Digital Financial Services as a Tool for Rural Women Empowerment

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Abstract: *Rapid growth of digital finance enhances financial inclusion along with rural women's empowerment. This study examines the women's empowerment level by utilizing fintech services with digital financial capability considered as a key variable , in selected districts of southern Tamil Nadu, namely Virudhunagar, Madurai, Tirunelveli, and Thoothukudi. Data were obtained from 384 rural women users of fintech services through a well-structured questionnaire using the judgment sampling technique. Confirmatory Factor Analysis and Structural Equation Modeling examined construct validity and relationships between variables. Result of the study indicates a moderate digital financial capability and empowerment among rural women. The results further indicate that digital financial capability has positively influences the rural empowerment by improving their financial decision-making ability, social participation, and economic independence. The study emphasizes the importance of enhancing digital financial literacy and accessibility in rural areas. Strengthening these capacities can enable rural women to participate more actively in economic activities and promote greater financial inclusion. The findings have important implications for policymakers, financial institutions, and development agencies in designing effective strategies to promote digital finance and women's empowerment in rural communities.*

Keywords: *Digital Finance, Women Empowerment, Financial Inclusion and Rural Development*

Introduction

Fintech services are playing the main role in the modern era. Fintech services are widely adoptely for everyday money transactions, while women achieve empowerment through self-help groups and government schemes. A lot of studies examined digital financial literacy and inclusion among rural women. But only limited studies focused on how digital financial capabilities influence women's empowerment, mainly via sophisticated analytical methods namely **Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM)**. So, the researcher aims to understand the digital financial services role in empowering rural women in selected southern districts of Tamil Nadu. Hence, this study investigates the link between digital financial capability and rural women's empowerment using structural modeling.

Review of Literature

Neetu Chhillar & et. al (2024) in their research title "Measuring Digital Financial Literacy: Scale Development and Validation" . This research measures digital financial literacy using digital financial risk, awareness, attitude, and skills. Purposive with snowball sampling techniques were used to find the respondents. They Used SPSS and AMOS for analyse the data. They stated results "The results indicated that the overall DFL score of the sample was 55.94 percent, which was deemed unsatisfactory given the study's focus on the metropolitan area of a developing nation such as India, where there is adequate infrastructure for digital financial services and information technology. These findings suggest that despite the presence of adequate infrastructure, there is a need to improve the digital financial literacy of individuals in the area." **Muhammed Basid Amnas et.al (2024)** in their research paper "FinTech and Financial Inclusion: Exploring the Mediating Role of Digital Financial Literacy and the Moderating Influence of Perceived Regulatory Support". This study measured the fintech use by three variables – Trust, Service Quality & Perceived Security. By through of Fintech use, authors used the Financial literacy is considers as mediate variable and Perceived Regulatory Support is considered as a moderate variable and finally they measure Financial Inclusion. Technological progress has increased the digital literacy significance in making sound financial choices and accessing financial services.

G.Marci-Boehncke, T.Vogel (2018) in their paper titled "Digital Literacy And Inclusion: The Impact Of Theory And Practice In Teachers' Education". The study covers the two courses about "Digital Learning in Heterogeneous Classes" and "Diagnosis Methods for Reading Competencies and Ideas for Reading Promotion" which took part once during winter term 2016/2017 and once during summer term 2017. This Research aimed to found what attitudes and experiences the students have a regards inclusive teaching and teaching with digital media. **Ahmad Aref M. Assaf (2024)** in her research title "Impact of Social Entrepreneurship on Women Empowerment through Financial Inclusion an Analytical Study from the Kingdom of Saudi Arabi". Women's Empowerment Framework as well as Financial Inclusion Models are equipped to investigate relationships among interdependent dimensions of collaboration, creativity, diversity, scalability of initiatives and financial inclusion strategies outsources and outcomes on women restructuration. The study shows good links between collective action, creativity, diversity, scalability and financial inclusion strategies and women's empowerment effects emphasizing the significance of custom-made social entrepreneurship to enhancing gender equality and economic opportunities.

