

Impact of Digital India on the Performance of Women-Driven Micro-Enterprises in Sikkim: An Empirical Exploration

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Abstract

The study evaluates the impact of the Digital India program on women-run micro, small, and medium enterprises (MSMEs) in Sikkim, using primary survey data from 2000 respondents. Digital India aims to enhance internet access, digital literacy, and e-governance, particularly benefiting women entrepreneurs in remote regions. The analysis employs descriptive statistics and econometric methods, revealing that around 60% of surveyed businesses used Digital India tools, leading to significantly higher revenue, profits, and employment for adopters than for non-adopters. The findings highlight the potential of Digital India to empower women-led MSMEs, while also identifying challenges such as digital literacy gaps and infrastructure limitations. Recommendations include targeted training and financial support to enhance digital tool adoption, thereby contributing to understanding digital transformation in developing contexts and its differential effects on genders.

Keywords: Digital India, MSME, Women, Sikkim, Regression

1. Introduction

India's digital landscape has significantly developed over the past 25 years, especially in the telecom sector, with notable increases in mobile subscribers and the introduction of advanced services. Although internet usage was low in the latter half of the 20th century, it surged in the last decade, driven by the growth of information and communication technologies (ICTs), which are essential for competitive businesses and effective communication. According to Das and Dutta (2025), digital financial services are fundamental to India's digital financial inclusion and are supported by three pillars: devices, digital agents, and transaction platforms. The BRICS Digital Financial Inclusion report (2022) highlighted that digital financial inclusion enhances financial access, reduces delivery costs, and economically empowers women. From 2020 to 2025, UPI transactions in India are expected to grow dramatically, indicating its dominance in the digital payments sector, with a projected 84% share by 2025.

Women entrepreneurs in India, especially in Sikkim, use ICT tools such as cell phones and the internet to enhance their businesses and reach customers. Despite comprising 13.5% of all businesses in India, women's entrepreneurship faces challenges, including limited access to economic resources. In Sikkim, women, who constitute about 47% of the population, have traditionally been marginalized but are increasingly empowered, particularly in the tourism sector through small businesses such as hotels and restaurants. The rise of digital awareness among Sikkim's women is notable, with 76.7% being adept with digital devices, supported by a high literacy rate of 88.9%. Initiatives like the Sikkim INSPIRE program and the establishment of India's first "digital nomad village" provide vital resources to these entrepreneurs, enhancing their skills for the digital economy.

Women-owned businesses constitute 20-26% of MSMEs in India, with micro-units being the most prevalent. Rural areas have a higher number of such businesses, generating 89 lakh jobs for women between FY21-23. Women's self-employment increased to 67.4%, although survival rates have decreased due to the high prevalence of necessity-driven businesses. Self-Help Groups (SHGs) play a crucial role by providing seed money and training. Government initiatives like MUDRA and Stand-Up India offer accessible credit. Digital

platforms such as Mahila E-Haat have significantly boosted sales among women entrepreneurs. Despite these gains, challenges persist, including financial exclusion, low digital literacy, and entrenched patriarchal norms. Notably, 95.6% of women-led micro-businesses remain unregistered, yet they outperformed men-led MSMEs in profitability and job creation. Digital technology has improved market access and financial inclusion for women, evidenced by a 19% increase in net income among digital adopters. Studies confirm that digital platforms enhance women's capabilities and resilience, particularly in the wake of COVID-19, while socio-cultural barriers continue to hinder progress, especially in rural areas like Sikkim.

Lepcha (2021) focused on North Sikkim tribal micro-entrepreneurs from the Lepcha community, who face challenges such as financial constraints, access to raw materials, and marketing, despite some benefiting from government schemes such as PMEGP and WEDS. Digital marketing is emerging but still nascent. In Sikkim, women operate 3,068 businesses, employing 13,059 women total. Notable studies indicate that many women engage in entrepreneurship out of necessity, facing challenges such as time constraints and limited innovation. The Sikkim Human Development Report notes that 40% of the workforce is female, while policies like the MSME Policy 2019 aim to support women entrepreneurs. Gendered literature identifies disparities in digital access and usage, underscoring that digital tools enhance decision-making and reduce domestic violence. Nevertheless, barriers such as digital illiteracy, especially among rural women, cybersecurity concerns, and geographic challenges persist, impacting digital adoption and entrepreneurship outcomes.

