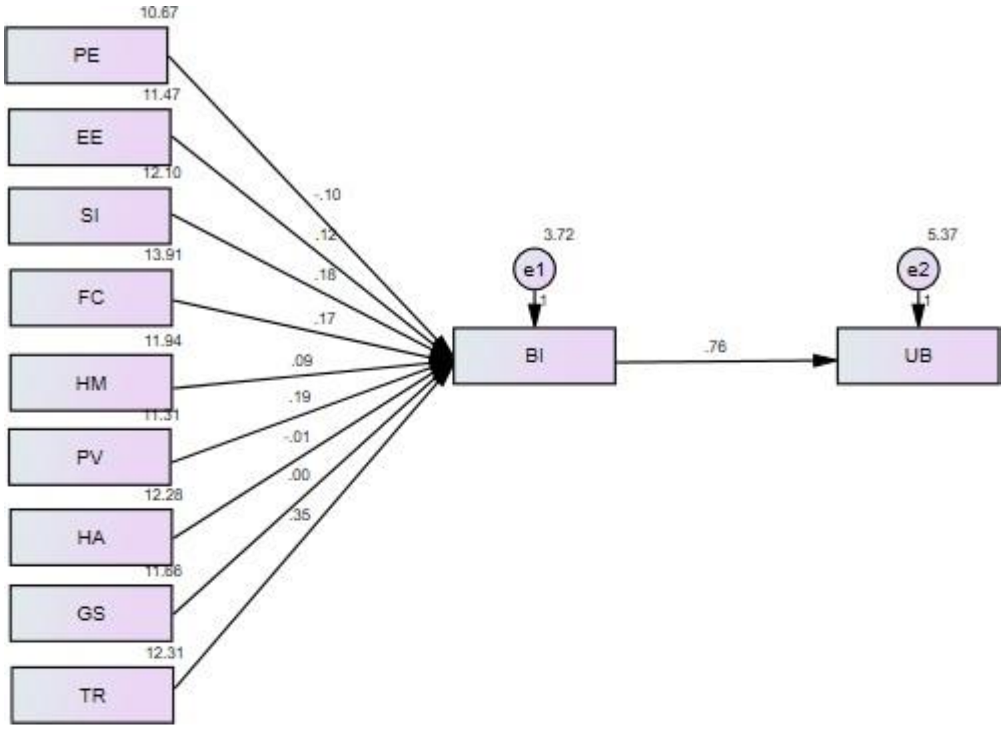
Trust (TR) has high correlations with Facilitating Conditions (FC) (r = .781) and Price Value (PV) (r = .750), highlighting the importance of supportive conditions and perceived value in building trust. Behavioral Intention (BI) (r = .791) also shows a strong relationship with Trust, indicating that trust significantly influences users' intentions to use technology.

Behavioral Intention (BI) exhibits strong correlations with Price Value (PV) (r = .762) and Facilitating Conditions (FC) (r = .755), suggesting that perceived value and supportive conditions heavily influence users' intentions. Habit (HA) (r = .703) and Social Influence (SI) (r = .745) are also significantly related to BI, indicating that habitual behavior and social factors play crucial roles in shaping behavioral intentions.

Use Behavior (UB) is strongly correlated with Behavioral Intention (BI) (r = .770) and Facilitating Conditions (FC) (r = .765), emphasizing that intentions and supportive conditions are key determinants of actual use. Social Influence (SI) (r = .768) and Price Value (PV) (r = .743) also show significant relationships with UB, highlighting the roles of social factors and perceived value in influencing use behavior.

The analysis demonstrates that various factors such as supportive conditions, social influence, perceived value, and enjoyment are significantly interrelated and play crucial roles in shaping performance expectancy, effort expectancy, trust, behavioral intention, and use behavior.

Fig.1: SEM Model



CONCLUSION AND SUGGESTIONS

Conclusion

This study meticulously examines gender differences in digital technology adoption within STEM education sectors in Delhi and Tamil Nadu, India, using the Unified Theory of Acceptance and Use of Technology (UTAUT2) model. The analysis reveals that multiple factors—performance expectancy, effort expectancy, social influence, hedonic motivation, price value, habit, and facilitating conditions—significantly impact technology adoption among women in STEM fields. Additionally, the study incorporates gender stereotypes, trust, and organizational support as key variables to further explore the barriers and enablers influencing digital adoption. The findings indicate that performance and effort expectancy are pivotal in shaping the intention to use technology, as women perceive tangible benefits and ease of use as crucial determinants. Social influence and facilitating conditions also play a substantial role, highlighting the impact of societal norms and the availability of resources in shaping adoption behaviours. However, gender stereotypes remain a significant barrier, affecting women's confidence and interest in engaging with technology. Trust in digital tools and the organizations providing them is essential, fostering a sense of security and reliability. Furthermore, organizational support, encompassing resources, training, and encouragement, emerges as a critical factor in overcoming gender disparities and promoting technology use among women. By integrating these insights, this study underscores the complex interplay of factors influencing technology adoption in the context of gender disparities. It provides a strong theoretical foundation for developing policies and practices to enhance digital inclusion and promote gender equality in STEM fields. The findings also offer valuable implications for educational institutions, policymakers, and organizations seeking to create more inclusive and supportive environments for women in STEM.

Suggestions

To address the identified barriers and facilitate greater technology adoption among women in STEM fields, several strategic recommendations are proposed. Firstly, educational institutions and organizations should work collaboratively to create a supportive and inclusive environment that fosters women's engagement with technology. This includes implementing mentorship programs, providing continuous learning opportunities, and promoting positive role models who can inspire and guide women in their technological pursuits.

Efforts should also be directed towards reducing gender stereotypes by challenging societal norms and promoting the narrative that technology is not gender-specific. Campaigns and initiatives aimed at raising awareness and changing perceptions about women's capabilities in STEM can significantly impact their confidence and interest in technology adoption.

Enhancing trust in digital tools and the organizations providing them is crucial. This can be achieved by ensuring the security, reliability, and transparency of technology and its applications. Organizations should also prioritize creating a culture of trust and support, where women's contributions are valued and recognized.

Facilitating conditions, such as access to resources and training, should be strengthened to empower women to use technology effectively. This includes providing necessary infrastructure, technical support, and user-friendly interfaces that cater to diverse needs and preferences. Moreover, emphasizing the perceived value and ease of use of technology can significantly influence women's habitual behaviors and social norms, making technology adoption more appealing and accessible.

A multifaceted approach that addresses the various determinants of technology adoption is essential for promoting digital inclusion and bridging gender disparities in STEM fields. By fostering a supportive environment, challenging stereotypes, enhancing trust, and providing necessary resources, educational institutions, policymakers, and organizations can create a more equitable and inclusive landscape for women in STEM, ultimately contributing to their empowerment and professional development.

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