



## Case Report

# Harnessing technology and innovation to mitigate vulnerabilities in micro small and medium enterprises (MSMEs) in India

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## Abstract

The Micro, Small, and Medium Enterprises (MSME) sector serves as a cornerstone of India's economy, playing a crucial role in contributing to GDP, generating exports, and creating employment opportunities. Despite its economic significance, the sector faces several challenges, including limited access to finance, intense competition, inefficiencies in operations, and slow adoption of advanced technologies. This chapter explores how technology and innovation can address these challenges and foster the sustainability and competitiveness of MSMEs in India. Emerging technologies such as digital payments, cloud computing, artificial intelligence (AI), and block chain are reshaping MSME operations by improving financial inclusion, streamlining processes, and expanding market access. Digital payment platforms, including UPI and fin tech solutions, have eased access to credit, while cloud technologies provide scalable and cost-efficient infrastructure. AI-powered tools and data analytics equip MSMEs with valuable insights into market trends and consumer behaviour, enabling more informed business decisions. Furthermore, block chain enhances supply chain transparency and security by minimizing fraud risks and building trust among stakeholders. The chapter also examines government initiatives, such as the Digital MSME Scheme and MSME Databank, which aim to accelerate technology adoption within the sector. However, several barriers remain, such as low digital literacy, the high upfront cost of technology investment, and concerns about data security. Overcoming these hurdles is critical to building a resilient MSME ecosystem that can adapt to economic fluctuations and compete effectively on a global scale. Through case studies and real-world examples, this chapter highlights the transformative role of technology in the MSME sector, offering practical insights for policymakers, business leaders, and entrepreneurs committed to driving sustainable growth.

**Keywords:** MSMEs, Technology adoption, Digital payments, Cloud computing; Artificial intelligence, Block chain; Fin tech, Digital literacy

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## 1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) form a crucial part of India's economy, contributing to industrial growth, employment generation, and equitable wealth distribution. Despite their importance, Indian MSMEs encounter several challenges that limit their development and sustainability. These obstacles include restricted access to formal financial services, limited market reach, low levels of technology adoption, inefficiencies in operations, and stiff competition from both domestic and international players.<sup>5</sup>The impact of these challenges was exacerbated by the COVID-19 pandemic, which highlighted structural vulnerabilities within the sector. Recent technological advancements and the acceleration of digital transformation have opened new avenues for MSMEs to address these challenges effectively. Digital solutions, including online

payment systems, cloud computing, artificial intelligence (AI), block chain, and data analytics, offer opportunities to enhance efficiency, increase financial inclusion, and expand market access. These technologies also enable MSMEs to remain competitive by helping them adapt to the rapidly changing digital environment. Innovation, fuelled by both technological advancements and entrepreneurial initiatives, plays a pivotal role in mitigating the risks and weaknesses that the sector faces. Government initiatives such as the Digital MSME Scheme, Start-up India, and Make in India have been instrumental in encouraging technology adoption by lowering costs and providing better access to resources.<sup>6</sup>However, challenges persist, including gaps in digital literacy, high implementation costs, and concerns related to data privacy and cyber security. This chapter examines how MSMEs can leverage technology and

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innovation to strengthen their resilience and sustainability. It discusses the integration of digital tools, explores supportive government policies, and provides real-world examples of Indian MSMEs successfully utilizing innovation to thrive in a competitive global market.

1.1 Overview of MSMEs in India

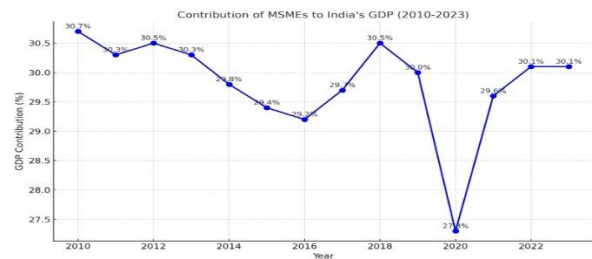
1.1.1. Economic contribution

MSMEs contribute significantly to India's economy, accounting for over 45% of industrial production and more than 40% of exports.<sup>1</sup>These enterprises form the backbone of the country’s manufacturing and service sectors, spanning across diverse industries, including textiles, food processing, chemicals, and engineering goods. With their vast presence in rural and semi-urban areas, MSMEs not only generate employment opportunities for millions of people but also play a crucial role in reducing regional economic disparities by fostering inclusive growth. Additionally, MSMEs promote entrepreneurship and innovation, driving local economies and empowering marginalized communities by offering them access to income-generating opportunities. Their contribution to the development of grassroots-level enterprises further strengthens India's socio-economic fabric, making them indispensable to the country’s sustainable growth and global competitiveness.

