

Digital divide, Digital Literacy and Digital adoption among MSMEs – A Study in the Indian Context.

A Thesis Submitted in Partial Fulfillment of the Requirements for the Award of the degree of

Doctor of Philosophy

In

Management

BY

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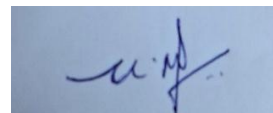


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DECLARATION

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Below are the details of Publications, Conferences & Coursework pursued during her PhD.

A. Journal Publications

- Naganjani, U., & Vanka, S. (2023). **Theoretical, practical and managerial implications of work from home: A systematic literature review**. *IUP Journal of Organizational Behavior*, 22(2), 10-23.
- Naganjani, U., & Sita, V. (2023). **Toward a Digital Competency Framework: An Assessment Model for Micro Small and Medium Enterprises in the Era of Digital India**. *SEDME (Small Enterprises Development, Management & Extension Journal)*, 50(4), 337-348.
- Case Study Published in The Case Centre. “**Bloom or Gloom: A case study of looming decisions of the Mangalagiri Cotton weavers in India (Case and teaching note)**”. <https://casecent.re/p/195096>

B. Conference Presentations

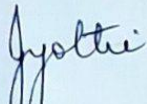
- Paper titled '**The Phygital Paradigm: A Student-Centric Approach to Management Education in India**' accepted to be presented in the annual conference of **Academy of Management, 2025**.
- Presented a paper in 4th Annual International Conference on Innovation and Sustainable Business Practices in the Digital Era (ICISD'25) on February 14th and 15th, 2025 conducted by VIT-AP, titled "**From Gaps to Growth: A Systematic Literature Review of Digitalization and Digital Literacy in MSMEs.**"
- Presented paper in **INDAM** conference 2024 titled "**Is 'Phygital' The Future of Management Education? - Developing an Integrated Framework of Learning Based on Students Perspective.**"
- Presented a case study Paper in International case study conference organized by Fore School of management titled "**Bloom or Gloom: A case study of looming decisions of the Mangalagiri Cotton weavers in India (Case & teaching note).**"
- Presented a paper titled '**The Concept of Work from Home – A Systematic Literature Review**' in the Symposium organized by School of Management studies, university of Hyderabad, Nov 18-19, 2022.

Further, the student has passed the following courses towards the fulfilment of the coursework requirement for PhD:

Course Code	Name	Credits	Pass / Fail
1. BA 105	Statistics for Business Analytics	3	Pass

2. EG 825	Academic Writing for Doctoral Students	3	Pass
3. PH 104	Research Methodology II	3	Pass
4. PH 102	Data Analysis for Social Science teachers (SWAYAM)	3	Pass

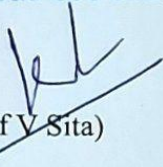
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ABBREVIATIONS

Sr No	Abbreviation	Full form
1.	MSME	Micro Small and Medium Enterprises
2.	KVIC	Khadi and Village industries Commission
3.	NSIC	National Small Industries Corporation Limited
4.	NI-MSME	National Institute for Micro Small and Medium Enterprises
5.	MGIRI	Mahatma Gandhi Institute for Rural Industrialization
6.	CAGR	Compound Annual Growth Rate
7.	UAP	Udyam Assist Platform
8.	GDP	Gross Domestic Product
9.	RAMP	Raising and Accelerating MSME Performance
10.	PTPFC	Public Tech Platform for Frictionless Credit
11.	ECLGS	Emergency Credit Line Guaranteed Scheme
12.	SDG	Sustainable Development Goals
13.	PMEGP	Prime Minister's Employment Generation Program
14.	CLCSS	Credit Linked Capital Subsidy Scheme
15.	PMGDISHA	PM Gramin Digital Saksharta Abhiyan

16.	MSE-CDP	Micro & Small Enterprises Cluster Development Program
17.	HTMT	Heterotrait-Monotrait

Acknowledgements

The completion of this thesis has been a long and enriching journey, and I am deeply grateful to all those who have contributed to its successful completion. This endeavour would not have been possible without the support, guidance, and encouragement of several individuals. It is with immense gratitude and heartfelt appreciation that I take this opportunity to acknowledge everyone who has been a part of this journey.

First and foremost, I express my sincere gratitude to my supervisor, Dr V Sita, Senior Professor, whose unwavering support, expert guidance, and invaluable insights have been instrumental in shaping this research. Throughout this journey, she has been not only my mentor and guide but also a source of inspiration. It is truly a blessing from God that I had the privilege of being her student. Words cannot fully express my profound gratitude for her constant support, encouragement, and belief in my abilities, which have shaped my academic and personal growth in immeasurable ways. In this juncture, I would like to extend my gratitude to Dr K Prabhakar Sir, for his support and treating me like part of their family. I express my sincere gratitude to my supervisor Dr P Jyothi, Professor, for her guidance and support throughout my Ph.D. journey. This work would not be completed without her valuable insights.

I would also like to extend my heartfelt thanks to the Doctoral Research Committee (DRC) members, Dr Sapna Singh, Dr D V Srinivas Kumar and Dr Punam Singh, whose valuable suggestions and critical evaluations have significantly improved the quality of this research.

I thank the Dean, school of Management studies, Dr GVRK Acharyulu and Former dean Dr V Mary Jessica and Faculty members, for their constant and timely support. I also would like to thank the staff members for their assistance during my doctoral journey.

I would like to extend my gratitude to my senior co-scholars, especially, Dr Srinivas Josyula, Dr Swati Singh, Dr Rajendra and Ms. Dashmiti, whose encouragement, moral support, and

willingness to share knowledge have made this journey more enjoyable and intellectually stimulating. A special mention to the friendship I have built during this journey that will remain close to my heart, Ms Navaneetha Lakshmi, which I would always cherish. I would also like to thank my batch mates, junior and senior scholars for their support.

A very special acknowledgment goes to my family. I thank the three most important ladies of my life – my daughter- Ms Gauri Sumedha, my mother- Mrs M Rajya Lakshmi, and my aunt- Dr U N Sarvari, whose unwavering support, sacrifices, and constant encouragement have been the driving force behind my academic pursuits. Their unconditional love, patience, and belief in me have been the foundation upon which I have built my aspirations. My father, Mr U H R R Narayana, a pillar of strength and deserves my everlasting gratitude for his support. Last but not least, I thank my husband Mr Pavan Kishore for being the reason behind me embarking on this journey.

Above all, I express my deepest gratitude to God Almighty for granting me the strength, wisdom, and perseverance to complete this research. I am grateful for the opportunities, the people, and the circumstances that have shaped this journey, and I humbly acknowledge that none of this would have been possible without His blessings.

With heartfelt gratitude,

U Naganjani

Abstract

The rapid digital transformation of businesses has created both opportunities and challenges for Micro, Small, and Medium Enterprises (MSMEs). This study examined the impact of digital literacy and the digital divide on digital adoption among MSMEs, along with demographic and business-related factors such as gender, education, sector, and enterprise location. By integrating theoretical perspectives from the Van Dijk's digital divide framework and the Unified Theory of Acceptance and Use of Technology (UTAUT), this research provided a comprehensive analysis of the factors influencing the digitalization of MSMEs. The study employed a quantitative research approach using the data collected from 410 MSMEs through a structured survey administered to the entrepreneurs across various sectors. Structural Equation Modelling (SEM) was used to analyze the relationships between digital literacy, digital divide, and digital adoption.

The findings revealed that digital literacy significantly influences digital adoption among MSMEs. The study also confirms that the digital divide remains a major barrier to digital adoption, particularly for enterprises with limited access to digital infrastructure and training opportunities. While gender does not significantly impact digital adoption, it does influence digital literacy levels, with male entrepreneurs exhibiting slightly higher digital proficiency. Education was found to be a key determinant of digital literacy, although its direct effect on digital adoption was minimal, suggesting that other factors, such as financial constraints and infrastructure limitations, moderate this relationship. The sector in which an MSME operates also plays a crucial role in digital literacy, with service-sector enterprises exhibiting higher digital competency than those in manufacturing and trading.

A key contribution of this study is the development of a digital literacy framework tailored for MSMEs. This industry-oriented framework provides a structured approach to assess digital

literacy levels among entrepreneurs, enabling policymakers and businesses to identify gaps and design targeted interventions. A validated measurement scale was also developed to quantify digital literacy among MSME entrepreneurs.

The findings have significant implications for policymakers, industry leaders, and MSME support organizations. Targeted digital literacy training, financial incentives for technology adoption, and sector-specific digital upskilling programs are crucial to ensuring inclusive digital transformation. The study emphasizes the need for strategic partnerships between government agencies, private sector organizations, and digital service providers to create customized training programs that address the unique needs of MSMEs across different sectors. Future research should explore the role of emerging technologies, such as artificial intelligence, blockchain, and cloud computing, in shaping the digitalization of MSMEs. Further exploration of regional and sectoral disparities in digital adoption would also be valuable in developing more tailored policy interventions.

In conclusion, digital literacy and the digital divide are critical factors influencing digital adoption among MSMEs. Addressing these challenges through targeted policy measures, industry collaborations, and capacity-building initiatives can accelerate the digital transformation of MSMEs, strengthening their competitiveness in an increasingly digital economy. By fostering an inclusive digital ecosystem, this study provided a foundation for future research and practical strategies aimed at ensuring that MSMEs thrive in the digital era.

Chapter 1

Introduction

The UN General Assembly created the "2030 agenda for sustainable development with 17 SDGs at its core" as part of the "post-2015 development agenda" following the success of the millennium development goals and its significance towards development. The call for action for these goals is ending poverty and deprivation, improving health, education, and reducing inequality while taking care of life on land and in the ocean. The emphasis of these goals was on the eradication of poverty and improving living conditions ([UNESCO 2016](#)). While all the United Nations member countries are working towards these goals, the COVID-19 pandemic has created a setback due to loss of life and livelihood. The negative impact on the world economy has left the countries floundering for solutions (Bremmer, 2020).

India is no exception to this fact. India, being home to one-sixth of the global population plays a significant role in the success of SDGs so much so that if India fails in its endeavors, the realization of sustainable development will be an impossibility (Niti Ayog, 2019-20). Hence, India is working proactively on a macroeconomic level to develop the nation socio-economically as well as environmentally despite facing challenges in terms of basic infrastructure, poverty, and quality of education among others. It is acknowledged long back that the role of the small and medium industries would be significant in the process of development (Kniivila, 2007). Small and medium enterprises are recognised as the 'lever' for the social and economic development of a country owing to their magnitude and diversity. Their strategic role in minimizing unemployment and poverty (Arifin et al.,2021) has been recognised recently prompting development initiatives by countries across the globe.

The concept of Micro, Small, and Medium Enterprises (MSMEs) emerged as a response to the need for economic inclusivity and the recognition of small-scale businesses as vital contributors to national economies. The origins of MSMEs can be traced back to the early days of industrialization in the 18th and 19th centuries when small workshops, family-run businesses, and local craftspeople formed the backbone of many economies. These small enterprises were essential in meeting local demand, creating jobs, and fostering entrepreneurship.

As economies grew and industrialized, the disparity between large corporations and small businesses became more apparent. Governments and policymakers began to recognize the unique challenges faced by smaller enterprises, such as limited access to capital, markets, and technology. This led to the development of specific policies and definitions to support and protect these businesses, marking the formal inception of the MSME sector.

The concept gained further prominence in the mid-20th century, especially after World War II, when rebuilding war-torn economies required the revitalization of small industries. Over time, international organizations, such as the United Nations and the World Bank, began to promote MSMEs as critical to economic development, particularly in developing countries. MSMEs are now recognized globally for their role in boosting innovation, job creation, and promoting economic growth, particularly in local and regional contexts.

1.1 MSME - The Global Scenario:

SMEs have a significant role in the emerging economies as they are vital in job creation and economic development. According to World Bank statistics (worldbank.org), SMEs are responsible for 90% of global businesses and more than 50% of employment worldwide. Emerging economies today can attribute their steady economic growth to the rise in small and medium businesses, pitting them squarely in the international business landscape (Ghauri et.al

2021). It is an acknowledged fact that the small and medium enterprises are the key engines for the economic development of nations (Tolstoy et.al 2021) and hence it is imperative to pay attention to the growth and development of this sector for all nations.

Micro, Small and Medium Enterprises (MSMEs) play a vital role in the global economy, serving as the backbone for socio economic growth, employment, and innovation across both developed and developing nations. SMEs, which are typically defined as businesses with fewer than 250 employees, account for the vast majority of enterprises worldwide, representing over 90% of the total business population (worldbank.org, 2022). Despite their small individual size, collectively, SMEs are responsible for generating a significant portion of global economic output, contributing an estimated 50% to 70% of global GDP. Beyond their economic impact, SMEs are also important drivers of employment, providing jobs for over 60% of the world's workforce. SMEs are particularly adept at creating new employment opportunities, with studies showing that they account for around 60-70% of all new jobs created (worldbank.org, 2022). This employment generation capacity is especially critical in developing economies, where SMEs often serve as a primary source of livelihood and income for large segments of the population. Furthermore, SMEs foster innovation through entrepreneurship, acting as breeding grounds for new ideas, products, and business models that can disrupt established industries and drive technological progress. Their nimble and adaptive nature allows them to respond quickly to changing market demands and capitalize on emerging opportunities, contributing to the dynamism and competitiveness of the global economy.

Given the vital importance of SMEs to the world's economies, governments, policymakers, and development organizations have increasingly recognized the need to create an ecosystem that supports the growth and success of these enterprises. Persistent and efficient initiatives to

address the unique challenges and unlock the full potential of SMEs are crucial for achieving inclusive and sustainable economic development on a global scale.

1.1.1 Global perspective

MSMEs have a significant global presence. In *North America*, MSMEs account for approximately 90% of all businesses, contributing significantly to employment and economic output. In the *United States*, SMEs generate about half of all jobs and contribute approximately 40% to the GDP. Furthermore, it is noteworthy that only 9% of female-led (WTO, 2022) which points to a glaring gender disparity. MSMEs in North America engage in international trade. Similarly, In *Europe*, there are approximately 24.4 million SMEs, predominantly composed of micro-sized enterprises. As of 2023, SMEs employed around 84.75 million people, representing a crucial component of the European labour market. These businesses contribute roughly 52% of the total value added to the European economy, amounting to about 4.15 trillion Euros. MSMEs are a vital segment of the *Asian* economy, constituting over 97% of all enterprises and employing approximately 69% of the workforce. They contribute around 41% to the GDP on average across the region. In *Southeast Asia* alone, there are at least 71 million MSMEs, providing employment for over 140 million people. In *Africa*, MSMEs represent nearly 90% of all businesses, responsible for two-thirds of all the jobs and contributes almost 50% to the continent's GDP. Specifically, around 44 million MSMEs exist in *Sub-Saharan Africa*, with micro-enterprises comprising 97% of this total. In *Latin America and the Caribbean*, MSMEs account for 99.5% of all businesses and provide about 60% of employment. Despite their prevalence, MSMEs contribute only around 25% to the regional GDP. In the *Middle East*, MSMEs account for approximately 80–90% of all businesses. They contribute to roughly 50% of employment in the region, with GDP contributions ranging between 4% and 40% in various Arab economies. For instance, in the UAE, SMEs contribute

approximately 63.5% to the non-oil GDP. It is precisely due to their vital contribution to the nation's development at both global and grassroot level, that the MSMEs has garnered the attention of researchers, governments as well as other commercial institutions.

1.1.2 Challenges for MSMEs on a global level

Access to finance is one of the most significant challenges for MSMEs. Many small businesses struggle to obtain loans due to high-interest rates, stringent requirements, and lack of collateral. In addition, regulatory Barriers in case of MSMEs are quite complex and burdensome stifling the growth of MSMEs. Simplifying these regulations and improving the ease of doing business are critical for the growth and development of MSMEs in both developed as well as developing economies. Further MSMEs often find it difficult to penetrate new markets due to limited resources and lack of information regarding the market access. In the post pandemic era, keeping up with technological advancements is a challenge as well as a necessity for many MSMEs, especially in developing countries where poor infrastructure and lack of digital skills hampers the growth and efficiency of MSMEs. While there are numerous obvious challenges, the future for MSMEs looks promising with continued support from governments, international bodies, and private sector initiatives. Digitalization, increased access to financing, and better regulatory environments will be key drivers for the MSME success across the world.

1.2 MSMEs in India

The 'MSME' term, initiated and run by the ministry of micro small and medium enterprises, constitutes bodies that are engaged in the manufacturing, production, processing and preservation of goods and commodities. The MSME Ministry heads five statutory bodies – KVIC, Coir Board, NSIC, NI-MSME, and the MGIRI, which are responsible for aiding MSMEs with respect to government schemes and policies.

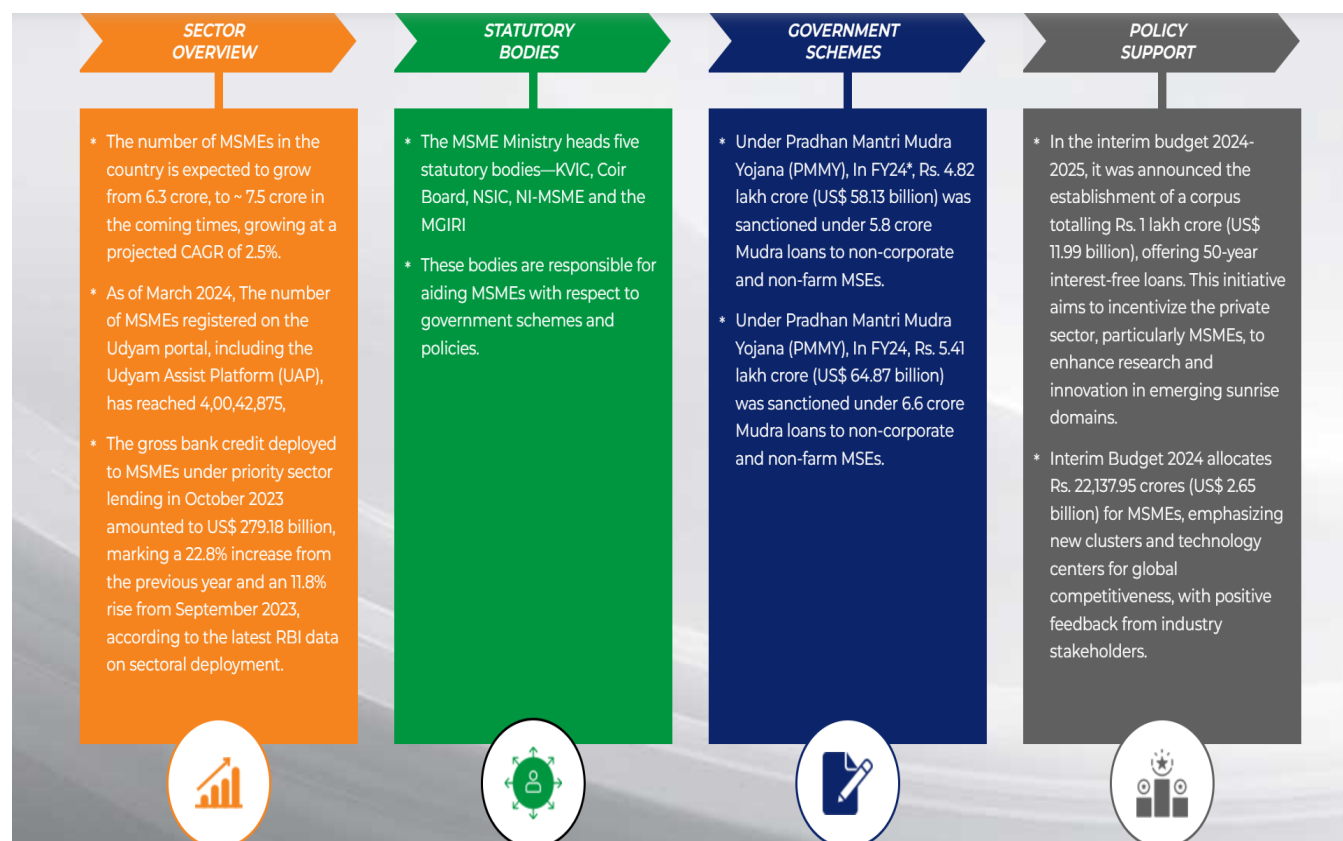
Figure 1.1: Distribution of MSMEs (micro, small and medium level) (Source: ibef.org)



According to a report from IBEF, 2024 report, there are a total of 6.339 Crore MSMEs in India, of which over 97% of total MSMEs are micro-enterprises accounting for almost 630.5 lakh enterprises (figure 1). There are a total of 3.3 lakh businesses that qualify as small businesses i.e. 1.5% of all MSMEs and just over 0.05 lakh qualify as medium businesses that comprise of 0.8% of all MSMEs. The rural areas majorly consist of 324.9 lakh businesses, while urban areas have 309 lakh businesses. Further, 608.41 lakh MSMEs are proprietary businesses and it is observed that men predominated proprietary MSME ownership which resulted in male holdings of 79.56% of micro businesses, 94.74% for small businesses and 97.63% for medium businesses (forbes.com, 2024). On the other hand, female ownership is 20.44% for micro businesses, 5.26% for small businesses and 2.77% for medium businesses which reveals a major gender disparity among the MSME sector similar to the global statistics. In addition, MSMEs are responsible for employment to a staggering 7.56 lakh individuals, home to 75,000 recognized start-ups out of which 12% cater to Information Technology services, 9% of the healthcare and life sciences, 7% to education, 5% to commercial and professional services and 5% to agriculture. Over the last six years, there has been a 110% yearly increase in the creation

of jobs (forbes.com, 2024) which highlights the significance of MSMEs as a major job avenue in a populous developing economy like India.

Figure 1.2: Brief overview of MSMEs in India (source: IBEF.org)



The number of MSMEs in the country is expected to grow from 6.3 crore to around 7.5 crore in the coming times, at a projected CAGR of 2.5% (Figure2). As of March 2024, the number of MSMEs registered on the Udyam portal, including the Udyam Assist Platform (UAP), has reached 4,00,42,875 (IBEF.org, 2024). In addition, the sector has gained importance due to its contribution to GDP, exports, and entrepreneurship development, especially in semi-urban and rural areas which prompted the government to promote this sector through various schemes like such as the Pradhan Mantri Mudra Yojana, Credit Guarantee Fund, and Raising and Accelerating MSME Performance (RAMP) program to name a few. The government has launched various initiatives to support MSMEs, such as the new online system of

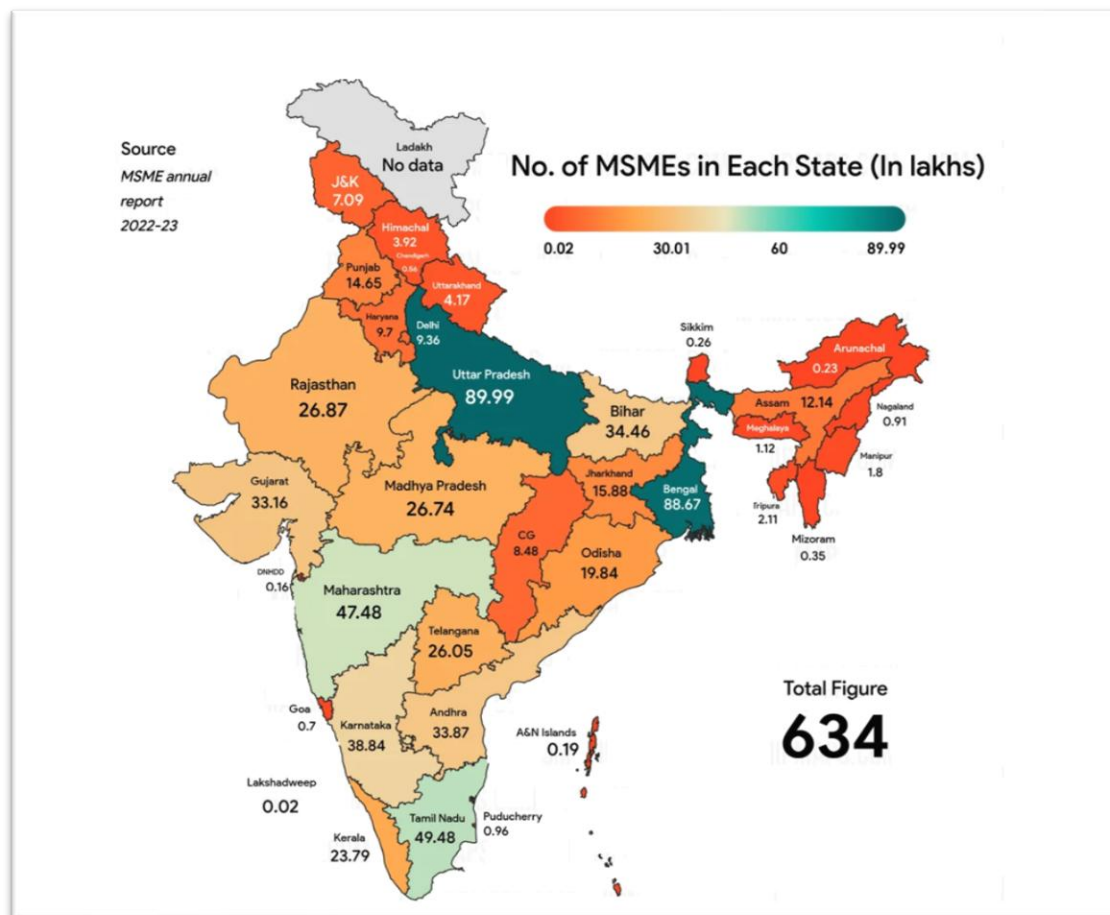
MSME/Udyam Registration, the Raising and Accelerating MSME Performance (RAMP) program, and the Self-Reliant India (SRI) fund. Initiatives like the Public Procurement Policy and the launch of the Public Tech Platform for Frictionless Credit (PTPFC) pilot project aim to promote and support the growth and development of MSME sector.

1.2.1 MSMEs in India

India's diverse and dynamic economy is marked by the prominence of various industries across its different states, each contributing uniquely to the nation's overall growth. The country's vast geographical expanse and cultural diversity have given rise to region-specific industries that not only cater to local markets but also drive national and international trade. From the IT hubs of Karnataka to the textile mills of Tamil Nadu, and from the agricultural powerhouses of Punjab to the automotive giants of Maharashtra, Indian states are home to a variety of top-performing industries of all sizes from large conglomerates to micro, small and medium enterprises.

MSME presence in India has been on a steady rise in recent years owing to the government support (MSME.gov.in, 2023) as well as the increased market demand for the products made in India (Saranga et al., 2017). Schemes like Emergency Credit Line Guaranteed Scheme (ECLGS) as part of Aatma Nirbhar Bharat (Self Reliant India) boosted the entrepreneurial activity in India during the recent years. State governments have also added to the support by introducing single window registrations and ease of doing business initiatives to induce growth opportunities and new entrepreneurial ventures in the individual states (figure 3).

Figure 1.3: State wise MSME distribution (Source: MSME.gov.in, 2023)



MSMEs have developed throughout time, moving from producing basic consumer goods in a small scale to producing a wide range of complex and precise goods, such as electronics, computer parts, microwave parts, electronic medical devices, and so forth. In India, MSMEs are regarded as crucial participants in the supply chain and established in nearly every significant industry sector including but not limited to Chemicals and pharmaceuticals, agri and associated products, food processing units, textiles, engineering, electronics & electrical systems, Aqua and meat products, leather, metal, plastic and wooden goods and computer and software products etc. These enterprises contribute significantly to industrial production, export, employment, and entrepreneurship, making them vital to both regional and national growth. In states like Tamil Nadu and Gujarat, MSMEs are deeply embedded in the textile and

manufacturing sectors, driving innovation and local employment. In Karnataka and Telangana, the focus shifts to IT and biotechnology, where MSMEs have become essential players in supporting larger industries and fostering technological advancements. Meanwhile, states like Uttar Pradesh and Punjab see a concentration of MSMEs in traditional industries such as handicrafts, leather, and agriculture-based sectors, sustaining cultural heritage while providing livelihoods to millions. Across India, the MSME sector not only enhances economic resilience by diversifying industrial bases but also promotes inclusive growth by empowering small entrepreneurs and boosting rural economies.

1.2.2 MSMEs in Andhra Pradesh and Telangana

Andhra Pradesh and Telangana are not only home to large-scale industries but also boast vibrant Micro, Small, and Medium Enterprises (MSME) sectors, which are crucial to their economic growth and employment generation. These MSMEs span a wide range of industries, contributing significantly to the regional economies by fostering local entrepreneurship, innovation, and inclusive development. Andhra Pradesh and Telangana combined account for the third largest MSME presence in the country, with close to 60 lakh units.

In Andhra Pradesh, MSMEs play a pivotal role across various sectors, particularly in *agriculture-based industries, textiles, and handicrafts*.

- *Agriculture and Food Processing:* Andhra Pradesh's strong agricultural base has led to the growth of numerous MSMEs in the food processing sector. These enterprises engage in processing rice, pulses, dairy products, and seafood, adding value to agricultural produce and creating employment opportunities in rural areas. The coastal belt in Andhra Pradesh is home to various port cities like Machilipatnam, Kakinada, Bapatla where sea food and Aqua industries are thriving.

- *Textiles and Apparel:* The state has a rich tradition in textiles, with MSMEs involved in spinning, weaving, and garment manufacturing. Cities like Guntur and Chirala are known for their production of cotton yarn and fabrics, while smaller towns contribute to the weaving of traditional handlooms like Mangalagiri, Uppada, Dharmawaram and Venkatagiri sarees.
- *Handicrafts and Handlooms:* Andhra Pradesh is renowned for its handicrafts, with MSMEs playing a crucial role in preserving and promoting traditional crafts. Industries such as Kondapalli toys, Etikoppaka woodwork, and leather puppetry from Anantapur are notable examples. These crafts not only support local artisans but also contribute to the state's export profile due to their geographical indication tags.
- *Renewable Energy and Electronics:* The MSME sector in Andhra Pradesh is also making strides in renewable energy, particularly in the manufacturing of solar panels and related components. Additionally, the electronics industry in cities like Visakhapatnam and Tirupati is seeing growth, with MSMEs engaged in the production of electronic goods and components.

Telangana's MSME sector is equally dynamic, contributing significantly to the state's economic landscape, particularly in *pharmaceuticals, IT services, agro-based industries, and handicrafts*.

- *Pharmaceuticals and Biotech:* Hyderabad, Telangana's capital, is a global hub for the pharmaceutical and biotech industries, and MSMEs form an integral part of this ecosystem. Small and medium enterprises in this sector are involved in the production of bulk drugs, formulations, and biotech products, contributing to the state's reputation as the "Pharma Capital of India."

- *Information Technology:* Telangana's thriving IT sector includes numerous MSMEs that provide IT services, software development, and support to larger corporations. These MSMEs are crucial in driving innovation and supporting the broader IT ecosystem in Hyderabad, often focusing on niche markets such as fintech, health tech, and cybersecurity.
- *Agro-Based Industries:* Similar to Andhra Pradesh, Telangana's agricultural strength supports a vibrant MSME sector in food processing. These enterprises are involved in the processing and packaging of cereals, millets, pulses, oilseeds, and spices, catering to both domestic and international markets.
- *Handlooms and Handicrafts:* Telangana is famous for its traditional crafts, with MSMEs at the heart of this industry. The state's handloom sector is renowned for the production of Pochampally ikkat, Narayanpet, Gadwal sarees, and Warangal durries. These enterprises not only preserve traditional techniques but also provide livelihoods to thousands of artisans across the state.
- *Aerospace and Precision Engineering:* Hyderabad's growing aerospace and defence sector also includes MSMEs engaged in precision engineering and manufacturing of components. These small and medium enterprises are vital in supporting the larger aerospace companies by providing specialized products and services.

In both Andhra Pradesh and Telangana, MSMEs are integral to the economic fabric, driving growth across traditional and emerging industries. Further, these enterprises not only contribute to the states' GDP but also play a crucial role in generating employment, fostering innovation, and promoting sustainable growth.

1.2.3 Contribution of MSMEs towards achieving SDGs in India:

Micro, small and medium enterprises play a significant role in the achievement of sustainable development goals in India. SDG number 9 which is Industrialization, innovation, and infrastructure is seen as a prerequisite for maximizing the effectiveness and efficiency of all the other SDGs as it provides the necessary economic playground. Other goals like Poverty (1), Goal 8 (Decent Work and Economic Growth), and Goal 11 (Sustainable Cities and Communities) are related to a well-established industrial development phase in a country. In addition to the directly affected SDGs, it is evidenced that the growth and development of MSMEs indirectly effect the achievement of the other SDGs as well, for example, they contribute to SDG 3 (Good Health and Well-being) by increasing access to healthcare services through small clinics, pharmacies, and affordable medical solutions.

Similarly, MSMEs support SDG 4 (Quality Education) by providing vocational training and e-learning platforms, enhancing skill development and employment opportunities for educators. They empower women entrepreneurs and offer employment opportunities to women, contributing to SDG 5 (Gender Equality). In the realm of clean water and sanitation, MSMEs develop innovative water management and purification solutions, supporting SDG 6 (Clean Water and Sanitation). By offering renewable energy solutions like solar panels and biogas plants, MSMEs advance SDG 7 (Affordable and Clean Energy), increasing energy access in underserved areas. They are vital to economic growth, contributing significantly to GDP and job creation, thus supporting SDG 8 (Decent Work and Economic Growth) along with their role in innovation and infrastructure development driving industrialization and technological advancements. MSMEs in India promote inclusive growth and regional development through their presence in rural and remote areas, reducing inequalities, thus supporting SDG 10 (Reduced Inequality). Their contributions to sustainable urban development, through housing, transportation, and community engagement, align with SDG 11 (Sustainable Cities and

Communities). Further, by adopting sustainable production practices and engaging in waste management, they support SDG 12 (Responsible Consumption and Production). In response to climate change, MSMEs develop and implement green technologies, contributing to SDG 13 (Climate Action), and they promote sustainable practices in fisheries and aquaculture to protect marine ecosystems, supporting SDG 14 (Life Below Water). They also engage in biodiversity conservation and sustainable land use, aligning with SDG 15 (Life on Land). By fostering ethical business practices and community development, MSMEs contribute to SDG 16 (Peace, Justice, and Strong Institutions). Finally, MSMEs enhance international cooperation and partnerships, integrating into global value chains and supporting SDG 17 (Partnerships for the Goals). Overall, MSMEs in India are integral to achieving the SDGs due to their widespread presence, adaptability, and innovative potential.