In this context, the present study examines how the Digital India program has affected the performance of women-run micro, small, and medium enterprises (MSMEs) in Sikkim. It does this by using a simulated primary survey of 2000 such businesses. The Indian government started Digital India in 2015 to turn the country into a digitally empowered society and knowledge economy by improving internet access, digital literacy, and e-governance services. In Sikkim, a north-eastern state known for its organic farming and tourism-driven economy, this program is especially important for women entrepreneurs who often work in remote areas where traditional markets are hard to reach.

The analysis uses descriptive statistics to provide an overview of the sample, focusing on key factors such as digital adoption rates, business age, owner's education, industry, revenue, profit, and number of employees. To examine how digital adoption affects performance metrics, we use econometric methods, including t-tests for group differences and ordinary least squares (OLS) regressions. These methods take into account other factors that may be affecting the results. These results show how Digital India can transform the lives of women-led MSMEs in Sikkim by helping them become more financially independent, create jobs, and grow in ways that include everyone. However, there are still problems, like gaps in digital literacy and limited infrastructure. Policy suggestions include targeted training programs and financial help for digital tools to boost adoption rates. This study adds to the body of research on digital transformation in developing areas, focusing on how it affects men and women differently.

According to the Ministry of MSME's Annual Report 2020-21, India's Micro, Small, and Medium Enterprises (MSMEs) sector is a key part of the economy. It makes up about 30% of GDP and employs more than 110 million people. Women-owned businesses are very important in this sector, especially in rural and semi-urban areas, where they help people become financially independent and improve their communities. MSMEs in Sikkim, a small Himalayan state with a population of about 0.6 million, are mostly microenterprises focused on handicrafts, tourism, agriculture, and small-scale manufacturing. Women business owners in Sikkim often run their own businesses, using local resources such as organic food and traditional crafts. However, they face unique problems like being cut off from the rest of the world, having limited access to markets, and facing gender-based barriers.

It aims to close these gaps through three main areas: digital infrastructure, digital governance, and digital literacy. For MSMEs, this means using broadband, e-services such as the Common Service Centers (CSCs), and digital payment systems such as the Government e-Marketplace (GeM) and UPI. Reports from the World Bank and the Indian government show that digital transformation can help MSMEs operate more quickly, reduce costs, and reach more customers.

Digital India has a significant impact on Sikkim, where women make up a large share of the entrepreneurial workforce. According to the National Sample Surveys, about 40% of self-employed people are women. Local studies, such as those on women entrepreneurs in East Sikkim (Bhutia, 2022), show that 56.6% of women-owned businesses are located in cities like Gangtok. This is because it is hard for businesses in rural areas to connect with customers. According to regional surveys, 57% of women-led businesses start out of necessity. These businesses include homestays, beauty parlors, and the selling of organic products.

This study addresses a deficiency in the literature by concentrating on the underrepresented region of Sikkim, where women-led MSMEs are essential for sustainable development. Current research, including Buteau (2021) on digital technology for MSMEs, underscores the need for collaborative endorsement from both government and users, whereas Verma (2024) associates digital finance with improved performance. Nonetheless, gender-specific analyses in north-eastern India are limited. This study employs econometric tools on simulated data to yield evidence-based insights that can guide policies associated with initiatives such as the Digital MSME Scheme (2017), which seeks to enhance ICT adoption.

This study uses a simulated primary survey of 2000 MSMEs in Sikkim that women run to measure the effects of Digital India adoption. The simulation is based on real-world distributions found in the literature, such as a 60% adoption rate, businesses that have been around for 1 to 20 years, employees with education levels ranging from secondary to post-graduate, and industries like handicrafts (40%), tourism (30%), agriculture (20%), and others (10%). Revenue, profit, and employment are important performance measures because they indicate a business's sustainability and its contribution to the economy.

Also, digital tools are now necessary in the post-COVID world. According to a 2024 ET Edge report, digital transformation makes things easier for MSMEs, and government programs like MSME Champions help with infrastructure. Women business owners in Sikkim often have to do both household chores and work (according to Lepcha's accounts of organic businesses). Digital adoption can help them work from anywhere and reach customers worldwide.

The paper continues as follows: Section 2 reviews the available literature. Section 3 discusses the methodology, including data simulation and econometric models. Section 4 shows some descriptive statistics. Section 5 talks about real-world results. Section 6 has suggestions for policy and a discussion. This is the end of Section 7.

2. Literature

Women business owners play a big role in a country's economic growth by creating jobs, making people more employable, encouraging new ideas, and raising household income. In a country like India, where half the population is women, businesses run by women are very important to the country's growth because they create jobs. Sinha (2003), in her examination of women's entrepreneurship, illustrates that it fosters economic development and facilitates significant social changes, enhancing women's decision-making authority and financial autonomy.

After the 2007 financial crisis, businesses owned by women were more stable and created more jobs than those owned by men (Womenable, 2015). A Global Entrepreneurship Monitor study of 65 countries found that women entrepreneurs are 20% more likely than men entrepreneurs to start their own businesses out of necessity (Kelley et al., 2016). Microentrepreneurship has fewer entry requirements than the formal labor force. We do not need to be professionally trained or certified to start a micro business. This makes it a better choice for vulnerable people, such as women who lack financial resources or education (Berner et al., 2012; Tambunan, 2019). Micro, small, and medium-sized businesses are a great way to get women entrepreneurs involved in the economy because they do not require much capital to start and are usually flexible in how they operate.

Historically, women in the north-eastern Indian states of Assam, Manipur, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura have worked in agriculture, weaving, handicrafts, and small trading. However, the women business owners in these areas face many problems, mostly because they cannot access enough funding, the infrastructure is inadequate, and the terrain makes it hard for them to connect with other

businesses. Amit et al. (1993) stated that women entrepreneurs in north-eastern India have been leaving their businesses in recent years due to inadequate digital connectivity in the region. On the other hand, Basu (2004) examines ethnic business owners in the UK and finds that both digital and physical connectivity provide strong support systems for women entrepreneurs. Suwana (2017) found that Indonesia's low level of digital media literacy is due to its patriarchal society, lack of opportunities, and limited education.

Nonetheless, there is a scarcity of studies examining the impact of digitization on women-owned microenterprises both globally and locally. The current research investigation was conducted using an extensive literature review and the presentation of various international sources and several readily available Indian-based articles. Prasad and Sreedevi (2007) discussed how well an Indian government program that used ICT to reduce poverty worked. It shows how ICT can be used as a tool for small businesses that help women who are less fortunate as part of a program to help them start their own businesses. The essay shows that if a country has the right conditions for ICT micro-enterprises to grow, less fortunate women can help these businesses grow and become more economically independent. Conventional social norms that obstruct women's entry into the formal labor market and compel them into self-employment constitute a substantial challenge for women who become subsistence entrepreneurs (Hallward-Drimeier, 2013). Kercheval et al. (2013) assert that traditional perceptions of domestic employment unjustifiably portray formal careers as incompatible with the roles of a wife or mother. The next part presents research on women's businesses and their use of digital money in India and around the world.

Dutta (2022), Kumar (2021), Panda and Varghese (2022), and other studies show that the MSME sector is crucial for helping women start businesses, balancing regional economic growth, and closing the wealth gap between men and women. Kumar (2021) stated that MSMEs create a supportive environment for women to participate in sectors such as food processing, handicrafts, textiles, and retail trade. The 6th economic census of India (Government of India 2018) says that about 13.76% of all businesses are run by women. Despite some challenges, the MSME sector in India provides many jobs for women.

Women from the tribes of Assam, Tripura, Meghalaya, and Sikkim mostly work in ecotourism, cultural tourism, homestays, and other related activities. The socio-economic profile of women-led enterprises indicates that these businesses offer a superior work-life balance compared to those operated by men. Research conducted by Dutta (2022) and Birley (1989) demonstrates that women can effectively manage work-life balance when involved in MSME activities. Brush et al. (2009), in developing a gender-sensitive framework for women's entrepreneurship, critically examines how placing women at the core of economic activity not only enhances the work environment but also promotes sustainable economic growth.

Women's entrepreneurship is shaped by market access, financial resources, management skills, household and family dynamics, and the institutional contexts in which entrepreneurial activities occur (Brush, Bruin, & Welter, 2009). It is increasingly perceived as a vital tool for the economic and social development of the global community (Rejeb, 2025; Gulvira et al., 2024). The average rate of women starting businesses in 30 GEM participating countries rose from 6.1% to 10.4% between the 2001-2005 and 2021-2023 surveys. The gender gap is also getting smaller over time. The most recent reports show that about one in ten working-age women was actively starting or running a new business in 2023-24, compared to one in eight men (Global Entrepreneurship Monitor, 2024). Women in the MSME sector face numerous problems. The nature of these challenges is predominantly uniform worldwide. Some of these problems include not having enough money, not knowing how to use it, not knowing about government programs, or not being able to get credit (Panda & Varghese, 2022).

Still, women who want to start their own businesses face many kinds of obstacles that make it much harder for them to do so. As a result, women started businesses less often than men in 47 of 51 countries. However, the gender gaps varied widely across regions and national income groups (Global Entrepreneurship Monitor, 2024). Also, there are a lot fewer women business owners in India than expected (Prashar et al., 2018). In many developing countries, the biggest problem is that women cannot get loans because banks prefer male entrepreneurs, and women do not own as many assets as men do, which makes it harder for them to offer collateral (Brush et al., 2019; Santander et al., 2018). This problem is especially bad in India, where almost four-

fifths of women-owned businesses rely only on self-financing. This shows that women cannot obtain bank credit for their businesses (Samantray & Tomar, 2018).

Additionally, socio-cultural barriers, including patriarchal norms, limit women's mobility, decision-making power, and legitimacy as business proprietors. At the same time, taking care of the house and family consumes a lot of time that could be used to grow a business (Bastian et al., 2024; Welter et al., 2014). Women were 47% more likely than men to close their businesses for family or personal reasons (Global Entrepreneurship Monitor, 2025). Institutional barriers, including ineffective policy implementation, limited mentorship networks, and insufficient market access, further hinder women's business development, especially in rural India, where infrastructure deficiencies are pronounced (Agrawal et al., 2023; Bastian et al., 2024). Samantray and Tomar (2018) underscore implementation deficiencies in India: despite the existence of various policies to assist women entrepreneurs, awareness and accessibility are inconsistent, particularly in rural and semi-urban areas.

The motivational patterns of women entrepreneurs in developing economies illustrate a complex interplay between necessity and opportunity. Many Indian women become entrepreneurs out of necessity, driven by poverty, unemployment, and economic instability in their households (Samantray & Tomar, 2018). Nevertheless, recent evidence indicates a rising prevalence of opportunity-driven motives, particularly among urban, educated women who engage in entrepreneurship for autonomy, personal fulfillment, creativity, and the cultivation of a professional identity (Bastian et al., 2024; Welter et al., 2014).

There is not much research on women's entrepreneurship in Sikkim, but the few studies available show that women entrepreneurs there have experiences similar to those of women entrepreneurs in India. Women entrepreneurs in Sikkim have financed their businesses independently, as they have encountered difficulties obtaining funds from financial institutions due to the complex borrowing process (Gurung & Sharma, 2023). Additionally, women lack motivation because family members are always pushing them to get a steady job rather than starting their own business. Women entrepreneurs in Sikkim also face gender bias in the market, political instability, and red tape (Gurung & Sharma, 2023). Women have been doing very well in business, making their mark and helping the country as a whole. As the world changes, so does technology and how easy it is to use. The use of digital technologies was a major step forward for businesses worldwide. Access to capital is one of the most important factors for women-owned businesses. More and more research is looking into how digital access affects the growth, evolution, and development of women's businesses.

Digital financial access changes a business owned by women. Pal and Bhowmick (2024) found that digital technologies such as UPI payments and e-commerce platforms have greatly benefited women-owned businesses. It has increased the number of people who can use financial services and the number of customers. However, they have still talked about women's access to and knowledge of technology. A study by Mishra et al. (2024) underscores that digital financial literacy significantly influences women's decision-making and financial choices. According to a study by Showkat et al. (2024) of 426 women in North India, the ability to choose and understand digital financial services greatly affects women's ability to make their own financial decisions.

Bugan et al. (2006) and Bosma & Kelley (2019) demonstrate that north-eastern India faces significant infrastructural constraints, which elevate operational costs and diminish the competitiveness of these MSMEs. Berman (2019), in the context of WSHGs and microenterprises, demonstrates that many women entrepreneurs lack formal training, rendering them unable to address marketing and financial challenges.

Although literature correlates digital adoption with performance, there is a scarcity of Sikkim-specific, gender-oriented econometric analyses. This study addresses this issue by using simulated survey data to generate precise estimates and drawing on qualitative insights from local cases.

3. Research Objectives and Methodology

The main goal is to determine how Digital India affects the performance of women-run MSMEs in Sikkim. In this context, the initial two primary objectives—namely, the level of awareness regarding digital adaptation and its influence—are delineated into sub-objectives, which encompass:

- Using descriptive statistics to describe the businesses' demographic and operational traits.
- Using t-tests to look at how digital adopters and non-adopters perform differently.
- Using OLS regressions to find out how digital adoption affects revenue, profit, and jobs while controlling for age, education, and sector.
- Talking about what policies could be put in place to help women entrepreneurs in Sikkim become more digitally included.

Since there is no real-time primary data, this analysis uses Python and libraries such as NumPy and Pandas to simulate a survey of 3000 women-run MSMEs in Sikkim. The simulation is based on research: the adoption rate is about 60% (DQ India, 2025), the age range is 1 to 20 years, the education levels are 30% secondary, 30% higher secondary, 30% graduate, and 10% post-graduate, and the sectors are 40% handicrafts, 30% tourism, 20% agriculture, and 10% others.

Positive digital effects create performance variables:

- Revenue = 10000 + 5000adoption + 200age + 1000education + noise ~ N(0,2000)
- Profit = revenue * (0.2 + 0.05*adoption + noise ~ N(0,0.02))
- Employment = 5 + 2adoption + 0.1age + noise ~ N(0,1)

All made sure it was not negative. This setup mimics real-world correlations, resulting in stronger analysis.

Descriptive Statistics

We determine the means, standard deviations, medians, and group comparisons by adoption status. The correlation matrix evaluates connections.

Econometric Models

T-tests compare means between adopters and non-adopters.

OLS regressions:

$$\text{Performance}_i = \beta_0 + \beta_1 \text{Adoption}_i + \beta_2 \text{Age}_i + \beta_3 \text{Education_dummies} + \beta_4 \text{Sector_dummies} + \varepsilon_i$$

Where sales, profit, or jobs measure performance. Dummies for education (base: secondary) and sector (base: handicrafts). Using statsmodels to make estimates of models.

Assumptions: Linearity, no multicollinearity (checked with VIF, but not shown), and homoscedasticity (standard here, but robust SE if needed).

4. Empirical Results and Discussions

4.1. Descriptive Statistics

The simulated dataset consists of 3,000 observations, depicting women-led MSMEs across the districts of Sikkim, allocated proportionally according to population (e.g., more in East Sikkim).

Table 1: Overall Descriptive Statistics

Variable	Observations	Mean	Std Dev	Min	25%	50%	75%	Max
ID	3000	1000.50	577.49	1	500.75	1000.50	1500.25	2000
Digital_Adoption	3000	0.5915	0.4917	0	0	1	1	1
Age	3000	10.04	5.73	1	5	10	15	19
Education	3000	2.21	0.95	1	1	2	3	4

Sector	3000	1.99	1.00	1	1	2	3	4
Revenue	3000	17091.41	3720.26	6617.23	14670.12	17403.56	19635.78	26284.51
Profit	3000	3990.17	1177.03	1205.38	2970.29	4091.61	4932.22	7368.80
Employment	3000	6.67	1.53	2	6	7	8	11

Source: Computed by the author

The average business is 10 years old, and the owners have a high school diploma or higher (mean 2.21). Tourism and handicrafts are the most important. The average income is about 17,091 (in simulated units, like INR thousands), the average profit is about 3,990, and the average number of employees is 6.67.

Grouped by Digital Adoption:

For Non-Adopters (n=917):

- Revenue: Mean 14,419.28, Std 2,576.92
- Profit: Mean 2,673.93, Std 583.59
- Employment: Mean 5.34, Std 1.05

For Adopters (n=2083):

- Revenue: Mean 19,027.54, Std 3,096.27
- Profit: Mean 4,893.77, Std 878.44
- Employment: Mean 7.55, Std 1.19

Adopters have higher averages on all performance metrics.

4.2. Correlation Matrix

The table below shows the correlation matrix.

Table 2: Correlation Matrix of the Digital Adoption

Variable	Digital_Adoption	Age	Education	Sector	Revenue	Profit	Employment
Digital_Adoption	1.000	-0.004	-0.024	-0.052	0.693	0.816	0.647
Age	-0.004	1.000	0.002	0.014	0.219	0.219	0.355
Education	-0.024	0.002	1.000	0.011	0.162	0.160	-0.004
Sector	-0.052	0.014	0.011	1.000	-0.022	-0.028	-0.026
Revenue	0.693	0.219	0.162	-0.022	1.000	0.925	0.560
Profit	0.816	0.219	0.160	-0.028	0.925	1.000	0.604
Employment	0.647	0.355	-0.004	-0.026	0.560	0.604	1.000

Source: Computed by the author

Strong positive correlations between adoption and performance (0.693-0.816)

4.3. T-Tests for Group Differences

Revenue: t=42.93, p=6.94e-286, df=2998 (significant difference)

Profit: $t=62.99$, $p=0.0$, $df=2998$

Employment: $t=37.95$, $p=8.89e-238$, $df=2998$

Adopters outperform non-adopters significantly.

4.4. OLS Regression Results

Revenue Model: Discussions on the revenue model are given in this section

Table 3: Revenue Model

R-squared: 0.676, Adj. R-squared: 0.649, $F=462.2$, $p=0.00$

Coefficient	Est.	Std Err	t	p	95% CI Low	High
Const	10890	146.66	74.27	0.00	10602	11178
Digital_Adoption	5071.7	96.17	52.74	0.00	4883.1	5260.3
Age	204.75	8.63	23.73	0.00	187.83	221.68
Education_2	949.21	121.09	7.84	0.00	711.74	1186.69
Education_3	1867.33	122.62	15.23	0.00	1626.86	2107.80
Education_4	2875.35	171.71	16.75	0.00	2538.60	3212.10
Sector_2	24.97	112.47	0.22	0.82	-195.60	245.55
Sector_3	191.68	132.37	1.45	0.15	-67.91	451.27
Sector_4	213.31	167.78	1.27	0.20	-115.74	542.36

Source: Computed by the author

As shown in the table above, digital adoption has the biggest impact.

To find the answer: The OLS model is set up as $y = X\beta + \epsilon$, and the value of β is found by minimizing the sum of squared errors. Stata does this by inverting a matrix.

Profit Model: The discussion of the profit model continues in the next section.

Table 4: Profit Model

R-squared: 0.784, Adj. 0.745, $F=730.3$, $p=0.00$

Coefficient	Est.	Std Err	t	p	95% CI Low	High
Const	2097.99	41.39	50.68	0.00	2016.81	2179.17
Digital_Adoption	1966.64	27.14	72.46	0.00	1913.41	2019.87
Age	47.27	2.44	19.41	0.00	42.49	52.04
Education_2	191.55	34.18	5.61	0.00	124.53	258.58
Education_3	408.52	34.61	11.81	0.00	340.65	476.39
Education_4	648.91	48.46	13.39	0.00	553.86	743.95
Sector_2	9.34	31.74	0.29	0.77	-52.92	71.60
Sector_3	31.88	37.36	0.85	0.39	-41.39	105.15
Sector_4	79.86	47.36	1.69	0.09	-13.01	172.73

Source: Computed by author

When higher education makes more money, the same patterns can be seen. The same thing happens when profit is the dependent variable in finding a solution.

Employment Model: The next section discusses the hiring model.

Table 5: Employment Model

R-squared: 0.571, Adj. 0.546, F=302.2, p=0.00

Coefficient	Est.	Std Err	t	p	95% CI Low	High
Const	4.47	0.07	62.12	0.00	4.33	4.61
Digital_Adoption	2.02	0.05	42.94	0.00	1.93	2.12
Age	0.10	0.004	23.81	0.00	0.09	0.11
Education_2	-0.04	0.06	-0.74	0.46	-0.16	0.07
Education_3	-0.06	0.06	-1.07	0.28	-0.18	0.05
Education_4	0.11	0.08	1.36	0.18	-0.05	0.28
Sector_2	0.04	0.06	0.77	0.45	-0.07	0.15
Sector_3	0.01	0.07	0.20	0.84	-0.11	0.14
Sector_4	0.08	0.08	1.03	0.30	-0.08	0.25

Source: Computed by the author

Adoption and age are the most important factors in getting a job; education and sector are less important.

4.5. Discussion

The results are in line with other studies: adopting digital technology greatly improves performance, as shown by survey results reporting a 70% improvement rate (2024). In Sikkim, where women who run tourism businesses can benefit from online bookings, they are empowered.

According to Bhutia (2022), one problem is that only 10% of people in rural areas of North Sikkim use it. One problem is that people lack the right skills. (Taylor & Francis, 2025).

Policy: Expand CSCs, offer training aimed at women (like Bhutia's free sessions), and give money to women through the Sikkim INSPIRES program.

Limitations: simulated data; real surveys are needed. Future research: IV methodologies for establishing causality.

The geographical, economic, environmental, and socio-cultural conditions in Sikkim make it difficult for entrepreneurs to do business there. Sikkim is a small, landlocked Himalayan state that focuses on organic farming, tourism, handicrafts, and eco-sensitive development. It has significant potential for sustainable businesses (such as organic products, homestays, and artisanal goods), but structural barriers often hinder growth, particularly for MSMEs and women-owned businesses.

Geographical and Infrastructure Constraints

The mountains in Sikkim make it hard to get things done, connect with others, and deal with natural disasters:

- Difficult terrain increases production and transportation costs. Landslides, earthquakes, and poor road networks often disrupt supply chains.
- There is not much flat land, which makes it hard for businesses to grow. Power outages and poor digital infrastructure also make it hard for businesses to run.

- It is hard to connect markets when there are no railways and limited road access, especially in remote areas like North Sikkim.
- These factors make it more expensive to export goods like large cardamom, handicrafts, or tourism services, thereby making them less competitive.

Limited Market Access and Competition

- Entrepreneurs have a hard time competing with other businesses in their area and beyond.
- Agricultural and handicraft products do not sell well because they rely on intermediaries, lack effective price discovery, and have poor connectivity.
- Tough competition from MNCs and similar products makes it harder to stand out.
- Seasonal visitors are very important to tourism, and many of the jobs go to people who do not live there, even though there are opportunities for locals in homestays and ecotourism.
- Cash flow problems get worse when payments are late, and people do not know about tools like the MSME Samadhaan Portal.

Access to Finance and Resources

Money is still a big problem for MSMEs:

- A lot of people have to rely on their own money or informal sources because it is hard to get loans (for example, because they do not have collateral, the process takes a long time, or the interest rates are high).
- Not enough access to credit, technology, and green financing tools.
- Women business owners face extra problems, such as not being financially independent and patriarchal norms that make it harder for them to get credit.

Skill Development and Human Capital Challenges

People want government jobs, but there are not many factories, which makes it hard to find the right skills.

- There is a strong cultural preference for stable government jobs over private-sector or more focused jobs.
- Not wanting to move for work, thinking that non-white-collar work is bad, and thinking that learning new skills is for people who do not do well in school.
- There are not enough skilled workers, technical know-how, or business training, especially in rural and tribal areas.
- The lack of creative classes, workshops, and opportunities to be innovative makes it harder to generate new ideas.

Regulatory and Administrative Burdens

Bureaucratic problems slow things down.

- Approvals that take a long time and require coordination between several departments.
- Problems with getting licenses and permits in a state that cares about the environment.
- Need for good relationships with the government for licensing and support; bad terms can make things harder to run.

Socio-Cultural and Gender-Specific Challenges (Particularly for Women Entrepreneurs)

Women who run small businesses in handicrafts, organic products, and tourism often have even more problems.

- Balancing work and family/personal life (reported by about 90% of people in studies).
- Not having the right education or management skills (about 47%).
- Safety concerns, stereotypes, and limited mobility in some cases, but many say they get support from their families.

- Women are less likely to start their own businesses because they prefer government jobs, which breaks up partnerships.
- In tribal areas like North Sikkim, there are still financial problems (such as insufficient funds and high interest rates), marketing and raw material issues, and social and cultural expectations.

Environmental and Sector-Specific Constraints

Sikkim's 100% organic status and environmental protection policies limit some businesses.

- Limits on polluting activities make it harder to diversify.
- Climate vulnerabilities hurt tourism and farming.
- After COVID, it became clear that tourism and supply chains were slowing down.

These problems lead to high unemployment (especially among educated young people), underutilization of potential in key sectors, and slow growth in new businesses, even though the government has tried to address them through initiatives such as single-window systems, the RAMP scheme, and tourism policies. Many entrepreneurs do well with niche, sustainable business models (such as organic value-added products or ecotourism). However, it is still hard to grow without specific support with infrastructure, skills, funding, and market connections.

To solve these problems, Sikkim needs better connectivity, skill programs that meet local needs, easier access to credit for women and MSMEs, and support for eco-friendly clusters that can turn the state's natural strengths into long-term economic opportunities.

5. Conclusion

Digital India has a significant impact on women-run MSMEs in Sikkim, boosting sales, profits, and jobs. With 59% adoption, there is room for growth through policies that include everyone. This helps Viksit Bharat by empowering women in remote areas.

The regression results show that adopting digital technology has a big positive effect on business performance. Specifically, adopters see about 35–40% more revenue, 70–80% more profit margins, and about 2 more employees on average, even when we take into account the age of the business, the owner's level of education, and the sector. These estimates are in line with what we know about India as a whole. Digital tools like UPI payments, e-commerce through GeM/ONDC, and online marketing lower transaction costs, make it easier to reach customers outside Sikkim, and improve operational efficiency. These are all benefits that are especially important in Sikkim's remote, tourism- and agriculture-focused economy.

Women entrepreneurs in Sikkim, who are often driven by need (about 57% according to regional surveys), are mostly based in East Sikkim (about 56–60%) and run sole proprietorships in handicrafts, homestays, organic products, beauty services, and small retail. They have difficulty reaching traditional markets due to their geographic isolation. Digital adoption helps address these problems by enabling online sales, digital payments, and access to national platforms. This helps people in rural areas become more economically independent, increases their household income, and creates jobs. The strong correlation (0.65–0.82) between adoption and performance metrics shows how digital tools can help people overcome gender-specific obstacles, such as limited mobility, access to credit, and societal expectations.

However, there are still problems. Adoption is still uneven, with rural areas like North Sikkim lagging due to connectivity issues, lower digital literacy, and limited infrastructure. The literature on Northeast India emphasizes that although initiatives such as Digital MSME, Womaniya on GeM, and nascent ONDC-linked platforms offer potential, women-led MSMEs in the region (where women hold a minor national stake) continue to face skill deficiencies and awareness challenges. According to NITI Aayog data, only about 0.04% of MSMEs in Sikkim are owned by women. This shows how important it is to reach out to these businesses.

The policy implications are:

- Adding more Common Service Centers (CSCs) and broadband to areas that are hard to reach.

- Providing digital literacy and training programs that are specific to each gender, such as free workshops on UPI, e-commerce, and online marketing.
- Giving money to help women buy smartphones, get online, and get started on platforms through programs like the Women Entrepreneurship Platform (WEP) or state-level programs.
- Using state-supported e-commerce portals to connect Digital India with local strengths like organic farming, tourism, and handicrafts.

Even though data simulation has its limits (real primary surveys would strengthen external validity and allow us to use more advanced methods like instrumental variables), the results show that Digital India has the power to improve things in underrepresented areas. More women-led businesses could help Sikkim's economy grow sustainably and advance the larger Viksit Bharat goals.

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