**Table 1:** Contribution of MSMEs to India's GDP (2010–2023)

Year	Contribution	Year	Contribution
2010-11	30.70%	2016-17	29.20%
2011-12	30.30%	2017-18	29.70%
2012-13	30.50%	2018-19	30.50%
2013-14	30.30%	2019-20	30.00%
2014-15	29.80%	2020-21	27.30%
2015-16	29.40%	2021-22	29.6% (impacted by COVID-19)
		2022-23	30.10%

Source: Ministry of Micro, Small& Medium Enterprises, (Release ID: 2035073)



**Figure 1:** MSMEs contribution to India's GDP (2010–2023)  
Source: Ministry of Micro, Small & Medium Enterprises, (Release ID: 203502.2. Employment generation

The MSME sector is a major contributor to employment generation in India, with over 111 million people engaged across different industries. It plays a pivotal role in integrating the expanding workforce, particularly in rural and semi-urban regions, by creating job opportunities for both skilled and unskilled labour. Due to its ability to function at lower capital costs compared to large-scale industries, MSMEs promote inclusive growth and help bridge regional disparities in employment. Moreover, MSMEs encourage entrepreneurship at the grass root level, promoting self-sufficiency and fostering innovation in sectors such as manufacturing, trade, and services. Initiatives such as the Prime Minister’s Employment Generation Programme (PMEGP) and the Skill India Initiative have further enhanced the MSME sector’s role in employment by offering skill development programs and financial assistance to aspiring entrepreneurs.<sup>7</sup> This makes MSMEs a key pillar in advancing India's goals of employment generation and economic development

**Table 2:** Employment generation by MSME in different sector

Sector-wise Distribution of MSMEs:		Number of Employees (Approximate):	
Manufacturing	31%	Manufacturing	3.73 crore employees
Trade:	36%	Trade	4.04 crore employees
Services:	33%	Services:	3.33 crore employees

Source: Reports and estimates from the central statistics office (CSO), Government of India

2.3. Vulnerabilities faced by MSMEs

Despite their vital role in driving India’s economy, MSMEs encounter several challenges that impede their growth and long-term sustainability. A key issue is restricted access to financing, which limits their ability to adopt advanced technologies, scale operations, and maintain healthy cash flow.<sup>2</sup> Additionally, navigating regulatory complexities and compliance requirements can be daunting for small business owners, adding to their operational burden. MSMEs are also vulnerable to market volatility and intense competition from larger enterprises that benefit from economies of scale. Another significant challenge is the shortage of skilled labour, as many small businesses find it difficult to attract and retain qualified employees.<sup>8</sup> Furthermore, inadequate infrastructure, such as inefficient transportation systems and unreliable utility services, hampers their operational efficiency and competitiveness. Overcoming these challenges is crucial to unlocking the true potential of MSMEs and promoting sustainable economic development.<sup>9</sup>

2.3.1. Limited access to finance

MSMEs often face difficulties in securing sufficient funding from financial institutions due to strict lending policies, the need for collateral, and insufficient credit histories. These challenges limit their ability to adopt modern technologies, scale up operations, or effectively manage working capital, hindering their potential for growth and expansion.

2.3.2. Regulatory burdens

Complex legal and regulatory frameworks such as those related to taxation, labour laws, and environmental standards can be challenging for MSMEs. Meeting statutory requirements, along with obtaining necessary licenses and permits, often demands considerable time and resources. These bureaucratic hurdles can divert the focus of small business owners from core operations, affecting their efficiency and ability to grow.