Micro small and medium enterprises in India, according to the confederation of Indian Industries acts as a “bulwark for Indian economy, providing it the resilience to ward off global economic shocks and adversities” (CII, 2020). There are around 63.4 million units out of which about 20% of them are in rural India, MSMEs contribute around 6.11% of the manufacturing GDP and 24.63% of the GDP from service activities as well as 33.4% of India's manufacturing output and has a consistent growth rate of about 10%. They provide employment to around 120 million persons and contribute around 45% of the overall exports from India (CII, 2021).

This is the only sector which has significant presence in rural areas after agriculture, which indicates the deployment of significant rural workforce in the MSME sector and hence plays a crucial role in promoting sustainable and inclusive development as well as generating large scale employment, in the rural areas (CII, 2021).

The financial goal of Government of India to double the economy to US\$ 5 trillion in the next 5 years can only be possible with the growth and development of MSMEs in India due to their significant contribution towards GDP, employment and general socio-economic development. (ibef.org, [Economic times](#), Feb 2022)

1.3 Role of MSMEs in Indian economy:

In the backdrop of global crisis created by the Covid-19 pandemic, keeping a steady income by having a job has become ever more difficult, especially in developing nations like India where the poverty rate is high and a major chunk of the population is dependent on jobs. In contrast to the poverty numbers, it is interesting to note that as per world bank statistics and IMF, India is the third-largest economy in terms of purchase parity power ([PIB, 2020](#)), the only country to register double-digit growth in 2021 ([global statistics 2020](#)). According to a survey, close to 7 million people lost their jobs during the pandemic. So, to counter this poverty caused by job loss and displacement, the Government of India is encouraging entrepreneurs to create more and more small and medium enterprises by giving different subsidies and financial assistance, by introducing many schemes like mudra, make in India, PMEGP (prime minister's employment generation program), etc. Special attention is paid to support, encourage and develop micro, small and medium businesses. As per the reports from ministry of MSMEs for the financial year 20-21 they contribute 30% of India's GDP and 49.5% of exports ([PIB, 2021](#)).

Table 1.1: Classification of MSMEs as per govt. of India

CLASSIFICATION	MICRO	SMALL	MEDIUM
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Manufacturing Enterprises and Enterprises rendering Services	Investment in Plant and Machinery or Equipment: Not more than Rs.1 crore and Annual Turnover; not more than Rs. 5 crore	Investment in Plant and Machinery or Equipment: Not more than Rs.10 crore and Annual Turnover; not more than Rs. 50 crore	Investment in Plant and Machinery or Equipment: Not more than Rs.50 crore and Annual Turnover; not more than Rs. 250 crore
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(source: www.ibef.org)

This increase of small and medium businesses, as well as solo Enterprises or self-employment, can be the answer to the poverty caused by unemployment (Singh et al. 2010). Under the Prime Minister's Employment Generation Program (PMEGP), the estimated employment generated (number of persons) in micro-enterprises during the year 2020-21 and 2021-22 (as on 01.07.2021) are 5.95 lakh and 1.19 lakh respectively ([PIB](#)). Since small and medium businesses and micro businesses constitute a large percentage of GDP, exports and employment, it is imperative to focus on development and support initiatives for their growth and sustainability in the long run. Digitalization is one such initiative for the growth of MSMEs. They have to take progressive measures in order to neutralize their disadvantage owing to their size of operations and inadequate resources and research has proven that digitalization is the solution for it (Raymond et al, 2005). Setting up e-commerce avenues may provide that competitive advantage and help the MSMEs to overcome the fierce competition at both domestic and global levels (Abebe, 2014).

1.4 Challenges faced by Indian MSMEs

The Micro, Small and Medium Enterprises (MSME) sector has emerged as a highly vibrant and dynamic sector of the Indian economy over the last five decades owing to their sheer numbers and spread across the country. They are widening their domain across sectors of the economy, producing diverse range of products and services to meet demands of domestic as well as global markets. However, at a grassroot level, there still are challenges faced by the MSMEs as the reach of the development programs by the government is not adequate for the MSMEs to reach their potential. According to the latest report by the Ministry (Ministry of MSME, GOI) the micro small and medium enterprises are currently facing challenges like access to credit, market access, technology upgradation, ease of doing business, social security for employees of MSMEs etc. (MoMSME, 2023 Annual Report). In addition to these domestic challenges, the progression of COVID-19 virus from beginning of the year 2020 aggravated the difficulties for MSMEs. To maintain its niche in the international and global markets, MSMEs have been required to remain globally competitive and consistently upgrade themselves to meet the challenges of new technology, changes in demands, emergence of new markets with an already existing financial and technological lag.

Technological advancement in the industry and market has proven to be a challenge for MSMEs across the globe and especially for a developing country like India, where 99% of the MSMEs are micro enterprises with less investment, working capital and work force. Post pandemic era has forced the businesses to undergo rapid technological changes in order to adjust to the evolving market demands and embrace digital tools and techniques (Sharma and Rai, 2023). Digitalization would facilitate MSMEs—which frequently have few resources—a great chance to compete with bigger, more well-established businesses in domestic as well as global markets (Hendrawan et al.,2024). However, in order to take advantage of the opportunities provided by the digitalization, MSMEs must create efficient technology

management plans like personnel training, suitable infrastructure and appropriate change and risk management plans.

1.5 Digitalization for the growth of MSMEs

1.5.1 Digital adoption among the MSMEs

Digital adoption among Micro, Small, and Medium Enterprises (MSMEs) in India is revolutionizing the sector, enhancing operational efficiency, market reach, and competitive edge. As vital contributors to the Indian economy, MSMEs are increasingly integrating digital technologies such as e-commerce, digital payments, cloud computing, and data analytics to streamline processes and expand their customer base. The current digital transformation is propelled by improved internet connectivity, cost-effective technological solutions, and supportive government initiatives like the Digital India campaign. However, research proves that businesses, especially the small and micro businesses based in rural and semi urban areas do not fully utilize the digital platforms available (like Facebook, AdWords, Instagram etc) to develop the businesses not just because there is lack of infrastructure and financial capability but primarily because they do not comprehend the relevance of digitalization (Ikrama & Ahmed 2018) or the multitude of opportunities provided by these digital platforms in terms of market expansion, product promotion, customer retention, acquisition, procurements or the ease of payments (Heeks, 2017). In addition, a significant digital divide exists, with disparities in access to technology between urban and rural areas, and among different socio-economic groups. Additionally, digital literacy remains a critical hurdle, as many MSME owners and employees lack the necessary skills to effectively utilize digital tools. These challenges hinder the full potential of digital adoption, creating gaps in efficiency and growth.

1.5.2 Digital Divide among the MSMEs

It is true that considerable efforts are being done by the government for assisting MSMEs, however, research has proven that the digital transformation of the businesses is the need of the hour (Chandrajit Banarjee, [The Indian express](#), Dec 2020; Klein & Todesco, 2021). Use of digital platforms for different business operations like marketing (Ahmad, et.al 2018), customer service (Nikunen et.al 2017) procurements and payments (Bigliardi, 2022) etc. are becoming the new normal and the pandemic situation has just accelerated the need for this digital transformation (Klein, 2021).

Despite the need for digitalization and the support provided by the government, there is still a considerable ‘digital divide’ among the entrepreneurs of micro and small businesses (Venkatesh & Sykes, 2013). The term digital divide refers to *the gap between individuals, households, businesses, and Geographic areas at different socio-economic levels with regard to both their opportunities to access Information and Communication Technologies and to their use of the internet for a wide variety of activities* ([OECD](#)). According to EU commission ([eurostat 2016](#)) “Digital divide refers to the distinction between those who have internet access and are able to make use of new services offered on the World Wide Web, and those who are excluded from these services.” This definition has been reconceptualized after extensive studies. The dichotomous view of digital divide about haves and have nots of accessibility has long since changed and has been modified into a multi perspective view which takes into consideration many other factors like geographic area, socio-economic status, gender, education qualification, IT literacy and technical aptitude etc. In recent times where smart mobile/ ICT device penetration is high in India (In 2020, 54% of population has smart phones according to [Statista.com](#) and 1.2 billion telecom connections according to [trade.gov](#)) the other allied factors like demographics, IT literacy etc. have a significant impact on the digital divide. This is more apparent in small and medium businesses in India due to their versatility in terms

of location, resources, size of operations as well as line of business. This digital divide among MSMEs in India is less due to lack of infrastructure but more due to lack of digital skills or IT literacy (Digital literacy) (Ollerenshaw, 2021).

1.5.3 Digital Literacy among the MSMEs

Research proves that the major roadblocks in the digital adoption of MSMEs are lack of infrastructure, lack of digital skills and expertise, lack of financial assistance, and lack of trust and security reasons among the entrepreneurs. Among these reasons, often the lack of skills and expertise to upgrade digital technologies, to implement more complex technologies and lack of awareness in identifying the value of implementing new technologies due to minimal resources is a major concern among MSMEs in India (Mohan & Ali, 2019). Developing awareness of the benefits of new technologies by reducing the digital literacy gap is one strategy to address the digital divide of SMEs (Oni & Papazafeiropoulou, 2014; Price et al., 2018) and bring them to the global competitive platform.

By definition *digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy* (UNESCO, 2018).

By this definition it is understood that digital literacy includes the competence or the skill to use, access, understand and integrate computer technologies in daily life as well as in the businesses. Hence it is not an exaggeration to say that for the growth and smooth operations of the businesses, the use of Information and Communication Technologies is imperative. To address the lack of digital adoption among the MSMEs due to digital literacy gap, various schemes and training programs are initiated and financial assistance to provide preliminary

support for rural SMEs are introduced, however, the generic focus of such methods can not address the specific needs and limitations of individual SMEs.

1.6 Need for the study

The study of digitalization among MSMEs is interdisciplinary, involving fields such as economics, sociology, information technology, and management. Technologically, the focus is on the development and adoption of digital tools, digital divide prevalent in the industry, digital literacy, cybersecurity challenges, and the evolution of digital infrastructures. Understanding digital adoption among MSMEs is essential to drive economic growth and enhance competitiveness. MSMEs constitute a substantial portion of India's economy, contributing significantly to GDP, employment, and exports. By adopting digital technologies, the MSMEs can streamline their operations, reduce costs, and improve productivity, thereby significantly impacting their growth and development, hence studying the extent and the factors affecting digital adoption helps in identifying gaps and opportunities, enabling targeted interventions to boost technological integration across the sector.

An emerging economy like India with a considerably large number of small and medium businesses in varied sectors of manufacturing and service delivery across the country, is bound to have entrepreneurs with diverse demographics, educational qualifications, digital skill sets and technical aptitude etc. Despite the extensive decade long research efforts in digital divide and its causes and effects, not much research has been done regarding the digital divide present among the MSMEs in India.

Further, research evidences that digital literacy is the foundation for effective digital adoption. Many MSME owners and employees lack the skills necessary to leverage digital tools fully. Although researchers are focussing on the issues and challenges faced by the small businesses,

there are limited studies pertaining to assessment of digital skills in MSMEs sector and hence a contextual study of digital literacy would help in designing appropriate training and educational programs leading to improved business operations, better customer engagement, and increased market access. The study attempted to explore the digital adoption and the factors affecting the digitalization of MSMEs in Indian context with a focus on digital divide and digital literacy among the entrepreneurs.

Despite contributing significantly to GDP and employment, many Indian MSMEs lag in adopting digital tools and technologies, primarily due to uneven access to digital infrastructure and varying levels of digital literacy. An empirical study would provide a data-driven understanding of these disparities, revealing how the digital divide and digital literacy impacts digital adoption across different regions and sectors in Indian context. The study attempted assessing the current levels of digital literacy and the factors influencing digital adoption, thus identifying specific barriers that MSMEs face and inform targeted interventions.

Summary

The Chapter introduced the definition and classification of Micro Small and Medium enterprises in global and Indian setting. The significance of small businesses in the global economy especially in a post pandemic era has been highlighted. In addition, the contribution of MSMEs to a country's economy has been explained in the chapter. In addition, the chapter explains the role of MSMEs in Indian economy and towards the achievement of SDGs as well as the challenges faced by the MSMEs in the current economy. The chapter highlighted the significance of digitalization of MSMEs in order for them to reach their optimum potential. Further, the barriers of digital adoption like digital divide and lack of digital literacy among the entrepreneurs have been included. The term digital divide and digital literacy has been defined

and explained in relation to the MSME's digital adoption in this chapter. The detailed extent of literature related to the MSMEs, their digitalization, digital divide and digital literacy will be further explored in the next chapter of literature review.

Chapter 2

Literature review

Micro, Small, and Medium Enterprises (MSMEs) have played a pivotal role in the global economy, serving as a backbone for innovation, employment, and economic growth (Omiunu, 2019; Kniivila, 2007). The history of MSMEs dates back to the early stages of industrialization when small-scale businesses began emerging as key drivers of economic activity. These enterprises were crucial in fostering local industries, promoting entrepreneurship, and contributing to the overall socio-economic development across the globe. Over time, as economies evolved, MSMEs adapted to changing market conditions, technological advancements, and policy frameworks, cementing their place as indispensable components of both developed and developing economies. From traditional crafts and family-owned businesses to modern tech startups, the journey of MSMEs reflects the broader trends in economic history, including industrialization, globalization, and digitalization. MSMEs are now recognized not only for their economic contributions but also for their role in driving inclusive growth and sustainable development worldwide (Mayanj, 2023). The significance of MSMEs also lies in their virtue of smaller gestation period, ability to capture smaller and niche markets and aiding in a fairer distribution of national income by providing entrepreneurial opportunities in the remote rural areas (Sridevi et al., 2023).

The emergence and history of Micro, Small, and Medium Enterprises (MSMEs) in India is deeply intertwined with the country's economic evolution, reflecting its journey from a predominantly agrarian society to a diversified industrial economy (Lokhande, 2011). The roots of MSMEs in India can be traced back to the Aryan civilization where there were small household businesses to meet the needs of the village (Bhattacharya, 2014). During the pre-independence era, the small-scale industries or the cottage industries like handlooms (Khadi),

handicrafts, and village-based enterprises played a crucial role in local and rural economies. Post-independence, the Indian government recognized the importance of these small industries in achieving economic self-reliance and fostering inclusive growth. The launch of the Industrial Policy Resolutions of 1948 and 1956 marked the beginning of a structured approach to support and protect small-scale industries, emphasizing their role in employment generation and regional development (Satish & Rajamohan, 2020).

In the recent past, as India's economy expanded and diversified, the MSME sector evolved, adapting to changing market dynamics and technological advancements. The introduction of liberalization policies in the 1990s further opened up new opportunities for MSMEs, enabling them to compete in global markets and access wider financial resources (Jahanshahi et al., 2011). Subsequent policy reforms and initiatives, such as the establishment of the Ministry of Micro, Small and Medium Enterprises and the implementation of the MSME Development Act in 2006, provided a more robust framework for their growth. MSMEs are recognized as the backbone of the Indian economy, contributing significantly to GDP, exports, and employment, while also driving innovation and entrepreneurship across the country.

This chapter reviews the existing literature on Micro, Small, and Medium Enterprises (MSMEs), their digitalization journey, and the impact of the digital divide and digital literacy on digital adoption. The chapter begins with an overview of MSMEs as a concept, tracing their evolution within the Indian context and highlighting their economic significance. This is followed by an exploration of research advances on the digital divide, emphasizing disparities in access to digital technologies across different socio-economic groups, regions, and business sectors. Additionally, the chapter delves into digital literacy, examining its role as a key enabler of digital adoption among MSMEs. The latter sections of the chapter synthesize studies on the

intersection of the digital divide and digital literacy with MSME digitalization along with the appropriate theories applicable to the study.

2.1 MSMEs – The concept

2.1.1 Evolution of the MSMEs

Micro, Small, and Medium Enterprises (MSMEs) have been pivotal in India's industrial and economic landscape, evolving through various policy interventions since the post independent era. This evolution is marked by significant Industrial Policy Resolutions (IPRs) and plans that have shaped the trajectory of MSMEs in India (Table 2.1).

Table 2.1: Industrial Policy resolutions

SR No	Industrial policy resolution	Key points
1.	Industrial Policy Resolution of 1948	• Delineating the roles of the state and private entities in industrial development. • Small-scale and cottage industries were recognized for their potential in economic development.
2.	Industrial Policy Resolution of 1956	• Detailed classification of industries • Industries were divided into three schedules
3.	Industrial Policy Statement of 1977	• Introduced the concept of "tiny units" • Promoting small-scale and cottage industries

4.	Industrial Policy Statement of 1980	• consolidated previous initiatives and introduced measures to promote both large and small industries. • Focus was also on modernizing industries to enhance competitiveness
5.	Industrial Policy of 1991	• Introduction of liberalization, privatization, and globalization (LPG) reforms. • Policy aimed to dismantle the License Raj and promote a more competitive industrial environment

Source: Author compilation

Industrial Policy Resolution of 1948

Post-independence, India sought to establish a mixed economy, balancing both public and private sectors. The Industrial Policy Resolution of 1948 laid the foundation for this economic structure, delineating the roles of the state and private entities in industrial development. Exclusive monopoly of central government on industries like arms and ammunition, atomic energy, and railways were reserved solely for the central government. Sectors such as coal, iron and steel, aircraft manufacturing, shipbuilding, telegraph, and telephone were earmarked for state government. Further, both the state and private sectors could participate in industries not explicitly mentioned in the first two categories and the remaining industries were left to the private sector, with the state providing necessary support and regulation. Within this framework, small-scale and cottage industries were recognized for their potential in

employment generation and regional development. The policy emphasized the importance of these industries in achieving equitable economic growth and reducing regional disparities.

Industrial Policy Resolution of 1956

The 1956 resolution is often regarded as the economic constitution of India, providing a more detailed classification of industries and reinforcing the state's commitment to industrialization. Industries were divided into three schedules- 17 industries exclusively reserved for the public sector (Schedule A), 12 industries where both public and private sectors could operate, with the state taking the lead in establishing new units (Schedule B) and schedule C consisting of all the remaining industries left to the private sector, with the state playing a regulatory role. This resolution accorded priority to small-scale industries (SSIs), recognizing their role in employment generation and equitable income distribution. The policy aimed to promote SSIs to ensure balanced regional development and prevent the concentration of economic power.

Industrial Policy Statement of 1977

The 1977 policy marked a significant shift towards promoting small-scale and cottage industries. It introduced the concept of "tiny units," defined as units with investment in machinery and equipment up to ₹1 lakh and situated in towns with a population less than 50,000. The policy emphasized decentralization encouraging the dispersal of industries to rural and backward areas to promote regional development. Further recognizing the labour-intensive nature of SSIs, the policy aimed to address unemployment and underemployment issues and limiting the expansion of large industries in sectors reserved for SSIs to protect and promote small enterprises. This policy underscored the government's commitment to reducing regional imbalances and promoting equitable growth through the development of SSIs.

Industrial Policy Statement of 1980

The 1980 policy sought to consolidate previous initiatives and introduced measures to promote both large and small industries. While it continued to support SSIs, the focus was also on modernizing industries to enhance competitiveness. The policy aimed at encouraging SSIs to adopt modern technologies to improve productivity and quality along with promoting linkages between large and small industries to create a symbiotic industrial ecosystem. The policy also sought to establish institutions for providing financial, technical, and marketing assistance to SSIs. This balanced approach aimed to integrate SSIs into the broader industrial framework, ensuring their growth alongside large industries.

Industrial Policy of 1991

The 1991 policy marked a paradigm shift with the introduction of liberalization, privatization, and globalization (LPG) reforms. The policy aimed to dismantle the License Raj and promote a more competitive industrial environment. Key features included de-licensing by abolishing industrial licensing for most industries, except for a select few. It aided in encouraging foreign direct investment (FDI) by liberalizing policies and allowing greater equity participation. The policy introduced MRTP Act Amendments, diluting the monopolies and restrictive trade practices act to facilitate the growth of large enterprises. For SSIs, the policy introduced measures to enhance their competitiveness, such as raising the investment ceiling for SSIs to enable technological upgradation, establishing industrial estates and areas with necessary infrastructure to support SSIs and strengthening financial institutions to provide better credit facilities to SSIs. This policy aimed to integrate SSIs into the global economy by enhancing their efficiency and competitiveness.

2.1.2 From SSIs to MSMEs

The journey from Small Scale Industries (SSI) to Micro, Small, and Medium Enterprises (MSME) in India marks a significant evolution in the country's industrial and economic landscape (Gupta, 2006). Initially, SSIs were the focus of India's industrial policies post-independence, recognized for their potential to drive employment, support rural development, and reduce regional disparities (Baral & Sahoo, 2013). These industries were typically small in scale, often family-owned, and played a crucial role in sectors like textiles, handicrafts, and agriculture-based production (Mozumdar, 2020). However, with the liberalization of the Indian economy in the 1990s and the subsequent rise of new industries and technologies, there was a growing need to broaden the definition and scope of these enterprises. This led to the reclassification of SSIs into the more inclusive and dynamic category of MSMEs, formally established with the MSME Development Act of 2006 (Lokhande, 2011). This transition acknowledged the diverse nature of small businesses and their evolving role in a globalized economy, providing a more comprehensive support system that included access to finance, technology, and markets, and ensuring their critical contribution to India's GDP, exports, and employment. Further, a comprehensive MSME policy and governing frameworks have been introduced by the government, which included the classification and definition of MSMEs.

Research evidences that definitions of MSMEs are constantly changing among governments, statistics agencies, and international organizations, and these definitions are more arbitrary than logically related to the type and degree of economic development (Berisha & Pula, 2015). Thus, the official definition of MSMEs was ever changing based on different classification criteria. Although researchers agreed on three most appropriate and inclusive criteria, the stratification of criteria was hard to agree upon based on the dynamic economic conditions (Reddy and Papaiya, 2017). Three options were presented to classify and modify the definition of MSMEs:

according to the number of employees, the amount of money they can invest, or a combination of the two factors. In 1950, the small-scale industries were first classified according to the headcount of employees and gross investment. The classification underwent incremental changes according to the changing economy and inflation rates, with the recent most classification being given by the Ministry of Micro Small and Medium Enterprises in the year 2020 (MSME.gov.in, Nema et al, 2021). The recent definition (July, 2020) states that both manufacturing and service units are defined in terms of investment and turnover thresholds, but within the same bounds. Micro enterprises are defined as those with revenues and investments up to Rs. 5 crores and Rs. 1 crore, respectively. Small enterprises are defined as those with annual revenue and investment limits of up to 50 crores and 10 crores, respectively. Businesses classified as medium sized have a revenue of up to 100 crores and an investment of up to 20 crores (MSME.gov.in, 2020). By categorizing enterprises based on investment and turnover, the MSME framework ensures targeted support and resources, enabling these businesses to thrive across various sectors. Thus, the classification of MSMEs has facilitated access to finance, technology, and markets, crucial for scaling operations and fostering innovation (Gautam & Tiwari, 2020).

As digitalization gained prominence across the globe, MSMEs in India have become key beneficiaries and contributors to this transformation (Negi & Kumar, 2024). Digital tools and platforms have empowered these enterprises to streamline operations, reach broader markets, and enhance productivity, thereby playing a vital role in the formalization of the economy. The integration of digital technologies enabled MSMEs to participate in e-commerce, improve supply chain efficiencies, and leverage data-driven decision-making, further accelerating economic growth (Candraningrat et al., 2021). Thus, the structured classification of MSMEs, coupled with the digital revolution, has not only spurred entrepreneurship and job creation but

also positioned these enterprises as pivotal players in India's journey toward a more inclusive and technologically advanced economy (Mahajan, 2023). Consequently, technology adoption has become a crucial determinant of MSME growth, competitiveness, and sustainability. The integration of digital tools, automation, and e-commerce platforms has enabled MSMEs to enhance their productivity, streamline operations, and expand their market reach beyond geographical limitations. With government initiatives such as Digital India, Startup India, and the MSME Digitalization Drive, there has been a significant push toward equipping small businesses with the necessary digital capabilities.

2.2 Digitalization in MSMEs

Digitalization refers to the integration of digital technologies into all aspects of life, fundamentally transforming how businesses, governments, and individuals operate and interact. The concept of digitalization is deeply rooted in corporate innovations, where early adopters—primarily large enterprises—leveraged enterprise resource planning (ERP) systems, cloud computing, and big data analytics to improve efficiency and customer experiences. Over time, digitalization expanded beyond corporate environments, influencing small businesses (including MSMEs), public sector operations, education, healthcare, and governance. Digital transformation of a company is defined as the use of technology to improve a company's performance (Westerman et al. 2011). Previously, 'Digital' was used synonymously with 'information Technology', however, progress in the research, industry and society prompted the readjustment of the term 'digital' to include mobile phones, social networking, augmented and virtual reality, block chains, artificial intelligence (AI) (Kumar et al.,2022), mobile apps, and much more than simply computers and the Internet (Gong & Ribiere, 2021) which prompted the academicians to reevaluate the definition of digital adoption to accommodate the

advancing technology (Table 2.2). ‘Digitalization’ refers to the integration of digital technologies into various aspects of businesses. In a business setting, digitalization is a process of converting the ‘physical’ or ‘analogue’ data, functions and processes into a digital format to improve the accessibility of information, thus setting stage for the digital adoption. Digital adoption, on the other hand, involves the *acceptance* and *effective use* of these digital technologies by the businesses, ensuring that the benefits of digitalization are fully realized.

Further, this shift in technology revolutionized industries by enabling automation, improving efficiency, and facilitating real-time communication and data analysis, breaking down geographical barriers and creating new opportunities for innovation and growth. Further, as digital technologies continue to evolve, they drive profound changes in economic structures, societal norms, and global connectivity, shaping the future of individuals as well as industries in unprecedented ways.

Table 2.2: Definitions of Digital adoption

Sr No	Source	Definition
1.	Venkatesh et al. (2003) - <i>Unified Theory of Acceptance and Use of Technology (UTAUT)</i> :	"Digital adoption refers to the process where users accept and make effective use of a technological innovation. It encompasses the stages of awareness, interest, evaluation, trial, and eventual adoption of the technology."
2.	Rogers (2003) – <i>Diffusion of Innovations</i> :	"Adoption is the decision to make full use of an innovation as the best course of action available. In the context of digital adoption, it implies the integration of digital tools into

		everyday practices after evaluating its benefits relative to existing alternatives."
3.	Sykes, Venkatesh, & Gosain (2009) <i>- Effectiveness of Digital Adoption Initiatives:</i>	Digital adoption is the extent to which intended users actually use a digital technology, system, or software in their work or personal life, and how this usage translates into productivity and efficiency improvements."
4.	Fichman (2000) - The Diffusion and Assimilation of Information Technology Innovations:	"Digital adoption refers to the initial decision to use an information technology, followed by the continuous integration of that technology into a user's work practices or the daily operations of an organization."
5.	Parthasarathy and Bhattacharjee (1998) - Understanding Post-Adoption Behavior:	"Digital adoption is not only about the initial acceptance of a technology but also involves the ongoing use and adaptation of the technology over time, reflecting a deeper integration into the user's or organization's routine."
6.	Gallivan (2001) - Organizational Adoption and Assimilation of Complex Technological Innovations:	"Digital adoption includes the stages of initiation, adoption decision, and post-adoption use, where an individual or organization progresses from being aware of

		the technology to fully integrating it into their daily operations."
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Digitalization has become a transformative force for Micro, Small, and Medium Enterprises (MSMEs) in India, revolutionizing the way these businesses operate and compete in the modern economy. Despite the numerous government schemes and financial aids, research has proven that the digital transformation of these businesses is the need of the hour (Banarjee, [The Indian express](#), Dec 2020, Klein & Todesco, (2021). Use of digital platforms for different business operations like marketing (Ahmad et.al 2018), customer service (Nikunen et.al 2017) procurements and payments (Bigliardi, 2022) etc. are becoming the new normal and the COVID -19 pandemic has just accelerated the need for this digital transformation (Klein, 2021). Further, research proves that by embracing digital tools and technologies, MSMEs would be able to streamline processes, enhance productivity, and expand their reach to new markets, both domestically and globally (Abebe, 2014). The adoption of e-commerce platforms, digital payments, cloud computing, and data analytics empower MSMEs to reduce operational costs, improve customer engagement, and make data-driven decisions. Researchers long back acknowledged that MSMEs can take advantage of numerous opportunities by implementing digital transformation. Empirical evidence illustrates that MSMEs that embrace digital technologies can achieve substantial growth in revenue, customer satisfaction, and operational efficiency (Tetteh & Burn, 2001). Automation is made possible by digital technology in a number of corporate tasks, including marketing and inventory management were the one of the first digital initiatives adopted by the small businesses.

Digital adoption among the MSMEs

MSMEs are the backbone of economy of a country especially that of the developing and underdeveloped economies, by virtue of their contribution towards employment and GDP of a country and hence there is considerable research been done in this area (Anshari & Almunawar, 2021). This research activity has become more crucial in the post pandemic era where the business continuity and sustainability has become the bottom line especially with the small and medium businesses (Yesmin et al., 2021). Smart and affordable business development avenues are the need of the hour in order for these small businesses to stay afloat and grow in these tough times. Research has proven that adoption of social media as a marketing tool is an effective strategy of business development (Ahmed, 2017). Not only for marketing and business development but digitalization of businesses is also acknowledged as the fulcrum for achieving the developmental goals of the businesses and consequently the economy in general (Kubabe, 2023). A study done by Huria et al. (2022) among Indian MSMEs in manufacturing sector has proven that higher level of digitalization has increased the likelihood of a firm's entry into export market. They also stated that technical knowledge alone will not be sufficient for globalizing the business unless it is complimented by the digital technologies. Continuing this thread of study, Gopalan et al., (2022) found out that a firm's digitalization is highly positively correlated to its Global value chain (GVC) participation in turn effecting its global market presence, hence making it imperative for the MSMEs to be receptive towards digital adoption in order to integrate into the 'digital economy' which now focuses on digitalisation of the business processes like payments, procurements, networks and customer services and other business operations. Leveraging technology is the most viable and sustainable solution to revive the industries at this time (Banerjee, 2020).

Research has broadly divided the reasons for lack of digital adoption among the MSMEs into four basic categories: lack of infrastructure, lack of skill, lack of finances and lack of trust among the owners or entrepreneurs ([Chauhan](#) et.al 2018; Mohan & Ali 2019). To this effect focus was on digital education and skill development in order to overcome the constraints for digital adoption. The digital literacy and digital divide are deeply intertwined with the digital adoption process among Micro, Small, and Medium Enterprises (MSMEs), however, research on digital literacy and digital divide is more often significantly related to the literacy and educational perspective and less often in the business and economic perspective. (Chen & Huang, 2010). The problems MSMEs face in adopting digital technology are access to financing and digital literacy (Rachbini et al.,2023). Evidence suggests that MSMEs must establish three key types of infrastructure in order to effectively benefit from digital adoption: ICT, financial, and legal /regulatory. Furthermore, having adequate digital skills is also crucial (Muller, 2020). But many MSMEs only have restricted access to digital skills and infrastructure, thus creating a digital literacy gap and digital access (divide) gap. Despite the increasing adoption of digital technologies among MSMEs, many businesses struggle to fully integrate and maximize their digital capabilities due to several challenges. Limited financial resources, inadequate digital literacy, infrastructural constraints, and resistance to technological change are common barriers that hinder the seamless adoption of digital tools. The Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) provide theoretical insights into these challenges. According to TAM (Davis, 1989), digital adoption is driven by perceived usefulness and perceived ease of use. However, in the case of MSMEs, while the usefulness of digital tools is acknowledged, the perceived complexity and lack of digital skills create resistance to adoption. Further, Research acknowledges the role of facilitating conditions in shaping technology adoption (Venkatesh et. al.,2003). Many MSMEs may recognize the performance benefits of digital tools but lack the

necessary support systems, such as training and financial assistance, to overcome adoption barriers. This gap highlights the need for targeted interventions that address digital skill development, improve financial accessibility, and create an enabling ecosystem to enhance digital adoption in the MSME sector.

UTAUT model

Numerous studies that are carried out throughout the past three decades have resulted in many theoretical models that are established to study the behavioural intentions towards technology adoption in various contexts. For example, the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Technology Acceptance Model (TAM) (Davis, 1989), the Combined -TAM-TPB model (C-TAM-TPB) (Taylor and Todd, 1995), the Motivational Model (MM) (Davis et al., 1992), the Innovation Diffusion Theory (IDT) (Rogers, 1995), Model of PC Utilization (MPCU) (Thompson et al., 1991), Social Cognitive Theory (SCT) (Bandura, 1988) etc are the well-known and well-studied models for ICT adoption. Venkatesh et al. (2003) combined all these 8 models to form Unified Theory of Adoption and Use of Technology (UTAUT) to study the behavioural intention to use technology. The model consists of four core determinants of intention and usage: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions and also of four moderators of key relationships: Gender, Age, Experience and Voluntariness. Various studies have used this model to study the behavioural intent of the individual towards technology adoption in various contexts and scenarios. Further research by Venkatesh, Thong and Xu (2012) added an extension to UTAUT and proposed UTAUT2 by contextualizing UTAUT to a consumer context with the addition of three predictors—hedonic motivation, price value, and habit—and dropping one of the moderators—voluntariness. Behavioural intention to use technology is impacted by performance expectancy, effort expectancy, and social

influence, according to UTAUT, whereas technology use is influenced by behavioural intention to use technology and facilitating conditions (Blut et.al, 2021). The Unified Theory of Acceptance and Use of Technology (UTAUT) model is a widely recognized framework that explains how users come to accept and utilize technology. This model is particularly relevant in understanding the digitalization of Micro, Small, and Medium Enterprises (MSMEs), as it provides insights into the drivers and barriers to technology adoption within the businesses paying a significant attention to the individual (entrepreneur's) intention to the technology adoption. As MSMEs increasingly integrate digital tools to enhance operations, expand markets, and improve customer interactions, the UTAUT model helps in analysing how these enterprises perceive the benefits of digitalization, the ease of adopting new technologies, and the influence of external factors such as customer demand and government support. By applying the UTAUT framework, stakeholders can better design interventions and support mechanisms to accelerate the digital transformation of MSMEs, ensuring they are well-equipped to compete in a rapidly evolving digital economy.