A.Arun Kumar (2014), this paper studied about the women empowerment especially those who lived in rural areas. The author said "Empowerment is a process aimed at changing the nature and direction of systematic forces which marginalize woman". In this paper, the author stated the Albert Einstein code that "The Woman who follows the crowd will usually go

no further then the crowd. The Woman who walks alone is likely to find herself in places no one has ever been before."His view differ from other authors that paper explained women empowerment will grow when government supports the women by through entrepreneurship training, seasonal business tactics, computer languages etc… This has helped women grow and stand on her feet. **Syed Luftu ul Hasnaen et.al.,(2023)** in their paper titled "Empowering Rural Women through Skill Development: A Pathway to Sustainable Livelihoods". This essay examined how women develop themselves from the current offers given by the government. They also find which factor affects them to grow. Data analyzed through qualitative methods which following thematic analysis. The study's high point is that only six women between the ages of 20 and 40 provided the data. The study emphasizes how crucial it is to use technology, particularly computer skills and internet knowledge. It offers suggestions like creating educational websites, enabling simple internet access, and establishing community centers. Additionally, the report recommends focusing on local resources and collaboration. It suggests combating preconceptions, awarding educational scholarships, and obtaining financial assistance.

Seema Ghosh et.al (2023) in their examination title "Achieving Sustainable Development Goal of Women Empowerment: A Study among Self-help Groups in India". This study evaluates the impact of self-help group (SHG) intervention and entrepreneurial traits of SHG members on the social and economic -cultural empowerment of rural women. The method of purposive sampling has been applied to collect a sum of 344 responses from the SHG of women who are engaged in entrepreneurial income-generating activities in their village. Regression analysis was carried out to analyze the data. The study found and argues that SHG interventions have a good association with the socio and economic-cultural empowerment of rural women. The study's discovered and analyzed criteria assist stakeholders make policy decisions that improve all the elements that contribute to the success and expansion of SHGs in general and SHG women entrepreneurs' micro-enterprises in particular.

Research Gap

Lot of research work focused on factors such as financial literacy, access to finance, and entrepreneurial abilities. A Few studies have looked at fintech use, digital financial capabilities, and their combined impact on many aspects of women's empowerment (economic, decision making and psychological). The majority of earlier research on women's empowerment and digital finance was done at the national or metropolitan levels. There's a geographical gap that has to be filled due to the paucity of earlier research work specifically on rural women in Tamilnadu's southern districts.

Regression analysis, descriptive analysis, and core statistical techniques have been applied in a lot of research. Some studies have applied **advanced** methods such as Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) to validate constructs and examine relationships among digital financial capability and women empowerment.

Objective

- To assess the extent of rural women empowerment via digital financial capabilities using fintech-based digital financial services.

Sub Objectives:

To achieve the above objective, the researcher formulated the following specific objectives:

1. To validate the measurement model of the elements that contribute to digital financial capability and rural women empowerment evaluated through Confirmatory Factor Analysis (CFA).
2. To analyze the gauge between digital financial capabilities and the rural empowerment

using Structural Equation Modeling (SEM).

Research Methodology

a) Procedure for Data Collection and selection of samples

This research focuses on only on selected districts of Southern Tamil Nadu such as Virudhunagar, Madurai, Tirunelveli, and Thoothukudi to analyze rural women's empowerment enabled by digital financial services

The Current study used both primary and secondary data and applies analytical methodolgy. Drawing from the 2011 Census of India, the rural female population in the chosen districts- accounts for approximately **23, 03,195**. Due to the size of the population, the researcher followed the sample size determination suggested by based on the sample size table developed by Krejcie and Morgan (1970), 384 samples are deemed suitable for large populations. Consequently, 384 respondents in all were picked from the selected districts. with 96 respondents from each district. Four villages were picked from each district and from each village, 24 rural women were chosen using judgment sampling. So, Data for the study came from 384 rural women who utilizing online financial services by well structured questionnaire.

b) Measurement of Study Variables

H€ : Digital financial capability does not influence the women's empowerment.