2.3.3. Market fluctuations

MSMEs are particularly vulnerable to market disruptions, such as economic slowdowns, inflation, or changes in consumer preferences. While larger enterprises can leverage their resources and scale to weather these fluctuations, smaller businesses often face challenges like declining sales, heightened competition, and shrinking profit margins, which can threaten their sustainability.<sup>3</sup>

2.3.4. Inadequate infrastructure

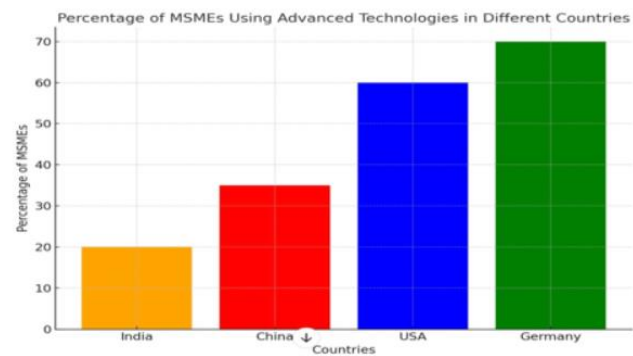
Many MSMEs are located in regions with inadequate infrastructure, such as inconsistent electricity supply, weak transportation networks, and limited access to advanced technologies. These challenges reduce their operational efficiency and drive up costs, making it difficult for them to remain competitive in national and international markets.

2.3.5. Skilled labour shortage

MSMEs face challenges in attracting and retaining skilled workers due to limited resources for competitive salaries, benefits, and training programs. This shortage of qualified labour affects productivity and limits their ability to innovate and improve product quality or services.

2.3.6. Technology adoption gap

MSMEs often lag behind in adopting modern technologies due to high costs, lack of awareness, or insufficient technical expertise. This limits their ability to improve efficiency, enhance customer experiences, and leverage digital tools for marketing, sales, and operations. Without access to the latest innovations like automation, e-commerce platforms, or cloud computing, MSMEs face difficulties in scaling and competing with larger, tech-savvy companies.<sup>10</sup> Percentage of MSMEs in India, China, USA, and Germany are using advanced technologies.

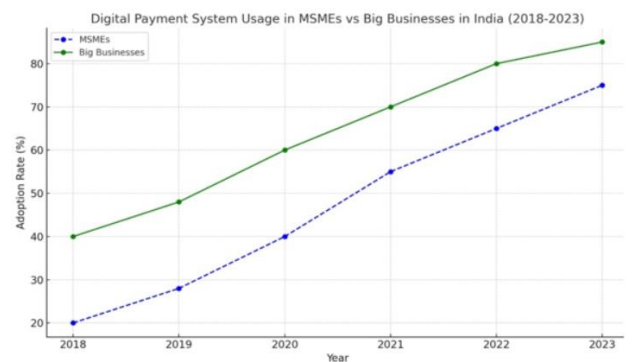


**Figure 2:** Percentage of MSMEs using advanced technologies in different countries  
Source: McKinsey & company (2024). The impact of technology on small business job creation.

2. Role of Technology in Mitigating MSME Vulnerabilities

2.1. Digital payments and financial inclusion

For MSMEs to effectively adopt digital payment solutions, selecting the appropriate platform—such as UPI, mobile wallets, or payment gateways—is essential. These systems should support various payment methods and integrate with accounting and inventory management software to automate invoicing and stock updates, enhancing efficiency. Contactless options like QR codes and NFC improve customer convenience, while ongoing employee training reduces errors. Leveraging payment analytics aids decision-making and robust cyber security ensures transaction safety.<sup>11</sup> Encouraging digital payments through incentives and reliable internet access can boost transaction speed and lower costs, ultimately enhancing operational efficiency and customer satisfaction.