2.3 Digital Divide among MSMEs

The term 'Digital divide' was first used by Llyod Morrisette, the former president of Markle foundation as the gap between information 'haves' and 'have nots' (Hoffman et. al 1998). Initial research is focussed on the digital divide based on 'accessibility', which is having access to a computer connected to internet to get information. According to Hanimann and Ruedin (2007) the term 'digital divide' consists of three distinctive divides: a geographical digital divide i.e. between developed and developing countries or regions of countries, a social digital divide i.e. between social classes, and an upgraded digital divide that is present between

technology and humans. In similar research, Norris(2001) and Branko (2005), suggested at least three major divides:

- A global divide between the developed and undeveloped worlds
- A social divide between the information rich and the information poor
- A democratic divide between those who do and those who do not use the new technologies.

Numerous studies attempted to understand and explain digital divide in the last two decades, resulting in the development of multi-dimensional frameworks that consider socioeconomic, demographic, and infrastructural factors influencing digital access and usage. Digital divide now has moved from just lack of access to ICT to various other factors like lack of skills and lack of usage opportunities (Van dijk 2011). Similarly, there are scholarly discourses towards understanding the reasons behind the digital divide in a certain demographic or a certain culture or a certain group of people. World Information Society (WIS) report suggests that the digital divide exists not just among different geographical areas but also among different genders, age groups, cultural or religious groups, etc. A study by Lythreathis, Singh, and El-Kassar (2022) defines digital divide as the difference in ICT access, usage, and outcome, which is influenced by nine major categories (social-demographic, socioeconomic, personal elements, social support, type of technology, digital training, rights, infrastructure, and large-scale events) and three distinct segments (education, age, and belief). It is being argued that groups that are disadvantaged offline may be more prone to have a disadvantage in digital areas as well (Robinson et al.,2015) not only in terms of access but in terms of usage opportunity and awareness. This argument can be extended to the small and medium businesses and work force in these businesses. Despite the need for digitalization and the support provided by the government, there is still a considerable ‘digital divide’ among the entrepreneurs of micro and small businesses (Venkatesh & Sykes, 2013). Venkatesh et al (2012) in his study about digital

divide in rural India found that technology acceptance is also influenced by the social networking among rural women. It is already proven that digital skills play a vital role in bridging the digital divide however another study by Singh et al., (2013) conducted in India, proves that education and familiarity with the English language is a crucial determinant of computer and Internet use signifying the role of formal education of owners (Werber, 2015) in digital adoption among the entrepreneurs. Research also emphasizes on the impact of digital divide on the digital adoption and consequently on the performance and productivity of the small business (Lukas & Hasudungan, 2023) thus highlighting the need of more in-depth studies in this context.

Table 2.3: Definitions of Digital Divide

SR No	Source	Definition
1.	OECD	The gap between individuals, households, businesses, and Geographic areas at different socio-economic levels with regard to both their opportunities to access Information and Communication Technologies and to their use of the internet for a wide variety of activities.
2.	EU commission (Eurostat, 2016)	Digital divide refers to the distinction between those who have internet access and are able to make use of new services offered on the World Wide Web, and those who are excluded from these services
3.	Gunkel, 2003	The digital divide commonly refers to the gap between those who do and those who do not have access to new forms of information technology.

4.	NTIA, dept of commerce, USA	"The digital divide refers to the growing gap between underprivileged members of society, especially the poor, rural, elderly, and handicapped portion of the population who do not have access to computers or the Internet; and wealthy, middle-class, and young Americans living in urban and suburban areas who have access.".
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Van Dijk model for Digital Divide

Research proves that the first barrier to all information inequality research and discourse is the complex idea of access (Van dijk, 1999), which requires a further and deep exploration in order to address the inequality or ‘digital divide’. In this context, The Van Dijk model for the digital divide being a comprehensive framework developed by Dutch sociologist Jan van Dijk, explores the multiple dimensions of the digital divide—the gap between those who have access to and can effectively use digital technologies, and those who do not. The model goes beyond simply identifying disparities in access to technology, by offering a more nuanced understanding by breaking down the digital divide into four key stages (Figure 2.1)

“1) Lack of any digital experience caused by lack of interest, computer fear and unattractiveness of the new technology constitutes ‘psychological access’: This stage addresses the willingness or desire to use digital technologies. Van Dijk (2005) emphasizes that the digital divide often begins with a lack of motivation, which may stem from technophobia, perceived irrelevance of technology, or a lack of understanding of its benefits.

2) No possession of computers and network connections constitutes ‘material access’: This stage focuses on the physical access to digital technologies, such as owning a computer, smartphone, or having an internet connection. Material access is often influenced by

socioeconomic factors, where disadvantaged groups may lack the resources to acquire the necessary hardware and connectivity (Rachbini et al.,2023).

3) *Lack of digital skills caused by insufficient user-friendliness and inadequate education or social support constitutes 'skills access'*: Having access to technology is not sufficient if individuals lack the digital literacy to use it effectively. Skills access involves the ability to navigate, operate, and understand digital tools and platforms. This stage highlights the importance of digital education and training to bridge the divide.

4) *Lack of significant usage opportunities constitutes 'usage access'*: Finally, usage access refers to the actual utilization of digital technologies in meaningful ways. This includes the diversity of uses, the frequency of use, and the ability to harness technology for tasks such as communication, education, work, and entertainment. Van Dijk points out that even among those who have access and skills, disparities exist in how effectively they use technology to improve their lives.

Figure 2.1: Aspects of Digital Divide (Source: Van Dijk, 2005)

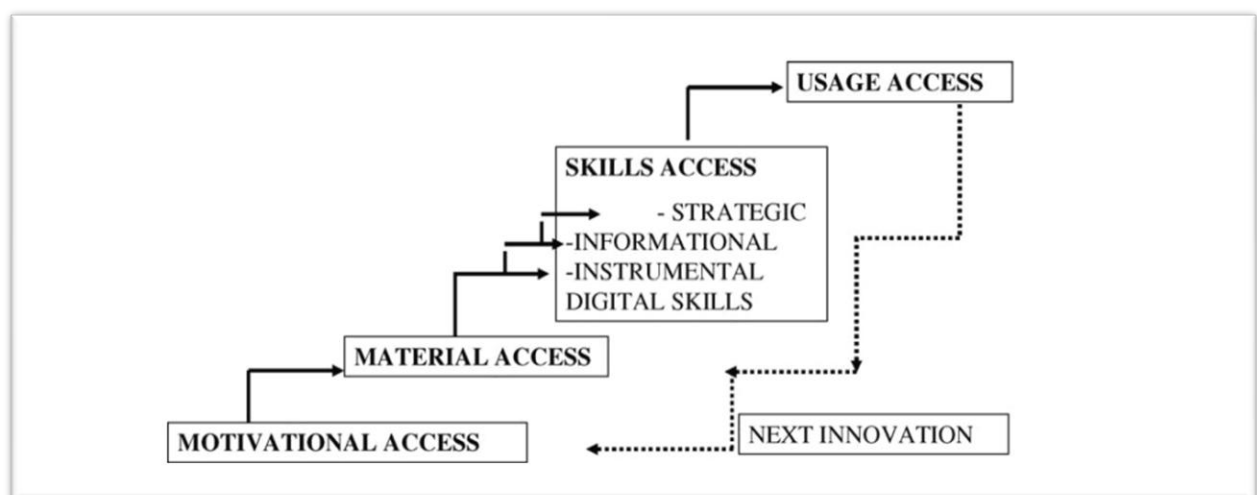


Figure 2.1: Aspects of Digital Divide by Van Dijk, 2005

The Van Dijk model illustrates that the digital divide is not a singular issue but a complex, multi-layered problem that requires addressing at various levels to ensure digital inclusion. It also underscores that bridging the digital divide involves more than just providing technology—it requires fostering motivation, improving digital literacy, and ensuring that people can use technology in ways that are beneficial to their personal and professional lives (Van Dijk, 2005).

The Van Dijk model for the digital divide provides a valuable lens through which to understand the challenges faced by Micro, Small, and Medium Enterprises (MSMEs) in their journey towards digitalization (Lukas and Hasudungan, 2023).

2.4 Digital Literacy among the MSMEs entrepreneurs

In spite of having close to 63 million MSMEs in India by the end of 2020 ([CII 2020](#)), reports suggest that only 5% of these have adopted digital transformation. Digital marketing and communication technology has opened new business opportunities to small businesses which previously (Eid and El-Gohary 2013) was impossible. It is also becoming an increasingly important source of competitive advantage in both B2B and B2C markets (Leeftang et al. 2014).

Research has proven that the use of internet marketing, digital tools, apps, etc. lead to innovative means of customer interaction and exploring new avenues of business and market spaces. ICT and e-commerce (Wigand, 1997) characterize the means to innovate in business processes and as a mode of communication amongst the stakeholders of the organization (Narayanasamy et al., 2008), and the adoption of it can significantly contribute to the growth of MSMEs (Hepworth and Ryan, 2000; Tan et al., 2009).

There is ample proof in previous research that Internet marketing and the use of digital platforms for business development activities help in customer acquisition, retention as well as customer service. The need for internet marketing for MSMEs arises from the fact that customer acquisition and retention is largely determined through consistent interaction and promotions (Neirotti et al., 2018) which becomes easier with the numerous digital platforms that are available.

Digitally enabled businesses also have a competitive advantage in terms of product or service delivery differentiation and customer service and customer relationship differentiation which will, in turn, result in positive business growth in the long term. It will also enable the businesses in adapting to the changing business environments and rapidly expanding market places and spaces by creating a business model change among MSMEs. These businesses can create an advantage by reshaping their business model by offering their products and services in tailor-made fashion to a global market (Kaptein & Parvinen, 2015).

In spite of all these competitive advantages, there is a significant digital divide, especially between developed and developing countries in terms of digital adoption among SMEs. The digital gap can be characterized as a problem that results from persistent socioeconomic inequalities and goes beyond access to technology (Servon, 2002). An implication of the digital divide is that online content is shaped by people who are connected and therefore able to create content, therefore when individuals who are digitally excluded manage to connect online, they do not find content that addresses their needs: “The kind of information they seek – information that is directly related to their lives and communities and cultures – does not exist.” (Servon, 2002) which again will further the digital divide thus creating a vicious circle.

Many SMEs especially in rural India lack a strong understanding of how the adoption of digital technologies will improve their business productivity and efficiency and how the lack of digital adoption can play a detrimental role in the sustainability of their businesses in the future. Research indicates that the main obstacles to MSMEs adopting digital technology are a lack of infrastructure, a lack of digital skills and experience, a lack of funding, and an absence of trust and security/privacy concerns among the owners. Among these, MSMEs in India frequently have serious concerns about the inability to upgrade digital technologies, implement more complex technologies, or recognize the value of implementing new technologies because of a lack of resources (Mohan & Ali, 2019). Developing awareness of the benefits by upgrading the digital skills is one strategy to address the digital divide of SMEs (Oni & Papazafeiropoulou, 2014; Price et al., 2018) and bring them to the global competitive platform.

Studies demonstrate that companies, particularly small and micro enterprises situated in rural and semi-urban regions, do not effectively leverage the digital platforms at their disposal (such as Facebook, AdWords, Instagram, etc.) to grow their enterprises. This is due, in part, to a lack of infrastructure and financial resources, but also largely to a failure to recognize the significance of digitalization (Ikrama & Ahmed, 2018) and the plethora of opportunities these platforms present in terms of product promotion, market expansion, customer retention, acquisition, procurement, and payment convenience (Heeks, 2019). This lack of awareness is attributed to the lack of digital literacy at a microlevel.

Studies reveal that a broad, generalized ‘one for all’ digital literacy program may not be the best way to digitalize Indian MSMEs and close the digital divide. This is largely because MSMEs in India are dispersed throughout the nation and operate in a variety of industries, catering to a broad spectrum of clients and markets (Nedungadi, 2018). Hence it is imperative

to have a tailor-made literacy framework for the MSMEs that can aid in assessing and upgrading the digital literacy levels among the entrepreneurs.

2.5 Digital Literacy framework

According to UNESCO definition (table2.4), digital literacy encompasses the ability to use, access, comprehend, and integrate computer technologies in both daily life and business settings. Research proves that the use of information and communication technologies is essential for the expansion and efficient operation of businesses. A digital literacy framework provides a structured approach to understanding and developing the skills necessary for effective participation in the digital world for the entrepreneurs.

Table 2.4: Definitions of Digital Literacy

Sr No	Source	Definition
1.	UNESCO	"Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy.
2.	DigEuLit	Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate,

		evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process”
3.	European Commission	"Digital literacy is the confident and critical use of information and communication technology (ICT) for work, leisure, learning, and communication. It includes skills in using digital devices, communication applications, and networks to access and manage information."
4.	The Ministry of Electronics and Information Technology	the ability of individuals and communities to understand and use digital technologies for meaningful actions within life situations. Any individual who can operate computer/laptop/tablet/smartphone and use other IT related tools is being considered as digitally literate”.

According to Bawden (2008), digital literacy encompasses a wide range of competencies, including the ability to read and interpret digital content, evaluate the credibility of sources,

and create new knowledge using digital tools (Ahsan et al.,2022). Martin (2005) expands on this by emphasizing that digital literacy involves not only technical skills but also cognitive abilities and attitudes that enable individuals to navigate and utilize digital resources in diverse contexts and life situations including business. Studies elucidate that the digital literacy includes multiple dimensions like information literacy, communication and collaboration literacy, media literacy and privacy/ security literacy (Livingstone et al., 2020; Buckingham, 2007; Ng, 2012). These dimensions reflect the multifaceted nature of digital literacy, which goes beyond mere technical proficiency to include critical thinking, ethical understanding, and creative expression in digital environments which are vital entrepreneurial attributes. Thus, frameworks are essential for guiding educational practices, training programs and policy-making, ensuring that individuals are equipped with the necessary skills to thrive in a digitally interconnected world (Bacalja et al.,2022).

The fact that there are many other broadly defined areas within the field of "digital literacy," such as media and communications, education, economics, corporates, etc., with potentially different connotations, is also well-researched (Covello, 2010; Gapsky, 2007). As a result, different tools and frameworks would be needed to measure or assess the competencies or levels of digital literacy in various contexts or disciplines. It can be argued, then, that any literacy program that is put into place must be carefully customized to meet the needs of MSMEs, which further necessitates an appropriate framework for digital literacy as well as an assessment model.

2.6 Research Gaps.

The past two decades witnessed studies which applied UTAUT in various contexts, locations, and businesses. However, there is still considerable scope of extending the theory by adding new constructs and testing its validity in various different contexts (Dwivedi et.al 2011). This

research is an attempt to extend it to new constructs - digital divide and digital Literacy and demographical factors and their impact on the behavioural intent of MSME owners towards digital adoption with the theoretical backup of UTAUT.

An emerging economy like India with a considerably large number of small and medium businesses in varied sectors of manufacturing and service delivery across the country, is bound to have entrepreneurs with diverse demographics, educational qualifications, digital skill sets and technical aptitude etc. Despite the extensive decade long research efforts in digital divide and its causes and effects, not much research has been done regarding the digital divide present among the MSMEs in India.

Prior research in the area of digital literacy has concentrated on curriculum development for different audiences, such as schoolchildren, college students, etc. (Soyeon Oh, 2021), which may not be appropriate for all audiences, particularly MSMEs, who operate in a very diverse environment overall. The development of a customized framework for assessing digital literacy will be crucial in determining the current state of digital literacy and adaptability among small and microbusiness owners. There is a gap in research and scope for future studies in creating a detailed and industry oriented digital literacy framework will help in creating tailor made policies and digital literacy programs.

Despite the need for SMEs to undergo digital transformation and the crucial role of the entrepreneur's digital capabilities in accelerating this process is not explored from a micro enterprise perspective. Specifically, there is a lack of research on the link between entrepreneur's digital literacy and digital transformation. This study aims to fill this gap, making it a unique contribution to the field.

Summary

The chapter discussed the extent literature on the topic of digital adoption, digital divide and digital literacy. The literature on these topics was systemically scanned both in general and in the context of MSMEs in India. The definitions of digital adoption, digital divide and digital literacy has been discussed and tabulated. An attempt has been made to highlight the interconnectivity of the three variables with respect to the MSME sector. The chapter emphasizes on the necessity of a specifically designed digital literacy framework in order to assess the literacy levels of the entrepreneurs. Additionally, the chapter also describes the theories (UTAUT and Van Dijk's model) that would be used in the study. The research methodology and the DL framework development would be discussed in chapter 4.

Chapter 3

Research Methodology

Research and experience established that MSMEs are the backbone of any economy and their growth and development in the new era is increasingly dependent on the digitalization. Digital adoption and technology adaptation are increasingly dependent on the digital capabilities, entrepreneurial orientation towards digitalization (Eriyanti et al.,2023). However, the research on digitalization among the MSMEs still remained in pioneering stage, especially in Indian context. Further, most of the studies were conducted in isolation without substantial empirical evidence. This calls for studies that focusses on digitalization, digital literacy and digital divide in the context of Indian MSMEs. Based on the research gaps, an attempt is made in this chapter to arrive at a digital adoption framework and the variables (Digital literacy, digital divide) that are connected to the framework. The chapter is further divided into two sections – **Section one** deals with the concept, conceptual framework of the study and defines the independent and dependent variables. Further, it provides theoretical support for the study. It also includes the research questions and the research objectives of the study leading to appropriate hypothesis based on the conceptual framework of the study.

Section two presents the research methodology adopted in the study. This section discusses the research area, scope, research design, sampling unit, sampling method and geographical coverage. Further, it lists down different industries considered for the study. The inclusion and exclusion criteria for the respondents and the sample size would be explained and justified in detail. In addition, initial reliability and validity scores of the constructs obtained through pilot testing and further data analysis structure is explained.

Section 1

3.1 The Concept

SMEs play a major role in the emerging economies as they have a pivotal role in job creation and economic development of a country. Micro small and medium enterprises in India constitute a large percentage of GDP, exports and employment, hence it is imperative to focus on development and support initiatives for their growth and sustainability in the long run (Patel & Tripathi, 2022). Digitalization is one such initiative for the growth of MSMEs. Digital adoption in a business has long been studied in various contexts throughout the world and it has been proven and documented that digital adoption is an effective strategy for business development (Wynn & Olayinka, 2021). Digitalization of businesses is also acknowledged as the fulcrum for achieving the developmental goals of not just the businesses but also the economy in general (Kadube, 2023). Use of digital platforms for different business operations like marketing (Ahmad & Sur, 2021), customer service (Nikunen et.al 2017) procurements and payments (Bigliardi et al., 2022) are becoming the new normal and the pandemic has just accelerated the need for this digital transformation (Klein & Todesco, 2021).

Despite this need for digitalization and the support provided by the government for it, there is still a considerable ‘digital divide’ among the entrepreneurs of micro and small businesses (Venkatesh & Sykes, 2013). In recent times where smart mobile/ ICT device penetration is high in India (In 2020, 54% of population has smart phones according to [Statista.com](https://www.statista.com) and 1.2 billion telecom connections according to trade.gov; further as of early 2025, there are close to 1.2 billion smart phone users according to [business inside](https://business.inside)) the other allied factors like demographics, IT literacy etc have a significant impact on the digital divide. This is more apparent in small and medium businesses in India due to their versatility in terms of location, resources, size of operations and line of business. This digital divide among MSMEs in India

is less due to lack of infrastructure but more due to lack of digital skills or IT literacy/ Digital literacy (Ollerenshaw et al., 2021). In addition to the digital literacy and digital divide, micro small and medium enterprises in India, owing to their diversity in terms of location, size and sector of operations have numerous other factors affecting their digital adoption.

While digital divide and digital literacy have been studied independently in various contexts, scant research is available on their effect on digital adoption among the MSMEs, especially in the Indian context. In addition, there is very less empirical research on the digital adoption and its contributing factors in an MSME setting. Further, research shows a lack of reliable and validated scale of measurement for digital literacy. While there is abundant literature on digital literacy frameworks, there is no validated instrument to measure digital literacy in an industrial/ MSME setting. Thus, in order to fully grasp the relationship of the antecedents towards digital adoption, an instrument for digital literacy was developed based on the conceptual framework developed, which will be explained subsequently in the chapter.

3.2 Operational definitions and Theoretical background

3.2.1 Digital divide:

The digital divide refers to the disparity among individuals, households, businesses, and geographic regions at varying socio-economic levels in terms of their ability to access and utilize ICT. This divide also encompasses differences in internet usage for various activities (OECD). As defined by the European Commission (Eurostat, 2016), the digital divide highlights the contrast between those who have internet access and can take advantage of emerging online services and those who remain excluded from these digital opportunities. The dichotomous view of digital divide about haves and have nots of accessibility has long since changed and has been modified into a multi perspective view which takes into consideration many other factors like geographic area, socio-economic status, gender, education

qualification, IT literacy and technical aptitude etc. Numerous theories help explain why this divide exists and how it impacts lives and businesses. For instance, *diffusion of innovations* theory (Rogers, 1962) which talks about different stages in which technology adoption occurs. In other words, individuals have different attitude and acceptance level of technology - Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. Similarly, *resource based view* given by Barney (1991) suggests that organizations adopt technology based on their access to resources (financial, human, and technological). For the current study, Van Dijk's digital divide model of multiple access levels is considered appropriate.

The digital divide framework given by Van Dijk (2003) provides a comprehensive theoretical background for understanding the multifaceted nature of the digital divide highlighting the disparities in access to and use of digital technologies, simultaneously identifying multiple dimensions contributing to these inequalities. The framework breaks down the digital divide into four key stages or types of access – (a) Motivational access also referring to mental access covering willingness, technophobia and motivation to use digital tools, (b) material access referring to the physical and financial ability to possess/access digital tools, (c) Skill access, referring to the ability or the skill to use digital tools meaningfully, (d) Usage access referring to extent and manner in which digital tools are used. The framework is a valuable theoretical tool for understanding and addressing the complexities of digital inequality. By breaking down the digital divide into motivational, material, skills, and usage access, the framework offers a comprehensive view of the factors contributing to digital disparities and provides actionable insights for bridging the gap in digital inclusion. This framework is used in the study to understand different access levels of digital divide prevalent in the MSMEs.

3.2.2 Digital Adoption:

Digital adoption refers to the process by which individuals and organizations fully utilize digital tools and technologies to achieve their goals effectively and efficiently. This involves not only the initial implementation of digital tools but also ensuring that these tools are used to their fullest potential to improve productivity, simplify tasks, and enhance user experience. For organizations, successful digital adoption is crucial as it directly impacts their ability to stay competitive and responsive in a rapidly evolving digital landscape. It involves integrating new technologies into business processes, training employees to use these tools effectively, and continuously adapting to technological advancements. Digital adoption among MSMEs is a critical driver of business growth, innovation, and resilience in today's fast-evolving economy. For Micro, Small, and Medium Enterprises, embracing digital technologies—such as cloud computing, digital payment systems, e-commerce platforms, and data analytics—can significantly improve operational efficiency, expand market reach, and enhance customer engagement. However, the journey toward digital adoption is often challenging for MSMEs, especially in developing economies, due to limited financial resources, inadequate digital infrastructure, and a lack of digital literacy

Technology adoption in every field has been extensively studied in the last two decades. Several studies talk about ICT, role of ICT, technology adoption, its impact on every aspect of life. These studies lead to development of various theoretical models explaining the behavioural intentions in technology adoption by individuals. Various theoretical models have been established to study the behavioural intentions to adopt technologies. Theoretical models like Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Theory of Planned Behaviour (TPB) (Ajzen, 1991), the Technology Acceptance Model (TAM) (Davis, 1989) have gained extensive attention in the studies related to ICT adoption in various contexts. Venkatesh

et al. (2003) combined 8 such models to form Unified Theory of Adoption and Use of Technology (UTAUT) to study the behavioural intention to use technology. This model consists of four core determinants of intention and usage: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions and also of four moderators of key relationships: Gender, Age, Experience and Voluntariness. This study applied the UTAUT model to understand and determine the technology acceptance behaviour among the MSMEs by studying the effect of Digital literacy and educational qualification as facilitating factors and Digital divide as a barrier.

3.2.3 Digital Literacy:

Digital literacy encompasses an individual's awareness, attitude, and capability to effectively utilize digital tools and resources for various purposes. These skills are applied within real-life contexts to foster meaningful social engagement and self-reflection (Martin, 2005). The European Commission's DigiComp 2.0 framework further refines digital literacy by outlining essential competencies needed to navigate and succeed in an increasingly digital world. The framework's components include media literacy, internet literacy, information literacy, and computer literacy. They evaluate a wide range of digital abilities ranging from fundamental hardware knowledge, such as switching computers, to sophisticated career-related competencies, safety, and content production. However, in order for these evaluation indicators to be applicable and helpful, they must be mapped to the DLGF (Digital Literacy Global Framework) and incorporate the context of usage and assessment purpose (UNESCO, 2018).

Further, literature observed that there is a lack of instruments utilized for this assessment that can offer universally applicable indicators for assessment in all situations. In order to measure the contextual variance between developing and developed nations as well as industries/sectors

that may improve the relevance and precision of assessment, it is further necessary to build a specialized framework and assessment instrument for the MSME sector in India. Based on the Digicomp 2.0 framework, a digital literacy skill assessment framework is proposed in this study, which can be used to develop an instrument to assess the digital literacy levels among the MSME entrepreneurs.

3.3 Research questions:

According to Socrates ‘Thinking is not derived by answers but by questions’ (Elder & Paul, 1998). Hence, questions are the basis on which a study takes place and exploration for the answers is attempted. A well-articulated research question is a primary requisite for the quality and success of a study (Agee, 2009). Hence, the following research questions are a starting point for the study:

- RQ1. How does **Gender** effect digital divide among MSMEs?
- RQ2. How does the **location** of the business affect digital divide among MSMEs?
- RQ3. How does the line of business operations (**MSME sector**) affect digital divide among MSMEs?
- RQ4. How does **education qualification** of the MSME owner affect the digital divide?
- RQ5. How does the **digital divide** affect the digital adoption (technology adoption) among the MSMEs?
- RQ6. How does the **education qualification** of MSME entrepreneurs affect the digital literacy among them?
- RQ7. How does the **education qualification** of the MSME entrepreneurs affect the digital adoption?

- RQ8. How does the **digital literacy** level among the MSME entrepreneurs affect the digital adoption?
- RQ9. How does **gender** of the Entrepreneur effect the Digital adoption among the MSMEs?
- RQ 10. How does the **gender** affect the Digital Literacy level of the entrepreneur?
- RQ11. Does the **location** of MSME has an impact on the digital literacy level of the entrepreneur?
- RQ12. Does the **location** of MSME has an impact on the Digital adoption among the MSMEs?
- RQ13. Does the **sector** or the nature of the business has an impact on the Digital adoption among the MSMEs?
- RQ14. Does the **Sector** or the nature of business has an impact on Digital literacy of the entrepreneur?

These research questions lead to the formulation of research objectives for the study.

3.4 Research Objectives

The primary objective of study is to examine the digital divide, digital literacy and digital adoption among the Indian MSMEs. More specifically, the study attempts:

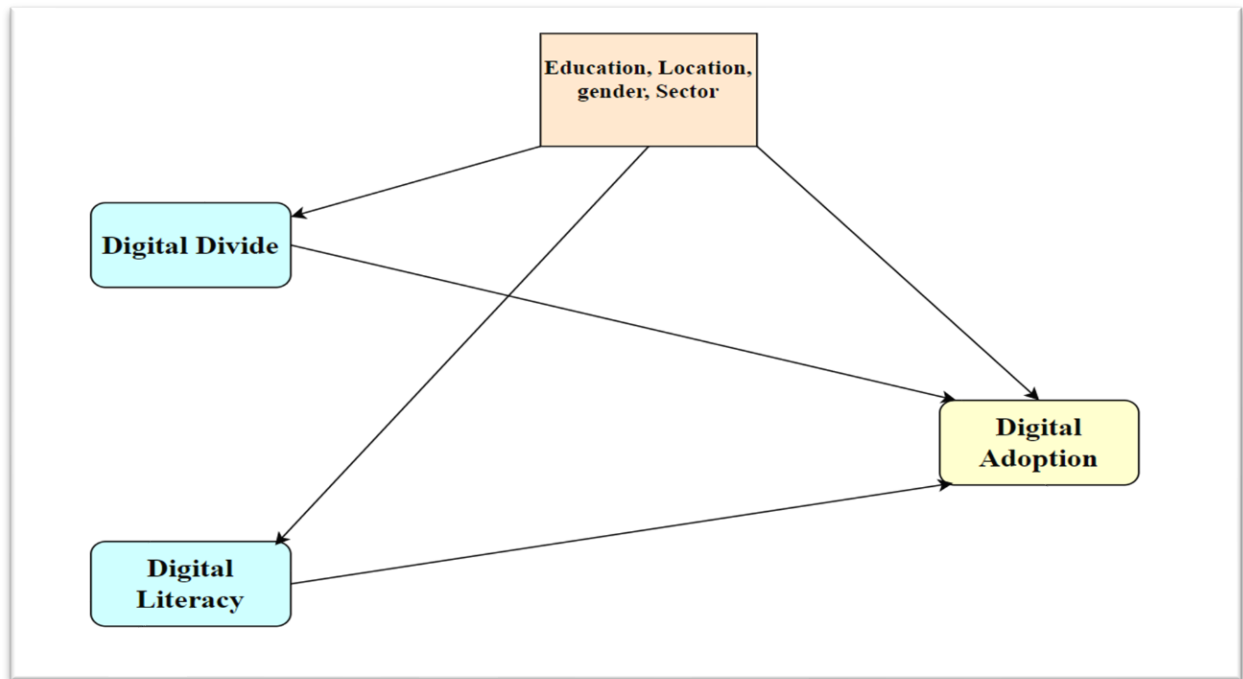
- RO1. To examine the effect of gender, location, line of business and education qualification of the entrepreneur on the **digital divide**.

- RO2. To examine the effect of gender, location, line of business and education qualification of the entrepreneur on **digital Literacy** of the entrepreneur.
- RO3. To examine the effect of gender, location, line of business and education qualification of the entrepreneur on **digital adoption** among MSMEs.
- RO4. To determine the effect of **digital divide on digital adoption** among MSMEs.
- RO5. To examine the effect of **digital literacy of the entrepreneurs** on the digital adoption among the MSMEs.

3.5 The conceptual framework:

A conceptual framework provides a structured approach to understanding the key variables, relationships, and theoretical foundations of a study. It serves as a visual or descriptive model that explains how different factors interact within the research context (Ravitch & Riggan, 2016). Based on the research objectives, the conceptual framework for the study was derived, which is presented in the figure below (Figure 3.1). The conceptual framework focused on assessment of digital literacy, determining the digital divide and studying the factors that enable and inhibit the digital adoption among the entrepreneurs. Factors like gender of the entrepreneur, educational qualification, location and sector (nature of business) of the enterprise and their impact on the digital adoption as well as digital divide and digital literacy was explored in the study.

Figure 3.1: Conceptual framework for the study.



3.6 Hypotheses:

Based on the conceptual framework of the study, the followed hypotheses can be inferred:

- H₁: Gender has a significant effect on the digital divide among the MSMEs.
- H₂: Line of business operations (MSME sector) has a significant impact on digital divide among the MSMEs.
- H₃: Location of the MSMEs has a significant impact on the digital divide among the MSMEs.
- H₄: Education qualification (literacy level) of the entrepreneur has a significant impact on the digital divide among the MSMEs.
- H₅: Digital literacy of the entrepreneurs has significant impact on the digital adoption among the MSMEs.

- H₆: Education qualification of the entrepreneur has a significant impact on the digital adoption among the MSMEs.
- H₇: Digital divide among the MSMEs have a significant impact on the digital adoption.
- H₈: Education qualification of the entrepreneur has a significant impact on the digital literacy level of the entrepreneur.
- H₉: Gender of the Entrepreneur has a significant impact on the Digital adoption.
- H₁₀: Gender has a significant Impact on Digital Literacy.
- H₁₁: Location of the MSME has a significant Impact on Digital Literacy.
- H₁₂: Location of the MSME has a significant Impact on Digital adoption.
- H₁₃: Sector (nature of the business) has a significant impact on the Digital adoption.
- H₁₄: Sector (nature of business) has a significant impact on Digital literacy.