The researcher analyzes rural women's empowerment through digital financial capability. So, digital financial capability is considered an independent variable and women's empowerment as a dependent variable. Digital financial capability is assessed through three key dimensions: Digital Financial Literacy (DFL), Digital Financial Accessibility (DFA), and Digital Financial Usage (DFU). Psychological Empowerment (PE), Economic Empowerment (EE), and Decision-Making Empowerment (DME) factors are used for measuring the empowerment. To analyze and confirm the factors and variables, the researcher implements the Confirmatory Factor Analysis and Structural Equation Model through Analysis of Moment Structures (AMOS).

Data Analysis and Interpretations

Reliability of each factor was tested before conducting CFA. Table 1 shows the reliability

Table 1: Reliability

Factors	Cronbach`s Alpha	No. of Items	Interpretation
Digital Financial Literacy	.852	7	Good Internal Consistency
Digital Financial Accessibility	.739	5	Acceptable Internal Consistency
Digital Financial Usage	.832	7	Good Internal Consistency
Economic Empowerment	.783	6	Acceptable Internal Consistency
Psychological Empowerment	.755	6	Acceptable Internal Consistency
Decision Making Empowerment	.820	6	Good Internal Consistency

Source : Computed Data

Reliability of the mentioned factors was evaluated using Cronbach's Alpha . A value above 0.70 indicates acceptable internal consistency (Jum C. Nunnally & Bernstein, 1994; Joseph F. Hair Jr. et al., 2019). So, all the factors have the eligibility to check the confirmatory factor analysis.

Confirmatory Factor Analysis – Digital Financial Literacy

Digital Financial literacy statements are connected to the expertise and abilities of rural women on digital financial services like understanding digital payment systems, security practices, and financial transactions. CFA assessed the measuring model's adequacy and concept validity. The Confirmatory Factor Analysis of Digital Financial Literacy is displayed in Figure 1.

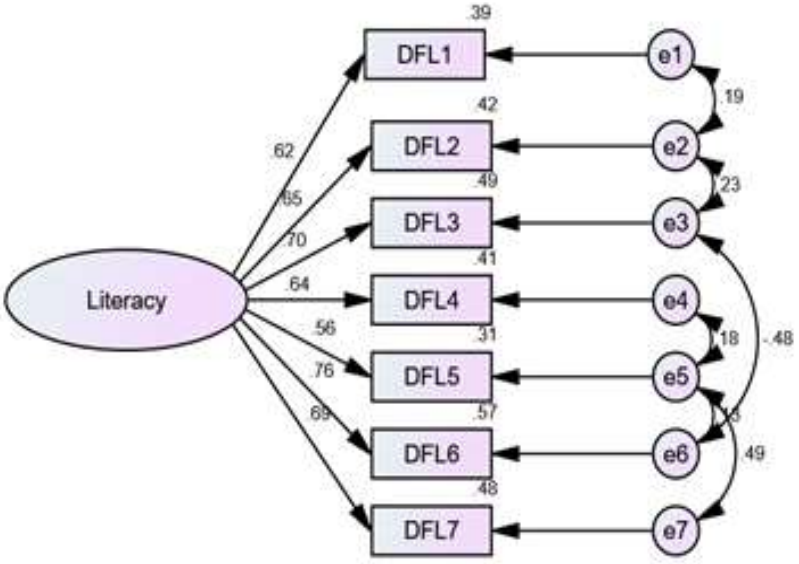


Figure 1: CFA - Digital Financial Literacy

Standardized factor loadings of all statements in Digital Financial Literacy exceeded the suggested cutoff point of 0.50 , indicating acceptable convergent validity.. Among these factors, the statement "I understand OTP usage" (DFL3) shows the highest standardized regression weight of 0.70, suggesting that it strongly represents the construct. Furthermore, the overall fit indices of the measurement model of digital financial literacy indicate a satisfactory model fit, thereby supporting the construct structure.

The model's adequacy was determined using absolute, incremental, and parsimony fit indices (Hair et al., 1995, 2006, 2010).One index for every model fit category should be used, according to Holme-Smith et al. (2006), who advise using a minimum of three fit indices. Every index complies with the cutoff values recommended by Hair et al. (2006). Table 2 displays the key indices that reflect the fit of the model for the digital financial literacy dimension.

Table2: CFA Model fit summary of Digital Financial Literacy

ues	P Value	RMSEA	GFI	AGFI	CFI	TLI	NFI	CMIN/df
ıal Value	.172	.034	.991	.970	.997	.991	.989	1.445
eshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
ult	Reached	Reached	Reached	Reached	Reached	Reached	Reached	Reache

Source: Computed Data

Indices Value confirms the digital financial literacy fit and suggests that the construct is valid. The statement " I know how to check balances online." has a critical ratio value of 11.086 and is discovered to be significantly different at the 0.05 level. Furthermore, the results show a significant difference at the 0.05 level across the six statements that affect the digital financial literacy dimension.

Confirmatory Factor Analysis – Digital Financial Accessibility

Digital Financial accessibility statements are linked to the availability and infrastructure of digital financial services in rural areas like accessibility of digital devices, banking facilities, internet connectivity, and infrastructure. The Confirmatory Factor Analysis of Digital Financial accessibility is displayed in Figure 2.

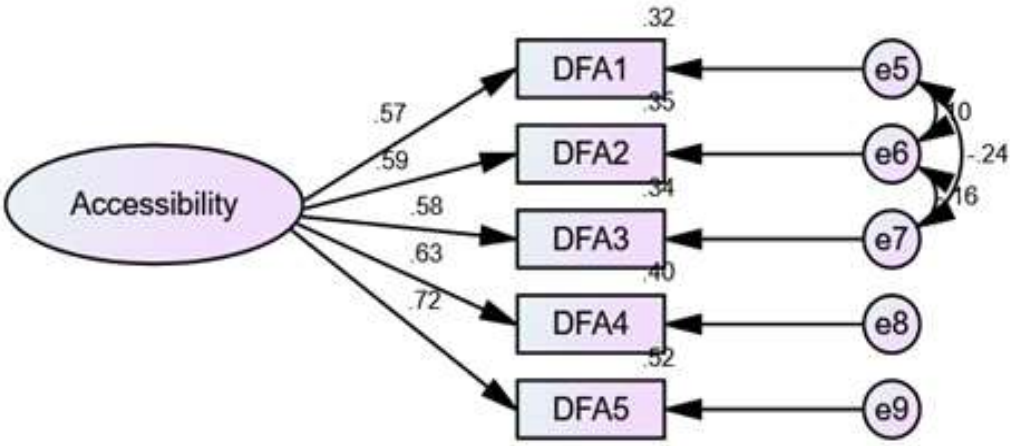


Figure 2: CFA - Digital Financial Accessibility

Standardized factor loadings assessed relationships between observed variables and constructs. All the statements of Digital Financial Accessibility exceeded the suggested cutoff point of 0.50, indicating acceptable convergent validity. Among these factors, the statement "I can access digital apps anytime" (DFA5) shows the highest standardized regression weight of 0.72, suggesting that it strongly represents the construct. Additionally, model fit indices were applied to evaluate the overall suitability of the measurement model. Table 3 presents the CFA results for digital financial accessibility.

Table3: CFA Model fit summary of Digital Financial Accessibility

Values	P Value	RMSEA	GFI	AGFI	CFI	TLI	NFI	CMIN/df
Actual Value	.951	.000	1.000	.999	1.000	1.025	1.000	0.50
Threshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
Result	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**

Source: Computed Data

Values of the stated indices confirm the fit of digital financial accessibility and suggest that the construct is valid. The statement "Internet is available locally" has a critical ratio value of 8.277 and is found to be significantly different at the 0.05 level. Additionally, the four items that influence the dimension of digital financial accessibility are also significantly different at the 0.05 level.

Confirmatory Factor Analysis – Digital Financial Usage

Digital Financial Usage statements reflect the actions of rural women in utilizing digital financial services including how far they use platforms such as UPI, online payments, digital transfers, and internet banking. Figure 3 presents the Confirmatory Factor Analysis of Digital Financial Usage.

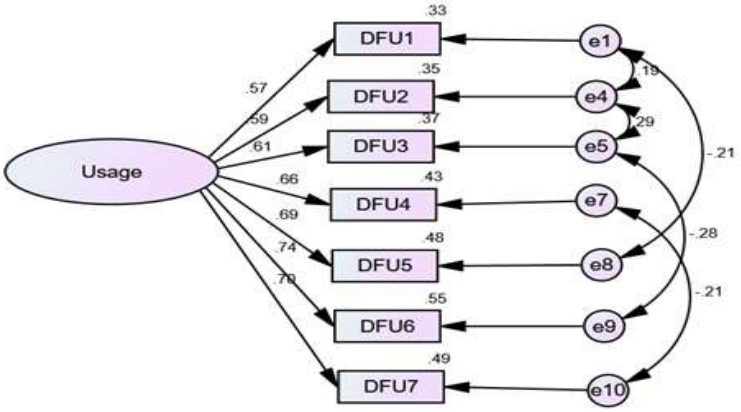


Figure 3: CFA - Digital Financial Usage

All the standardized factor loadings of the Digital Financial Usage exceeded the suggested cutoff point of 0.50, indicating acceptable convergent validity. Among these factors, the statement "I use mobile payments regularly" (DFU6) shows the highest standardized regression weight of 0.74, suggesting that it strongly represents the construct. Table 4 shows the CFA Results of Digital Financial Usage.

Table4: CFA Model fit summary of Digital Financial Usage

Values	P Value	RMSEA	GFI	AGFI	CFI	TLI	NFI	CMIN/df
Actual Value	.257	.026	.992	.975	.997	.994	.987	1.254
Threshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
Result	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**

Source: Computed Data

The Values of these indices confirm the fit of digital financial usage and suggest that the construct is valid. The statement "I recharge digitally" has a critical ratio value of 10.233 and is found to be significantly different at the 0.05 level. Additionally, the six items that influence the dimension of digital financial usage are also significantly different at the 0.05 level.

Confirmatory Factor Analysis – Economic Empowerment

Economic Empowerment is linked with the rural women ability to earn, control their income and make financial decisions in their life. Here, the researcher asked statements related to the economic empowerment such as **income control, savings, financial independence, and economic opportunities by using of digital financial services**. Figure4 shows the Confirmatory Factor Analysis of Economic Empowerment.

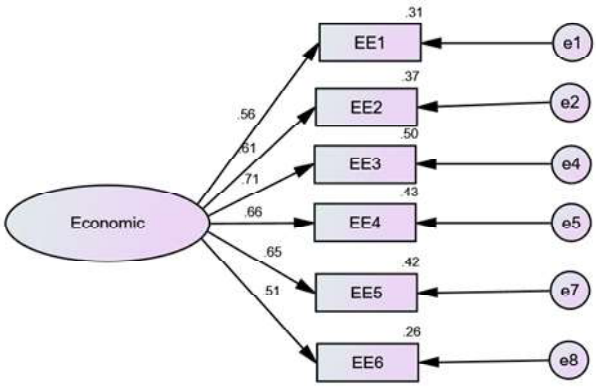


Figure 4: CFA – Economic Empowerment

All the standardized factor loadings of Economic Empowerment exceeded the suggested cutoff point of 0.50, indicating acceptable convergent validity. Among these factors, the statement "I feel financially independent" (EE3) shows the highest standardized regression weight of 0.71, suggesting that it strongly represents the construct. Table 5 shows the CFA Results of Economic Empowerment.

Table5: CFA Model fit summary of Economic Empowerment

Values	P Value	RMSEA	GFI	AGFI	CFI	TLI	NFI	CMIN/ df
Actual Value	.056	.047	.987	.969	.986	.976	.969	1.839
Threshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
Result	**Reac hed**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reache d**	**Reache d**

Source: Computed Data

The index values presented above confirm the fit of economic empowerment and suggest that the construct is valid. The statement "I manage my own savings" has a critical ratio value of 9.231 and is found to be significantly different at the 0.05 level. Additionally, the six items that influence the dimension of economic empowerment are also significantly different at the 0.05 level.

Confirmatory Factor Analysis – Psychological Empowerment

Psychological Empowerment shows the rural women inner strength, self belief and feeling in charge of their own lives and choices. Here, the researcher asked statements for measuring the psychological empowerment such as **self confidence, self efficacy and independent in financial matters when using digital financial services.** Figure 5 shows the Confirmatory Factor Analysis of Psychological Empowerment.

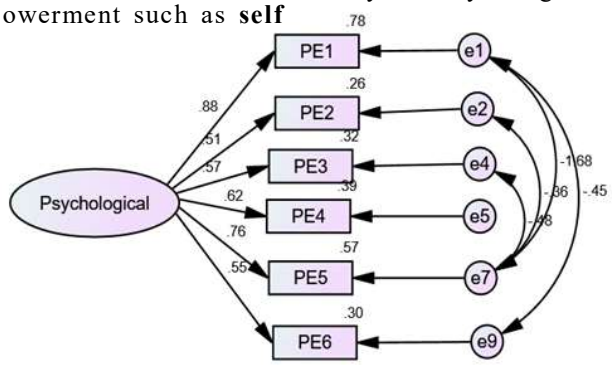


Figure 5: CFA – Psychological Empowerment

All the standardized factor loadings of Psychological Empowerment exceeded the suggested cutoff point of 0.50, indicating acceptable convergent validity. Among these factors, the statement "I trust my decisions." (PE1) shows the highest standardized regression weight of 0.88, suggesting that it strongly represents the construct. Table 6 shows the CFA Results of Psychological Empowerment.

Table6: CFA Model fit summary of Psychological Empowerment

Values	P Value	RMSEA	GFI	AGFI	CFI	TLI	NFI	CMIN/df
Actual Value	.955	.000	.999	.996	1.000	1.021	.998	.217
Threshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
Result	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**

Source: Computed Data

Indices value confirms psychological empowerment fit and suggests that the construct is valid. The statement "I express financial opinions." has a critical ratio value of 10.837 and is found to be significantly different at the 0.05 level. Additionally, the five items that influence the dimension of economic empowerment are also significantly different at the 0.05 level.

Confirmatory Factor Analysis – Decision Making Empowerment

Decision Making Empowerment refers to the ability and freedom of an rural women to participate in financial decision that affect their personal and financial life through the use of financial services. Here, the researcher asked statements for measuring the decision making empowerment such as women's participation and influence in household purchases, financial planning, loan decisions, and other major family matters.. Figure6 shows the Confirmatory Factor Analysis of Decision Making Empowerment.

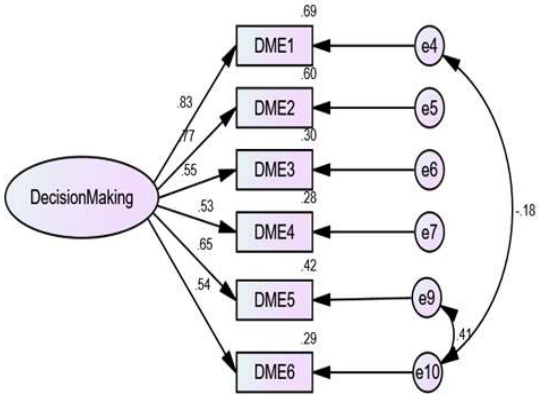


Figure 6: CFA – Decision Making Empowerment

All the standardized factor loadings of Decision Making Empowerment exceeded the suggested cutoff point of 0.50, indicating acceptable convergent validity. Among these factors, the statement "I decide household purchases." (DME1) shows the highest standardized regression weight of 0.83, suggesting that it strongly represents the construct. Table 7 shows the CFA Results of Decision Making Empowerment.

Table7: CFA Model fit summary of Decision Making Empowerment

Values	**P Value**	**RMSEA**	**GFI**	**AGFI**	**CFI**	**TLI**	**NFI**	**CMIN/df**
Actual Value	.870	.821	.995	.985	1.000	1.004	.993	.821
Threshold Value	>0.05	<0.08	>0.90	>0.90	>0.90	>0.90	>0.90	<5.0
Result	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**	**Reached**

Source: Computed Data

The Values of these indices confirm the fit of decision making empowerment and suggest that the construct is valid. The statement "My opinion is respected." has a critical ratio value of 14.490 and is found to be significantly different at the 0.05 level. Additionally, the five items that influence the dimension of decision making empowerment are also significantly different at the 0.05 level.