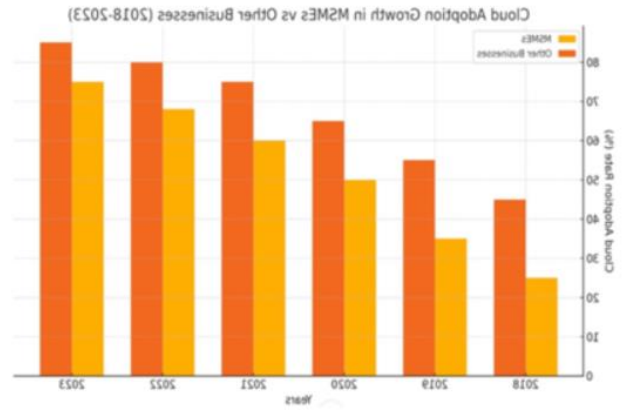


**Figure 3:** Growth in digital payment adoption by MSMEs and other business (2015–2023)  
Source: Sundar, K. R. S., & Gupta, A. K. (2022), Digital payment systems: A comprehensive guide - Wiley.

2.2. Cloud-based ERP (Enterprise resource planning) and CRM (Customer relationship management)

Cloud-based ERP and CRM systems are revolutionizing how MSMEs handle their operations. By using cloud technology, MSMEs can store data, access real-time analytics, and streamline processes without needing a large upfront investment. These systems offer cost-effective solutions by operating on subscription models, helping MSMEs avoid the high initial costs tied to traditional ERP and CRM systems. They also reduce the need for in-house IT support, as maintenance and updates are managed by the cloud provider. One key advantage is scalability—cloud systems enable businesses to grow easily, adding users, features, or functions without heavy infrastructure costs. The pay-as-you-go model helps MSMEs control expenses by selecting services based on current needs. Another benefit is accessibility—cloud systems can be used from any device with internet access, allowing employees to work remotely and collaborate efficiently.<sup>12</sup> This improves communication, enabling teams to share information and work together in real time, no matter their location. Real-time analytics provided by these systems empower MSMEs to make quicker, data-driven decisions based on current trends and customer behaviours. Customizable dashboards also allow businesses to monitor key performance indicators (KPIs) specific to their roles. In terms of customer relationship management, cloud-based CRM systems offer a complete view of customer interactions, preferences, and purchase history. This enables businesses to personalize their marketing efforts and enhance customer service. Automated communications, such as email campaigns and follow-ups, can also be easily managed.

Cloud-based ERP and CRM systems offer seamless integration with other third-party applications, improving functionality and centralizing data management. This ensures all business data is stored in one place, reducing data silos and improving accuracy. Data security is another major benefit, with top providers offering advanced measures such as encryption, regular backups, and multi-factor authentication. Many systems also help MSMEs comply with regulations like GDPR and HIPAA. Additionally, these solutions enable faster implementation and updates, allowing MSMEs to quickly benefit from new features without manual intervention. Customization is strength, with many platforms offering flexible modules and user-friendly interfaces tailored to meet specific business needs. Finally, cloud-based systems enhance collaboration across departments by fostering unified communication and enabling cross-functional insights through real-time data sharing.



**Figure 4:** Cloud adoption growth in MSMEs vs other business (2018-2023)  
Source: McKinsey & Company. (2024), The impact of technology on small business job creation.

This improved collaboration leads to better strategic planning and overall execution across the organization. The bar chart illustrates the comparison of cloud adoption rates between MSMEs and other businesses from 2018 to 2023. It highlights the steady increase in cloud adoption across both categories over the years. While MSMEs have shown considerable growth in adopting cloud technology, they are gradually narrowing the gap with larger businesses. However, other businesses continue to have a slightly higher rate of adoption overall. This trend underscores the growing importance of cloud solutions in enhancing operational efficiency in MSMEs

2.3. Artificial intelligence and machine learning

The integration of Artificial Intelligence (AI) and Machine Learning (ML) can significantly enhance the performance and growth of MSMEs by streamlining both operational and strategic functions. These technologies help businesses anticipate market shifts, streamline supply chain operations, and improve customer engagement through personalized experiences. Automating repetitive tasks with AI and ML also cuts operational costs and boosts productivity. Additionally, these tools enable data-driven decisions, such as identifying fraudulent activities by spotting irregular patterns and tightening security measures. AI and ML also optimize inventory control, support dynamic pricing adjustments using real-time data, and predict equipment maintenance needs, minimizing downtime. This allows MSMEs to operate more efficiently, reduce expenses, and maintains a competitive edge in the digital economy. By leveraging AI and ML; MSMEs can not only enhance operational efficiency but also make informed decisions that drive long-term success.<sup>4</sup>

**Table 3:** Adoption of artificial intelligence and machine learning in different sector

Year	MSME Adoption (%)	Manufacturing Adoption (%)	Retail Adoption (%)	Healthcare Adoption (%)	Financial Services Adoption (%)
2020	22%	35%	30%	45%	40%
2021	27%	40%	35%	50%	45%
2022	34%	48%	42%	55%	50%
2023	40%	55%	50%	60%	55%

Sources: McKinsey & company. (2024), The impact of technology on small business job creation.

As other industries such as manufacturing, retail, healthcare, and financial services show higher adoption rates, MSMEs may feel competitive pressure to keep up. The increasing use of AI and ML by larger organizations highlights the necessity for MSMEs to adopt these technologies to remain competitive and relevant in their respective markets. MSMEs are often resource-constrained, making operational efficiency a critical factor for their growth. The adoption of AI and ML can help automate repetitive tasks, optimize processes, and reduce operational costs. As the data suggests, many MSMEs are recognizing this potential and taking steps to incorporate AI/ML into their business models.

The improved data-driven decision-making capabilities provided by AI and ML are becoming essential for MSMEs to thrive. With increased adoption, MSMEs can leverage analytics for better forecasting, inventory management, and customer engagement, which are crucial for driving growth.

2.4. E-commerce platforms and marketplaces

E-commerce platforms present a vital growth opportunity for MSMEs by enabling them to reach broader markets, both nationally and internationally, at a low cost. The shift toward online marketplaces like Amazon, Flipkart, and Alibaba has allowed small businesses to improve market access, diversify revenue streams, and reduce dependence on local customers. Additionally, platforms such as Shopify and Woo Commerce make it easy for MSMEs to set up online stores without requiring large upfront investments. Digital marketing tools like Google Ads, Face book Ads, and HubSpot further empower MSMEs to enhance visibility, generate leads, and engage customers effectively. Businesses adopting e-commerce solutions have reported up to a 65% increase in turnover and significant improvements in profits, showcasing the strong business case for digitization. However, despite these benefits, only a fraction of MSMEs currently leverage these technologies, with just 12% considered digitally mature. To remain competitive in an evolving digital

economy, MSMEs must accelerate their adoption of e-commerce platforms. This not only ensures business continuity but also creates new growth avenues, helping them better withstand market disruptions and attract investor interest.

3. Discussion

3.1. Case Studies: MSMEs leveraging technologya

Udaan – Digital Marketplace for Small Businesses: Udaan, a B2B e-commerce platform, connects MSMEs across India with suppliers and buyers, reducing procurement costs and improving access to markets. As of 2022, over 3 million MSMEs were registered on Udaan.

**Table 4:** Udaan’s impact on MSME procurement costs

Category	Traditional Procurement (in Rs)	Procurement via Udaan (in Rs)	Savings (%)
Product Cost (Bulk Rates)	100,000	85,000	15%
Logistics & Transport	15,000	8,000	47%
Inventory Holding Costs	20,000	12,000	40%
Payment Processing Fees	3,000	1,500	50%
Total Procurement Cost	138,000	106,500	22.80%

Source: Ministry of Micro, Small& Medium Enterprises

Table 4 indicates that MSMEs save nearly 23% on total procurement costs by using Udaan compared to traditional methods. The major savings come from bulk discounts, reduced logistics costs, and optimized inventory management.

3.2. Government initiatives to support technology adoption

Here a detailed and overview of the government initiatives to support technology adoption in Micro, Small, and Medium Enterprises (MSMEs) in India, with added content for each point is analysed.

3.2.1. Digital MSME scheme

This scheme aims to enhance the digital capabilities of MSMEs by promoting the use of digital tools and platforms. The Digital MSME Scheme provides financial assistance for the purchase of software and hardware that can improve operational efficiency. It encourages MSMEs to adopt e-commerce platforms for marketing and selling products online. Additionally, the scheme includes training programs



to equip MSME employees with digital skills, ensuring they can effectively use new technologies.