Section- 2

3.7 Scope of the study

The Micro small and medium enterprises in India are spread across the length and breadth of the country. In addition, the government, as part of promotional schemes has recognized and assigned specific geographic areas for MSMEs which includes, SEZs, industrial areas and specific clusters where MSMEs are congregated. For instance, industrial area in Patancheru (Hyderabad), Industrial clusters in different parts of Andhra Pradesh specialized in different industries, like gold plating industry (jewellery) in Machilipatnam to name a few. This study focussed on MSMEs belonging in all industries and sizes operating in Andhra Pradesh and Telangana for more than two consecutive years. Digital adoption, digital divide and digital literacy among MSMEs can be determined by examining the length and breadth of the MSMEs

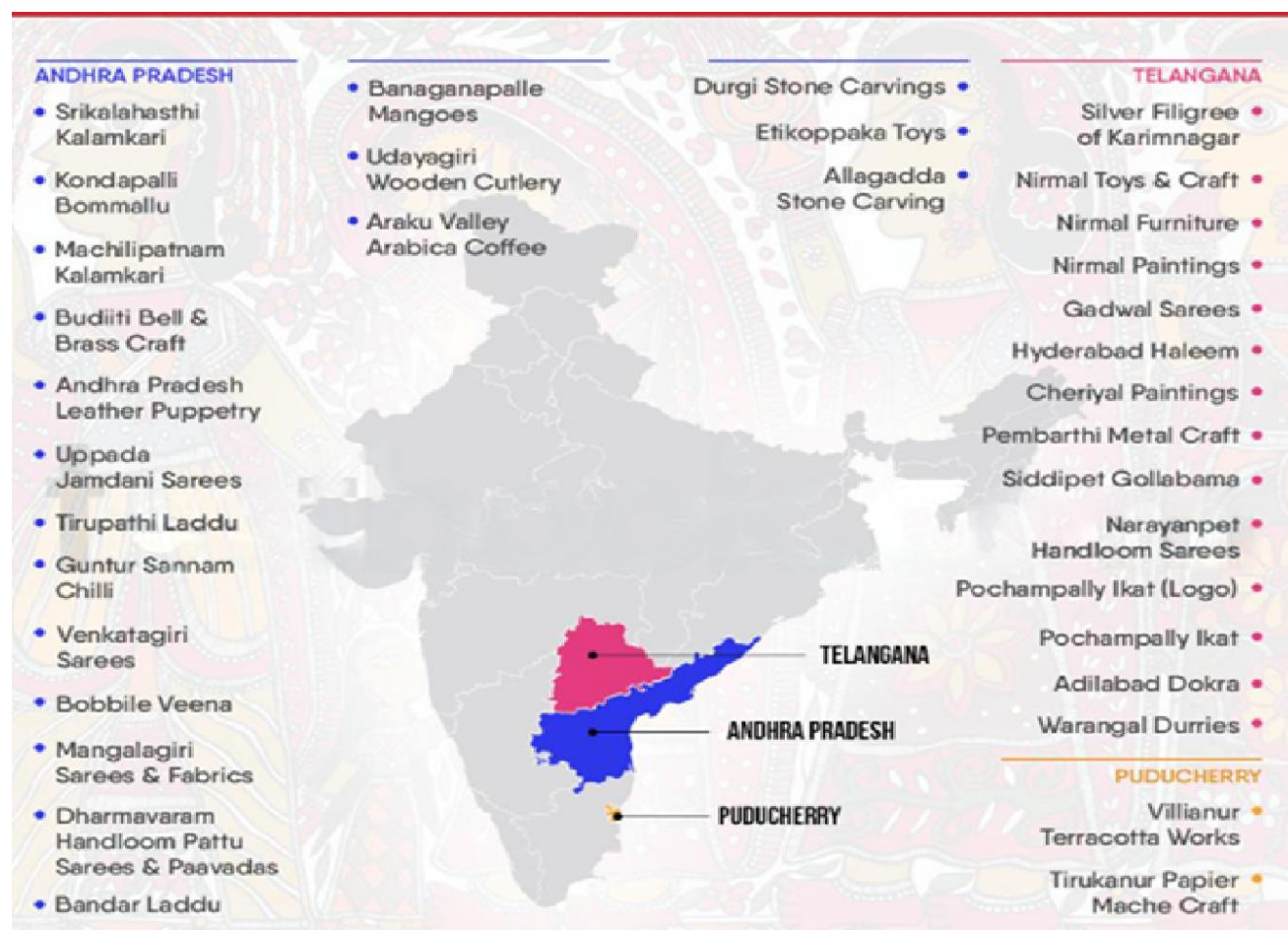
and hence, an effort was made to collect data from all the major types of industries (metal manufacturing, handlooms, apparel, handicrafts, IT startups, consultancies etc) with different size of operations (micro, small and medium), in all the sectors (manufacturing, services, trading) and various locations (rural, urban and towns). Additionally, home businesses, unnamed businesses, gig workers and freelancers were excluded from the sample. Further, for this study, no distinction of the size of the enterprise was made, in other words, Micro small and medium enterprises were all considered for the study as MSMEs.

3.8 Research Area

India is a developing nation, vibrant in terms of business climate, in a variety of businesses like pharma, IT, education, construction, chemicals etc. With a growing emphasis on the development of MSME sector by the government, the number of industrial areas, MSME clusters and individual businesses across the country witnessed exponential growth in the recent years and thus forms the research area for this study.

Based on the criteria identified, in the MSME sector, it was decided to select the MSMEs in Andhra Pradesh and Telangana for this study. The two states combined place 3rd in number of MSMEs India with close to 60 lakh MSMEs covering all the major industries in manufacturing, services and trading. Further, various industrial clusters which support specific industries across the states provide diverse entrepreneurial portfolio. For instance, handloom industries in Mangalagiri, Uppada, Gadwal and Pochampalli, handicraft industries in Kondapalli, Udayagiri, food processing industries in Bandar and Araku are some of the industrial clusters in Andhra Pradesh and Telangana with GI tag (figure 3.2).

Figure 3.2: Map of GI products in Andhra Pradesh and Telangana as on 2018



Source: X page ([Link](#))

MSME landscape in Andhra Pradesh:

As of 2024, Andhra Pradesh has seen significant growth in its MSME sector, with the number of MSMEs increasing by 60% over the past four years. According to the annual report 2024 by the MSME.gov.in, Andhra Pradesh has 33.87 lakh MSMEs, constituting 5 % of total numbers in India placing the state among the top ten list. In addition, Micro businesses dominate the State MSME sector, accounting for approximately 97% of all

registered businesses, which is consistent with the national trend, and 92% of all MSME sector employment. The top 12 districts are home to about 70% of MSMEs (Investindia.com, 2024). Based on the NIC classification, food processing (~32%), Textiles (26%), Wooden products (6%), Non-metallic minerals (5%) have the largest sector share within manufacturing. With a total land area of 2,329 acres and 29 operational MSME Parks spread across 17 districts, the state boasts a strong industrial infrastructure. With clear and efficient guiding principles of the policy for the growth and development of MSMEs in the state (figure 3.3), the MSME sector in Andhra Pradesh is well suited for the study.

Figure 3.3: Guiding principles of MSME policy in Andhra Pradesh



Source: Investindia.com

MSME Landscape in Telangana

The national sample survey estimated around 26 lakh MSME units that are operational in Telangana state as of 2023. The MSMEs in Telangana employ close to 33 lakh people which is highest in the state. Service industry is the major contributor in Telangana, closely followed

by food processing, chemical and pharmaceutical manufacturing, engineering, electronics and FMCG. Telangana policy proposes increasing availability of infrastructure, access to finance, raw materials, labour and technology to aid the growth and development of MSME sector in the state (Figure 3.4).

Figure 3.4: Policy Proposal of Telangana.



Source (Invest India, 2023)

3.9 Research design

Research design provides a suitable framework for a study (Dannels, 2018). It guides how pertinent data for a study will be gathered, analysed to achieve the research objectives of the study (Sileyew, 2020). It is a blueprint for the research process including collection, measurement and analysis of the data. Thus, the research design for this study is as follows.

The study attempted to determine the digital divide, digital literacy and digital adoption among the MSMEs and hence is exploratory in nature. Exploratory research aims at uncovering new insights into a phenomenon. An exploratory study is employed to gain more background information and to extend the discussion on the existing phenomenon (Thomas & Lawal,

2020). The objective of the study is to examine various factors impacting the digital adoption among the MSMEs. As such the study used exploratory research methods in so far as digital divide and digital literacy is concerned. Descriptive and quantitative method is applied to study the digital adoption and its antecedent variables.

For further ease and clarity, the research is divided into three studies (table 3.1).

Study 1 – to determine the effect of gender, location, education qualification and the sector of the MSMEs on the digital divide. This study takes into consideration, the opinions and perceptions of the entrepreneurs about different types of access to the digital tools following Van Dijk’s model and analyses the significance of factors like gender, education qualification, sector and location on the digital divide.

Study 2 – to determine the digital literacy among the MSMEs. This study focusses on assessing the literacy levels of the MSME entrepreneurs through the developed digital literacy assessment scale. The study includes developing the measurement instrument for the digital literacy and testing the scale.

Study 3– to determine the effect of digital divide, digital literacy, and demographic variables like gender, education qualification, sector and location on the digital adoption among the MSMEs.

Table 3.1: Research Design

Study	Purpose/objective	Method	Constructs	Theoretical model	Analysis
Study 1	To determine the effect of gender, location, education qualification, and Sector on the Digital divide.	Exploratory study	Digital divide, Gender, Sector/line of business, educational qualification, location	Van Dijk model for Digital divide	Analysis of factual data – through PLS SEM
Study 2	To study the digital literacy level among the MSMEs	Exploratory, Scale development and assessment	Digital literacy	Digital Literacy framework	Competency Assessment and Scale development
Study 3	To determine the effect of digital divide, digital literacy and education qualification on the digital adoption among the MSMEs	Empirical study	Digital divide, digital literacy, education qualification and digital adoption	UTAUT	CB SEM through Smart PLS

3.10 Data Collection

3.10.1. Tools and techniques

The use of questionnaire as a tool of data generation through surveys is well documented in the literature and surveys are the most used data gathering technique in social sciences (Neuman, 2014). The emphasis on evidence based and empirical research necessitates a well-developed and rigorous instrument for measuring the constructs of the study. Thus, the tools and

techniques for the study included a specifically designed questionnaire to collect the data from the entrepreneurs through a cross-sectional survey.

3.10.2. Questionnaire design

A questionnaire is a structured tool used for data collection in research, designed to gather information from respondents in a systematic manner. A well-articulated questionnaire is essential to ensure the reliability, validity, and effectiveness in addressing the research objectives (Neuman, 2014). For this study, the questionnaire is designed to gather information on the demographic profile of the MSMEs and the variables of the study. Thus, the questionnaire for the study has four sections.

- *Section 1:* This section has questions related to the demographic profile of the MSMEs. Specifically, information related to the entrepreneur and the enterprise. Questions pertaining to the age, gender, education qualification of the entrepreneur and location, sector, industry, registration status of the enterprise were included in this section.
- *Section 2:* This section consists of questions measuring the digital divide among the MSMEs. The questions are designed to capture the opinions and perceptions of the entrepreneur pertaining to various levels of access to digital technologies. The Digital Divide included motivational access, skill access, usage access and material access as per Van Dijk's model with 8 items with items like "I have access to ICT devices at my work place" and "I use ICT devices for my business".
- *Section 3:* The questions in this section are designed to measure the digital literacy among the entrepreneurs. included items from the scale prepared with 18 items corresponding to the key dimensions of the framework with items like "I can browse internet to gather information for my business", "I can create content for promotion of my business", I have knowledge of data privacy and web security" etc. These were the questions used for developing a measurement scale for digital Literacy among MSMEs.
- *Section 4:* The section included questions related to behavioural intention towards digital adoption. It has 4 items taken from the scale given in the UTAUT model.

The questionnaire is intended to capture the factual information about the entrepreneurs/partners along with their opinions and perceptions on the constructs of the study on a 5-point Likert scale – *strongly agree to strongly disagree* -with a score of 5 to 1.

3.10.3. Questionnaire administration

The questionnaire was administered to the respondents who are MSME owners/entrepreneurs. In addition, the decision makers of the enterprise for instance, managers and or partners were also taken into consideration for the survey. The questionnaire was designed to elicit the following information.

- Demographic data of the entrepreneurs – Age, educational qualifications, gender, location of the enterprise, sector, nature of business (industry), type of business (proprietorship, partnership etc), role of the respondent in the enterprise (owner, partner or manager).
- The opinions and perceptions of respondents on digital adoption and access to digital technology, usage levels. Assessment of the digital literacy level based on their perceptions and knowledge of digital technology was gathered through the questionnaire.
- Data was collected in person by administering the questionnaire to the respondents by visiting their place of business.

3.11. Sampling Unit and Sampling method

- *The Target population* for the study are the MSME entrepreneurs, partners in the enterprise, managers/decision makers (responsible for digital operations of the enterprise) of the MSMEs located in the states of Andhra Pradesh and Telangana, which are operational for two consecutive years.

- *The Sampling unit* for the study is an individual respondent - entrepreneur/partner/manager of the enterprise.
- *The Sample size* for the study was determined through Cochran's formula (Cochran, 1977) and also satisfies the sample size proposed by Hair et al (2019) for structural equation modelling.

The sample size for this study was calculated by Cochran's formula which is:

$$n_0 = Z^2 pq / e^2$$

e is the desired level of precision (i.e., the margin of error) which is 5%

p is the (estimated) proportion of the population which has the attribute in question. For this study 50% of variability will be considered. Therefore $p=0.5$

q is $1 - p$, therefore $q=0.5$

The z-value is found in a Z table, for a 95% of confidence level, z value is 1.96

n_0 is the sample size which comes out to be

$$((1.96)^2 (0.5) (0.5)) / (0.05)^2 = 385$$

So, the minimum sample size for this study would be 385 MSMEs.

Sampling Technique: For this study, purposive stratified sampling is used. A select number of entrepreneurs from each stratum were purposely approached for data collection.

The Strata that are considered are provided in the table -

- a) Industry division (as per the NIC codes): 20 (table 3.2)

Table 3.2: Divisions considered for sample collection.

SR No	Division
1	Manufacture of food products and beverages
2	Manufacture of textile and apparel
4	Tanning and dressing of leather; manufacture of luggage, handbags saddlery, harness and footwear
5	Manufacture of wood and of products of wood and cork, manufacture of articles of straw and plating materials
6	Manufacture of paper and paper products
7	Manufacture of chemicals and chemical products
8	Manufacture of rubber and plastic products
9	Manufacture of other non-metallic mineral products
10	Manufacture of metal and metal products
12	Manufacture of machinery and equipment
13	Manufacture of furniture
15	Construction and Real estate services
16	Wholesale trade and commission trade, except of motor vehicles and motorcycles
17	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods

18	Hotels and restaurants
19	Computer and related activities
20	Other business and service activities

b) Geographical area: MSMEs in Andhra Pradesh and Telangana (2) are considered as two strata.

Based on the Strata that was identified the sample can be divided as follows:

No of MSMEs in each division will be 10 Nos, since there are 20 divisions, the total will be $20 \times 10 = 200$

No of location considered are 2, hence the total number of MSMEs will be $200 \times 2 = 400$.

Hence, for the purpose of this study a sample of 400 MSMEs across all the divisions, in manufacturing, trading and service sectors located in both Andhra Pradesh and Telangana were considered. The questionnaires were distributed to the entrepreneurs in person. 450 initial responses were collected out of which total number of valid samples after the data cleaning came out to be 410.

3.12. Pilot Study

A pilot study is recommended in order to confirm that the scale uses clear, precise and legible language which is correctly understood by the respondents. It is particularly vital in studies that develop new measurement scale (Johanson & Brooks, 2009). Although there are studies highlighting the significance of pilot studies are numerous throughout the literature, the sample size requirement for these studies is still vague, especially in exploratory studies. However,

some studies suggest that a sample size between $N=10-30$ have advantages in terms of practicality, ease of calculation and overlooking any weakness of the treatment affects. Similarly, Treece and Treece (1977) suggests that for every 100 people in the sample, 10 respondents in the pilot study should be a reasonable number. Hence, a pilot study was conducted using a sample of 50 respondents to check the feasibility of the study, clarity of the questionnaire. Construct reliability and validity was also checked in the pilot study. Since there are three studies out of which one (Study 2) is scale development, the construct validity and reliability of digital literacy has been explained in the next chapter (chapter 4) for better understanding.

3.13. Reliability and validity of the measuring Instruments

While reliability ensures consistency, validity focuses on whether the questionnaire measures what it is supposed to measure. Content validity is established through expert review, ensuring that all aspects of the concept are adequately covered. For the pilot testing the questionnaire was reviewed by an academician, an industry expert and an entrepreneur. Construct validity examines whether the questionnaire aligns with theoretical expectations and is often tested to validate the underlying structure of the instrument (Hair et al., 2014). For this pilot study, construct reliability and convergent validity have been estimated through Smart PLS with 50 samples, the values of which are given in the table below (table 3.3). The Cronbach's alpha values of all the constructs (DA = Digital adoption, Digital divide) are above the threshold level which proves that the measurement instrument is reliable. The values for Digital Literacy (DLA, DLB and DLP) are further explained in the next chapter of scale development. The AVE values representing the convergent validity are also above the threshold level and hence considered acceptable. However, precise value of each item can be measured on further data analysis, which will determine the items that can be retained.

Table 3.3: Reliability and AVE scores of pilot testing.

	Cronbach's alpha (standardized)	Cronbach's alpha (unstandardized)	Composite reliability (rho_c)	Average variance extracted (AVE)
DA	0.898	0.895	0.853	0.646
DLA	0.922	0.922	0.922	0.632
DLB	0.935	0.934	0.938	0.738
DLP	0.930	0.929	0.927	0.813
Digital divide	0.919	0.918	0.920	0.671

3.14. Data Analysis

Data analysis of the responses was done using appropriate statistical techniques and software. The data obtained from the survey is appropriately cleaned and coded for further analysis. Further, data was analysed using descriptive statistics such as frequency and percentages for analysing the factual information of the demographic profile of the entrepreneurs and the enterprises, comprising of information related to age, gender, education qualification, location of the business, industry etc.

Since the study is exploratory in nature, the KMO measure and Bartlett's test of Sphericity was conducted to check the sampling adequacy. Further, to check the auto correlation between the constructs, the Durbin Watson test was also performed to arrive at the DW statistic. Normality check was performed through Shapiro-Wilk test and Kolmogorov Smirnov test to check the distribution of the data. Since there are three studies as per the research design, data analysis for each study is done separately thereafter.

The perceptions and opinions of the entrepreneurs related to access to the digital tools (digital divide- study 1) based on the scores of the five-point Likert scale used in the study has been analysed using SPSS 25 version. Study 2 comprising of scale development and digital literacy assessment is carried out by conducting EFA and CFA of the data. This analysis is done using CB-SEM in Smart PLS 4. Further, the data obtained is analysed in excel and SPSS to assess the literacy level of the entrepreneurs. Finally, digital adoption among MSMEs and the significance of digital literacy, digital divide and other factors like education qualification, age, gender, location, sector were analysed in study 3 using structural equation modelling in smart PLS 4.

Summary

The chapter described the research strategy, design and the methods deemed appropriate for the current investigation. The conceptual framework for the study was proposed and explained along with research questions and research objectives. A research design was created to achieve the research objectives. Additionally, data collection process was explained long with sampling technique and the research instruments. The chapter also described how the measurement tool used in the study was created and distributed. The process of gathering data, the results of the pilot study, and the data analysis were described. The scale development process for digital literacy and the resultant measurement instrument is explained in the next chapter.

Chapter 4

Scale Development of Digital Literacy

Studies related to digital literacy in the context of Indian MSMEs and their digital adoption were negligible and thus no proven instrument exists, which can be used as a scale for measurement. Evidence suggests developing digital literacy framework as a curriculum in educational and training context. The study fills the gap by developing a reliable and valid measurement scale for digital literacy assessment in MSME context. This chapter elaborates on the instrument development and methods of data collection. A review of literature helped to generate a pool of items and the instrument was developed using the scale development procedure given by Nunnally (1978). The instrument reliability was tested using Cronbach-alpha. Based on the examination of factor loadings, content validity and reliability, items not meeting the established criteria were deleted. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used for the scale refinement which is explained in the chapter.

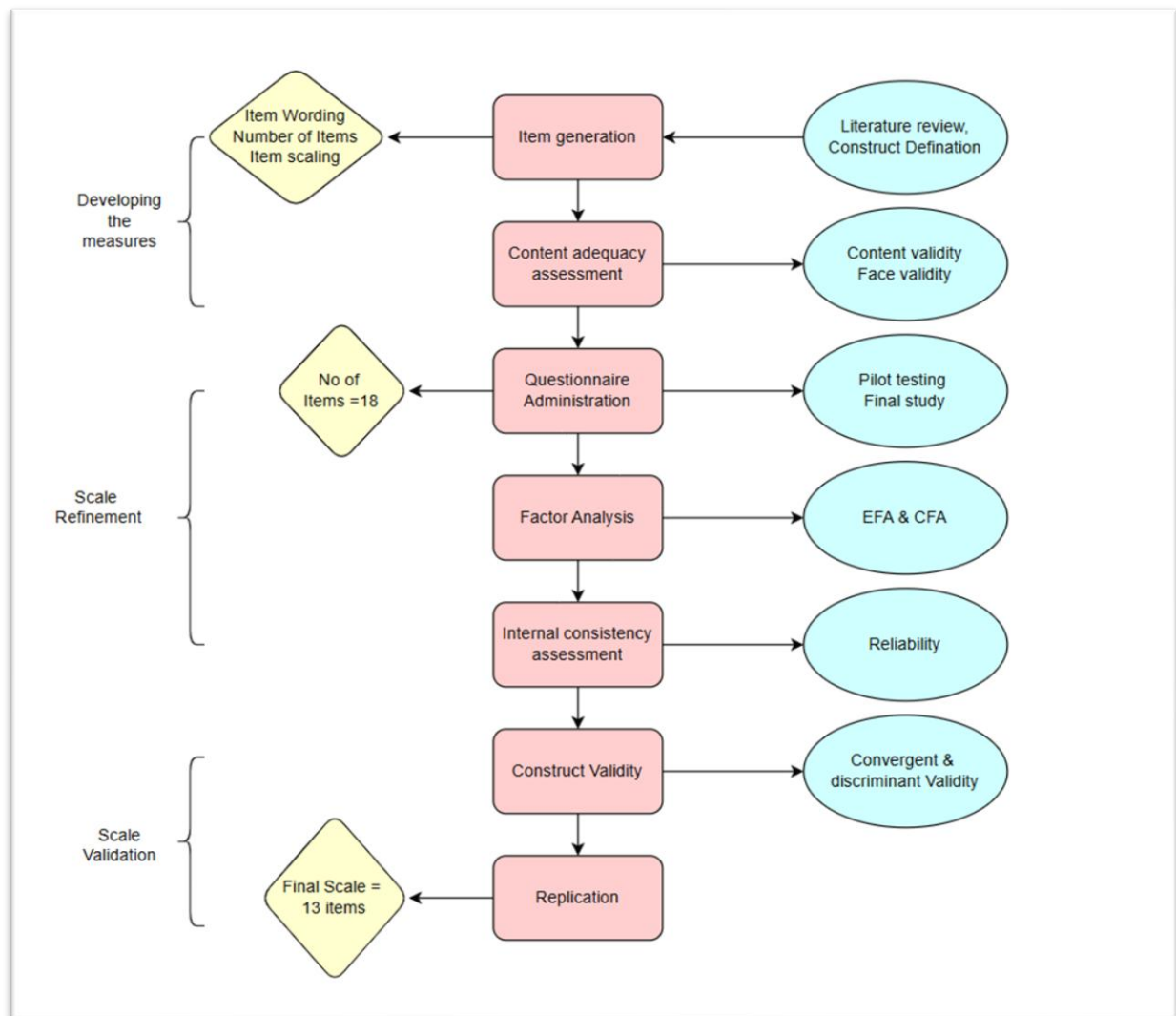
4.1 Scale development for ‘Digital Literacy’

One of the objectives of the study is to determine the impact of digital divide, educational qualification, gender, location, sector of the enterprise on the digital literacy of the entrepreneur along with the impact of digital literacy on the digital adoption among the MSMEs. The achievement of this objective necessitates having a reliable and valid instrument to measure digital literacy as a construct.

Scale development refers to the process of creating reliable and valid measurement instruments, typically for use in research, that can quantify abstract concepts, attitudes, behaviours, or traits.

This process involves several steps to ensure that the scale accurately captures the underlying construct and is both consistent and applicable across different populations or settings. Hinkin (2005) broadly classifies scale development process in two stages – Developing the measures and Testing the Measures. The first phase of ‘developing the measures’ is further divided into - Item Generation, Item Wording, Number of Items, Item Scaling and Content Validity (adequacy) Assessment. The testing of measures is further divided into scale refinement phase containing questionnaire administration, pilot testing, factor analysis and internal consistency assessment, while scale validation phase tests the construct validity and replication (Figure 4.1).

Figure 4.1: Scale development Process



4.2 Defining the Construct:

The first stage of the scale development is defining the construct and item generation which is a part of developing the measures and includes creation of questions that can assess the construct under question (Hankin, 2005). A *construct* is a conceptual term used to describe a phenomenon of theoretical interest that cannot be observed directly (Edwards & Greenberg, 2003). This involves a thorough literature review to understand the variables and dimensions that constitute the construct.

The construct - *digital literacy*, in literature is studied majorly in the context of education and computer science leaving a gap in the context of business and management. Further, the literature has no valid measurement scale that can be used reliably by the researchers. The scale in this study was developed from the frameworks given by OECD and DigiComp 2.0. (Annexure1). Based on the dimensions given in the OECD framework and key competencies attributed to those dimensions, the competency descriptors, along with the examples were described in the conceptual framework for this study (refer to the table 4.1). The framework for digital literacy assessment presented in the study is modified to suit the MSME or the business context.

4.2.1 Assessment framework:

The suggested assessment system (table 4.1), based on the operational definition and the Digicomp guidelines comprises three levels of digital literacy, namely *basic*, *proficient*, and *advanced*. The awareness and the capacity to use computers and the internet to obtain information, as well as an understanding of digital skills such as emailing, surfing the web for information, downloading and completing forms, and using a computer, are examples of basic digital competencies. Similarly, the capacity to use digital tools correctly for various tasks in a professional/business setting is measured by proficient digital competency. Using various apps, social media sites, business order processing, internet purchasing, or net banking are a few examples. Further, the advanced level of digital literacy assesses the professional, analytical and safety aspects of digital literacy in a business setting. Creating algorithms, developing apps, analysing data, webmasters, data privacy and security or professional training in advanced software are a few examples of possessing an advanced digital knowledge. Based on the framework describing competencies and their descriptors the dimensions were derived and an

instrument of measurement was developed which will be explained further in the following section.

Table 4.1: Digital literacy assessment framework

Level of literacy & Dimensions	Key competency areas	Competence descriptors	Examples
0. Absent	No knowledge or awareness of ICT	Neither have knowledge nor access to ICT tools	NA
1. Basic (awareness and usage)	1.1 Hardware literacy 1.2 Data / information literacy	a) Use of computer/ smart phone/tablet etc. b) Knowledge of Internet c) Browsing for information	Switching on and off a computer, laptop. Searching for information on smart phone or computer, understanding computer instructions, awareness of various apps and sites for information. Having an email ID or a social networking account
2. Proficient (communication and creation)	2.1 Communication 2.2 Usage 2.3 content creation	a) Working knowledge of different social media or communication tools b) Working knowledge of apps used in different business operations. c) Creating content for business promotion etc.	Using and marketing on social media apps, Online shopping, financial transactions, creating content for social media and digital advertising. Using apps or software for business operations.
3. Advanced (safety and development)	3.1 Development 3.2 Analytics 3.3 safety	a) Development of apps/ tools /platforms for business operations	Creating and developing apps and software for business ops.

		b) Using advanced software c) Analyzing data d) web designing and webmasters e) safety, privacy and data security	Using advanced software for data analytics and business functions. Knowledge of web safety, webmasters and web designing.
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4.2.2. Item Generation: Once the construct is defined, the next step is to generate a pool of items or questions that represent different aspects of the construct. This step involves both deductive approaches, where items are derived from existing theories or scales, and inductive approaches, where items are generated based on observations or qualitative data (Hinkin, 2005). A deductive approach was used for the study, where the items are generated based on an existing framework.

For the item generation, the competency descriptors were considered and questions were formed to record the response for that particular descriptor. For instance, for the key competency of ‘hardware literacy’ the competency descriptor is ‘having the knowledge of operating the ICT device’ and the example for the descriptor is ‘to be able to switch on and off the computer device/tablet/smart phone. The item was worded in such a way to record the perception of the respondent about his capability in handling the hardware of ICT devices – “I have knowledge of operating an ICT device (computer/tablet/smartphone etc.)”. Similarly, items are generated based on all the descriptors mentioned in the framework and attention was paid on wording and parsimony.

4.2.3. Content adequacy assessment – face validity and content validity

After generating items, the face validity of the questionnaire was tested by the experts. The questionnaire was reviewed by an academician, industry expert and an entrepreneur (from NIMSME conference) to test the wording, clarity, language and redundancy. Content adequacy assessment was followed to test if there is any ambiguity in the items and the items make sense to the respondents. Thus, after expert advice, 18 items were included covering three dimensions for pilot testing.

Table 4.2: Dimensions and number of Items

SR No	Dimension	No of Items for pilot testing
1	Basic level (ICT awareness, information and knowledge) – 5 items	5 items
2	Proficient level (Communication, Usage and creation)	6 items
3	Advanced level (Development, analytics and safety)	7 items

4.2.3 Pilot Study:

Pilot testing the scale on a small sample was done to check for clarity and any potential issues with the items (Netemeyer, Bearden, & Sharma, 2003). The respondents were approached in person through a conference of MSME entrepreneurs and survey was conducted in an offline mode. The respondents were explained the questions and the responses were collected manually. Manually collecting the responses not only helped in reducing the ambiguity of the questions but also to gather qualitative feedback about the instruments, which later helped in finalizing the instrument.

The analysis for pilot testing was conducted using smart PLS 4. Smart PLS is compatible when dealing with a small sample size and hence is ideal for the analysis (Ringle et al., 2012; Hair et

al., 2013; Shackman, 2013). The data was cleaned and coded after which an initial testing for reliability of the measuring instruments was performed. Three items were dropped after the pilot testing due to low Cronbach's alpha values (<0.5).

4.3 Final Survey

4.3.1 Data Collection

The revised questionnaire with 15 items was administered for the final survey. Data was collected from the entrepreneurs, partners and managers of the MSMEs. A total of 450 respondents were contacted for the survey. Data was collected by contacting the respondents and distributing the questionnaire in person. A total of 410 samples were obtained with a response rate of 91%. 5-point Likert scale was used to collect the responses and the respondents choose from 1-5, where 5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree and 1= strongly disagree.

4.3.2 Exploratory Factor Analysis

Statistical analyses such as exploratory factor analysis (EFA) are conducted to assess the scale's structure and identify items that do not fit well with the overall construct. Items may be refined or removed based on their performance (Worthington & Whittaker, 2006). The final scale is then subjected to rigorous testing for reliability (e.g., internal consistency using Cronbach's alpha) and validity (e.g., convergent, discriminant, and criterion-related validity). These tests ensure that the scale consistently measures the construct and accurately reflects what it is intended to measure (Churchill, 1979). Several standards have been put forth to evaluate the psychometric soundness of behavioural measures. They should exhibit parsimoniousness, internal consistency, criterion-related validity, and content validity. These all then help to

demonstrate construct validity, or how the measure relates to the underlying quality it is meant to evaluate (Hinkin, 2005).

4.3.2.1. Sample Adequacy

Exploratory factor analysis has been applied on 15 items with a sample of 110 responses. Before proceeding to factor analysis, KMO test was done to confirm the sample adequacy. The KMO measure evaluates the suitability of sample size for factor analysis. It ranges from 0 to 1, with higher values indicating better suitability. With a KMO value of 0.876 (table 4.3), the data is adequate for factor analysis.

Table 4.3: KMO and Bartlett's test.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.876
Bartlett's Test of Sphericity	Approx. Chi-Square	1068.239
	df	105
	Sig.	0.000

Similarly, Bartlett's Test of Sphericity examines whether the correlation matrix is an identity matrix, which would indicate that variables are unrelated and therefore unsuitable for structure detection. The null hypothesis indicates that the correlation matrix is an identity matrix (i.e., variables are unrelated, while the alternate hypothesis indicates that the correlation matrix is not an identity matrix (i.e., there are significant correlations among variables). The results of the test reveal a Chi-Square value of 1068.23 with 105 degrees of freedom, and the associated p-value (Sig.) is 0.000, which indicates that the null hypothesis can be rejected. This indicates

that there are significant correlations among the variables, further justifying the use of factor analysis.

4.3.2.2. Factor analysis

Table 4.4: Principal component analysis

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %						
1	6.706	44.710	44.710	6.706	44.710	44.710	4.335	28.900	28.900
2	2.813	18.755	63.465	2.813	18.755	63.465	3.300	21.999	50.899
3	1.079	7.192	70.657	1.079	7.192	70.657	2.964	19.759	70.657
4	0.688	4.584	75.242						
5	0.620	4.133	79.375						
6	0.556	3.704	83.078						
7	0.443	2.952	86.031						
8	0.404	2.694	88.725						
9	0.366	2.443	91.168						
10	0.335	2.231	93.399						
11	0.263	1.756	95.154						
12	0.211	1.408	96.562						
13	0.197	1.312	97.874						
14	0.183	1.221	99.096						
15	0.136	0.904	100.000						
Extraction Method: Principal Component Analysis.									

The table reveals information about the eigenvalues and the percentage of variance explained by each principal component before and after rotation. The components with Eigenvalue of more than 1 is considered and the results yielded three such factors. The cumulative percentage values indicate the amount of variance explained by each component before and after rotation. Component 1 has Eigenvalue of 6.706, which explains 28.9% of variance after rotation. Component 2 has the Eigenvalue of 2.813, which explains 20.99 % of the variance and finally

component 3 has the Eigenvalue of 1.079, which explains 19.7 % of the variance. Cumulative Variance for all the three factors which has more than 1 Eigenvalue is 70.657%. The table 4.4 shows that the total variance explained by the first component is 28.9 % which is less than 50% and hence proves that there is no common method bias (Harman's Single factor Test).

4.3.2.3. Factor Loadings

Factor analysis aims at condensing the data from several original variables into a smaller set of variables with the least amount of variable loss. Factor analysis is regarded as being highly objective for developing summated scales since it offers an empirical approximation of the variables' structure. Factor loadings <0.50 (Karatepe et al., 2005) and cross loading >0.40 or communalities (Hair et al., 1998) are the criteria used to eliminate items. This led to the removal of two more items from the questionnaire resulting in 13 items for further analysis. The factor loadings are shown in the table 4.5 below;

Table 4.5: Factor loadings

	DLA	DLB	DLP
DLA1	0.822		
DLA3	0.905		
DLA4	0.815		
DLA5	0.723		
DLA6	0.739		
DLA7	0.742		
DLB2		0.697	
DLB3		0.846	
DLB4		0.869	
DLB5		0.792	
DLP1			0.855
DLP2			0.864
DLP3			0.727

4.3.3 Confirmatory factor analysis

Confirmatory Factor Analysis (CFA) is a crucial step in scale development used to test the validity and reliability of a proposed measurement model. It helps confirm whether the selected items accurately represent the underlying latent constructs. According to Hair et al. (2010), CFA is a structural equation modelling technique that permits separate relationships for each of the dependent variables. It is comprised of two parts: the structural model and the measurement model. While the measurement model allows the use of multiple variables for a single independent or dependent variable, the structural model is the path model that links the independent to dependent variable. CFA makes it possible to evaluate each scale item's contribution and take into account how well the scale gauges reliability and validity. Thus, confirmatory factor analysis was conducted on 13 items resulting from the factor analysis. A sample of 300 new responses was used for the analysis.

4.3.3.1 First Order model

The fundamental requirement for testing the first order CFA model is to test that all the three factors are correlated to each other. In the first order model, the single latent factor explains covariances between variables. Figure (4.2) shows the structural model of the three factors and their correlations. The analysis revealed a strong positive correlation (table 4.6) between the factors (0.776, 0.762, 0.516). Further, indicator correlation is shown in the table (4.7).