Structural Equation Model

Following the Verification of CFA and Model Fit Indices, digital financial capability level and women empowerment level were calculated independently using SPSS. The method of Mean $\pm$ Standard deviation was applied to find Digital Financial Capability (DFC) level and Women Empowerment (WE) level was divided into Low, Moderate, and High.

Table 8 : Classification of Levels

Variable	**Mean**	**SD**	**Low (Below)**	**Moderate (Between)**	**High (Above)**
DFC	74.11	6.48	67.63	67.63-80.89	80.59
WE	62.44	10.90	51.54	51.54-73. 34	73.34

Source : Computed Data

Table 8 shows the calculation of variable levels, from that the researcher found that the both variables shows a moderate level among respondents (Digital Financial Capability (262 out of 3

384)). After understanding the level, examine the structural relationship on how extend the women got empowered via digital financial capability. To gauge the relationship, Structural Equation Modeling (SEM) was applied.

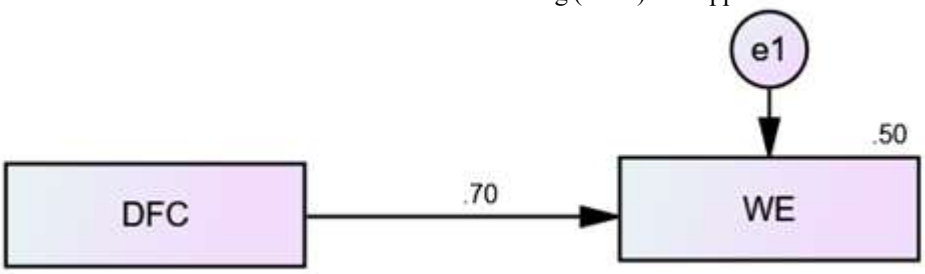


Figure 7: Structural Equation Model

Figure 7 presents the structural model examining how exact digital financial capability influence women empowerment. The standardized path coefficient from digital financial capability to women empowerment is 0.70; Each SD increase raises empowerment by 0.70 SD. The Squared Multiple Correlation (R^2) value for empowerment indicates that exactly 50% (0.497) of the variation in empowerment is explained by digital financial capability.

Standard error (SE) is relatively low (0.041), suggesting that sample is sufficiently large and representative of the selected population. Furthermore, the degree of digital financial capability is statistically significant in women empowerment at the 0.05 level, as the critical ratio (CR = 13.383) reaches the cutoff value of 1.96. Thus, it is concluded that rural women's degree of empowerment is positively impacted by digital financial capability.

Findings

1. Each component's Cronbach Alpha values of Digital Financial Capabilities and Women Empowerment are achieved and suggest internal consistency.
2. A Confirmatory Factor Analysis (CFA) was performed for each factor, and all model fit indices satisfied the required threshold values, with standardized regression weights exceeding the recommended cutoff value of 0.50.
3. Based on the mean and standard deviation analysis, rural women of Virudhunagar, Madurai, Tirunelveli, and Thoothukudi Districts were found to have a moderate level of digital financial capabilities (264/384) and a moderate level of empowerment (250/384).
4. From the structural equation modeling, the usage of digital financial services empowered 70% of rural women.

Conclusion

Using the variable of digital financial capabilities, this study investigated the scale of empowerment of rural women through the employment of fintech-based digital financial services. It conclusions highlight that digital financial capability can serve as an useful instrument for improving financial inclusion and rural women are empowered economically & psychologically, and then it leads them to have decision-making power. This research presents empirical data on the relationship between digital finance and women's empowerment.

The study's findings may assist policymakers, financial institutions, and fintech service providers in designing effective strategies to encourage the inclusion of digital finance among rural women. Meanwhile, rural women are lagging on digital financial knowledge, like they don't know about investing digitally in bitcoins, cryptocurrencies, stocks, etc. So, the government should conduct regular digital financial literacy programs to improve rural women's knowledge of digital financial services.

The study is, however, restricted to rural women in Virudhunagar, Madurai, Tirunelveli and Thoothukudi districts only, and and the results might not be generalized to other regions. Further studies could expand this study by considering other regions, larger samples, or additional variables to further explore the relationship between digital finance and women empowerment.

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