### 3.2.2. *Make in India*

Launched in 2014, the Make in India initiative seeks to position India as a global manufacturing hub and attract foreign investment. The initiative encourages innovation and technological advancement in the manufacturing sector by simplifying regulations and enhancing the ease of doing business. It includes support for MSMEs in the form of infrastructure development, financial assistance, and technology transfer, thereby facilitating their integration into global supply chains. Moreover, it promotes a culture of entrepreneurship, inspiring MSMEs to innovate and compete on an international scale.

### 3.2.3. *Technology Up gradation fund scheme (TUFs)*

The TUFs is designed to promote technology up gradation in the textile and garment industry, which is vital for enhancing productivity and competitiveness. The scheme, offers financial assistance in the form of interest subsidies to MSMEs that invest in modernizing their machinery and adopting new technologies. It aims to enhance the quality of products manufactured, reduce production costs, and increase overall efficiency. Furthermore, the TUFs supports skill development programs to ensure that the workforce is trained to operate advanced machinery effectively.

### 3.2.4. *MSME technology development centre (MTDC)*

The MTDC aims to provide a comprehensive range of technical support services to MSMEs across various sectors. These centres offer access to cutting-edge technology, research and development facilities, and consultancy services tailored to the needs of MSMEs. They also conduct training sessions and workshops focused on technology adoption and quality improvement. By facilitating collaboration between MSMEs and research institutions, the MTDC fosters innovation and helps businesses develop new products and processes.

**3.2.5. Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGTMSE):** This scheme aims to enhance the flow of credit to MSMEs by providing credit guarantees to financial institutions. The CGTMSE provides a guarantee cover for loans extended to MSMEs, reducing the risk for banks and encouraging them to lend to smaller enterprises that may not have substantial collateral. This scheme has been pivotal in promoting entrepreneurship and innovation by making it easier for MSMEs to secure funding for technology investments and operational expansions. Additionally, it contributes to job creation by supporting the growth of new businesses.

### 3.2.6. *Start-up India*

Launched in 2016, the Start-up India initiative aims to foster innovation and support the growth of start-ups, many of

which are MSMEs. This initiative provides a range of benefits, including tax exemptions, easier compliance, and access to funding through government schemes and venture capital. It also facilitates mentorship programs, connects start-ups with industry leaders, and encourages collaboration with research institutions. By promoting a robust start-up ecosystem, the government aims to enhance technological advancements and spur economic growth.

### 3.2.7. *Production linked incentive (PLI) scheme*

The PLI scheme is designed to boost domestic manufacturing by providing financial incentives to companies that meet specified production targets. The scheme targets key sectors such as electronics, pharmaceuticals, and textiles, encouraging MSMEs to adopt new technologies and improve production processes. By providing incentives for investment in manufacturing capabilities, the PLI scheme helps MSMEs enhance their competitiveness and fosters innovation. This, in turn, supports job creation and contributes to the overall growth of the manufacturing sector.

### 3.2.8. *Skill India mission*

The Skill India Mission aims to equip the workforce with the skills needed for various sectors, including MSMEs, to thrive in a competitive landscape. The mission focuses on training programs that cover both technical skills and soft skills, ensuring that employees are well-prepared to operate advanced technologies and engage with customers effectively. By collaborating with industry stakeholders, the Skill India Mission aims to create training programs that meet the evolving needs of MSMEs, ultimately enhancing their productivity and operational efficiency.

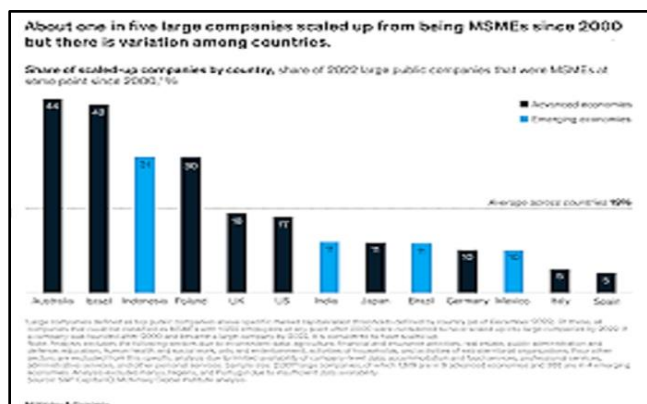
### 3.2.9. *National policy on electronics (NPE)*

The NPE aims to promote the growth of the electronics manufacturing sector in India, emphasizing technology adoption. The policy encourages MSMEs to invest in electronics manufacturing by providing incentives such as subsidies, access to technology, and support for research and development. By fostering an environment conducive to innovation, the NPE aims to reduce reliance on imports and enhance domestic production capabilities in the electronics sector, thereby creating new opportunities for MSMEs.

### 3.2.10. *Atmanirbhar Bharat abhiyan*

Launched in response to the economic challenges posed by the COVID-19 pandemic, the Atmanirbhar Bharat Abhiyan aims to promote self-reliance and resilience in the Indian economy. The initiative includes financial packages and support measures specifically designed for MSMEs, enabling them to recover and thrive. It emphasizes technology adoption, skill development, and market access, helping MSMEs become more competitive and self-sufficient. By promoting local manufacturing and reducing dependency on imports, the initiative aims to build a robust ecosystem for

MSMEs. These government initiatives collectively create a supportive ecosystem for MSMEs in India, encouraging them to adopt technology, enhance their capabilities, and contribute significantly to the nation's economic growth. Through targeted financial assistance, training programs, and policy support, the government aims to empower MSMEs to innovate and compete effectively in the global market. MSME growth among different countries is shown in **Figure 5**.



**Figure 5:** MSME growth in different countries

Source: <https://www.emerald.com/insight/content/doi/10.1108/jbim-09-2023-0512/full/pdf?title=what-drives-the-adoption-of-digital-technology-in-the-micro-small-and-medium-enterprises-sector-in-a-developing-economy>

## 4. Challenges in Technological Adoption by MSMEs

### 4.1. Digital literacy and skill gaps

According to a report by the Confederation of Indian Industry (CII), more than 70% of employees in Micro, Small, and Medium Enterprises (MSMEs) lack the essential digital skills needed to effectively leverage modern technologies. This substantial skill gap poses a critical challenge for MSMEs striving to enhance their competitiveness in an increasingly digital marketplace. The report highlights that a vast majority of MSME employees are either unfamiliar with digital tools or possess only basic digital skills, which limits their ability to utilize advanced technologies such as cloud computing, data analytics, and e-commerce platforms. The lack of digital proficiency is a major barrier preventing MSMEs from adopting innovative technologies that could streamline operations, improve customer engagement, and drive growth. Without a skilled workforce, these enterprises may struggle to compete with larger organizations that are more adept at utilizing technology. The skills gap can hinder MSMEs' growth potential, reducing their ability to innovate and adapt to changing market demands. As digital transformation becomes essential for business sustainability, MSMEs must invest in training programs to bridge this skill gap. To address this issue, targeted training and development initiatives are essential. Collaborations between government, industry

associations, and educational institutions can facilitate the upskilling of employees, ensuring they are equipped with the necessary digital competencies. By investing in digital skills development, MSMEs can improve operational efficiency, enhance customer experiences, and ultimately contribute to economic growth. A digitally literate workforce is vital for the survival and success of MSMEs in the modern economy.

### 4.2. High initial costs of technology

Many MSMEs function with tight financial margins, making it challenging to allocate funds for technology investments. The upfront costs associated with purchasing hardware, software, and other technological solutions can be prohibitive. Beyond the initial purchase price, there are often hidden costs that can add to the overall expense of technology adoption. These can include installation fees, ongoing maintenance, training for employees, and potential disruptions during the transition period. For many MSMEs, the prospect of investing in new technology involves a degree of risk, especially if the expected return on investment (ROI) is uncertain. This hesitation can prevent businesses from making the necessary investments in technology that could enhance their operations. Access to financing options can be limited for MSMEs, particularly in rural areas or among businesses without established credit histories. This lack of financial support can hinder their ability to invest in essential technologies. