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Bridging The Credit Divide: Empowering Women-Led Msmes Through Mobile Technology in Kerala

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Abstract
This research paper investigates the impact of mobile technology on empowering women-led Micro, Small, and Medium Enterprises (MSMEs) and promoting inclusive entrepreneurial development. The primary emphasis is on how mobile technology enables first-generation women entrepreneurs to become more self-reliant in managing their businesses, improves access to credit and government schemes, promotes financial inclusion, strengthens business networks, and supports the socioeconomic advancement of women in rural Kerala. In addition, the study analyzes the influence of demographic factors on the use of mobile technology among women entrepreneurs in the MSME sector.
The study was conducted in ***Idukki****, a predominantly rural and high-range district in Kerala, where infrastructural limitations and digital exclusion pose significant challenges to entrepreneurship. Data were collected from* ***187 first-generation women entrepreneurs*** *through semi-structured interviews, questionnaire surveys, and focus group discussions (FGDs). The data were analyzed using the paired t-test and Garratt ranking method.*
The findings demonstrate that mobile technology significantly enhances awareness of credit facilities, digital banking usage, and access to government support schemes, thereby contributing to the empowerment of women-led MSMEs. However, challenges such as limited digital literacy, weak mobile infrastructure, and low awareness of financial services continue to hinder progress. The study highlights the transformative role of mobile technology in bridging the credit divide, fostering entrepreneurial inclusion, and supporting the growth of women-led MSMEs in rural settings.
Keywords: *women-led MSMEs; mobile technology; AI; credit access; financial inclusion; rural entrepreneurship; digital empowerment; first-generation women entrepreneurs; Kerala*

INTRODUCTION

Technological advancements have continuously transformed industries, economies, and the way individuals interact, from the Industrial Revolution to the era of Artificial Intelligence (Xu et al., 2018) [1]. Among these advancements, mobile technology has emerged as a pivotal tool in reshaping business environments, enhancing communication, and fostering entrepreneurship (Chown & Nascimento, 2022) [2]. Smartphones, in particular, have revolutionized how individuals access services, conduct transactions, and make business decisions in real-time. This transformation is especially significant for Micro, Small, and Medium Enterprises (MSMEs), which serve as the backbone of developing economies like India.

In recent years, researchers and policymakers have increasingly focused on the intersection of gender and entrepreneurship in developing countries, where systemic gender inequality continues to hinder inclusive economic growth. Similar to the challenges observed in agriculture, women-led MSMEs face gender-specific barriers that limit their productivity, access to formal credit, and contribution to the broader economy and community well-being (Mulema & Damtew, 2016) [11]. In this landscape, Information and Communication Technology (ICT)—particularly mobile technology—has emerged as a transformative force for enhancing the financial resilience of women entrepreneurs. Mobile platforms have enabled better access to financial services, business knowledge, and peer networks, thereby reducing isolation and offering women entrepreneurs the tools to navigate credit systems, markets, and government schemes more effectively (Rahman & Huq, 2023) [12]. Crucial to the adoption of such digital tools are factors like perceived usefulness and ease of use, which significantly influence how first-generation women entrepreneurs engage with mobile-based financial applications and government schemes (Sullivan et al., 2022) [13]. The ongoing digitization of financial services has made mobile technology an increasingly attractive and accessible channel for promoting inclusive economic participation among rural women, aligning with the broader goals of gender equity and digital empowerment (Kitole et al., 2024) [14].

MSMEs in India contributed nearly 30% to the national GDP in 2024, and government initiatives aim to raise this to 35% in the near future (The Hindu, 2025). However, the sector's growth potential is constrained by deep-rooted structural inequalities, especially gender disparities in credit access. According to the Reserve Bank of India, only 7% of the total outstanding MSME credit is directed toward women-led enterprises, despite numerous financial schemes intended to support them (The Hindu, 2025). Another report highlights that "Women MSMEs still struggle for credit despite schemes," pointing to limited access to formal credit and widening credit gaps that prevent women entrepreneurs from achieving their business goals.

Despite national policies promoting gender equality and financial inclusion, women entrepreneurs—particularly first-generation business owners in rural areas—continue to face institutional and socio-economic barriers. These include lack of collateral, inadequate credit histories, and low financial literacy, all of which restrict access to mainstream financial systems (Akhter & Cheng, 2020) [5]. This results in exclusion from formal banking channels and government schemes, reinforcing a cycle of limited capital and low growth. As reported in The Hindu, many women remain dependent on informal lending sources due to systemic biases and procedural complexities, even though the Reserve Bank of India has introduced liquidity support policies for the MSME sector.

Kerala, known for its progressive social indicators and high female literacy rates, presents a nuanced context. While there has been a rise in women's participation in entrepreneurship, districts like Idukki—which are geographically isolated, agrarian, and digitally under-resourced—offer a contrasting scenario. Here, women-led MSMEs frequently operate informally and encounter substantial hurdles in accessing formal credit systems and digital tools. Just as mobile technology has revolutionized access to agricultural services, its role in rural enterprise development is becoming increasingly vital to bridge the credit divide and promote economic inclusion.

Mobile phones have significantly altered the socio-economic fabric of rural India by enabling unprecedented access to digital banking, credit schemes, and entrepreneurial resources. This technological shift holds the potential not only to enhance financial inclusion for women but also to catalyze broader community development by strengthening women's economic agency.

This study builds on these insights by exploring how mobile technology can bridge the credit gap among women-led MSMEs in Kerala, with a special focus on the challenges and opportunities experienced by first-generation women entrepreneurs in Idukki. It evaluates the extent to which mobile platforms are used to access formal credit, government schemes, and market networks—ultimately contributing to inclusive growth and digital transformation in rural enterprise ecosystems. Additionally, the research will analyze demographic factors—such as age, education, and socio-economic background—that influence the adoption and effective use of mobile technologies for business advancement.

By evaluating both the challenges and enablers of mobile technology adoption among women-led MSMEs, this research contributes to the growing body of knowledge on digital empowerment and inclusive entrepreneurship. It seeks to provide insights that can inform targeted policy interventions, improve access to financial services, and support sustainable and equitable development within rural enterprise ecosystems.

Recognizing the critical role of Micro, Small, and Medium Enterprises (MSMEs) in driving inclusive economic growth, the Government of India—through the Ministry of MSME—has launched a comprehensive set of schemes to address challenges related to credit access, skill development, market promotion, and technology upgradation. Key credit-focused interventions include the **Prime Minister's Employment Generation Programme (PMEGP)**, which has extended margin money assistance of ₹4,735.93 crores to nearly 1.94 lakh MSMEs, and the **Credit Guarantee Trust Fund for Micro and Small Enterprises (CGTMSE)**, which has provided credit guarantees worth over ₹80,000 crores, benefitting more than 16 lakh enterprises. Additionally, the **Credit Linked Capital Subsidy Scheme (CLCSS)** has supported over 20,000 units with technology upgradation subsidies worth ₹1,169.03 crores.

To bolster financial inclusion and competitiveness, the **Zero Defect Zero Effect (ZED)** scheme encourages MSMEs to adopt quality standards and environmentally sustainable practices. Entrepreneurship promotion is supported through schemes like **ASPIRE** and the **National SC/ST Hub**, which nurture marginalized entrepreneurs through training and ecosystem development. The Ministry also runs extensive **skill development programs** through various platforms, including NSIC, MGIRI, NIMSME, and Technology Centers, collectively training millions in entrepreneurship, technical skills, and business management.

On the digital front, platforms such as **MyMSME**, **Udyog Aadhaar**, **MSME Samadhaan**, and **MSME Sambandh** have made significant strides in digitizing MSME registration, grievance redressal, and market access. These ICT tools are mobile-friendly and aim to simplify interactions with government systems, making them more accessible to rural and women entrepreneurs.

Despite these interventions, however, **gender-based disparities in credit access remain stark**. According to recent data, only 7% of the total outstanding MSME credit reaches women-led enterprises, underscoring the need to improve the reach and effectiveness of these schemes, particularly in rural areas such as Idukki, Kerala. This highlights a critical gap that mobile technology could bridge by enhancing awareness, access, and usage of financial and developmental schemes among first-generation women entrepreneurs.

In addition, this research will assess the extent to which mobile phones facilitate the empowerment of women-led Micro, Small, and Medium Enterprises (MSMEs) in rural Kerala by improving their access to formal credit, financial services, entrepreneurial information, and market linkages. The study also seeks to identify the constraints that first-generation women entrepreneurs face in leveraging mobile technology—particularly socio-economic barriers such as caste, education, digital literacy, and economic status—that influence their ability to fully benefit from ICT-based tools and platforms. By exploring these dynamics, the research aims to inform future policy interventions and institutional support mechanisms that can enhance the adoption and effectiveness of mobile technology. Ultimately, it seeks to foster a more inclusive, digitally empowered, and financially sustainable environment for women entrepreneurs in rural enterprise ecosystems.

Table 1: Trend of Wireless Subscriber Base (in Millions)

Month & Year	Rural Subscribers (million)	Urban Subscribers (million)	Total Subscribers (million)
March 2025	531.18	632.57	1,163.76
February 2025	526.34	634.23	1,160.57
March 2024	531.02	634.47	1,165.49
February 2024	528.53	636.11	1,164.64
January 2024	526.75	633.96	1,160.71
December 2023	525.05	633.44	1,158.49
November 2023	523.45	630.72	1,154.17
October 2023	520.62	630.36	1,150.98

Source: Indian Telecom Services Performance Indicator Report, 2024

According to the Indian Telecom Services Performance Indicator Report (2024), there has been a consistent increase in rural wireless subscribers in India from October 2023 to March 2024, while urban subscriptions have shown a slight but noticeable fluctuation. As of March 2024, rural areas had 531.02 million wireless subscribers—up from 520.62 million in October 2023—marking a steady growth of over 10 million users in just six months. In contrast, urban subscribers rose marginally from 630.36 million in October to 634.47 million in March, despite peaking at 636.11 million in February. This trend highlights a narrowing urban-rural digital gap, driven by expanding mobile penetration in rural regions. The sustained growth in rural connectivity underscores the increasing relevance of mobile technology as a channel for financial access and business engagement among rural populations. For first-generation women entrepreneurs, particularly in semi-remote districts like Idukki, this mobile expansion creates new opportunities to access digital financial services, credit information, and government schemes—tools that are vital for bridging the credit divide and fostering inclusive entrepreneurship.

LITERATURE REVIEW

The intersection of **mobile technology** and **women-led MSMEs** in India—especially in rural areas—has gained increased scholarly and policy interest due to its transformative potential for **financial inclusion**, **credit access**, and **digital empowerment** (Rahman & Huq, 2023; Brown et al., 2022). Mobile platforms are now widely recognized for their ability to reduce informational asymmetries, deliver timely market intelligence, and connect **first-generation women entrepreneurs** to government schemes and digital financial tools (Sullivan et al., 2022). In regions like **Kerala**, where women's literacy and grassroots

mobilization are relatively high, these technologies offer a promising avenue for advancing **rural entrepreneurship** and overcoming structural barriers in the MSME sector (Nair & Joseph, 2023).

Despite such optimism, recent studies note that the **adoption of mobile and AI-based tools** among women entrepreneurs remains uneven, often shaped by socio-economic constraints such as caste, income, education, and digital literacy (Mulema & Damtew, 2016; Chatterjee & Das, 2024). Scholars emphasize the importance of **perceived usefulness and ease of use** as determinants in the technology adoption lifecycle among marginalized women (Sullivan et al., 2022). In this context, **AI-powered mobile applications** are emerging as important enablers, offering automated business insights, risk management tools, and personalized financial support (Sharma & Patel, 2024).

At the policy level, several government interventions have aimed to support **women-led MSMEs** through credit schemes and digital platforms. Key among these are the **Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)**, **Prime Minister's Employment Generation Programme (PMEGP)**, and **Udyog Aadhaar**, each aiming to simplify credit access and reduce dependency on collateral for small women-run businesses (MSME Ministry, 2024). However, challenges in implementation—particularly in remote areas—continue to restrict the full potential of these schemes (Reddy & Kumar, 2023).

Additionally, the role of mobile technology in enhancing the **agricultural productivity** of women producers in Kerala is underexplored, even though **ICTs** are widely acknowledged as tools for **rural development**. As Gupta and Agrawal (2024) argue, mobile phones have the potential to improve access to agricultural extension services, sustainable farming techniques, and digital marketplaces for female farmers, yet empirical research on these effects in Kerala remains limited. This gap is particularly notable in geographically isolated districts such as Idukki, where women play key roles in agriculture but often lack visibility and support within digital financial ecosystems.

Collaboration among researchers, policymakers, and the private sector is increasingly focusing on the development of **gender-responsive ICT business models**, particularly within agriculture and MSME sectors. Larsson (2012) highlights early signs of inclusive ICT innovation driven by female users, despite uncertainties around long-term commercial viability. Such innovation underscores the growing recognition that gender is not just a demographic variable but a strategic lever in designing effective digital solutions for rural economies.

In sum, the literature emphasizes that while **mobile technology** and **AI-enabled tools** offer significant potential for enhancing **credit access**, **financial inclusion**, and **entrepreneurial capacity** among **women-led MSMEs** in rural India, actual outcomes depend on a combination of technological, socio-cultural, and institutional factors. This study addresses these gaps by examining how mobile technology functions as both a bridge and a barrier for **first-generation women entrepreneurs** in **Kerala**, particularly within MSME and agrarian sectors, contributing to a more inclusive understanding of **digital empowerment** in rural contexts.

Research Questions

1. What is the relationship between demographic factors—such as age, education, and socio-economic status—and the use of mobile phones among first-generation women-led MSME entrepreneurs in Kerala?
2. To what extent do mobile phones facilitate access to formal credit, digital financial tools, and entrepreneurial networks for women-led MSMEs in rural Kerala?
3. What challenges and limitations do women entrepreneurs face in adopting mobile technology for business purposes, especially in financially underserved regions like Idukki?

Hypotheses

- **H_{01}**: There is no statistically significant association between the demographic characteristics of women entrepreneurs (e.g., age) and their use of mobile phones for MSME-related activities.
- **H_{02}**: There is no significant difference in the level of empowerment and credit access among women-led MSMEs before and after adopting mobile technology.

DATA AND METHODOLOGY

This research employed primary data to gather data with the assistance of a questionnaire. The data were gathered through semi-structured interviews, questionnaire surveys, and focus group discussions (FGDs).

Description of the Study Area

This study was conducted in **Idukki district**, located in the **southern Indian state of Kerala**. Idukki, renowned for its mountainous terrain and lush greenery, is one of Kerala's most **geographically diverse and topographically challenging** districts. It lies between **9°30′ and 10°20′ north latitude** and **76°40′ and 77°15′ east longitude**, occupying a significant portion of the Western Ghats.

Idukki is bordered by the districts of **Pathanamthitta**, **Kottayam**, **Ernakulam**, **Thrissur**, and **Coimbatore (Tamil Nadu)**, and is **predominantly rural**, with over **97% of the population residing in non-urban areas**. The district is administratively divided into **eight taluks** and **52 grama panchayats**, comprising small towns and remote highland villages.

The population of Idukki, as per the **2011 Census**, is approximately **1.1 million**, with a near-equal gender distribution. A notable demographic feature of Idukki is the high proportion of **Scheduled Tribes and first-generation settlers**, many of whom are engaged in **agriculture and micro-enterprises**. Despite its relatively low population density, Idukki plays a critical role in Kerala's economy due to its **hydropower infrastructure**, **spice cultivation**, and **eco-tourism potential**.

Agriculture remains the backbone of Idukki's rural economy, with major crops including **cardamom, pepper, tea, coffee, ginger, and vegetables**. The district is also a leading producer of **plantation crops** and is home to several **women-led Micro, Small, and Medium Enterprises (MSMEs)** involved in food processing, handicrafts, and agri-based services.

Idukki experiences a **tropical highland climate**, with heavy rainfall concentrated during the **southwest monsoon (June to September)**. Its **rugged terrain**, **forest cover**, and limited infrastructure pose unique challenges to rural entrepreneurship, including poor **digital connectivity** and **limited access to financial institutions**. However, recent improvements in **mobile phone penetration** and **digital services** have begun to reshape economic participation, particularly for **women entrepreneurs** in remote areas.

Given these characteristics, Idukki provides a **relevant and critical context** for investigating the role of **mobile technology in improving credit access, digital inclusion, and economic empowerment** among **women-led MSMEs**.

RESEARCH METHODOLOGY

A **mixed-methods approach** was employed to gather comprehensive data for this study, aiming to understand the role of mobile technology in facilitating credit access and empowering women-led Micro, Small, and Medium Enterprises (MSMEs) in Kerala. This methodology combined **quantitative surveys** with **qualitative techniques** to capture both measurable impacts and contextual experiences of first-generation rural women entrepreneurs.

Semi-structured interviews were conducted alongside **self-administered questionnaires** to explore the patterns, perceptions, and challenges associated with mobile phone use in business operations. In addition, **three focus group discussions (FGDs)** were organized—each consisting of five women entrepreneurs—to gather qualitative insights into their lived experiences navigating credit systems, digital platforms, and entrepreneurship.

To assess perceived changes in access to credit, business growth, and empowerment before and after mobile technology adoption, the self-administered questionnaire included both **open- and closed-ended questions**, as well as a **four-point nominal scale**.

A **seven-point Likert scale** was also used to evaluate the **barriers and constraints** faced by these entrepreneurs in utilizing mobile technology for financial and business-related activities, particularly in rural and semi-rural contexts. These challenges included issues related to digital literacy, network access, trust in digital platforms, and the gendered dimensions of mobile usage.

The questionnaire was distributed to **230 women-led MSMEs**, and responses were received from **203 participants** following continuous engagement. After data cleaning, **192 complete and valid responses** were retained for analysis. To ensure inclusivity and avoid language-based bias, all tools were translated into **Malayalam** and administered with the assistance of trained local enumerators. Each in-depth interview lasted approximately **35 to 45 minutes**.

The triangulation of data sources—surveys, interviews, and focus groups—ensured both **validity and reliability**, enabling a nuanced understanding of how mobile technology influences credit access, business practices, and digital empowerment among women entrepreneurs in Kerala.

Tool of Analysis

To analyze and interpret the collected data, **both statistical and ranking methods** were employed. The **Garrett Ranking Technique** was used to identify and prioritize the key barriers faced by women-led MSMEs in adopting mobile technology, particularly in rural and semi-urban settings. This method provided weighted rankings based on respondents' perceptions of challenges such as digital literacy gaps, unreliable connectivity, affordability, and lack of training.

Additionally, a **paired t-test** was conducted to assess the difference in business performance indicators—such as credit access, customer engagement, financial record-keeping, and market expansion—**before and**

after the adoption of mobile technology. This test helped measure the extent to which mobile usage influenced the empowerment and operational efficiency of women entrepreneurs.

These analytical tools enabled a robust evaluation of the impact of mobile technology on the credit divide and helped in drawing meaningful conclusions on how digital access empowers women-led enterprises in Kerala.

Data Analysis

Respondents were categorized based on their reported level of mobile phone utilization for business-related activities, with classifications such as **low**, **moderate**, and **high usage**. This categorization enabled an assessment of how effectively women-led MSMEs engage with mobile technology to access formal credit, digital payment systems, government schemes, customer networks, and market information.

To examine the relationship between **demographic variables (such as age, education level, and business experience)** and mobile phone usage, a **Chi-square test** was conducted. This statistical method tested whether there was a significant association between respondent profiles and their extent of mobile technology usage in business operations.

The results offer insights into the differential adoption patterns of mobile tools among first-generation women entrepreneurs and shed light on factors influencing their digital engagement—especially in relation to financial inclusion and credit access.

Table 2. Demographic data concerning age.

Age Group	**Less than 25**	**26–40**	**41–55**	**More than 55**	**Total**
No. of Respondents	13	53	88	38	192
Percentage (%)	6.8%	27.6%	45.8%	19.8%	100%

The majority of respondents (45.8%) belonged to the **41–55 age group**, indicating that mid-life women entrepreneurs form the largest demographic segment of mobile technology users among women-led MSMEs in Idukki, Kerala. This is followed by those aged **26–40 (27.6%)**, suggesting active engagement of early to mid-career entrepreneurs. A smaller proportion of respondents were aged **above 55 (19.8%)** and **below 25 (6.8%)**, highlighting that younger women are less represented in MSME ownership or are possibly less active in credit-oriented digital entrepreneurship. This distribution provides key insights into age-related adoption trends of mobile platforms for financial inclusion.

Table 3. Mobile Technology Usage Across Age Groups Among Women Entrepreneurs in MSMEs

Age Group	**Low Usage**	**Medium Usage**	**High Usage**
Less than 25	0	0	13
26–40	3	20	30
41–55	7	27	49
More than 55	9	27	2

The Chi-square test is a statistical technique employed to examine the relationship between categorical variables. It helps determine whether the differences between observed and expected frequencies are statistically significant. In this study, a Chi-square test of independence was conducted to explore the association between age group and mobile phone usage among women entrepreneurs in Micro, Small, and Medium Enterprises (MSMEs) in Kerala. The data were categorized into four age groups and three levels of mobile usage (low, medium, and high). Observed frequencies were recorded in a contingency table, and expected frequencies were calculated under the assumption of no association between age and mobile usage. The Chi-square statistic was computed by comparing the observed and expected frequencies, providing insights into how mobile technology adoption may vary across age segments among women-led MSMEs. (Table 4)

Table 4. Chi-square test

O	E	O − E	$(O - E)^2$	$(O - E)^2 / E$
1	1.31	-0.31	0.0961	0.0733
4	5.20	-1.20	1.44	0.2769
7	8.68	-1.68	2.82	0.3248
9	3.79	5.21	27.14	7.16
1	4.91	-3.91	15.28	3.11
17	19.85	-2.85	8.12	0.409
27	32.95	-5.95	35.40	1.07

29	14.30	14.70	216.09	15.11
12	6.81	5.19	26.93	3.95
33	27.90	5.10	26.01	0.93
53	46.31	6.69	44.77	0.97
3	20.01	-17.01	289.34	14.46

A **Chi-square test of independence** was conducted to examine the relationship between **age group and mobile technology usage** among **women entrepreneurs in MSMEs across Kerala**, specifically in the context of accessing **credit-related and business-support information**. The observed data were organized into a **contingency table** and compared with the expected frequencies under the assumption that **no relationship** exists between the two variables.

- **O (Observed Frequency):** The actual number of respondents in each age and usage category.
- **E (Expected Frequency):** The estimated number of respondents in each category if age and mobile usage were independent.
- **$(O - E)^2/E$:** This value represents the Chi-square component, measuring the deviation between observed and expected frequencies. A larger value indicates a greater discrepancy and increases the likelihood that a **significant relationship** exists between the variables.

The results are presented in **Table 5**, which highlights the degree of association and supports the conclusion that **age is a significant factor influencing mobile technology adoption among women-led MSMEs**.

Table 5. Result of Chi-square Test

Chi-Square Value ($\chi^2 = \sum(Oi - Ei)^2 / Ei$)	**Degrees of Freedom (Rows − 1) × (Columns − 1) → (4 − 1) × (3 − 1)**	**Significance Level**	**Tabular Value**	**p Value**
50.41	3 × 2 = **6**	0.05	12.59	5.0302

Based on the results, the **calculated Chi-square value (50.41)** is **greater than the tabular value (12.59)** at a 0.05 significance level. Therefore, the **null hypothesis (H_{01})**—which assumes no association between age and mobile usage—is **rejected**.

This indicates a **statistically significant relationship between age group and mobile phone usage** for accessing credit and business-related information among **women entrepreneurs in MSMEs**. The analysis suggests that **age is a determining factor**, with **younger women more likely to use mobile technology** to bridge gaps in information access and financial inclusion.

T-Test on Level of Access to Entrepreneurial Resources Before and After Mobile Usage

The **t-test** is used to determine whether there is a significant difference in the level of access to various entrepreneurial and financial activities **before and after the adoption of mobile technology** by women-led MSMEs in Kerala. The analysis examines changes in access across four levels—**No, Low, Medium, and High**—and is expressed in percentages (Tables 6 and 7).

Table 6. Access Percentage of Various MSME-Related Activities Before and After Mobile Technology Adoption Among Women Entrepreneurs.

Sl. No.	**Activities**	**Level of Access to Activities in %**							
		Before Mobile Usage				**After Mobile Usage**			
		No (%)	**Low (%)**	**Medium (%)**	**High (%)**	**No (%)**	**Low (%)**	**Medium (%)**	**High (%)**
1	Getting pricing information of raw materials and products	50	64	51	25	5	28	66	93
2	Accessing markets to sell or buy business products	41	70	49	32	10	55	70	57
3	Expressing business opinions and sharing feedback	56	74	38	26	3	26	61	100

4	Attending training programs on business strategies and digital skills	61	76	34	21	6	40	65	81
5	Access to financial services (loans, insurance, digital payments)	42	58	56	36	9	42	68	75
6	Connecting with peer women entrepreneurs and support networks	47	60	52	31	5	28	72	91
7	Receiving updates on government schemes and business support programs	56	68	39	27	7	30	65	90
8	Online procurement of business supplies and equipment	86	60	25	21	5	26	69	88
9	Accessing business-related information and resources without physical travel	62	62	41	25	3	24	56	107

Table 7. Analysis of t-test.

	No	**Low**	**Medium**	**High**
t-values	10.12	8.51	-6.63	-9.72
Critical t-value (0.05)	2.306	2.306	2.306	2.306
Degrees of Freedom (n − 1)			8	

At a 95% confidence level, the critical t-value of 2.306 is typically employed for a t-distribution with degrees of freedom (n − 1 = 8). When comparing the absolute values of the calculated t-values with the critical value of 2.306, it becomes evident that the values 10.12, 8.51, −6.63, and −9.72 all exceed the critical threshold. As a result, the null hypothesis is rejected across all access categories—indicating that the differences in access levels before and after mobile phone adoption are statistically significant.

This finding suggests that mobile phone usage has had a **transformative impact on women's access to entrepreneurial and business-support activities within MSMEs** in Kerala. Across most measured indicators—including market access, financial services, training, and government scheme awareness—the comparison between pre-mobile and post-mobile usage reveals **substantial improvements**. These improvements reflect how digital tools help overcome long-standing structural barriers, particularly for women entrepreneurs operating in rural or semi-urban areas.

The survey results align with existing literature, such as **Mittal and Mehar (2016)**, which emphasized the **transformative role of mobile technology** in improving access to timely and actionable business information, especially for rural women entrepreneurs. Their findings indicate that mobile phones enable smoother and faster dissemination of critical data regarding markets, credit services, logistics, and operational strategies. This supports the present study's conclusion that **mobile technology has significantly enhanced women entrepreneurs' ability to participate actively in the MSME sector**—allowing for **informed decision-making**, **better access to credit**, and **stronger business networks**.

Moreover, mobile phones play a crucial role in **bridging the credit divide** by giving women real-time access to financing options, micro-loans, insurance, and mobile banking tools. In the past, many women-led enterprises were marginalized due to limited access to formal credit channels. However, the adoption of mobile technology is helping to **democratize access to financial resources**—making it easier for women to learn about, apply for, and manage credit and other financial services.

The increasing affordability and availability of mobile phones in **rural Kerala** has also led to a significant empowerment of women. This **digital inclusion** allows them not only to run businesses more effectively but also to participate meaningfully in areas such as **education**, **healthcare**, and **community development**. The ability to access online resources, government portals, and financial tools has further **reduced dependency on intermediaries**, enhanced productivity, and built resilience among women-led MSMEs.

In the context of micro, small, and medium enterprises, **enhanced digital connectivity** provides essential, real-time updates on **market prices**, **demand trends**, **policy changes**, and **logistics**. These updates are vital for making smart, data-driven business decisions. By bridging the information and financial access gap,

mobile phones have become a **powerful enabler of productivity, competitiveness, and sustainability** for women entrepreneurs.

In conclusion, the data clearly demonstrate that mobile phone adoption significantly improves women's access to business-critical information, finance, networks, and government resources—ultimately **bridging the credit divide** and strengthening the **entrepreneurial ecosystem for women-led MSMEs in Kerala**.

Garrett Ranking Test

The **Garrett Ranking Test** was employed to evaluate and prioritize the challenges faced by women entrepreneurs in using mobile phones within the MSME sector in rural Kerala. This method helps identify the most pressing issues that hinder mobile phone usage, particularly in business-related contexts, enabling researchers and policymakers to extract valuable insights.

Each respondent rated the severity of challenges based on a predefined scale, where higher scores indicated more critical barriers. The scores assigned by respondents were converted to Garrett scores using Garrett's conversion table, and the **mean score** for each challenge was calculated. Based on these mean scores, the challenges were ranked—**with the highest mean score representing the most significant challenge**.

Sl. No	Problems with Using Mobile Phones in Rural Areas	1	2	3	4	5	6	7	No. of Respondents	Total Score	Mean Score	Rank
1	Dependency on male family members for monetary choices	70	43	27	25	27	0	0	192	1012	112.44	3
2	A lack of education makes it difficult to use	17	18	17	15	23	37	65	192	541	59.55	6
3	Limited coverage in rural regions	80	57	30	25	0	0	0	192	1132	125.22	1
4	Lack of guidance on mobile phone usage	15	17	20	18	23	34	65	192	540	60.00	5
5	Technical support services are lacking in rural locations	69	48	29	23	23	0	0	192	1028	114.22	2
6	Mobile services not available in regional/local languages	26	40	32	0	0	46	48	192	722	79.89	4
7	Health risks from mobile phone radiation	0	0	0	0	39	53	100	192	183	20.33	7

The Garrett Ranking analysis of issues associated with mobile phone usage among women-led MSMEs in rural Kerala reveals that **limited coverage in rural regions** stands out as the most pressing challenge, with a **mean Garrett score of 125.22**. This confirms prior findings by Riddlesden and Singleton (2014) [29], which highlight inadequate mobile and broadband connectivity in underserved areas as a critical barrier to digital access. In the context of MSMEs, poor connectivity restricts access to real-time information, market intelligence, and digital financial tools—thereby limiting women entrepreneurs' ability to fully engage in and benefit from mobile technologies.

The second and third most critical issues are **lack of technical support services in rural areas** (mean score: 114.22) and **dependency on male family members for monetary choices** (mean score: 112.44). These findings underline the infrastructural and socio-cultural barriers that continue to affect women entrepreneurs. Limited technical support impedes troubleshooting and efficient mobile usage, while financial dependence on male relatives hampers autonomy and decision-making in business operations.

Further down the ranking, the **lack of guidance on mobile phone usage** (mean score: 60.00) and **lack of education making usage difficult** (mean score: 59.55) suggest that digital literacy and user support remain important—though comparatively less urgent—issues. These areas highlight the need for targeted training programs aimed at enhancing digital competencies among rural women entrepreneurs.

Mobile services not being available in regional languages ranks sixth (mean score: 79.89), indicating a moderate barrier, especially for first-generation entrepreneurs. Finally, **health risks from mobile phone radiation** are perceived as the least pressing concern, with a **mean score of just 20.33**, implying that health-related apprehensions are not a major deterrent to mobile usage.

Overall, the ranking emphasizes that **connectivity, technical support, and autonomy in financial decisions** are the most substantial barriers preventing rural women entrepreneurs from effectively utilizing mobile technology in their MSME activities. Addressing these key challenges is essential for bridging the credit and information divide, ultimately empowering women-led MSMEs to thrive in a digitally connected economy.

5. Discussion and Conclusions

To enhance the adoption and effective utilization of mobile technology among **women-led Micro, Small, and Medium Enterprises (MSMEs)** in rural Kerala, it is imperative to design **frequent, targeted digital training sessions** tailored specifically to their entrepreneurial needs. Practical, hands-on workshops and demonstrations should be offered within rural communities to build familiarity and confidence in using mobile applications relevant to MSME operations.

The positive perception of ICT tools among rural businesswomen in Kerala aligns with findings from similar regional studies (D. & Natarajan, 2020) [30], which highlight the value of digital access in empowering underserved populations. Encouraging **peer learning, mentorship, and role modeling** from experienced entrepreneurs can further accelerate the digital inclusion of older or less tech-savvy women.

This study finds strong evidence that mobile phone usage significantly improves **access to markets, financial services, training programs, and government schemes**—all crucial pillars for MSME success. Similar to the impact observed in agriculture (Mittal et al., 2010) [31], the use of mobile phones by women entrepreneurs reduces reliance on physical travel for acquiring market data and streamlines their business operations. Information that once required travel and time can now be accessed instantly via mobile phones, cutting costs and enabling faster decision-making.

To unlock the full potential of mobile technology for women-led MSMEs, **gender-sensitive policies** must be enacted. These should acknowledge unique challenges faced by rural women, such as limited digital literacy, dependency on male intermediaries, and inadequate technical support. This is particularly relevant in light of existing schemes like the **Mukhya Mantri Mahila Udyami Yojana**, **SHE Scheme**, and **REACH**, which support skill-building and financial independence among women entrepreneurs. Aligning digital inclusion efforts with such policies will promote broader gender equality and sustainable economic development.

The findings further emphasize the need for **improved mobile infrastructure**—such as broader coverage and better support services—in rural and semi-urban regions. Public-private partnerships can help deploy reliable broadband, affordable smartphones, and user-friendly applications in local languages. Collaboration with **local educational institutions and community-based organizations** can enhance outreach and tailor content to regional business contexts.

While this study provides meaningful insights, it is **context-specific to the Idukki district of Kerala**, which may limit generalizability. Variations in mobile penetration, literacy, and access to credit across other districts or states may yield different results. Future research should explore these dynamics across wider geographic areas and assess the long-term impact of policy interventions on women's digital empowerment within MSMEs.

The transformative potential of mobile technology for women-led MSMEs is clear—it empowers women with timely access to information, builds market linkages, expands financial inclusion, and enhances their capacity to make informed business decisions. To further this impact, **governments, NGOs, and business support services** should actively promote mobile usage through **short-term, low-interest loans for device procurement**, digital upskilling workshops, and mobile-based platforms for business training and networking.

In conclusion, mobile technology serves as a catalyst for **bridging the credit and information divide** in women-led MSMEs. By integrating mobile tools into enterprise development strategies, Kerala can foster a more inclusive and resilient entrepreneurial ecosystem that uplifts rural women and contributes to sustainable economic growth.

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