Table 4.6: Correlation among the factors

	DL	DLA	DLB	DLP
DL	1.000			
DLA	0.711	1.000		
DLB	0.725	0.516	1.000	
DLP	1.071	0.762	0.776	1.000

Figure 4.2: First order structural model.

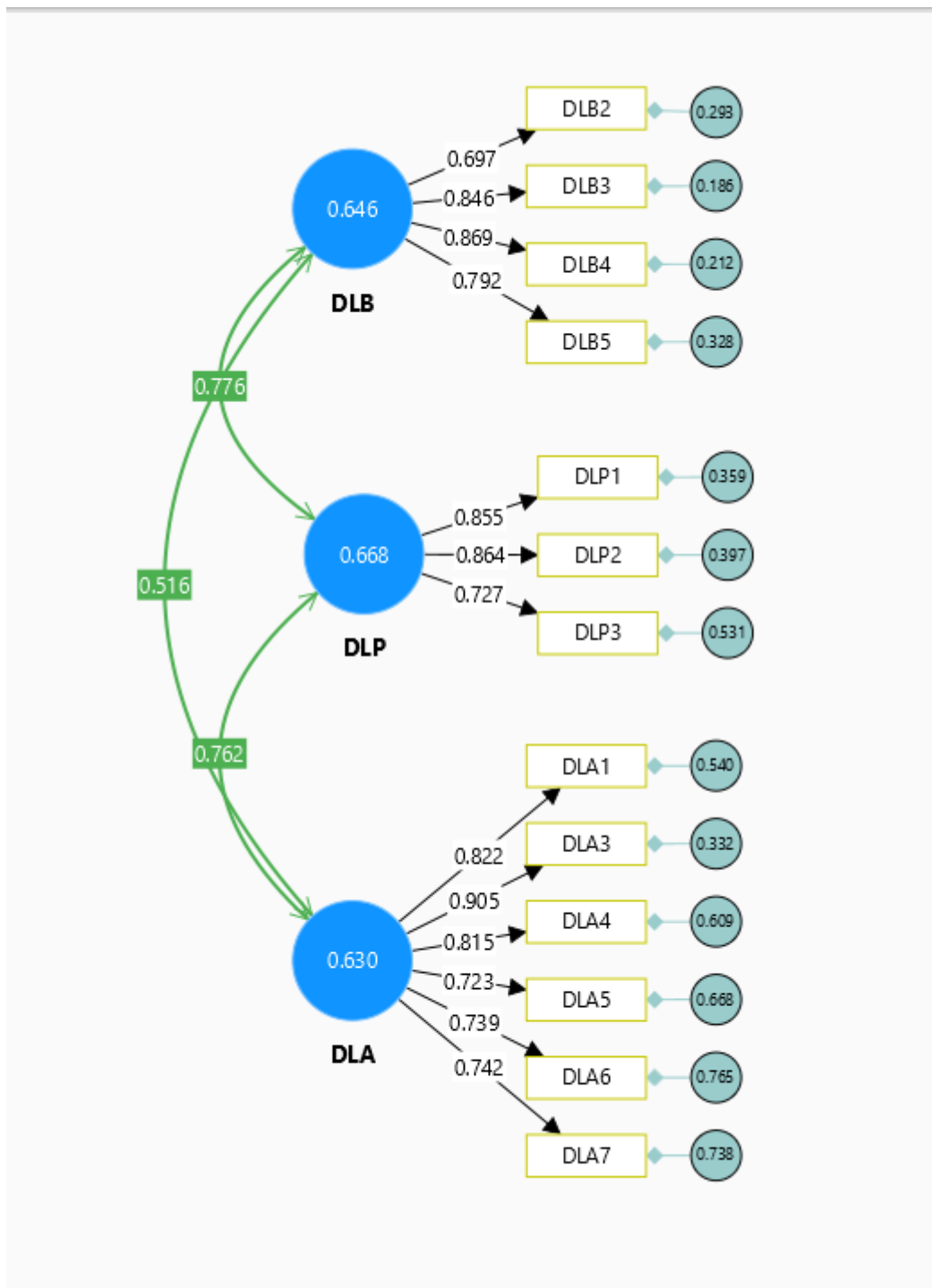


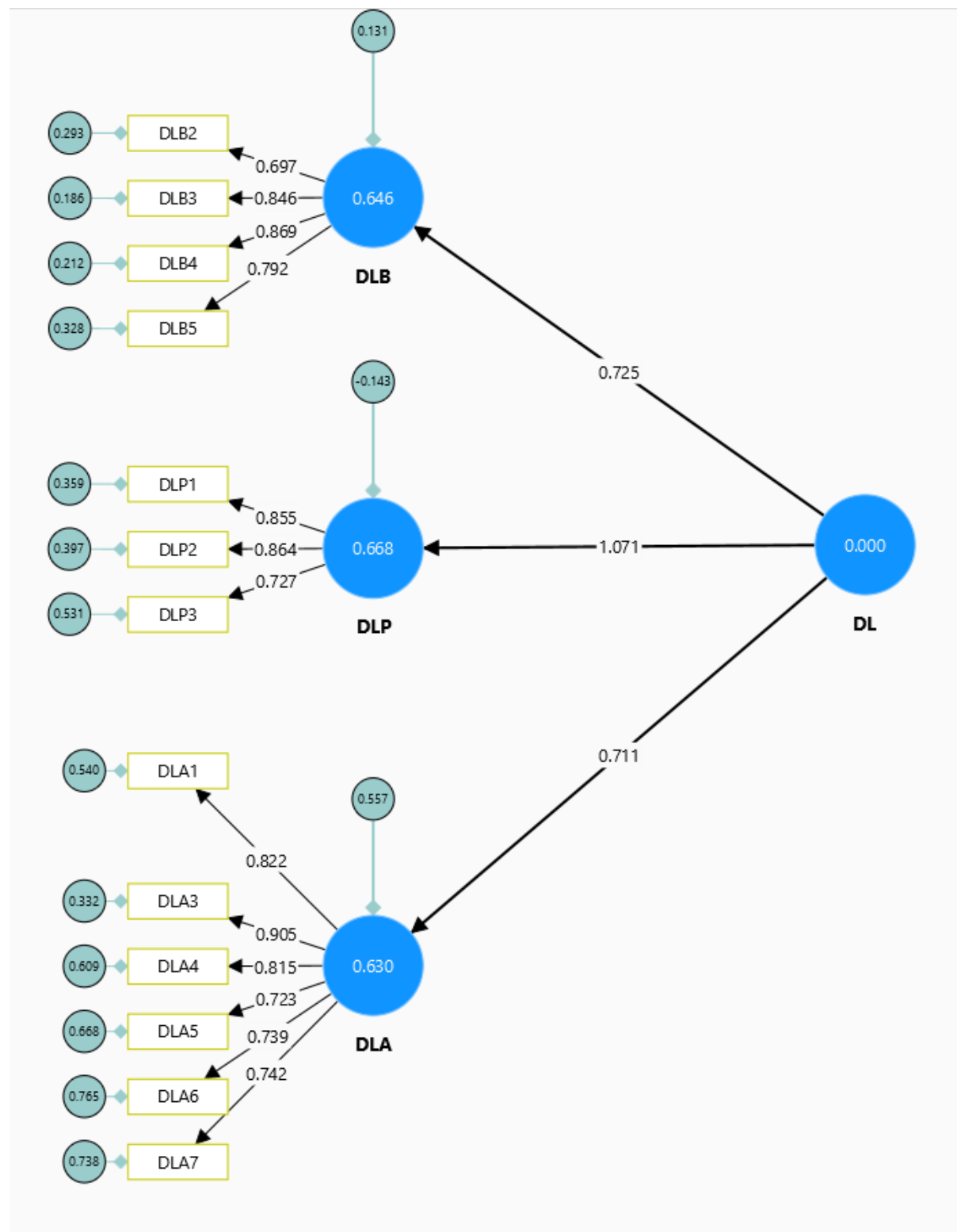
Table 4.7: Indicator correlation matrix

	DLA1	DLA3	DLA4	DLA5	DLA6	DLA7	DLB2	DLB3	DLB4	DLB5	DLP1	DLP2	DLP3
DLA1	1.000												
DLA3	0.744	1.000											
DLA4	0.670	0.737	1.000										
DLA5	0.594	0.654	0.589	1.000									
DLA6	0.608	0.669	0.603	0.535	1.000								
DLA7	0.610	0.671	0.605	0.536	0.549	1.000							
DLB2	0.295	0.325	0.293	0.260	0.266	0.266	1.000						
DLB3	0.359	0.395	0.355	0.315	0.323	0.324	0.589	1.000					
DLB4	0.368	0.405	0.365	0.324	0.331	0.333	0.606	0.736	1.000				
DLB5	0.336	0.370	0.333	0.295	0.302	0.303	0.552	0.670	0.689	1.000			
DLP1	0.535	0.589	0.531	0.471	0.481	0.483	0.462	0.561	0.577	0.526	1.000		
DLP2	0.541	0.596	0.537	0.476	0.487	0.489	0.467	0.568	0.583	0.532	0.739	1.000	
DLP3	0.455	0.501	0.451	0.400	0.409	0.411	0.393	0.477	0.491	0.447	0.621	0.628	1.000

4.3.3.2 Measurement Model

The measurement model in the structural equation modelling evaluates how well observed variables (indicators) represent their underlying latent constructs. The graphical output of the measurement model is presented in the figure (4.3).

Figure 4.3: Measurement model



4.3.3.3 Construct reliability

Construct Reliability measures the internal consistency of a set of indicators (items) that form a latent construct. It assesses how well the indicators correlate with each other. Cronbach's Alpha is a measure of internal consistency, indicating how closely related a set of items are as a group. It is also a measure of scale reliability. Alpha values above 0.70 are generally considered good, however, values above 0.6 are considered acceptable for exploratory studies. The results reveal that all the factors have Cronbach's alpha above the threshold level and hence are accepted (table 4.8).

A construct's ability to capture variance from its indicators in relation to the amount of variance caused by measurement error is measured by AVE. Good convergent validity is demonstrated by AVE values above 0.50, which show that the construct explains more than half of the variance of its indicators. The findings show that all construct values above 0.5 indicate acceptable scores.

Table 4.8: Construct reliability and AVE scores

	Cronbach's alpha (standardized)	Cronbach's alpha (unstandardized)
DLA	0.910	0.910
DLB	0.877	0.875
DLP	0.845	0.846

4.3.3.4 Construct Validity

Construct validity ensures that a measurement tool accurately represents the theoretical concept it intends to measure and is essential for reliable research outcomes. It consists of convergent validity, which examines whether indicators of the same construct are strongly correlated, and discriminant validity, which ensures that different constructs are sufficiently distinct. Convergent validity is assessed through factor loadings (≥ 0.7),

Composite Reliability ($CR \geq 0.7$), and Average Variance Extracted ($AVE \geq 0.5$), indicating that indicators effectively measure their intended construct. A construct's ability to capture variance from its indicators in relation to the amount of variance caused by measurement error is measured by AVE. Good convergent validity is demonstrated by AVE values above 0.50, which show that the construct explains more than half of the variance of its indicators. The findings show that all construct values above 0.5 indicate acceptable scores (table 4.9).

Table 4.9: Composite reliability and AVE scores

	Composite reliability (rho_c)	Average variance extracted (AVE)
DLA	0.912	0.630
DLB	0.882	0.646
DLP	0.862	0.668

Discriminant validity, on the other hand, is commonly evaluated using the Heterotrait-Monotrait Ratio (HTMT) and the Fornell-Larcker Criterion. HTMT assesses the degree of similarity between constructs by comparing their correlations, with values ≤ 0.85 or 0.90 suggesting an acceptable level of distinction. If HTMT values are too high, it indicates potential issues with discriminant validity, requiring modifications such as removing overlapping indicators or refining construct definitions. The results of current study show acceptable levels of HTMT scores indicating good distinction among the indicators (Table 4.10).

Table 4.10: HTMT scores

	DLA	DLB	DLP
DLA			
DLB	0.498		
DLP	0.769	0.824	

The Fornell-Larcker Criterion compares the square root of AVE for each construct with its correlation to other constructs, ensuring that a construct shares more variance with its own

indicators than with other constructs. The results of the study reveal that the constructs are valid (table 4.11).

Table 4.11: FL criterion

	DL	DLA	DLB	DLP
DL				
DLA	0.711	0.794		
DLB	0.725	0.516	0.804	
DLP	1.071	0.762	0.776	0.818

4.3.3.5. Model Fit Indices

Model fit indices evaluate how well a proposed model represents the observed data, ensuring that relationships between latent constructs and observed variables are accurate. These indices fall into three categories: absolute fit indices, incremental fit indices, and parsimonious fit indices. Absolute fit indices assess how well the proposed model reproduces the observed data without comparing it to a baseline model. The Chi-Square test (χ^2) measures the difference between observed and expected covariance matrices, where a non-significant p-value ($p > 0.05$) suggests good model fit, though it is highly sensitive to sample size. The analysis showed that $\chi^2 = 4.40$ which is between the acceptable range of 3-5. The Standardized Root Mean Square Residual (SRMR) quantifies the average discrepancy between observed and predicted correlations, with values ≤ 0.08 indicating a good fit. The current model reveals SRMR score of 0.066 which is considered good model fit. The Root Mean Square Error of Approximation (RMSEA) evaluates model fit while considering complexity, with values ≤ 0.06 indicating good fit and ≤ 0.08 considered acceptable; a 90% confidence interval should have a lower bound close to 0 for a well-fitting model. The results for the current model reveal a score of 0.044 which is considered a good model fit.

Incremental fit indices compare the proposed model with a baseline model that assumes no relationships between variables. The Comparative Fit Index (CFI) assesses how well the model improves fit compared to the worst-fitting independent model, where $CFI \geq 0.95$ indicates good fit and ≥ 0.90 is acceptable. The current study has the comparative fit index of 0.926 which is considered acceptable. Similarly, the Tucker-Lewis Index (TLI), also known as the Non-Normed Fit Index (NNFI), adjusts for model complexity by penalizing overly complex models, with values ≥ 0.95 considered good and ≥ 0.90 acceptable. The results of the analysis yielded a TLI score of 0.907 which is acceptable. Further, the Normed Fit Index (NFI) compares the χ^2 value of the proposed model with the null model, where values ≥ 0.90 indicate an acceptable fit, and with a score of 0.911, the current model is considered acceptable (table 4.12).

Table 4.12: Model Fit Indices

ChiSqr/df	RMSEA	GFI	SRMR	NFI	TLI	CFI
4.450	0.044	0.877	0.066	0.911	0.907	0.926

An attempt was done to develop a digital literacy scale with three key dimensions, three literacy levels and 13 items to provide a structured and reliable approach in measuring individuals' competencies in the digital domain (table 4.13).

Table 4.13: Final dimensions and items

Basic level (ICT awareness, information and knowledge) – 4 items
Proficient level (Communication, Usage and creation) – 3 items
Advanced level (Development, analytics and safety) – 6 items

The three levels—Basic, proficient and advanced —capture essential aspects of digital proficiency in terms of ICT awareness, information, knowledge, communication, usage,

creation, development, analytics and safety. Basic technical skills assess an individual's ability to navigate and use digital tools effectively while proficient information literacy evaluates the capacity to search, evaluate, and apply online information critically. Advanced Digital skills examined the ability to interact and collaborate in digital environments like developing, analysing, safety and security aspects. A well-validated digital literacy scale can serve as a valuable tool for researchers, educators, and policymakers to assess digital competence, identify gaps, and develop targeted interventions to enhance digital skills in various populations.

Summary

Chapter four arrived at a conceptual framework for Digital literacy. Based on the variables identified in the digital literacy framework by the DiGiComp, and the literature review, an attempt was made to define, develop and validate scale for digital literacy. The scale that was developed was validated through the exploratory factor analysis. Further, confirmatory factory analysis was conducted to confirm the final items. Reliability, convergent and discriminant validity was checked using appropriate statistical analysis. In addition, Goodness of fit index also established that the model was acceptable. Descriptive Statistics and hypothesis testing for all the three studies are presented in the next chapter.

Chapter 5

Data Analysis

The data analysis chapter presents the procedures and techniques used to examine the data collected to address the research objectives. The scale development was presented in the previous chapter. This presents the testing of the hypotheses and analysing the results. It begins with data screening, cleaning, coding, including checks for missing values, outliers, and normality to confirm that the dataset is suitable for further statistical testing. Further, the demographic profile of the entrepreneurs and the enterprises is presented in the form of frequencies and percentages to gauge the sample distribution of key characteristics, such as age, gender, education level, business experience, MSME sector, and firm type. Statistical tests to verify the sample adequacy, data distribution along with measures of central tendency and factor analysis are explained in *section one*. The chapter then proceeds to *section two*, wherein the analysis of quantitative data collected from the entrepreneurs in the three studies is presented.

In *study 1* the factual data is analysed through PLS SEM to determine the effect of gender, location, education qualification, and MSME sector on the Digital divide prevalent among the MSMEs. *Study 2* deals with development of digital literacy scale and assessment of digital literacy among the entrepreneurs. While the scale development part has been covered in chapter 4, this chapter covered the assessment of digital literacy. The data collected was analysed using Microsoft Excel and SPSS 25 Version, where descriptive statistics such as frequencies, percentages, and means, were used to summarize the respondents' digital literacy levels.

Additionally, sector and gender wise digital assessment is presented. Finally, *study 3* attempted to determine the effect of digital divide, digital literacy and education qualification on the digital adoption among the MSMEs by analysing the data through CB-SEM. The measurement model and the structural model obtained through analysis were presented thereafter in this chapter.

Section 1

5.1 Demographic profile

Analysis of demographic profile provides insights into the composition of the sample gaining an understanding of background of respondents and the nature of their businesses thus, ensuring a comprehensive portrayal of the entrepreneurial landscape and allowing for meaningful interpretations. Additionally, demographic profiling aids in identifying potential patterns or trends that may influence the study's findings, contributing to a more nuanced analysis of digital literacy, digital divide and digital adoption among entrepreneurs.

The analysis of data consisting 410 samples for the study, reveals that the majority of respondents are male (68.5%), while females make up 31.5% of the sample (table 5.1). This percentage is in accordance with the national statistics of gender ratio among the MSMEs and as such was not a resultant of sampling error. In terms of age distribution, most participants fall within the 31-50 age group (59%), followed by those above 51 years (21%), and 18-30 years (20%), indicating that middle-aged individuals represent a majority of entrepreneurs. Regarding education qualification, most of the respondents hold a graduate or postgraduate degree (40.7%), while 28.3% have completed education up to the intermediate level (10+2), and 21% have pursued studies beyond the postgraduate level. A small percentage (10%) have education below the 10th grade. Examining the roles within enterprises, entrepreneurs make up the largest group (61.2%), followed by managers or employees (30.5%), while partners account for 8.3%.

Table 5.1: Entrepreneur Profile

Description	Total number	Percentage
Gender:		
• Female	129	68.5
• Male	281	31.5
Age:		
• 18-30	82	20%
• 31-50	242	59%
• Above 51	90	21%
Education:		
• Below 10 th	10	10%
• 10 th - intermediate	116	28.3%
• Graduate – post graduate	167	40.7%
• Above post graduate	86	21%
Role		
• Entrepreneur	251	61.2%
• Partner	34	8.3%
• Manager/employee	125	30.5%

The demographic distribution of enterprises provides valuable insights into their sector, location, registration status, and ownership structure (Table 5.2). The results revealed that the majority of businesses operate in the services sector (45.3%), followed by manufacturing (38%), while trading (9.8%) and other sectors (6.3%) represented a smaller portion of the sample. It was observed during data collection that the enterprises under ‘others’ were usually

comprised of a mix of two or more sectors like manufacturing and trading or manufacturing and services. In terms of location, urban-based enterprises make up 56.7%, while town-based businesses account for 27.1%, and rural enterprises constitute 16.3%, reflecting a higher concentration of businesses in urban areas. Regarding MSME registration, 65.5% of businesses were registered, while 30.6% remain unregistered, and 3.9% of respondents were unsure about their registration status, highlighting a significant portion of informal businesses. Ownership patterns revealed that single proprietorships dominate (67.8%), followed by partnerships (21%) and private limited companies (8.5%), with 2.7% falling under other ownership structures. These statistics provide a comprehensive overview of the business landscape, helping to contextualize further analysis.

Table 5.2 Enterprise Profile

Description	Total number	Percentage
Sector:		
• Manufacturing	156	38%
• Services	188	45.3%
• Trading	40	9.8%
• others	26	6.3%
Location:		
• Urban	230	56.7%
• Rural	66	16.3%
• Town	110	27.1%
MSME registration:		
• Registered	268	65.5%
• Unregistered	125	30.6%
• Don't Know	16	3.9%

Ownership of business		
• Single proprietor	278	67.8%
• Partnership	86	21%
• Pvt Limited	35	8.5%
• others	11	2.7%

5.2 Descriptive Statistics

Descriptive statistics provide a summary of the data by organizing, presenting, and analysing key characteristics in a meaningful way. They help in understanding the overall distribution of responses, identifying patterns, and offering insights into the dataset. Additionally, measures of central tendency, including mean, median, and mode, indicate the average or most common values in the dataset, while measures of dispersion, such as standard deviation and range, help assess the variability within the data. Descriptive statistics are crucial part of data analysis as they provide a clear overview of the dataset before moving into more complex inferential analyses.

The descriptive statistics provided key insights into the distribution and characteristics of digital divide, digital literacy (basic, proficient, and advanced), and digital adoption among the respondents as shown in table 5.3. The sample size (N) for each variable after data cleaning and removing outliers was 410, ensuring a consistent dataset for analysis. The mean values indicated that digital literacy (basic) and digital adoption have the highest average scores (4.12 and 4.08, respectively), suggesting a strong presence of basic digital skills and adoption of digital tools among the entrepreneurs. Further, digital divide with a mean of 3.92, reflected moderate disparities in access or usage of digital technologies, while digital literacy both proficient and advanced, have lower means (3.51 and 2.72), indicating that fewer entrepreneurs

possess higher levels of digital skills. The median values closely align with the means, reinforcing the central tendency of the data.

The standard deviations revealed that digital literacy (advanced) and digital literacy (proficient) exhibit the highest variability (1.05 and 1.01, respectively), suggesting significant differences in entrepreneur's skill levels. In contrast, digital divide, digital literacy (basic), and digital adoption showed lower standard deviations (0.696, 0.691, and 0.707, respectively), indicating more consistency in responses. The skewness values were all negative, suggesting that the data distribution is slightly left-skewed and deviated from normal distribution. Further, it also meant more respondents reported higher digital literacy and adoption levels. Digital adoption (-0.908) and digital literacy (basic) (-0.868) exhibit the most pronounced negative skewness, indicating a higher concentration of respondents with basic digital literacy and adopting digital technology. The kurtosis values further describe the shape of the distributions, with digital adoption (1.78) showing a more peaked distribution, whereas digital literacy (advanced) (-0.987) has a more flattened distribution, indicating a wider spread of responses.

The descriptive statistics highlight that while basic digital literacy and digital adoption are relatively high and consistent across respondents, proficiency and advanced skills exhibit greater variability.

Table 5.3 Descriptive statistics for the constructs

Descriptive Measures	Digital Divide	Digital Literacy (basic)	Digital Literacy (Proficient)	Digital Literacy (Advanced)	Digital Adoption
N	410	410	410	410	410
Mean	3.92	4.12	3.51	2.72	4.08

Median	4	4.2	3.67	2.86	4
Standard deviation	0.696	0.691	1.01	1.05	0.707
Variance	0.484	0.477	1.03	1.09	0.5
Skewness	-0.603	-0.868	-0.557	-0.184	-0.908
Std. error skewness	0.121	0.121	0.121	0.121	0.121
Kurtosis	-0.00173	0.622	-0.322	-0.987	1.78
Std. error kurtosis	0.24	0.24	0.24	0.24	0.24

5.3 Sample adequacy

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy yielded a score of 0.920 (table 5.4), which was above the threshold level of 0.6. A KMO value above 0.9 indicated an excellent sample size and sufficient correlations among variables for factor analysis.

Bartlett's Test of Sphericity examines whether the correlation matrix is significantly different from an identity matrix, meaning it checks if there are significant relationships between the variables. The Chi-Square value is 8092.670, with 351 degrees of freedom (df), and p (Sig) value is 0.000, which is highly significant ($p < 0.05$). This indicated that the correlation matrix is not random and that factor analysis is appropriate. Thus, these results confirmed that the dataset is well-suited for factor analysis, with strong correlations among variables and adequate sample size.

Table 5.4: Test for sample adequacy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.920
Bartlett's Test of Sphericity	Approx. Chi-Square	8092.670
	df	351
	Sig.	0.000

5.4 Normality Test

The Tests of Normality (table 5.5) presents results from the Kolmogorov-Smirnov (K-S) test and the Shapiro-Wilk (S-W) test, both of which are used to assess normality of the dataset. The results indicated that for all variables, both tests yielded statistically significant p-values (Sig. = 0.000), which are below the 0.05 threshold, confirming that the data significantly deviates from normality. The K-S statistics range from 0.303 to 0.365, while the Shapiro-Wilk statistics were notably low (0.674 to 0.845), further supporting non-normality.

Table 5.5: Test for normality

Tests of Normality				
	Kolmogorov-Smirnov^a	Shapiro-Wilk		

	Statistic	df	Sig.	Statistic	df	Sig.
DD3	0.327	406	0.000	0.713	406	0.000
DD4	0.365	406	0.000	0.674	406	0.000
DD5	0.314	406	0.000	0.788	406	0.000
DD6	0.343	406	0.000	0.795	406	0.000
DD7	0.303	406	0.000	0.845	406	0.000
DD8	0.280	406	0.000	0.858	406	0.000
DLB1	0.260	406	0.000	0.758	406	0.000
DLB2	0.263	406	0.000	0.720	406	0.000
DLB3	0.303	406	0.000	0.783	406	0.000
DLB4	0.321	406	0.000	0.804	406	0.000
DLB5	0.335	406	0.000	0.787	406	0.000
DLP1	0.280	406	0.000	0.863	406	0.000
DLP2	0.242	406	0.000	0.888	406	0.000
DLP3	0.339	406	0.000	0.804	406	0.000
DLA1	0.217	406	0.000	0.864	406	0.000
DLA2	0.265	406	0.000	0.827	406	0.000
DLA3	0.266	406	0.000	0.849	406	0.000
DLA4	0.253	406	0.000	0.853	406	0.000
DLA5	0.281	406	0.000	0.831	406	0.000
DLA6	0.310	406	0.000	0.814	406	0.000
DLA7	0.319	406	0.000	0.823	406	0.000
DAI1	0.313	406	0.000	0.746	406	0.000
DAI2	0.264	406	0.000	0.809	406	0.000

DAI3	0.296	406	0.000	0.809	406	0.000
DAI4	0.275	406	0.000	0.824	406	0.000
a. Lilliefors Significance Correction						

5.5. Factor Analysis

Factor analysis is a statistical technique used to identify underlying latent variables (factors) that explain the correlations among observed variables. It helps in data reduction and structure detection by grouping related variables into meaningful factors.

The first factor has the highest eigenvalue of 11.083, explaining 41.049% of the total variance. The second factor explains an additional 13.375%, bringing the cumulative variance explained to 54.424%. The third, fourth, and fifth factors explain 5.568%, 4.470%, and 3.966%, respectively, resulting in a cumulative variance of 68.428% before rotation. Only the five factors with eigenvalues greater than 1 are retained as per Kaiser's Criterion. The remaining components have eigenvalues below 1, suggesting they contribute minimal variance and were thus excluded from further analysis.

Rotation improves factor interpretability and the variance is more evenly distributed across the factors. After varimax rotation, each factor's contribution was 23.578%, 22.448%, 13.359%, to 4.807% and 4.237% respectively, maintaining the cumulative variance explained at 68.428%. These results suggest that the dataset can be effectively reduced to five key factors, which together account for a significant portion of the variance. Further, the first factor contributes to 23.578 % which is less than 50%, thus signifying that there is no common method bias due to sampling errors (Harman's Single factor test).

Table 5.6: factor analysis

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.083	41.049	41.049	11.083	41.049	41.049	6.366	23.578	23.578
2	3.611	13.375	54.424	3.611	13.375	54.424	6.061	22.448	46.026
3	1.503	5.568	59.992	1.503	5.568	59.992	3.607	13.359	59.384
4	1.207	4.470	64.462	1.207	4.470	64.462	1.298	4.807	64.191
5	1.071	3.966	68.428	1.071	3.966	68.428	1.144	4.237	68.428
6	0.960	3.554	71.982						
7	0.859	3.182	75.164						
8	0.694	2.569	77.733						
9	0.652	2.413	80.146						
10	0.584	2.162	82.308						
11	0.534	1.977	84.285						
12	0.463	1.715	86.001						
13	0.434	1.606	87.607						
14	0.392	1.452	89.058						
15	0.376	1.393	90.451						
16	0.320	1.185	91.636						
17	0.300	1.109	92.745						
18	0.272	1.008	93.753						
19	0.263	0.972	94.726						
20	0.239	0.884	95.610						
21	0.222	0.823	96.432						
22	0.196	0.725	97.158						
23	0.182	0.675	97.833						
24	0.157	0.583	98.416						
25	0.156	0.579	98.994						
26	0.141	0.522	99.516						
27	0.131	0.484	100.000						

The Rotated Component Matrix given in the table 5.7 presents the factor loadings of each observed variable on the five extracted factors after applying Varimax rotation in Principal Component Analysis (PCA). The first component, Digital Literacy Advanced level (DLA), comprises variables that measure an entrepreneur's advanced level digital competency in using

digital tools, platforms, and their applications in business operations. The high factor loadings for DLA1 (0.783), DLA2 (0.800), DLA3 (0.833), DLA4 (0.808), DLA5 (0.821), DLA6 (0.685), and DLA7 (0.710) suggest that this component captures the advanced digital literacy levels of MSME entrepreneurs. The second component, Digital Literacy Basic Skills (DLB), consists of fundamental digital competencies required to operate in a digitally evolving business environment. Variables such as DLB1 (0.605), DLB2 (0.681), DLB3 (0.736), DLB4 (0.732), and DLB5 (0.617) highlight the ability of entrepreneurs to perform basic tasks such as using the internet, computer and smart phones for business purposes. The third component, Digital Adoption Intention (DAI), includes DAI1 (0.829), DAI2 (0.762), DAI3 (0.762), and DAI4 (0.682), emphasizing the entrepreneur's readiness and willingness to adopt digital technologies. The fourth component, Digital Literacy Proficiency level (DLP), consists of intermediate-level digital skills that bridge the gap between basic literacy and advanced competencies. DLP1 (0.578), DLP2 (0.687), and DLP3 (0.634) show the entrepreneur's ability to perform tasks such as using social media, ecommerce platforms etc for their business. The fifth component, Digital Divide (DD), captures disparities in digital access, resources, and skills among entrepreneurs. Variables such as DD1R (0.828), DD2R (0.508), DD3 (0.534), DD4 (0.677), DD5 (0.774), DD6 (0.754), DD7 (0.701), and DD8 (0.589) reflect challenges such as lack of digital infrastructure, affordability issues, and limited digital training opportunities

The values indicated the strength of the association between a variable and a given factor. Higher loadings (≥ 0.4) suggest that the variable contributes significantly to that factor. Further, the absence of strong cross-loadings reveals a well-structured factor solution, confirming that the extracted components effectively represent distinct dimensions of digital literacy, digital divide and digital adoption.

Table 5.7: Principal component matrix after rotation

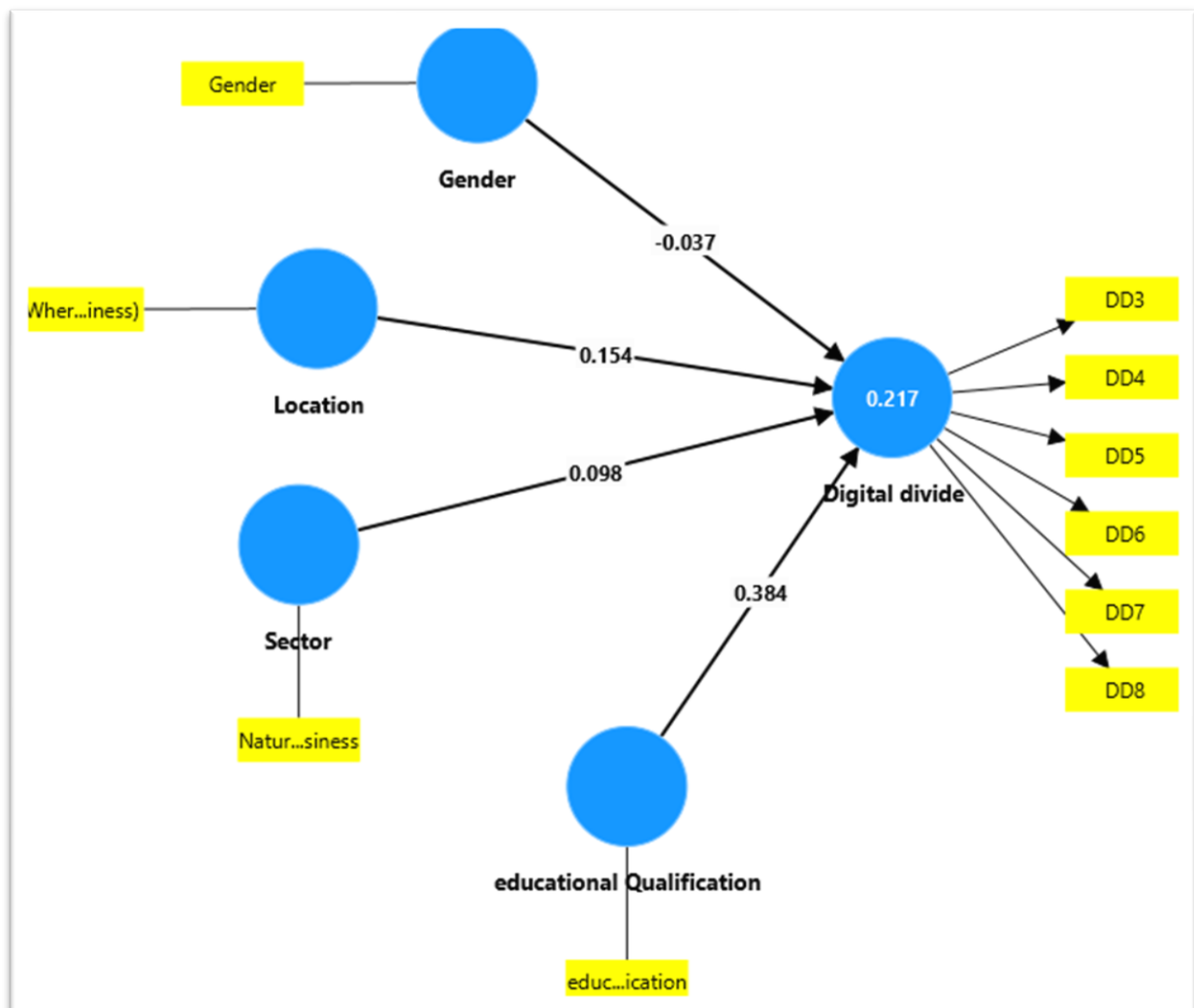
Rotated Component Matrix^a					
	Component				
	1	2	3	4	5
DD1R					0.828
DD2R					0.508
DD3					0.534
DD4					0.677
DD5					0.774
DD6					0.754
DD7					0.701
DD8					0.589
DLB1		0.605			
DLB2		0.681			
DLB3		0.736			
DLB4		0.732			
DLB5		0.617			
DLP1				0.578	
DLP2				0.687	
DLP3				0.634	
DLA1	0.783				
DLA2	0.800				
DLA3	0.833				
DLA4	0.808				
DLA5	0.821				
DLA6	0.685				
DLA7	0.710				
DAI1			0.829		
DAI2			0.762		
DAI3			0.762		
DAI4			0.682		
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					

Section 2

5.6 Study 1

The study aimed to examine how gender, educational qualification, location, and MSME sector influence the digital divide among entrepreneurs. By analysing these demographic and enterprise-related factors, the research sought to understand disparities in digital access. To this extent, the quantitative data was analysed using PLS SEM in Smart PLS to obtain the results and test the hypotheses. The graphical output shown in figure 5.1 presents the structural model. The path coefficients of the model (table 5.8) signify the parameter estimates of each relationship. The construct reliability (Cronbach's $\alpha = 0.825$) and convergent validity by the way of AVE scores (0.551) are presented in the table 5.9. Since both the values are above threshold level; the construct is considered reliable and valid.

Figure 5.1 Graphical output of Digital Divide



The path coefficients (table 5.8) indicate that educational qualification has the strongest influence on the digital divide, with a path coefficient of 0.384. This suggests that individuals with lower educational qualifications are more likely to experience digital disparities. Further, location also plays a significant role, with a path coefficient of 0.154 indicating that people living in rural or less developed areas are more likely to face digital exclusion. The sector of in which the enterprise operates has a moderate effect (0.098), implying that digital access varies across different industries. Some sectors, such as IT or finance, may provide better digital resources and training, while others, like agriculture or traditional manufacturing, may have

fewer opportunities for digital engagement. Finally, gender has a minimal negative impact (-0.037), meaning that gender differences in digital access are relatively small. The negative coefficient suggests that as the gender variable increases, the digital divide slightly decreases. However, the effect size is very small, indicating that gender is not a major determinant of the digital divide in comparison to education or location.

Table 5.8 Path coefficients

Relationship	Path coefficients
Gender -> Digital divide	-0.037
Location -> Digital divide	0.154
Sector -> Digital divide	0.098
educational Qualification -> Digital divide	0.384

Table 5.9 Construct reliability and AVE scores

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Digital divide	0.825	0.878	0.875	0.551

The model fit indices for both the saturated model and the estimated model (table 5.10) provide an overall fitness of the structural equation model in PLS-SEM. The Standardized Root Mean Square Residual (SRMR) value of 0.080 is within an acceptable range (≤ 0.08), suggesting a moderate model fit. The d_ULS (Unweighted Least Squares Discrepancy) and d_G (Geodesic Discrepancy) values are very close between the saturated and estimated models (0.351 vs. 0.352 and 0.134 vs. 0.134, respectively), indicating stability in the model. The Chi-square

values (331.854 for the saturated model and 332.526 for the estimated model) are comparable, further supporting model consistency. The Normed Fit Index (NFI) values (0.764 for the saturated model and 0.763 for the estimated model) suggested a moderately good model fit.

Table 5.10 Model Fit Indices for digital Divide

	Saturated model	Estimated model
SRMR	0.080	0.080
d_ULS	0.351	0.352
d_G	0.134	0.134
Chi-square	331.854	332.526
NFI	0.764	0.763

5.6.1 Hypothesis testing

Hypothesis wise analysis and results obtained in the structural equation model for study 1 is presented below.

H₁: Gender has a significant effect on the digital divide among the MSMEs.

The given hypothesis has a negative path coefficient of -0.037 (table 5.8), indicating an inverse relationship between gender and the digital divide. It suggests that gender has a statistically significant impact on the digital divide, albeit with a small effect size. A negative path coefficient suggests that as the value of the independent variable (gender) increases, the dependent variable (Digital Divide) tends to decrease. In practical terms, this could imply that a specific gender (e.g., females) experiences a lower digital divide compared to the other, or

vice versa. Even though the effect size (-0.037) is relatively small, the significance of results suggested that gender differences play a role in digital inclusion or exclusion, aligning with previous research on gender disparities in digital access (Sanchez & Morales, 2023). In the context of MSME entrepreneurs, this finding aligns with existing research demonstrating that female entrepreneurs faced unique challenges in digital adoption. Women-led businesses often encounter barriers such as lower access to digital resources, limited technical training, and socio-cultural constraints that widen the digital divide (Rathi et al., 2024). Moreover, the small effect size (-0.037) suggests that while gender differences exist, other structural factors play a more dominant role in influencing digital adoption among MSMEs. Factors such as education, firm size, industry type, location (urban vs. rural), and access to financial resources may have a considerable impact on the digital divide than gender alone.

H2: Line of business operations (MSME sector) has a significant impact on digital divide among the MSMEs.

The positive path coefficient (0.098) (Table 5.8) between sector and the digital divide in the PLS-SEM model suggests that the type of MSME sector has a statistically significant impact on the extent of the digital divide among entrepreneurs. It implies that certain sectors face a greater digital divide than others, which can be attributed to differences in technology accessibility, digital literacy, infrastructure availability, and industry-specific digital requirements. MSME entrepreneurs operate in diverse sectors such as manufacturing, services, and trading, each of which has different levels of digital integration and dependency thus significantly impacting the digital divide. For instance, the manufacturing sector relies heavily on automation, digital tracking, and online procurement systems, yet many small manufacturers struggle with financial constraints, limited digital infrastructure, and a lack of skilled workforce, contributing to a higher digital divide. Similarly, the services sector,

encompassing IT, healthcare, finance, and hospitality, tends to have greater digital adoption due to its reliance on digital communication, transactions, and online platforms. However, traditional service providers, particularly in rural areas, may still experience digital access gaps. This difference also explains the significant yet a small effect size of the impact of sector on digital divide.

H3: Location of the MSMEs has a significant impact on the digital divide among the MSMEs.

The positive path coefficient (0.154) between location and the digital divide in the PLS-SEM model suggests that the geographical location of MSMEs plays a significant role in digital accessibility and adoption. The variation in digital access across urban, rural, and semi-urban (town) locations influences the extent to which businesses can integrate technology into their operations, thus leading to digital inequality or digital divide. The path coefficient indicates a moderate relationship, emphasizing that location-based disparities significantly affect digital divide. This result aligns with existing research highlighting the urban-rural digital gap, where urban MSMEs are better equipped to leverage digital tools for business operations, marketing, and financial transactions, whereas rural businesses struggle with digital integration due to socio-economic and infrastructural limitations.

Prior research acknowledged that urban MSMEs typically benefit from better digital infrastructure, high-speed internet connectivity, access to financial and technical resources, and greater exposure to digital tools and platforms, leading to a lower digital divide. Conversely, rural MSMEs face significant challenges such as poor internet connectivity, lack of digital literacy, limited access to digital financial services, and inadequate technical support, exacerbating the digital divide. Even though semi-urban MSMEs (town-based businesses) have

relatively better access than rural areas, they still encounter infrastructural gaps, inconsistent internet availability, and limited awareness regarding digital adoption.

H4: Education qualification (literacy level) of the entrepreneur has a significant impact on the digital divide among the MSMEs.

The positive path coefficient (0.384) between educational qualification and the digital divide in the PLS-SEM model indicated a strong and significant relationship, emphasizing that the literacy level of MSME entrepreneurs plays a crucial role in determining their level of digital access. A higher education qualification generally correlates with better digital literacy, greater awareness of digital tools, and a higher likelihood of integrating technology into business operations. This finding aligns with indicating that entrepreneurs with higher education are better equipped to navigate digital transformation, access online financial services, and utilize digital platforms to expand their businesses. On the other hand, MSME owners with limited formal education may lack confidence in using technology, have minimal exposure to digital tools, and be resistant to digital adoption due to fear of cybersecurity risks or operational complexities (Hashim et al., 2022)

The four hypotheses examining the impact of gender, location, sector and education qualification on the digital divide concluded study 1. The summary is given in the table 5.11.

Table 5.11: Study 1 hypothesis decision

SR No	Hypothesis	Path coefficient	decision
H1	Gender has a significant effect on the digital divide among the MSMEs.	-0.037	Supported

H2	Line of business operations (MSME sector) has a significant impact on digital divide among the MSMEs.	0.098	Supported
H3	Location of the MSMEs has a significant impact on the digital divide among the MSMEs.	0.154	Supported
H4	Education qualification (literacy level) of the entrepreneur has a significant impact on the digital divide among the MSMEs.	0.384	Supported

5.7 Study 2

The analysis in this study provided insights into key dimensions of digital literacy, helping to identify trends and variations among participants. It intends to offer a clear and comprehensive understanding of digital literacy levels among respondents, forming the basis for further interpretation and discussion. The data collected from the respondents were collected and analysed item wise to gather insights which are discussed in this study.

5.7.1 Basic level Digital literacy

The descriptive statistics for digital literacy among MSME entrepreneurs indicate a high level of self-reported digital competence, particularly in '*searching for information through ICT devices*' (Mean = 4.32, SD = 0.755), which has the highest mean score among the statements (table 5.12). This suggests that most entrepreneurs feel confident in using their digital devices

to access business-related information. The negative skewness (-1.529) and high kurtosis (3.775) indicate that responses are clustered toward the higher end of the scale, suggesting a strong agreement among respondents.

Similarly, ‘*the ability to download apps and content for business purposes*’ (Mean = 4.10, SD = 0.811) shows a high level of digital adoption, though with slightly lower skewness (-0.959) and kurtosis (0.858) compared to information searching. Entrepreneurs also report a good understanding of ‘*following digital instructions for downloading and operating apps*’ (Mean = 3.95, SD = 0.934), with negative skewness (-1.033) and moderate kurtosis (0.819), indicating that while most respondents find it easy to follow digital instructions, there is some variation in responses.

Finally, ‘*the use of social media for acquiring information*’ (Mean = 3.95, SD = 0.941) has a negative skewness (-1.190) and kurtosis (1.384), reflecting that the entrepreneurs are comfortable using digital platforms like social media for business insights, but there is variation in digital skills among them. Overall, the results indicate a high level of basic digital literacy, with most entrepreneurs demonstrating confidence in accessing information, using apps, and leveraging social media for business purposes. However, the presence of negative skewness across all items suggests that some entrepreneurs are still not competent to access the digital technologies available.

Table 5.12: Item-wise analysis for basic level of digital literacy

Statement	Mean	Std. Deviation	Skewness	Kurtosis

	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
I can search information through my ICT device	4.32	.755	-1.529	.121	3.775	.240
I can download app sand content for my business through my ICT device	4.10	.811	-.959	.121	.858	.240
I can follow digital instructions for downloading and operation apps that are useful for my business	3.95	.934	-1.033	.121	.819	.240
I can use social media to get information	3.95	.941	-1.190	.121	1.384	.240

5.7.2 Proficient level digital Literacy

The descriptive statistics highlight varying levels of digital literacy among MSME entrepreneurs, particularly in *information searching, digital content creation, and technology integration in business operations* (table 5.13). The highest mean score (Mean = 4.32, SD = 0.755) is observed for the '*ability to search for information through ICT devices*', indicating that entrepreneurs are highly confident in leveraging digital tools for accessing relevant business-related content. The strong negative skewness (-1.529) and high kurtosis (3.775)

suggest that responses are concentrated at the higher end, with a majority expressing strong agreement with this statement.

In contrast, '*the ability to create digital content for business promotion*' (Mean = 3.23, SD = 1.254) has a lower mean score, reflecting a relatively lower level of confidence in using digital marketing tools such as Facebook pages, Instagram ads, and Google AdWords. The skewness (-0.285) is closer to zero, indicating a more even distribution of responses, while the negative kurtosis (-1.078) suggests that responses are spread out, indicating variation in digital marketing proficiency among MSME entrepreneurs.

The *use of technology across different business functions* (Mean = 3.75, SD = 1.062) shows moderate digital adoption, with negative skewness (-1.086) and positive kurtosis (0.669), implying that most respondents use technology for business purposes, but there are some variations in adoption levels. While many entrepreneurs integrate technology into their operations, some still face challenges in adopting digital tools for different operations in the enterprise. In conclusion, the results suggest that while MSME entrepreneurs demonstrated strong digital literacy in searching for information, their ability to create digital content for business promotion is relatively weaker.

Table 5.13: Item-wise analysis for proficient level of digital literacy

Statement	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
I can search information through my ICT device	4.32	.755	-1.529	.121	3.775	.240
I can create digital content for my business promotion (eg: direct	3.23	1.254	-.285	.121	-1.078	.240

email, Fb page, Instagram ad, adwords)						
I use technology for different aspects in my business (machinery, accounts, communication etc)	3.75	1.062	-1.086	.121	.669	.240

5.7.3 Advanced level Digital Literacy

The descriptive statistics provide insight into the advanced digital skills of MSME entrepreneurs, highlighting areas of proficiency and gaps in digital literacy (table 5.14). The ‘*ability to use advanced software and applications for business*’ has a mean score of 2.91 (SD = 1.353), suggesting that entrepreneurs have limited proficiency in utilizing specialized software tools. The negative skewness (-0.188) indicates a slight leaning toward agreement, while the negative kurtosis (-1.408) reflects a broad range of responses, implying considerable variation in skill levels across the sample.

Similarly, ‘*the ability to analyse business data*’ is reported at a low mean of 2.85 (SD = 1.348), further emphasizing a lack of data literacy skills among MSME entrepreneurs. The negative skewness (-0.135) suggests a fairly even distribution of responses, while the negative kurtosis (-1.425) indicates that responses are widely dispersed, meaning that some entrepreneurs possess data analysis skills while many others lack them.

Notably, ‘*knowledge of web development and programming languages*’ has the lowest mean score (2.27, SD = 1.184), with a positive skewness (0.639) suggesting that most responses are concentrated towards the lower end, indicating very limited expertise in coding or web development. Additionally, the negative kurtosis (-0.804) shows a more even spread of responses, implying variability in skill levels across different entrepreneurs.

Conversely, ‘*knowledge of web security and data privacy*’ is slightly higher, with a mean of 3.02 (SD = 1.301). The negative skewness (-0.445) suggests a moderate inclination towards agreement, but the negative kurtosis (-1.283) shows that responses are fairly dispersed, indicating differences in cybersecurity awareness among entrepreneurs.

Lastly, ‘*formal training in digital technologies and IT*’ has a mean score of 3.12 (SD = 1.283), implying that some entrepreneurs have received digital training, but overall proficiency remains limited. The negative skewness (-0.476) shows a slight lean towards agreement, while the negative kurtosis (-1.175) indicates wide variation in the level of formal IT education among respondents. The findings suggest that while MSME entrepreneurs possess some knowledge of web security and have received digital training to some extent, their proficiency in advanced digital skills such as programming, data analysis, and using specialized software remains quite low.

Table 5.14: Item-wise analysis for Advanced level of digital literacy

Statement	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
I used advanced software and apps for my business	2.91	1.353	-.188	.121	-1.408	.240
I can analyse data for my business	2.85	1.348	-.135	.121	-1.425	.240
I have knowledge of web masters and or programming language	2.27	1.184	.639	.121	-.804	.240
I have knowledge of web security and data privacy	3.02	1.301	-.445	.121	-1.283	.240
I have formal training in digital technologies and IT.	3.12	1.283	-.476	.121	-1.175	.240

5.7.4 Sector wise Digital literacy assessment

The data was analysed to provide valuable insights into the digital literacy levels of male and female MSME entrepreneurs in the manufacturing and service sector, categorized into basic, proficient, and advanced levels. The analysis highlighted gender-based differences in digital capabilities and the extent to which entrepreneurs in these sectors adopted digital tools.

The analysis was done in excel by ranking the data. Scores were given to each response based on the original coding (strongly disagree to strongly agree from 1-5). These scores were categorised into ranks by adding them in each literacy level. For instance, there are 4 items in basic level and the scores range from 4 to 20, where 4 is the minimum score and 20 being the maximum score. The score thus obtained is converted into percentage and ranked from very bad to very good.

For example, if a respondent ticked the answers of 4 items in basic level as - agree, agree, neither agree nor disagree and disagree, he/she will get a score of 4, 4, 3, and 2 respectively, making a total of 12 out of 20 (maximum score). This comes to be 60% score. Based on the percentage the respondents were categorised under 5 levels: Very good (80-100%), good (60-80%), moderate (40-60%), bad (20-40%) and very (0-20%). Hence, the respondent would be categorised as having ‘good’ skills in basic literacy level. Based on the percentage the respondent scores, the ranking from *Very bad* to *Very good* was assigned and the total number of respondents in each rank was calculated to assess the digital literacy skills among the entrepreneurs. The analysis below attempted to explore the literacy levels of male and female entrepreneurs in manufacturing and service sectors.

5.7.4.1 Manufacturing Sector

Male Entrepreneurs in Manufacturing

Among male entrepreneurs (table 5.15), basic digital literacy appeared relatively strong, with 61% scoring in the 80-100% (Very Good) range, indicating that a majority of them have mastered fundamental digital skills such as searching for information, using basic applications, and operating ICT devices efficiently. Only 2% fall in the 20-40% (Bad) category, suggesting that very few struggle with foundational digital knowledge.

However, when it comes to proficient level digital literacy, which includes skills such as downloading and using business-related apps or navigating digital platforms effectively, there is a noticeable gap. While 40% fall in the 60-80% (Good) category, a combined 20% are in the Bad and Very Bad categories. This suggests that while many male entrepreneurs can use digital tools at a functional level, a significant proportion still faces challenges in more advanced digital tasks that require greater proficiency.

Similarly, at the advanced digital literacy level, the majority (47%) of male entrepreneurs fall in the low to moderate range (0-60%), indicating limited adoption of advanced digital tools such as data analytics, web security, programming, or the use of specialized software. Only 2% score in the Very Good (80-100%) category, highlighting that most MSME entrepreneurs were not using digital technologies to their optimum potential.

Female Entrepreneurs in Manufacturing

The digital literacy levels of female entrepreneurs in the manufacturing sector presented a different pattern. Interestingly, none of the female respondents fall in the 0-20% (Very Bad) category for basic digital literacy, suggesting that most women entrepreneurs possess at least some level of digital knowledge. However, only 38% reach the Very Good category (80-100%), compared to 61% of men, indicating that fewer women have mastered basic digital skills.

When examining proficient digital literacy, 22% of female entrepreneurs fall in the Very Bad and Bad categories (0-40%), demonstrating a more significant skill gap in digital proficiency compared to their male counterparts. However, 28% score in the Good (60-80%) category, showing that some women have managed to develop intermediate digital skills, though they still lag behind men in this area.

At the advanced digital literacy level, the disparity became even more evident. Only 3% of female entrepreneurs achieved a Very Good rating, while 50% score in the 0-40% range, indicating a significant lack of expertise in advanced digital tools such as data analytics, web security, and specialized software applications. These findings suggested that many women entrepreneurs in manufacturing struggle with the adoption of complex digital technologies, limiting their ability to leverage digital solutions for business growth and competitiveness.

The findings reveal several important patterns regarding digital literacy among male and female MSME entrepreneurs in the manufacturing sector. First, male entrepreneurs tend to exhibit stronger digital literacy across all three levels compared to female entrepreneurs, particularly in proficient and advanced digital skills. While women demonstrate a reasonable grasp of basic digital literacy, a significant proportion faces challenges with higher levels of digital proficiency and advanced applications. Further, the data highlights a clear gap in advanced digital literacy for both genders, suggesting that many MSME entrepreneurs have yet to fully integrate digital tools into their business operations. This limitation can hinder business efficiency, innovation, and competitiveness, especially in an era where digital transformation is crucial for business sustainability.

Table 5.15: Digital Literacy in Manufacturing sector

Sector	Gender		Digital literacy level basic	Digital literacy level Proficient	Digital literacy level Advanced
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		Digital literacy level (percentage)	Respondents for each category	Proficiency level wise percentage of sample	Respondents for each category	Proficiency level wise percentage of sample	Respondents for each category	Proficiency level wise percentage of sample
Manufacturing	male							
		0-20(Very Bad)	0	0%	6	5%	29	23%
		20-40(Bad)	3	2%	19	15%	30	24%
		40-60(Moderate)	10	8%	31	25%	29	23%
		60-80(Good)	35	28%	49	40%	33	27%
		80-100(very Good)	76	61%	19	15%	3	2%
		Total Sample	124	100%	124	100%	124	100%
Manufacturing	female	0-20(Very Bad)	0	0%	2	6%	8	25%
		20-40(Bad)	0	0%	7	22%	8	25%
		40-60(Moderate)	6	19%	7	22%	5	16%
		60-80(Good)	14	44%	9	28%	10	31%
		80-100(very Good)	12	38%	7	22%	1	3%
		Total Sample	32	100%	32	100%	32	100%

5.7.4.2 Service Sector

The data on digital literacy levels among male and female entrepreneurs in the services sector was analysed to reveal key insights into the extent of digital skills at different proficiency levels. The findings highlight both gender-based and skill-level disparities, providing a clearer picture of digital competencies (table 5.16).

Male Entrepreneurs in the Services Sector

Among male entrepreneurs in the services sector, basic digital literacy is widely established, with 96% of respondents scoring in the 60-100% range (Good -51% to Very Good - 45%). This suggests that most male entrepreneurs in services have developed strong fundamental digital skills, such as using ICT devices, searching for information online, and performing essential digital functions relevant to their businesses. Only 4% fall in the 20-40% (Bad) category, indicating that very few male entrepreneurs struggle with basic digital competencies.

At the proficient digital literacy level, which involves using business-related applications, managing online transactions, and effectively navigating digital platforms, male entrepreneurs still maintain strong digital capabilities, but there is a slight drop in performance compared to basic literacy levels. While 73% remain in the Good and Very Good (60-100%) categories, a combined 27% score in the 0-60% range, indicating that some entrepreneurs struggle with more advanced digital functions. Despite this, more than half (53%) score in the 60-80% category, showing that a significant portion of male entrepreneurs have a good command of digital tools essential for business operations.

At the advanced digital literacy level, which includes data analytics, cybersecurity, programming, and specialized software usage, the competency levels declined further. Only 5% of male entrepreneurs reach the Very Good (80-100%) level, and 46% fall into the Good (60-80%) range, suggesting that while some have advanced digital competencies, many are still in the learning or adoption phase. A significant 49% of respondents score in the 0-60% range, indicating that nearly half of the entrepreneurs lack the necessary skills for highly technical digital operations. Notably, 21% of male entrepreneurs fall in the Bad (20-40%) range, showing that a substantial portion struggles with integrating advanced digital tools into their business operations.

Female Entrepreneurs in the Services Sector

Among female entrepreneurs in the services sector, basic digital literacy is relatively strong, with 92% falling in the 60-100% range (Good to Very Good categories). Interestingly, 46% of female entrepreneurs score in the 80-100% (Very Good) category, matching their male counterparts in basic digital skills. This indicates that women in the services sector have developed foundational digital competencies, such as browsing, using ICT devices, and accessing information online. Unlike their male counterparts, no female respondents fall in the

0-40% (Very Bad or Bad) range, suggesting that all women respondents have at least moderate digital literacy skills.

At the proficient digital literacy level, female entrepreneurs presented strong capabilities, though it slightly lags behind that of male entrepreneurs. A combined 80% score in the 60-100% range (Good to Very Good categories), with 47% in the Good (60-80%) range and 33% in the Very Good (80-100%) range. This suggests that a majority of female entrepreneurs in services have adapted to digital technologies at a functional level, enabling them to manage digital transactions, interact with business applications, and use digital tools effectively. However, 20% of female respondents scored below 60% (Moderate, Bad, or Very Bad), indicating room for improvement in digital proficiency.

At the advanced digital literacy level, there was a noticeable decline in proficiency among female entrepreneurs. Only 10% reached the Very Good (80-100%) category, while 46% remained in the Good (60-80%) range. Meanwhile, 44% scored below 60%, highlighting a lack of expertise in advanced digital competencies such as data analytics, cybersecurity, and web development. Notably, 27% of female entrepreneurs were in the 40-60% (Moderate) range, while 11% score in the Bad (20-40%) category, showing that many struggle to adopt advanced digital tools.

The findings highlight that both male and female entrepreneurs in service sector demonstrated strong basic digital literacy, with more than 90% scoring in the Good to Very Good categories. Proficient digital literacy remains high across both genders, but women lag slightly behind men in terms of overall digital competency. Advanced digital literacy levels remain a challenge for both male and female entrepreneurs, with a significant portion of respondents scoring in the low to moderate range (0-60%). This suggests that while entrepreneurs can manage basic and

intermediate digital functions, they struggle with highly technical tasks such as data analysis, cybersecurity, and programming.

Gender disparities in digital literacy are more prominent at higher proficiency levels, with male entrepreneurs showing slightly greater competence in proficient and advanced digital skills compared to female entrepreneurs. However, the gap is not as pronounced as in manufacturing sector, indicating that women in the services sector are ahead in digital adoption. It may be likely due to the nature of the industry, which heavily relies on digital platforms, online transactions, and technology-driven business models.

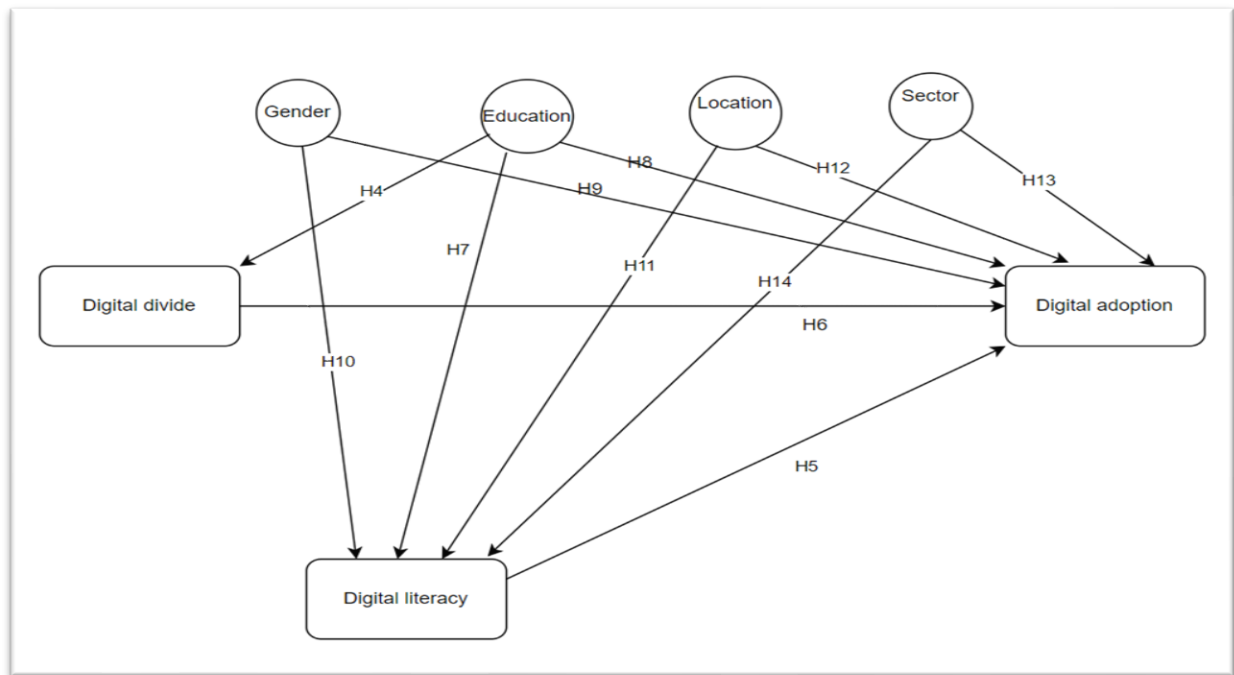
Table 5.16: Digital Literacy in Service sector

Sector	Gender		Digital literacy level basic		Digital literacy level Proficient		Digital literacy level Advanced	
			Respondents for each category	Proficiency level wise percentage of sample	Respondents for each category	Proficiency level wise percentage of sample	Respondents for each category	Proficiency level wise percentage of sample
Services	Male	Digital literacy level (percentage)						
		0-20(Very Bad)	0	0%	0	0%	3	3
		20-40(Bad)	2	2%	8	7%	25	21
		40-60(Moderate)	2	2%	24	20%	30	25
		60-80(Good)	60	51%	62	53%	54	46
		80-100(very Good)	54	45%	24	20%	6	5
		Total Sample	118	100%	118	100%	118	100%
	female							
		0-20(Very Bad)	0	0%	0	0%	4	6
		20-40(Bad)	0	0%	2	3%	8	11
		40-60(Moderate)	6	8%	12	17%	19	27
		60-80(Good)	32	46%	33	47%	32	46
		80-100(very Good)	32	46%	23	33%	7	10
		Total Sample	70	100%	70	100%	70	100%

5.8 Study 3

Study 3 attempted to examine the impact of digital literacy and digital divide on the digital adoption among the MSMEs. Further, the study explored the influence of gender, location, sector and education qualification of the entrepreneur on the digital adoption. CB-SEM through Smart PLS 4 (Covariance-Based Structural Equation Modelling) was conducted to analyse the relationships among these variables, test the hypothesized model, and assess the model's overall fit. This method was chosen as it allows for a comprehensive examination of direct and indirect effects, ensuring a robust statistical validation of the proposed relationships. Additionally, CB-SEM was utilized to measure construct validity, reliability, and the structural path coefficients, providing deeper insights into the factors influencing digital adoption in MSMEs. The Proposed model along with hypothesised relationships are presented in figure 5.2.

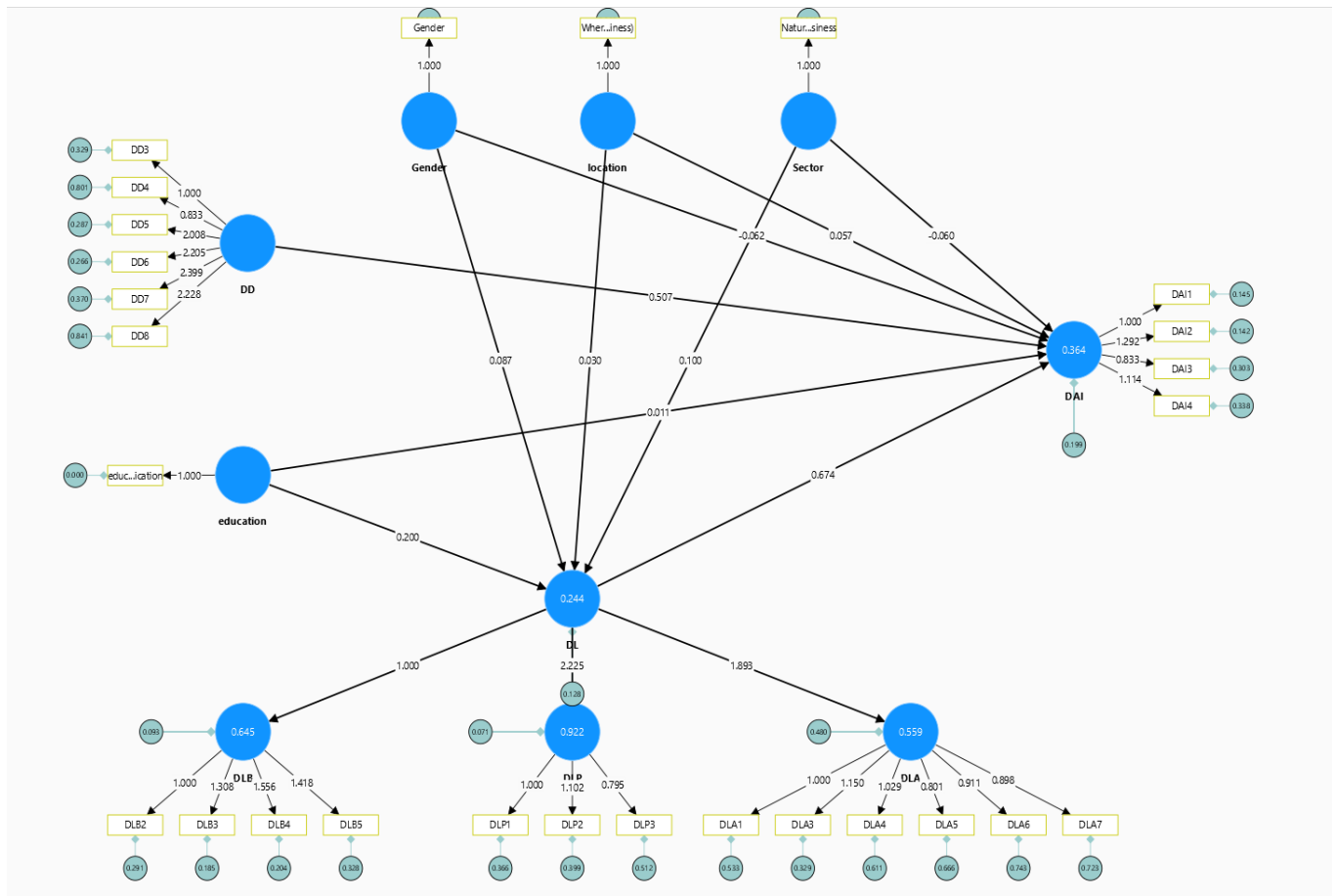
Figure 5.2: Study 3- Proposed model and Hypotheses



5.8.1 Graphical output of the model

The graphical output of the CB-SEM model (figure 5.3) visually represents the structural relationships among the constructs, including digital literacy, digital divide, and digital adoption among MSMEs. Further, the impact of gender, location, sector, and education qualification on digital adoption, is highlighted. Thus, this visual representation helps in understanding the significance and magnitude of various factors influencing digital adoption in MSMEs.

Figure 5.3 Graphical output of the structural model



5.8.2. Path coefficients

The results (table 5.17) indicate that the *digital divide* (DD) has a significant positive effect on digital adoption (DAI) with a path coefficient of 0.507 ($p < 0.001$), suggesting that as digital divide decreases, digital adoption among MSMEs increases. Similarly, *digital literacy* (DL) significantly influences digital adoption (DAI), with a path coefficient of 0.674 ($p < 0.001$), emphasizing that higher digital literacy leads to greater digital adoption.

Table 5.17: Path coefficients

	Parameter estimates	Standard errors	T values	P values
DD -> DAI	0.507	0.117	4.349	0.000
DL -> DAI	0.674	0.113	5.940	0.000
Gender -> DAI	-0.062	0.055	1.115	0.266
Gender -> DL	0.087	0.043	2.037	0.042
Sector -> DAI	-0.060	0.032	1.904	0.050
Sector -> DL	0.100	0.025	4.060	0.000
education -> DAI	0.011	0.034	0.331	0.741
education -> DL	0.200	0.027	7.309	0.000
location -> DAI	0.057	0.035	1.631	0.104
location -> DL	0.030	0.028	1.070	0.285

The results reveal that *gender* does not have a significant direct impact on digital adoption (DAI) ($\beta = -0.062$, $p = 0.266$), indicating that gender differences do not significantly determine digital adoption levels among MSMEs. However, gender has a small but significant impact on digital literacy (DL) ($\beta = 0.087$, $p = 0.042$), suggesting that gender may play a role in determining digital literacy levels, which in turn can influence digital adoption.

The sector (manufacturing, services or trading) of MSMEs has a notable impact on digital adoption and literacy. While its direct effect on digital adoption (DAI) is marginally significant ($\beta = -0.060$, $p = 0.050$), it has a stronger influence on digital literacy (DL) ($\beta = 0.100$, $p < 0.001$), implying that the sector in which the MSME operates in affects the digital literacy levels of entrepreneurs. This suggests that businesses in certain sectors may have better access to or a greater need for digital skills.

Regarding *education*, the results indicated that education does not significantly impact digital adoption (DAI) ($\beta = 0.011$, $p = 0.741$), suggesting that formal education alone may not directly

translate to higher levels of digital adoption. However, education has a strong positive influence on digital literacy (DL) ($\beta = 0.200$, $p < 0.001$), indicating that higher educational qualifications contribute to better digital skills, which could indirectly influence digital adoption.

Finally, location does not significantly impact digital adoption (DAI) ($\beta = 0.057$, $p = 0.104$) or digital literacy (DL) ($\beta = 0.030$, $p = 0.285$), suggesting that the geographical location of MSMEs does not play a major role in determining their digital capabilities or adoption levels. This could indicate that digital infrastructure and access to digital resources may be relatively uniform across different locations, reducing the influence of geographic disparities on digital engagement.

5.8.3 Factor loadings

Factor loadings represent the correlation between observed variables (items) and their respective latent constructs. Higher factor loadings indicate a stronger relationship between an item and its corresponding factor. Ideally, factor loadings above the threshold level of 0.6 are considered acceptable. The results revealed (table 5.18) that all factor loadings exceed the acceptable threshold (0.6), confirming that the selected items are valid indicators of their respective constructs. Further, the overall strong loadings suggest that the items reliably capture their respective constructs.

Table 5.18: Factor loadings

	DAI	DD	DL	DLA	DLB	DLP
DAI1	0.827					
DAI2	0.887					
DAI3	0.747					
DAI4	0.731					
DD3		0.743				

DD4		0.726				
DD5		0.811				
DD6		0.845				
DD7		0.825				
DD8		0.769				
DLA1				0.819		
DLA3				0.902		
DLA4				0.808		
DLA5				0.715		
DLA6				0.741		
DLA7				0.741		
DLB2					0.789	
DLB3					0.842	
DLB4					0.870	
DLB5					0.786	
DLP1						0.845
DLP2						0.858
DLP3						0.727

The results show that Digital Adoption Intention (DAI) is strongly represented by DAI2 (0.887), making it the most significant indicator of how intensely digital tools are integrated into business operations. Similarly, the Digital Divide (DD) is well-explained by multiple indicators, with DD6 (0.845) being the strongest, suggesting that *user friendliness* or the ease in the use of the ICT devices significantly contribute to digital inequality. Within Digital Literacy (DL), which is categorized into Advanced (DLA), Basic (DLB), and Proficient (DLP) levels, the highest factor loadings are observed for DLA3 (0.902), DLB4 (0.870), and DLP2 (0.858), highlighting the most critical aspects of each literacy level. Advanced digital literacy

is best represented by DLA3, which reflects ability to use advanced software and programming knowledge, whereas basic literacy is well captured by DLB4 (0.870), signifying fundamental skills like following digital instructions for ICT usage. Proficient literacy, essential for business applications such as digital marketing and software usage, is most strongly reflected in DLP2 (0.858) capturing the ability to create content and use digital platforms for business promotion.

5.8.4 Reliability and Convergent validity

The reliability and convergent validity measures of the constructs confirm consistency and reliability of the measurement model. Cronbach's alpha is a measure of internal consistency, where a value above 0.7 is considered acceptable, while values above 0.8 indicate good reliability. The results of the study revealed (table 5.19), Digital Adoption Intention (DAI) (0.879), Digital Divide (DD) (0.825), Digital Literacy Advanced (DLA) (0.91), Digital Literacy Basic (DLB) (0.877), and Digital Literacy Proficient (DLP) (0.845) all exhibit strong internal consistency, confirming that the items effectively measure their respective constructs. Composite reliability (ρ_c) is another measure of reliability, where values above 0.7 indicate good construct reliability. All constructs exceed this threshold, demonstrating high composite reliability.

Average Variance Extracted (AVE), which assesses convergent validity, should be greater than 0.5 to confirm that the construct explains more than half of the variance of its indicators. The results indicate that all constructs meet this threshold, with DLP (0.659), DLB (0.64), and DLA (0.624) displaying strong AVE values, confirming that a significant portion of the variance in these constructs is accounted for by their indicators.

Table 5.19: Reliability and AVE scores

	Cronbach's alpha (standardized)	Cronbach's alpha (unstandardized)	Composite reliability (rho_c)	Average variance extracted (AVE)
DAI	0.879	0.876	0.858	0.606
DD	0.825	0.823	0.844	0.584
DLA	0.91	0.91	0.91	0.624
DLB	0.877	0.875	0.879	0.64
DLP	0.845	0.846	0.857	0.659

5.8.5 Validity – HTMT scores

The Heterotrait-Monotrait (HTMT) ratio is a measure of discriminant validity of the constructs. It assesses how well constructs in a model are distinct from each other. The HTMT threshold value is 0.85. A value exceeding this threshold suggests that the constructs may be too similar, indicating poor discriminant validity. The HTMT values given in the table 5.20 confirm discriminant validity of the constructs, as most values remain below the 0.85 threshold.

Table 5.20: HTMT Scores

	DAI	DD	DLA	DLB	DLP
DAI					
DD	0.668				
DLA	0.480	0.604			
DLB	0.717	0.832	0.498		
DLP	0.614	0.754	0.769	0.824	

5.8.6 Model Fit Indices

R-square (R^2) is a measure of the proportion of variance in the dependent variable that is explained by the independent variables in the model. It ranges from 0 to 1, where higher values indicate a better explanatory power of the model. Based on the values, the strength of the model is interpreted as weak (0.19 or below), moderate (0.20-0.49), substantial (0.50-0.74) and strong (0.75 or above). The results revealed (table 5.21) R^2 value for Digital Literacy Proficient (DLP) at 0.922, indicating that the model is highly effective in explaining variations in digital literacy proficiency. The Digital Literacy Basic (DLB=0.645) and Digital Literacy Advanced (DLA=0.559) constructs also have strong explanatory power, while Digital Adoption Intensity (DAI) and overall Digital Literacy (DL) have moderate R^2 values, indicating that additional factors may influence digital adoption and overall literacy levels.

Table 5.21: R square values

	R-square
DAI	0.364
DL	0.244
DLA	0.559
DLB	0.645
DLP	0.922

The model fitness is assessed using various indices that determine how well the proposed model aligns with the observed data. The Chi-square statistic ($\chi^2 = 2002.766$, $df = 315$) assesses the difference between the expected and observed covariance matrices (table 5.22). A lower chi-square value relative to degrees of freedom indicates a good fit; however, since χ^2 is sensitive to sample size, it is often used in combination with other fit indices.

The Root Mean Square Error of Approximation (RMSEA) = 0.054, is an absolute fit index that evaluates how well the model approximates the data. Values below 0.05 indicate excellent fit,

between 0.05 and 0.08 signify a good fit, and above 0.10 suggest a poor fit. The RMSEA value of 0.054 was within the acceptable range, indicating a good model fit. Similarly, the Standardized Root Mean Square Residual (SRMR) = 0.069 evaluates the difference between observed and predicted correlations, with values below 0.08 considered a good fit. The SRMR value of 0.069 confirmed the model's suitability.

Incremental fit indices such as the Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) compare the proposed model to a baseline model, with values above 0.90 indicating an acceptable fit and values above 0.95 suggesting an excellent fit. The results yielded a CFI value of 0.970 signifying an excellent fit, while the NFI (0.939) and TLI (0.943) indicate a good model fit.

Finally, Akaike Information Criterion (AIC) = 2128.766 and Bayesian Information Criterion (BIC) = 2382.548 are used for model comparison. These indices are considered when selecting among competing models. In this study, the AIC and BIC values suggest that the selected model is efficient and parsimonious, supporting its theoretical and empirical validity. Thus, the resulted model demonstrated a strong fit, as supported by multiple indices. While the Chi-square statistic is significant, which is common in large sample sizes, the high CFI (0.970), TLI (0.943), and acceptable RMSEA (0.054) and SRMR (0.069) confirmed that the model adequately explains the data and supports the proposed relationships.

Table 5.22: Model Fit Indices

	Estimated model
Chi-square	2002.766
Number of model parameters	63.000
Number of observations	415.000
Degrees of freedom	315.000

RMSEA	0.054
SRMR	0.069
NFI	0.939
TLI	0.943
CFI	0.970
AIC	2128.766
BIC	2382.548

5.8.7 Hypothesis testing – result analysis

H5 & H6: Both Digital Literacy and Digital divide has a significant impact on Digital adoption among the MSMEs.

The digital divide (DD) significantly impacts digital adoption (DAI) with a parameter estimate of 0.507 ($p = 0.00$), confirming that MSMEs facing a digital divide struggle with adopting digital technologies. Studies confirmed various factors for the rise of digital divide between the developed and developing economies (Wechuli, 2021), inhibiting digital adoption. This may be attributed to the accessibility to infrastructure/resources (high speed internet and continuous industrial electrical supply, skilled professionals) that these enterprises have, both in terms of physical and technology.

Similarly, digital literacy (DL) strongly influences digital adoption (DAI) with a high parameter estimate of 0.674 ($p = 0.00$), indicating that entrepreneurs with better digital literacy are more likely to integrate digital tools into their business operations. Digital skills directly and significantly impact the entrepreneurial attitude to technology adoption.

H7 & H8: While education has a significant Impact on Digital literacy, the results indicate that education does not have significant impact on the Digital Adoption among the MSMEs.

The results indicate that education qualification of the entrepreneur does not significantly impact digital adoption ($p = 0.741$), but it does have a strong effect on digital literacy ($p = 0.000$), highlighting that higher education levels contribute to better digital literacy skills.

Digital adoption among the MSMEs largely depend on the financial feasibility and operational requirement (Ghobakhloo & Ching, 2019) which supersedes the impact of education in many instances. Research also evidences that digital adoption barriers among the small enterprises like entrepreneur's attitude and perceived control over the digital aspects are prevalent. However, the same negative factors may turn to technology adoption predictors due to social pressure, competitive innovation and operational need (Juniarti and Omar, 2021) thus overcoming the educational barrier. Employing skilled professionals to digitalize the enterprise has been observed among the respondents.

Research evidences the significance of education on the digital aptitude and skills; thus, the results of the present study support this hypothesis.

H9 & H10: While gender has a significant impact on digital literacy of the entrepreneur, it does not have a significant impact on the digital adoption in the enterprise.

Results revealed that the gender of the entrepreneur does not have a significant impact on digital adoption ($p = 0.266$), implying that digital adoption is not necessarily driven by gender differences. However, gender does influence digital literacy ($p = 0.042$), suggesting that men and women exhibit different levels of digital literacy skills. The results are further proven in study 2.

Gender inequality due to lack of opportunities and resources play a critical role in the literacy level in general and digital literacy in particular among women. In a developing context, gender inequality is prevalent in every stratum of the society creating a dearth of learning and usage opportunities (Van dijk, 2005). Thus, gender plays a significant role in digital literacy of the entrepreneurs. However, with regards to the digital adoption in the enterprise, numerous other predictors like business need, perceived benefits, financial feasibility, competitive advantage play a detrimental role minimizing the significance of gender (Ghobakhloo and Ching, 2019).

H11 & H12: The location of the MSME has no significant impact on either digital adoption or the digital literacy.

The study demonstrated that location of the MSME does not significantly impact either digital adoption ($p = 0.104$) or digital literacy ($p = 0.285$), suggesting that geographical factors alone may not determine an entrepreneur's ability to adopt or develop digital skills.

These results, especially in Indian context are indicative of infrastructural facilities in SEZs, industrial estates, semi urban and rural areas. These results are consistent with studies in the other developing contexts where more information/ resource availability has led to easy accessibility and usage as they provide a platform for accessing valuable information and transmitting countryside generated information on different fields (Onwukanjo, 2017).

H13 & H14: The line of business or the MSME sector does not have a significant impact on the digital adoption, however it has a significant impact on the Digital literacy.

The study established that sector of the MSME does not significantly affect digital adoption ($p = 0.050$), but it does have a significant impact on digital literacy ($p = 0.000$), indicating that the nature of the business (e.g., manufacturing, services, trading) plays a role in shaping entrepreneurs' digital skills owing to the need of business.

Research revealed that while scope of business may play a significant role in digital adoption, it is determined that the financial scope, feasibility and magnitude of operations play a decisive role in digital adoption among micro and small business. It is also noted that scale of operations plays a definitive role as opposed to the nature of operation (Chatzoglou & Chatzoudes, 2015) implying that as business grows in size, the need and affordability of digital technologies increase irrespective of the sector in which the business operates.

It is proven in the past studies that Digital literacy has a significant impact on digital adoption and consequently on the growth and development of the enterprise (Ojobo et al., 2023). It is also proven that entrepreneurial attitude is a predictor for digital adoption. The entrepreneur's decision to adopt digital technologies in his/her enterprise is also determined by the business need, competitive pressure and innovation opportunities prompting digital literacy initiatives. Technology intensive industries are significantly proactive to invest in digitally literate and skills human resources.

The hypothesis, their respective relationship between the constructs, parameter estimates, significance values and the result of the hypothesis testing is presented in the tabular form below (Table 5.23).

Table 5.23: Hypothesis testing results

Hypothesis	Relation	Parameter estimates	P values	Decision
Digital divide among the MSMEs have a significant impact on the digital adoption.	DD -> DAI	0.507	0.00	Accepted
Digital literacy of the entrepreneurs has significant impact on the digital adoption among the MSMEs.	DL -> DAI	0.674	0.00	Accepted

Gender of the Entrepreneur has a significant impact on the Digital adoption.	Gender -> DAI	-0.062	0.266	Not accepted
Gender has a significant Impact on Digital Literacy.	Gender -> DL	0.087	0.042	Accepted
Sector (nature of the business) has a significant impact on the Digital adoption.	Sector -> DAI	-0.06	0.050	Not accepted
Sector (nature of business) has a significant impact on Digital literacy.	Sector -> DL	0.1	0.000	Accepted
Education qualification of the entrepreneur has a significant impact on the digital adoption among the MSMEs.	education -> DAI	0.011	0.741	Not accepted
Education qualification of the entrepreneur has a significant impact on the digital literacy level of the entrepreneur.	education -> DL	0.2	0.000	Accepted
Location of the MSME has a significant Impact on Digital adoption	location -> DAI	0.057	0.104	Not accepted
Location of the MSME has a significant Impact on Digital Literacy.	location -> DL	0.03	0.285	Not accepted

In conclusion, the findings highlight that digital literacy and digital divide played a critical role in digital adoption among MSMEs, while categorical factors like gender, education and sector had no significant influence. On the other hand, these categorical factors had a significant impact on both Digital divide and Digital literacy. Location, however, had no significant impact on either digital literacy or digital adoption.

Summary

Chapter five presented the data analysis and hypothesis testing. The demographic data captured through the questionnaire was analysed and presented through frequencies and percentages and in the form of descriptive statistics. Tests for checking sampling adequacy, data normality along with factor analysis and principal component analysis were performed and results were presented. Further analysis was divided into 3 sub studies to examine three constructs (digital divide, digital literacy and digital adoption) and their impacting factors. In addition, hypothesis testing was done using PLS SEM and CB SEM. Path coefficients, factor loadings, reliability and validity scores were presented. Measurement models along with the goodness of fit indices were also presented in this chapter. Digital literacy assessment based on the data gathered was analysed and the findings were discussed. The discussion, conclusion and implications is elaborated in the following chapter.

Chapter 6

Discussion

Micro Small and medium enterprises (SMEs) are unique economic entities that play a crucial role in driving economic growth, job creation, and innovation at grassroot level, thus bridging socio- economic inequalities in the society. The scenario appears same both at the global level and the developing countries like India. The MSMEs however, start their operations on a limited scale. The integration of digital technologies within Micro, Small, and Medium Enterprises (MSMEs) is pivotal for enhancing their chance of survival and operational efficiency. As digital transformation takes root globally, MSMEs must adapt to remain competitive. The COVID-19 pandemic has further accelerated the need for digital adoption among MSMEs. Research by the Centre for Financial Inclusion (CFI, 2022) indicates that many MSMEs utilized digital tools during the pandemic, such as accepting payments via digital platforms, to sustain their operations amidst restrictions. This rapid digital shift underscores the importance of digital readiness in ensuring business continuity during unforeseen disruptions. However, challenges such as digital literacy gaps and the digital divide significantly impact the rate and success of digital adoption among these enterprises, requiring studies in this direction.

This study explored the impact of digital literacy, the digital divide, and various demographic and business-related factors on the digital adoption of MSMEs. Further, the study attempted to develop a valid instrument to measure digital literacy among the entrepreneurial digital competencies. After the scale development, the study assessed the digital skills of entrepreneurs in different sectors and both the genders to highlight the skill gaps present among

the respondents. The study also examined the influence of gender, location, sector and education qualification of the entrepreneurs on the digital divide prevalent among the MSMEs. By employing structural equation modelling, the research provided valuable insights into the structural relationships between these factors. This chapter delves into the results of the study, presents a comprehensive explanation along with objective-wise discussion and conclusions, followed by implications and limitations.

6.1 Demographic profile

The data was collected from MSMEs operating in diverse industries across the target location. The respondents belonged to diverse socio-economic status in terms of their location, financial status and education.

Entrepreneur Profile

In terms of gender, analysis of data revealed that the MSME ecosystem is male dominated with close to 70% enterprises being owned/ operated by men. Female entrepreneurs constituted close to 30%. The marked gender disparity aligns with the national statistics as observed in the report by ministry of MSME (Annual Report 2022-23), wherein India has approximately 6.3 crore MSMEs out of which 95.98% are proprietary establishments, with 79.63% male ownership and 20.37% owned by females. Further data from the Udyam Registration Portal indicates that since its inception on July 1, 2020, women-owned MSMEs constitute 20.5% of total registrations. These statistics highlight a growing trend of female entrepreneurship in India's MSME sector, though male ownership continues to predominate. The underrepresentation of female entrepreneurs in MSME sector is attributed to various factors like societal norms and gender bias wherein the cultural and societal value systems motivate women to behave in a certain way and adopt certain predetermined roles (Hofstede, 1998). Conversely, entrepreneurship, which demands qualities like independence, assertiveness, self-

reliance, and boldness, that are commonly linked to men (Gupta et al., 2009). In addition, gender specific barriers to entrepreneurship may include difficulties in obtaining institutional support, family support, securing financing, building network with suppliers and customers which add to the existing risk aversion prevalent among the females (Shinnar et al., 2012). Research demonstrates that reinforcing positive self-efficacy (Baughn et al., 2006; de Bruin et al., 2007), entrepreneurial education and institutional support by the way of government policies and financial schemes for women is required to minimize the gender gap. Further, access to support mechanisms such as chamber of commerce and specialized agencies that offer guidance, training, and connections to key resources, including lenders, consultants, mentors, and professional networks like co-operative societies would assist prospective female entrepreneurs to overcome the barriers (Shinnar et al., 2012).

Age plays a crucial role in entrepreneurship, as it influences an individual's ability to settle into their business, adapt to market dynamics, and leverage experience for strategic decision-making. The study reveals that MSME ecosystem is dominated by the entrepreneurs aged 31-50 accounting for 51% of the respondents, while an additional 20% are above 51 years. The results align with similar surveys conducted in the MSME sector (icrier. Org, 2023). The dominant middle-aged (30-50) group among the entrepreneurs implies the several key factors influencing business ownership and success. Evidence suggests that this age group typically possesses significant industry experience, allowing them to make informed business decisions, manage risks effectively, and drive sustainable growth. Further, individuals in this bracket are more likely to have financial stability, enabling easier access to capital through savings, investments, or creditworthiness, which is crucial for starting and scaling a business. Additionally, their well-established professional networks provide valuable mentorship, business partnerships, and market insights, further enhancing their entrepreneurial success.

The lower representation of entrepreneurs aged 18-30 may indicate barriers such as limited access to capital, lack of experience, or inadequate support systems for young entrepreneurs, calling for targeted programs to provide mentorship, training, and financial support to encourage youth participation in entrepreneurship. On the other hand, the relatively smaller proportion of entrepreneurs above 50 years indicates potential challenges in adopting new business models, technology, or the digitalization required for modern business operations. These trends highlight the need for targeted policies that support entrepreneurs through skill development initiatives, and mentorship, while also encouraging knowledge transfer and succession planning among older entrepreneurs to ensure business continuity.

Education drives entrepreneurial success. The MSME entrepreneurs showed a positive trend with 60% of the respondents with a minimum of graduation or above. The results align with literature indicating that formal education enhances entrepreneurial skills (Ahn & Winters, 2023), financial literacy, and the ability to adopt digital tools and innovative business practices (Naudé, 2010). Additionally, through education and training, MSMEs are able to comprehend and adhere to pertinent business regulations, foster innovation and adjust to changes in the dynamic market space. Studies suggest that entrepreneurs with higher education are more likely to embrace digital tools, e-commerce, and automation to improve productivity (Ayyagari et al., 2011) along with having better access to business networks, investors, and government schemes that support MSMEs, giving them a competitive advantage (Wu & Si, 2018). This underscores the importance of education as a driver of entrepreneurial success, reinforcing the need for policies that promote skill-building and digital literacy to support MSMEs across different education levels. While highly educated entrepreneurs are leading in digital adoption, policies must focus on training programs for those with lower educational qualifications to ensure inclusive growth.

Enterprise profile

The analysis of the sectoral distribution among MSMEs reveals that 45.3% operate in the services sector, 38% in manufacturing, 9.8% in trading, and 6.3% in other sectors, with the latter often encompassing enterprises combining multiple sectors, such as manufacturing and trading or manufacturing and services. This distribution aligns with recent trends observed in the MSME landscape. The prominence of the service sector among MSMEs can be attributed to lower capital requirements, reduced regulatory barriers, and the sector's adaptability to digital platforms. This flexibility allows for rapid establishment and scaling of businesses. Additionally, services such as IT support, consulting, and logistics have experienced increased demand, providing fertile ground for MSME growth. On the other hand, the substantial representation of MSMEs in manufacturing is driven by the sector's role in supporting larger industries through ancillary units. Additionally, government initiatives like 'Make in India' pushed to establish manufacturing units. Conversely, the relatively smaller proportion of MSMEs in trading was due to intense competition, thin profit margins, and the rise of large retail chains and e-commerce platforms, which overshadowed smaller trading enterprises. Thus, the sectoral distribution of MSMEs reflects adaptive strategies to market conditions, resource availability, and economic opportunities calling attention to the need for policies to be tailor made accordingly.

The distribution of enterprises indicates that 56.7% are urban-based, 27.1% are town-based, and 16.3% are rural-based, highlighting a significant concentration in urban areas. Urban areas offer superior infrastructure, including transportation, communication networks, in addition to a large customer base and skilled labour pool, all of which are essential for efficient business operations (Rahman & Kabir, 2019). The development of special economic zones, industrial clusters and business parks are vital in shaping the distribution of MSMEs across urban, town,

and rural areas. SEZs and industrial clusters are primarily concentrated in urban and surrounding suburban regions, offering world-class infrastructure, tax incentives, and streamlined regulatory frameworks that attract businesses. This explains the higher proportion of MSMEs in urban areas, where such facilities are more prevalent.

However, recent government policies have focused on expanding industrial clusters to smaller towns and rural areas to promote balanced regional development. Initiatives like the Micro & Small Enterprises Cluster Development Programme (MSE-CDP) and the Rural Industrialization Strategy aim to create growth hubs in non-urban locations by improving infrastructure and providing financial and technological support thus neutralizing the urban rural economic divide. The establishment of business parks and smart industrial zones also fosters sector-specific MSME growth, encouraging technology-driven and export-oriented enterprises. This trend aligns with studies highlighting how targeted policy interventions in industrial zones lead to higher productivity, better market linkages, and greater financial accessibility for MSMEs ([UNIDO, 2022](#), [World Bank, 2023](#)).

The study results indicating that 65.5% of businesses are registered, 30.6% remaining unregistered, and 3.9% of respondents being unsure about their registration status highlighted a substantial segment of informal enterprises within the MSME sector. This trend is consistent with the national statistics where, out of 6.3 crore MSMEs, only 4.15 crore MSMEs are registered on Udyam Assist Platform (UAP) (MSME.gov.in, 2024). The lack of formalization among the MSMEs can be attributed to lack awareness about government programs and the benefits of registration. Additionally, some enterprises may not perceive sufficient benefits from formalization to outweigh the associated costs and efforts, especially if they operate successfully within informal networks. While there has been progress in formalizing MSMEs, a significant percentage of MSMEs remains informal due to various challenges. Addressing

these issues through targeted policies, awareness campaigns, and support systems is crucial for integrating these enterprises into the formal economy, thereby enhancing their growth prospects and contributions to the economy.

The findings highlighted key demographic trends within the MSME sector, including a dominance of middle-aged entrepreneurs, a higher concentration of businesses in urban areas, and a significant presence in the services and manufacturing sectors. The study also focussed on digital divide and literacy gaps and their impact on digital adoption, with factors such as gender, sector, location and education playing varying roles. The results of the analysis to achieve the research objectives are discussed below.

6.2 Objective wise conclusion and discussion

RO1: To study the effect of gender, location, line of business and education qualification of the entrepreneur on the digital divide.

The results established that gender, location, line of business (sector) and education qualification of the entrepreneur has a significant impact on the digital divide prevalent among the MSMEs.

Women entrepreneurs in India constitute approximately 21% of MSMEs. Digital divide takes several forms, one of which is seen between men and women (gender wise DD) for various social, personal and cultural reasons. Research long ago has confirmed that women have been less inclined towards online compared to men and even if they go online, they spend less time than men (Kennedy et al., 2003). The gender issue continues in the current till date and highly relevant in developing countries like India where women have less access than men. Further, the confidence and self-efficacy to use digital tools is observed to be low among females as opposed to their male counterparts (Chandra, 2022). Further, the other challenges in terms of

affordability, growing population, delays in the implementation of government programs are the other challenges for the digital divide. However, very few women who venture into entrepreneurship are taking advantage of the government schemes and other promotional aspects by the government. In the context of this study, the very fact that they have a decent education, having access to infrastructure/ resources in the industrial estates, in the urban areas gave them a platform for similar status as males in terms of digital adoption. Even those with low education, entrepreneurs had the professionals to manage the digital aspects of the enterprise resulting in a significant impact of location, sector and education qualification of the entrepreneur on the digital divide prevalent among the MSMEs. However, there still continues a considerable gender divide calling for initiatives to mitigate the inequality through education, policy interventions, and targeted programs promoting gender inclusivity in the digital age.

Location:

The location of Micro, Small, and Medium Enterprises (MSMEs) significantly impacts the digital divide, influencing their access to digital technologies and, consequently, their performance and growth. This divide is evident in various regions and countries, affecting MSMEs differently based on their geographic and economic contexts. Research evidences that MSMEs located in urban areas have significantly higher digital adoption rates compared to those in rural and semi-urban locations (Busnetty & Tambunan, 2020). This is primarily due to better access to internet connectivity, infrastructure, and digital literacy programs. Urban enterprises benefit from well-developed technological ecosystems, while rural enterprises often struggle with poor digital infrastructure and limited awareness of digital tools (Sekhar, 2025). Urban areas generally have better internet penetration, stable power supply, and advanced IT infrastructure, facilitating digital adoption among businesses. In contrast, rural MSMEs face unreliable internet services and frequent power outages, limiting their ability to integrate digital

solutions (World Bank, 2022). MSMEs in cities have greater access to digital training programs, government initiatives, and private sector-led capacity-building efforts. Rural enterprises often lack exposure to digital skills training, resulting in lower confidence in adopting technology (Canton, 2021) thus aggravating the digital divide. However, Special Economic Zones (SEZs), business parks, industrial estates, and various government schemes play a critical role in mitigating these disparities by providing essential infrastructure, incentives, and digital support. SEZs, which are geographically demarcated zones with policy incentives, contribute to bridging the digital divide by offering high-speed internet, modern IT infrastructure, and access to digital financial services (Sekhar, 2025; Maity & Sahu, 2022). These zones also promote e-commerce adoption, cloud computing, and technology-driven exports, allowing MSMEs to integrate into global digital networks. Similarly, business parks and industrial estates, particularly in semi-urban areas, serve as economic hubs that encourage MSME digitalization by offering shared digital resources, automation facilities, and technology-based training programs (Kadaba et al., 2023). These industrial clusters reduce individual adoption costs, making digital transformation more accessible and affordable for small businesses. Further, initiatives like UPI-based digital payments and ONDC (Open Network for Digital Commerce) enabled small businesses in Tier-2 and Tier-3 cities to engage in digital transactions and online sales, reducing urban-rural digital disparities (NPCI, 2022; DPIIT, 2023). The cumulative impact of these interventions has been significant, leading to improved broadband penetration, enhanced financial inclusion, and increased participation of MSMEs in digital commerce. However, challenges remain, including low awareness of digital initiatives, affordability of digital solutions, and regional disparities in implementation. Therefore, while SEZs, industrial hubs, and government schemes have substantially reduced location-based digital gaps, continued policy efforts, infrastructure expansion, and capacity-

building initiatives are necessary to ensure equitable digital access for MSMEs across all regions of India (World Bank, 2022).

Sector:

The sector in which a Micro, Small, and Medium Enterprise (MSME) operates—be it manufacturing, services, or trading—significantly influences its digital adoption levels, thereby impacting the digital divide within the MSME sector. The sector specific disparities in digital usage arise due to reasons like resource availability, operational requirement etc. For instance, manufacturing enterprises often exhibit lower levels of digital adoption compared to their counterparts in the services and trading sectors. This lag can be attributed to the traditional nature of manufacturing processes and a focus on physical production over digital processes. In addition, challenges such as high costs of implementing digital technologies (costly machinery), lack of digital skills among the workforce, and concerns about cybersecurity contribute to slower digital integration in manufacturing MSMEs. On the other hand, service-oriented MSMEs tend to adopt digital technologies more readily (Hendrawan et al., 2024). The intangible nature of services makes them more adaptable to digital platforms, facilitating online service delivery, digital marketing, and remote customer engagement. Further, lower entry barriers for digital tools, the necessity for online presence, and the demand for digital payment options drive higher digital adoption in the services sector. While manufacturing and service sector exhibit a definite trend in digital adoption, trading enterprises usually show varying levels of digital adoption. While some MSMEs embraced e-commerce platforms to expand their market reach, others remain reliant on traditional sales channels.

In addition to the sector specific digital trends, the underlying reasons for the digital adoption among MSMEs like nature of operations, skill requirement, affordability have a significant contribution to the digital divide. In the context of the study, factors like size of the operations

significantly influenced the entrepreneur's decision to adopt digital technologies. While digital payments have been easily adopted due to the ease of payments through UPI, other complicated and highly techno-based options were still shunned by majority of the micro entrepreneurs. For instance, a micro family-based enterprise selling pickles and processed food serving a small locality is less likely to adopt digital technology (e.g automated machinery, e commerce channels) as opposed to a small food processing enterprise selling packaged pickles to a large customer base. Thus, although sector has a significant influence on digital divide, numerous other factors within a particular sector contribute to the digital adoption calling for tailor made interventions to bridge the digital divide.

Policymakers should design sector-specific support initiatives that address unique challenges, such as providing subsidies for digital machinery in manufacturing or training programs for digital marketing in services. Investments in digital infrastructure should consider sectoral needs, ensuring that manufacturing hubs have access to robust industrial IoT networks, while service sectors benefit from high-speed internet connectivity. Customized training programs that enhance digital skills relevant to each sector can empower MSMEs to adopt and utilize digital technologies effectively.

Education qualification:

The education qualification of MSME entrepreneurs plays a critical role in determining their ability to adopt and utilize digital technologies, thereby significantly impacting the digital divide. Higher educational attainment is associated with greater digital literacy, better decision-making, and enhanced adaptability to technological advancements, while lower education levels often result in limited digital awareness and adoption. Research demonstrated a strong positive correlation between educational attainment and the success of female entrepreneurs in the MSME sector. Higher education levels and skill enhancement lead to greater business

success and personal empowerment, highlighting the need for targeted educational initiatives (Kumari, 2024). Further, educated entrepreneurs have a higher propensity for innovation and are more likely to leverage government digital initiatives and financial incentives (Wu & Si, 2018). Furthermore, entrepreneurs with higher education are more likely to participate in training programs on digital skills and technological advancements (UNCTAD, 2020). They are also better positioned to access professional networks, mentorship, and government programs aimed at enhancing digital competencies in MSMEs (Acs et al., 2018). This calls for an action from the policymakers to focus on targeted digital literacy programs, financial incentives, and easy access to digital infrastructure. Closing this gap is essential to ensuring that all MSMEs—regardless of the entrepreneur’s education level—can participate in the digital economy and remain competitive in a rapidly evolving business landscape.

RO2. To study the effect of gender, location, line of business and education qualification of the entrepreneur on Digital Literacy of the entrepreneur.

Gender

The results of the study revealed a significant impact of gender on the digital literacy of the entrepreneur. Digital literacy along with entrepreneurial literacy inculcate a creative spirit and an entrepreneurial inclination in the individual (Aboobaker & KA, 2023). Gender inequality and stereotypes create a barrier in female empowerment, growth and development (Dhiman, 2023). This phenomenon is evidenced in the statistics of number of female entrepreneurs in developing contexts as opposed to male entrepreneurs. The significant impact of gender on digital literacy among MSME entrepreneurs can be attributed to various socio-economic, cultural, and educational factors. Research evidenced that women entrepreneurs often face limited access to digital tools and training due to structural barriers, including gender norms and lower levels of formal digital education (Dhiman, 2023). According to UNESCO (2021),

women in many developing economies, including India, historically had lower access to technology and digital training programs compared to their male counterparts, leading to a gender gap in digital literacy. Further, women-owned businesses are often smaller in scale and operate in sectors that rely less on digital infrastructure, limiting their exposure to technological advancements (McKinsey report, 2019). Additionally, societal perceptions about entrepreneurship and technology being male-dominated fields discourage women from actively engaging in digital upskilling (Agarwal & Lenka, 2018). Another critical factor is the lack of digital mentorship and networking opportunities for women. Male entrepreneurs tend to have better access to business networks (Powell & Eddleston, 2013) and industry associations that offer digital training, giving them an advantage in technological adoption (Moetse, 2019). These barriers collectively create a significant gender gap in digital literacy levels among MSME entrepreneurs.

The gender gap in digital literacy has significant implications for business growth, competitiveness, and economic development. Women-led MSMEs that struggle with digital adoption may face reduced efficiency, limited market reach, and weaker financial performance. OECD (2021) highlights that digitally literate businesses are more likely to adopt e-commerce, automate processes, and utilize digital marketing strategies, leading to increased revenue and scalability. Therefore, if female entrepreneurs lack digital proficiency, their businesses may lag behind in terms of innovation and market expansion.

Additionally, the lack of digital literacy among women entrepreneurs limits their ability to leverage government and financial support schemes designed to promote MSME growth. For instance, government programs, such as Digital India and Startup India, require digital engagement for application processes, compliance, and financial transactions. As noted by NASSCOM (2022), digitally excluded entrepreneurs may miss out on critical funding and

training opportunities, further widening the gap between male and female-led enterprises. This disparity also affects job creation and overall economic participation, as businesses with lower digital integration tend to experience slower growth and reduced employment opportunities.

To address the gender gap in digital literacy, policymakers and industry stakeholders must implement targeted interventions that promote equal access to digital education and resources. Government-sponsored digital literacy programs specifically designed for women entrepreneurs can help bridge the skills gap. Initiatives such as SheTrades by ITC and Google's Women Will have demonstrated success in enhancing digital capabilities among women-led businesses. Expanding such programs at the grassroots level can provide women entrepreneurs with hands-on training in essential digital tools. Financial incentives and grants for women-owned MSMEs can encourage investment in digital infrastructure. The government and financial institutions should introduce subsidized loans and tax benefits for businesses that adopt digital solutions, ensuring that female entrepreneurs are not left behind due to financial constraints (IFC, 2021). Establishing women-focused digital business forums and mentorship programs can help female entrepreneurs gain insights, share best practices, and access technical support. Partnerships between private technology firms, NGOs, and academic institutions can facilitate digital upskilling initiatives targeted at women. Bridging the digital divide through community-based training is crucial. Localized digital education programs, delivered through Self-Help Groups (SHGs), women's cooperatives, and vocational training centres, can enhance digital literacy among women entrepreneurs in semi-urban and rural areas (Sowmya &Pai, 2025). By implementing such holistic measures, policymakers can ensure greater gender inclusivity in digital adoption, fostering long-term economic growth and empowerment among women entrepreneurs in the MSME sector.

Location

The study revealed that the location of an MSME enterprise—whether urban, semi-urban, or rural—has no significant impact on the digital literacy of entrepreneurs indicating that digital skill acquisition may be influenced more by individual, economic, and educational factors rather than geographical ones. It was observed that while urban areas generally have better digital infrastructure, entrepreneurs across different locations increasingly have access to similar digital learning opportunities due to the expansion of digital training programs and mobile internet penetration. Additionally, with the rise of affordable smartphones, mobile data plans, and government-backed digital inclusion initiatives, entrepreneurs from various regions can access online learning resources, reducing the gap between urban and rural digital literacy levels (Ayyagari et al., 2011).

Furthermore, digital literacy is often linked more to educational background, exposure to digital tools, and personal motivation rather than location (World bank report, 2020). Many rural entrepreneurs who have completed higher education or have prior digital experience can exhibit similar digital proficiency levels as their urban counterparts. For instance, women entrepreneurs, who have the drive and attitude to achieve success, clearly show an inclination towards personal and organizational growth to overcome location barriers (Ojobo et al., 2023). Hence the location of the establishment may not prove an impediment in digital literacy, especially in Indian context with high level of mobile penetration and availability of affordable network options.

Additionally, government schemes such as Digital India and PM Gramin Digital Saksharta Abhiyan (PMGDISHA) have played a role in promoting digital literacy in rural areas, helping bridge the divide in digital knowledge. Studies suggest that rural and semi-urban entrepreneurs

who actively participate in digital training workshops show competency levels comparable to urban entrepreneurs, reinforcing the finding that location alone does not determine digital literacy (Nayyar et al., 2019).

The lack of a significant impact of enterprise location on digital literacy has both positive and negative implications for MSME development. On the positive side, this finding suggests that access to digital knowledge is becoming more democratized across regions, reducing regional disparities in technological capability. Entrepreneurs from towns and rural areas are no longer at a substantial disadvantage when it comes to adopting digital tools, as they can leverage digital education platforms, remote training programs, and e-learning courses. This enhances opportunities for MSMEs in non-urban areas to compete in digital markets and expand their business operations beyond local geographies (OECD, 2021). However, while digital literacy levels may be comparable across locations, rural and semi-urban enterprises still face infrastructural barriers that limit their ability to fully utilize digital knowledge. MSMEs often struggle with issues such as unstable internet connectivity, lack of access to advanced technological tools, and lower financial resources to invest in digital transformation. Even though entrepreneurs may possess digital literacy, their ability to implement digital solutions in business operations may be constrained by these external limitations. Hence, while digital literacy is not significantly affected by location, other location-based factors such as digital infrastructure, financial accessibility, and logistical challenges still impact the digitalization of MSMEs.

To ensure that digital literacy translates into digital adoption and business growth, focus on addressing location-based digital infrastructure gaps is critical call for action. Development of digital infrastructure in rural and semi-urban areas by enhancing broadband connectivity and setting up more public digital access center should be a priority. Awareness towards programs

such as BharatNet, which aims to improve rural internet access, should be prioritised to ensure that digitally literate entrepreneurs can effectively use their skills in real-world business scenarios (TRAI, 2022). Further, localized training and support networks should be strengthened to ensure entrepreneurs in all locations receive continued digital education and mentorship.

Sector

The study's finding that the sector of the MSME enterprise significantly impacts the digital literacy of entrepreneurs aligns with existing literature, which highlights that different industries have varying levels of digital adoption and technological exposure. The manufacturing, services, and trading sectors operate in distinct business environments, each requiring different digital competencies. Service-based enterprises, such as IT firms, e-commerce businesses, and financial services, tend to require a higher degree of digital literacy as digital tools are integral to their daily operations (Ayyagari et al., 2011; Blichfeldt & Faullant, 2021). These businesses rely heavily on digital marketing, online transactions, automation, and cloud-based solutions, necessitating that entrepreneurs develop strong digital skills. On the other hand, manufacturing-based MSMEs often exhibit moderate levels of digital literacy, as their digital adoption is driven by automation, supply chain management software, and online procurement processes. However, entrepreneurs in this sector may not necessarily use digital tools extensively in customer-facing activities or daily operations (World Bank, 2020). Meanwhile, trading businesses, particularly small retailers and wholesalers, often display lower digital literacy levels since traditional business operations in this sector have historically relied on offline transactions, physical supply chains and pre-established B2B marketing channels. Additionally, trading MSMEs, especially those in rural and semi-urban

areas, may lag in adopting digital tools such as e-commerce, inventory management software, and digital payment solutions due to a lack of digital training and awareness.

The significant impact of enterprise sector on digital literacy has important implications for the digital transformation of MSMEs. The service-sector entrepreneurs are more likely to embrace digital tools for growth, enhancing their competitiveness in both local and global markets. This sectoral advantage suggests that policymakers and industry stakeholders should ensure that digital literacy initiatives are appropriately benefiting all the sectors. On the other hand, manufacturing and trading enterprises that exhibit lower levels of digital literacy face challenges in adapting to e-business environments. The increasing digitalization of supply chains, production processes, and customer engagement strategies requires even traditional businesses to develop at least a baseline level of digital proficiency. OECD (2021) warns that sectors with lower digital literacy may struggle with efficiency, scalability, and long-term sustainability if they do not embrace digital tools at the same rate as other industries. Additionally, lack of digital literacy in certain sectors could widen the competitiveness gap, leading to unequal economic growth among MSMEs and reducing their ability to integrate with digital supply chains and e-commerce platforms.

To bridge the digital literacy gap across different MSME sectors, sector-specific digital training programs should be introduced. Government and industry bodies should develop customized digital skill-building initiatives that cater to the unique needs of manufacturing, services, and trading businesses. For instance, service-sector MSMEs may benefit from advanced training in AI-driven automation, cloud computing, and digital marketing, while manufacturing firms need education on smart production systems, IoT-enabled machinery, and digital inventory tracking (Chabalala et al., 2023).

Government-backed financial incentives such as subsidized digital training programs, tax benefits for digital adoption, and grants for technology upgradation should be provided to MSMEs in manufacturing and trading sectors. Programs like Digital MSME Scheme and Credit Linked Capital Subsidy Scheme (CLCSS) should be expanded to support digital literacy enhancement in traditional businesses (TRAI, 2022). Further, public-private partnerships (PPPs) should be leveraged to promote digital literacy in underserved MSME sectors. Large corporations, technology providers, and industry associations can collaborate with MSMEs to offer mentorship programs, digital literacy workshops, and hands-on training with industry-relevant digital tools. By implementing sector-focused digital literacy strategies, policymakers can ensure balanced digital growth across industries, enhancing the competitiveness and resilience of MSMEs across all sectors.

In conclusion, business demand and an opportunity to grow prove to be motivators for digital transformation (Zhao et al.,2023) leading entrepreneurs to invest more in digital literacy especially in a developing context and small and medium businesses. The scope and nature of business demands digital transformation of an enterprise prompting the entrepreneur to become tech savvy. Research proves that compared to manufacturing, service industries are more conducive and demanding digital literacy among the employees. Similarly, education level of the entrepreneur facilitates the technical aptitude (Krajcik et.al.,2023).

RO3: To study the effect of gender, location, line of business and education qualification of the entrepreneur on digital adoption among MSMEs.

The study revealed that gender, location, line of business, and education qualification of the entrepreneur does not have a significant impact on digital adoption among MSMEs. This finding challenges commonly held assumptions that demographic and educational factors are

key determinants of digital transformation. Instead, it aligns with studies suggesting that external market forces, technological infrastructure, and financial constraints play a more decisive role in digital adoption among MSMEs than individual characteristics (Ayyagari et al., 2011; OECD, 2021).

One possible reason for the insignificance of gender in digital adoption is the increasing availability of gender-neutral digital resources and training programs, making digital tools equally accessible to both male and female entrepreneurs. While historical gender disparities in digital access exist, government initiatives such as Digital India and Skill India have helped bridge this gap, reducing gender-based differences in digital adoption rates (Upadhyaya, 2024).

Similarly, the location of MSMEs (urban, semi-urban, rural) does not significantly impact digital adoption, likely due to the widespread availability of mobile internet and digital payment solutions. In the context of the study, it was observed that though urban enterprises have better infrastructure, rural businesses have increasingly adopted digital payment systems and online marketplaces, reducing the urban-rural divide. The proliferation of affordable smartphones, ease of digital banking, UPI payments and e-commerce platforms has enabled businesses in all regions to adopt digital solutions at comparable rates.

Furthermore, the line of business (sector of operation) does not significantly determine digital adoption, likely because digital tools have become sector-agnostic, meaning businesses across manufacturing, services, and trading increasingly use similar digital technologies for payments, banking services, business promotions etc. Even traditionally non-digital industries have adopted online marketing, digital payments, and enterprise resource planning (ERP) software, leading to convergence in digital adoption across industries (World Bank, 2020).

Lastly, education qualification of entrepreneurs does not significantly impact digital adoption, as many digital tools are now designed to be user-friendly and require minimal technical

knowledge. Digital platforms such as social media marketing, e-commerce, and fintech applications are designed to be intuitive, enabling entrepreneurs with varying education levels to adopt them with ease (Kumar et al., 2024). Additionally, government and industry-led digital literacy initiatives have provided basic digital training to MSME owners, ensuring that education level does not act as a barrier to adoption (RBI, 2021).

The findings indicate that structural and systemic factors, such as affordability, internet connectivity, and government policies, may play a more significant role in digital adoption than individual entrepreneur characteristics. This suggests that digital adoption is no longer restricted to highly educated, urban-based, or male entrepreneurs, making digital transformation more inclusive across the MSME sector. However, despite widespread digital adoption, challenges such as inadequate financial resources, cybersecurity concerns, and digital skill gaps remain significant barriers for MSMEs (OECD, 2021). Furthermore, while gender, location, sector, and education do not significantly impact digital adoption, this does not imply that all MSMEs adopt digital technologies at an optimal level. Many businesses still face challenges in scaling digital adoption, particularly in leveraging advanced technologies like AI, big data analytics, and cloud computing (Loo et al., 2023). Thus, policymakers should focus on expanding financial assistance for MSMEs through subsidized loans, digital transformation grants, and tax incentives to encourage deeper digital integration and scaling of the operations. The Digital MSME Scheme and Credit Linked Capital Subsidy Scheme (CLCSS) is one such step to support small businesses in upgrading their digital capabilities.

Additionally, tailored digital skill development programs should be promoted for MSMEs, focusing on practical, hands-on training in e-commerce, digital finance, and online marketing. Public-private partnerships (PPPs) can play a crucial role in providing free or subsidized training programs to ensure that businesses fully utilize digital tools.

Lastly, improving digital infrastructure, particularly in semi-urban and rural areas, should remain a priority. By addressing systemic barriers rather than focusing solely on individual characteristics, digital adoption among MSMEs can be further accelerated, ensuring long-term growth, efficiency, and competitiveness in the digital economy.

In conclusion, digital adoption in a business context is predicted by many factors like business need, financial feasibility, entrepreneurial attitude, innovation opportunities, technological environment, infrastructure, and competitive pressure etc along with other factors like perceived benefits, perceived use, facilitating factors etc. (Shahadat & Nekmahmud, 2023). Factors like gender, location of the enterprise, line of business and education qualification of entrepreneur has a minimal significance in the business decision towards digital adoption. The study demonstrated that the digital adoption is based on the strategic demands of the enterprise.

RO4: To study the effect of Digital divide on digital adoption among MSMEs.

The study confirmed that the digital divide has a significant impact on digital adoption among MSMEs, highlighting disparities in access to technology, internet connectivity, digital literacy, and usage opportunities. The digital divide refers to the gap between those who have access to digital technologies and those who do not (Van Dijk, 2020). For MSMEs, this divide manifests in limited access to high-speed internet, inadequate digital skills, financial constraints, and lack of awareness about digital tools, all of which hinder the adoption of digital technologies (OECD, 2021).

One of the major factors contributing to the digital divide is unequal access to ICT infrastructure. MSMEs, particularly those in rural and semi-urban areas, suffer from poor internet connectivity and unreliable electricity, limiting their ability to leverage digital

solutions for business operations (Laskar, 2023). Moreover, high costs of digital tools and software act as barriers for small enterprises, especially for those with limited working capital (Ayyagari et al., 2011).

Another critical aspect of the digital divide is the lack of digital literacy among MSME entrepreneurs and employees. Studies indicate that businesses with low digital literacy levels struggle to integrate digital payment systems, e-commerce platforms, and cloud-based solutions due to a lack of technical know-how (Loo et al., 2023). Many entrepreneurs, particularly in the traditional manufacturing and trading sectors, perceive digital transformation as complex and risky, further slowing down adoption (World Bank, 2020).

Additionally, financial barriers limit digital adoption, as many MSMEs face challenges in accessing credit for digital investments. While large businesses can afford to invest in advanced digital tools, small businesses often lack the necessary funds to adopt and scale digital solutions (RBI, 2021). Limited awareness of government digitalization schemes and incentives also prevents MSMEs from leveraging available financial support. This persistence of the digital divide exacerbates business inequalities by preventing many MSMEs from competing effectively in the digital economy (OECD, 2021). Without digital transformation, MSMEs remain vulnerable to economic shocks and face challenges in scaling operations, ultimately impacting their profitability and sustainability. The digital divide also contributes to job losses and reduced productivity, as businesses that fail to adopt digital technologies lose competitiveness in both domestic and international markets (World Bank, 2020).

To bridge the digital divide and promote digital adoption among MSMEs, a multi-pronged strategy involving government, private sector, and non-profit organizations is necessary. Improving ICT infrastructure in terms of network connectivity, affordable digital tools and accessible support systems in rural and semi-urban areas should be prioritized.

Second, government and industry associations should strengthen digital literacy programs, ensuring that MSME entrepreneurs and employees receive hands-on training in digital tools such as e-commerce, fintech, cloud computing, and data analytics. Digitalization supporting initiatives should be provided to offer sector-specific digital training programs to enable MSMEs to integrate technology into their operations effectively. Additionally, financial support mechanisms must be enhanced to encourage digital adoption. MSMEs should have greater access to subsidized loans, digital transformation grants, and tax incentives to facilitate investments in digital technologies (RBI, 2021).

Further, creating awareness about digital adoption benefits and available government incentives is crucial. Policymakers should collaborate with MSME associations, chambers of commerce, and digital solution providers to organize workshops, webinars, and awareness campaigns aimed at educating MSMEs about the advantages of digital transformation and the support mechanisms available (OECD, 2021).

By addressing these barriers through improved digital infrastructure, training, financial assistance, and awareness initiatives, the digital divide can be effectively reduced, ensuring widespread digital adoption among MSMEs and enhancing their overall competitiveness, productivity, and long-term sustainability in the evolving digital economy.

RO5: To study the effect of digital literacy of the entrepreneurs on the digital adoption among the MSMEs.

The study demonstrated a significant impact of digital literacy on digital adoption among MSMEs, suggesting that entrepreneurs with higher digital skills are more likely to integrate digital technologies into their business operations. Digital literacy refers to an entrepreneur's ability to effectively use digital tools, platforms, and technologies, including e-commerce, cloud computing, digital payments, and online marketing (Van Laar et al., 2017). One of the

key reasons for this impact is that digitally literate entrepreneurs have greater confidence in adopting and utilizing digital solutions, enabling them to enhance business efficiency, customer engagement, and market reach (Rahayu & Day, 2017). Studies have shown that entrepreneurs with higher levels of digital literacy are more inclined to use online business tools, such as social media marketing, automated inventory systems, and fintech solutions, leading to improved operational effectiveness (Nambisan, 2017).

Additionally, digital literacy reduces the perceived risk and complexity associated with digital adoption. Many small business owners hesitate to adopt digital tools due to fear of cybersecurity threats, lack of technical expertise, and concerns about return on investment (OECD, 2021). Entrepreneurs with digital literacy are better equipped to navigate these challenges, making informed decisions about adopting and implementing technology within their enterprises (Ayyagari et al., 2011). Furthermore, government and financial institutions increasingly require MSMEs to adopt digital systems for compliance, financial transactions, and taxation. For instance, in the context of this study, initiatives like GST e-filing, Udyam Registration, and digital loan applications require a certain level of digital literacy. Entrepreneurs who lack digital skills struggle to meet regulatory requirements, limiting their ability to access government incentives and financial support.

The strong correlation between digital literacy and digital adoption has significant implications for MSME growth, competitiveness, and long-term sustainability. Digitally literate entrepreneurs are more likely to embrace e-commerce platforms, expanding their market reach beyond local boundaries and competing in global markets (Nambisan, 2017). This is particularly relevant in India, where initiatives like Digital India and Make in India encourage MSMEs to integrate technology for business growth. Moreover, businesses led by digitally literate entrepreneurs experience higher productivity, reduced operational costs, and better

financial management (Sariwulan et al.,2020). MSMEs using digital accounting software, AI-driven inventory systems, and fintech applications can significantly improve cash flow management, optimize supply chains, and automate routine processes (World Bank, 2020). The absence of digital literacy, on the other hand, results in missed opportunities for efficiency gains and business expansion.

Additionally, digital adoption among MSMEs directly influences job creation and employment patterns. As digital technologies transform business operations, MSMEs require employees with digital skills, leading to increased demand for digitally skilled workers (OECD, 2021). If entrepreneurs themselves lack digital literacy, they may fail to recognize the importance of digital upskilling among employees, further slowing business growth and digital transformation efforts.

To bridge the gap in digital literacy and enhance digital adoption among MSMEs, a comprehensive strategy involving government, educational institutions, and private sector stakeholders is necessary. Government-led digital literacy training programs must be expanded, such as the Digital MSME Scheme and Skill India Digital Training, which provide free or subsidized digital training for MSME entrepreneurs. Creating online learning platforms with self-paced modules on digital finance, cybersecurity, and e-commerce can also help entrepreneurs enhance their digital skills. Industry collaborations with technology firms, fintech companies, and business associations can further strengthen digital literacy among entrepreneurs. These partnerships can provide hands-on workshops and mentorship programs, equipping MSME owners with practical digital skills. Additionally, business incubators and accelerators should focus on digital skill development alongside business training to ensure entrepreneurs are well-prepared for the digital economy.

For rural and semi-urban entrepreneurs, targeted outreach programs are essential to bridge the skill digital divide. Establishing Digital Learning Centres in Tier 2 and Tier 3 cities can provide MSME entrepreneurs with training on digital entrepreneurship, online sales, and cloud computing. Mobile digital literacy units that travel to rural areas, offering live demonstrations and interactive sessions, can further increase digital adoption rates.

By implementing these solutions, digital literacy gaps among MSMEs can be reduced, ensuring higher rates of digital adoption, improved business sustainability, and stronger contributions to the digital economy. A digitally empowered MSME sector can lead to greater economic resilience, innovation, and inclusive growth, helping small businesses thrive in the modern digital landscape.

6.3 Theoretical Implications:

The study contributed to the existing literature by introducing a conceptual framework designed to assess digital literacy levels among MSME entrepreneurs in India or developing context. Unlike generic digital literacy models, this framework is industry-oriented, acknowledging the sector-specific challenges and requirements faced by MSMEs in adopting digital technologies. Additionally, the study developed a robust measurement scale for assessing digital literacy among entrepreneurs, offering a standardized method to evaluate digital competencies. This scale goes beyond just measuring access to digital tools; it considers proficiency in using digital platforms, awareness of cybersecurity, and the ability to integrate digital solutions into business operations.

The study made a significant theoretical contribution to the existing literature on the digital divide, particularly in the context of developing economies, where MSMEs play a crucial role in economic growth and employment generation. Traditional digital divide research primarily

focussed on access to digital infrastructure, often overlooking the contextual factors that shape digital adoption among small and medium enterprises.

This study extends the theoretical understanding of the digital divide by incorporating a multidimensional perspective that goes beyond mere access and explored the role of education, sectoral differences, and socio-economic factors in shaping digital adoption. By emphasizing digital skill access as one of the key determinants of the digital divide, the study extended the discourse from infrastructural deficiencies to skill-based disparities, which is particularly relevant in developing economies where technology access is improving but skill gaps persist. The study built upon existing digital divide theories, such as Van Dijk's (2005) "Successive Levels of Digital Divide," and tested the impact of variables like gender, location, sector and education qualification of the entrepreneur on the digital divide. Additionally, the study integrated insights from the Unified Theory of Acceptance and Use of Technology (UTAUT), by demonstrating that digital literacy and digital divide influence the individual's intention to adopt digital technologies.

6.4 Practical implications:

The practical implications of this study are significant for policymakers, industry stakeholders, and MSME entrepreneurs, as it provided actionable insights into digital literacy and adoption among small businesses. One of the primary implications is the need for sector-specific digital literacy programs. Since digital literacy levels vary across different industries, a one-size-fits-all approach may not be effective. Government agencies and business associations should develop training programs tailored to the unique technological needs of the manufacturing, services, and trading sectors. For instance, while manufacturing enterprises may benefit from automation and digital supply chain management, service-oriented businesses may require training in customer relationship management (CRM) software, digital marketing, and online

service delivery. Implementing sector-focused training initiatives can enhance digital competencies, leading to increased competitiveness and productivity in MSMEs.

Another critical implication is the necessity of targeted policy interventions to bridge the digital divide among MSMEs. The study highlighted the role of factors such as gender, location, and education in digital literacy and adoption. Policymakers must introduce inclusive digital literacy programs, ensuring that entrepreneurs from diverse backgrounds have equal access to technological resources and training. For example, women entrepreneurs often face systemic barriers to digital adoption due to limited access to finance and digital skills. Government initiatives should focus on empowering female-led MSMEs through financial incentives, mentorship programs, and training workshops that specifically address their challenges. Similarly, rural and small-town enterprises require better digital infrastructure and connectivity to facilitate online business operations. Expanding broadband access and offering subsidies for digital tools in underserved areas can help bridge this gap, promoting more inclusive economic growth.

Furthermore, financial institutions and investors can leverage the study's findings to design targeted financial products that support digital transformation in MSMEs. Digital adoption often requires significant investment in infrastructure, software, and workforce training, which may be financially challenging for smaller businesses. Banks, venture capital firms, and government-backed financial institutions should offer digital transformation loans or grants to encourage MSMEs to invest in technology. These financial products should be designed with flexible repayment structures and incentives, such as lower interest rates for businesses that demonstrate digital growth. Additionally, integrating digital literacy assessments into loan approval processes can ensure that MSMEs receiving financial support are equipped with the necessary skills to utilize digital tools effectively.

Finally, the study provided valuable insights for academic and industry research by introducing a validated measurement scale for digital literacy. This tool can be utilized to assess the digital competency of not only entrepreneurs but also employees within MSMEs, helping businesses identify skill gaps and training needs. Large corporations that collaborate with MSMEs in supply chains can use this scale to evaluate their partners' digital readiness and offer targeted support to improve efficiency and integration. By fostering a digitally competent workforce, businesses can enhance operational efficiency, expand market reach, and ensure long-term sustainability in an increasingly digitalized economy.

In summary, the study's findings have far-reaching practical implications, emphasizing the need for customized digital literacy programs, inclusive policy interventions, financial support mechanisms, and workforce skill development. By addressing these areas, stakeholders can facilitate the seamless digital transformation of MSMEs, ensuring their continued growth and competitiveness in the modern economy.

6.5 Limitations and future scope of the study

No single study can encompass the entirety of a topic without some limitations. Despite its contributions, this study also has some limitations that should be acknowledged. One limitation is its cross-sectional research design, which captures data at a single point in time. A longitudinal study would provide deeper insights into how digital literacy evolves over time and how it influences digital adoption in the long run. Longitudinal research would also help assess the impact and sustainability of digital interventions and training programs, offering a more dynamic perspective on the digital transformation journey of MSMEs.

The study employed quantitative method which, while effective in measuring trends and relationships, may not fully capture the nuances of digital literacy and adoption challenges faced by MSME entrepreneurs. A qualitative approach, such as in-depth interviews or case

studies, could provide insights into the barriers, motivations, and contextual factors influencing digital adoption. Additionally, qualitative research could help uncover sector-specific challenges that may not be apparent through survey-based data collection. Future studies should consider a mixed-methods approach to provide a more holistic understanding of digital literacy and adoption in the MSME sector. Lastly, the study though covering diverse industries and sectors, is geographically limited to two states. Expanding the scope to multiple regions with diverse socio-economic conditions could enhance the robustness of the findings.

The study took the enterprise as unit and did not differentiate in the size of the enterprise. Taking the size into consideration, could have provided a better understanding of digital literacy and adoption. Micro-enterprises, often operate with limited budgets and may struggle to invest in digital infrastructure, whereas larger SMEs may have better access to capital and skilled employees, allowing for more seamless digital integration. However, due to the financial sensitivity of such information, many MSME owners were reluctant to disclose detailed financial data, making it challenging to assess how enterprise size affects digital adoption. Future research could explore alternative methods to categorize MSMEs without requiring sensitive financial disclosures, such as using operational metrics like employee count or revenue brackets from publicly available data.

Additionally, the study does not account for potential variations in digital adoption within MSMEs of same industry with different scales. Tailoring digital literacy programs based on firm size and specific industry would likely yield more effective results, as smaller enterprises may need foundational training, while larger ones might require advanced digital transformation strategies. Future studies could incorporate stratified sampling methods or industry-specific case studies to explore how digital adoption differs across MSME categories.

Summary

The chapter provides an in-depth analysis of the findings, examining the impact of digital literacy and the digital divide on digital adoption among MSMEs. Further, the chapter discussed the results of the analysis with respect to the research objectives of the study. Additionally, the role of government initiatives, infrastructure development, and financial incentives in addressing digital gaps among MSMEs was also discussed. The chapter presented the theoretical and practical contributions of the study, particularly the development of a conceptual framework for assessing digital literacy in an industry-specific context. It further examined the implications of the study, emphasizing the need for targeted interventions such as digital training programs, financial support mechanisms, and policy reforms to facilitate inclusive digital growth. Lastly, limitations of the study are acknowledged along with the future scope for further research, including the need for longitudinal research, qualitative analysis, and consideration of MSME size for a more comprehensive understanding of digital adoption patterns.

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Digital Literacy and Digital adoption among the MSMEs - Questionnaire

Digitalization is the new normal in every walk of life and same applies to the Micro, Small and medium enterprises. This survey is part of Ph.D. thesis titled 'Digital divide, Digital literacy and Digital adoption among the MSMEs' by U Naganjani (20MBPH11), School of management Studies, University of Hyderabad. Your co-operation in filling out the survey questionnaire is solicited for the research. The responses will be kept confidential and will only be used for research work.

Thank you for your time and Cooperation.

U Naganjani

6302735185

Participant Information:

- 1) Name (Optional) -----
- 2) Email ID/Website URL (optional) -----

- 3) Age : tick the appropriate box
Below 20 []
20-30 []
31-40 []
41-50 []
51-60 []
Above 60 []
- 4) Educational Qualification:
Below 10th standard []
10th –graduation []
Graduation –PG []
Above PG []

5) Gender :

Male []

Female []

Others []

6) Name of business -----

7) Location of Business -----

Rural (Panchayat) []

Town (municipality) []

Urban (Corporation) []

Others

8) Product or service _____

9) Sector _____

10) Nature of the business.

Manufacturing []

Service []

Trading []

Others []

11) Is your business a registered MSME. Yes [] No []

12) Ownership of business?

Single Proprietor [] Partnership [] Private limited []

others []

13) My role in the Business (MSME)

Entrepreneur []

Manager []

Partner []

Other -----

14) ICT devices that I use

Smart phone []

Laptop []

PC []

Tablet []

15) Apps / Software that I use for my business

Section 1: Digital divide

- ICT devices: smart phone, laptop, tablet, computer etc.
- Web based tools: social media apps, WhatsApp etc.
- Please read the statement and tick the relevant column.

Ques. No	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
15	I find that ICT devices are very difficult to use and understand					
16	Using ICT devices for business purposes gives me anxiety and discomfort					
17	I have access to ICT devices that I can use for my business					
18	I have access to internet network at my business place					
19	I know how to use ICT devices to get work done					
20	I find that ICT devices and tools are user friendly					
21	I frequently use ICT devices for my business					
22	I frequently use Internet and web based tools for my business					

Section 2: Digital literacy

Basic Level: Information and Operation

Ques No	Question	Strongly agree	agree	Neutral	disagree	Strongly disagree
23	I can use ICT devices (switch on and operate)					
24	I can search for information on internet through my ICT device					
25	I can download apps and content through my ICT Device					
26	I can follow digital instructions for downloading and operating apps that are useful for my business					

27	I can use social media to get information					
----	---	--	--	--	--	--

Proficient Level: Usage, Communication and creation

Ques No	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
28	I can use social media apps for my business (eg. FB business page, Instagram etc.)					
29	I can create digital content for my business promotion (E.g. FB page, Instagram ad, email or WhatsApp ad)					
30	I use technology for different aspects of my business					

Advanced Level:

Ques No	Question	Strongly agree	agree	Neutral	Disagree	Strongly disagree
31	I have knowledge of advanced software (SAP, Hotsuite, Google analytics etc)					
32	I have knowledge of software and app development					
33	I use advanced software and apps for my business					
34	I can analyse data or use data analytics apps for my business					
35	I have knowledge of webmasters or /and programming language					
36	I have knowledge of web security and data privacy					
37	I have formal training in computer and IT					

Study iii (digital adoption)

How likely are you to use digital tools/technologies in future for your business (if you are trained and ICT tools are available and affordable?)

Ques No	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
38	I intend to use digital tools in future					

39	I intend to use digital tools in business operations frequently/regularly					
40	I intend to recommend the use of digital tools to other people (MSMEs) while I am using them					
41	I intend to buy digital tools or apps for my business in future					

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Digital divide, Digital Literacy and Digital adoption among MSMEs - A Study in the Indian context

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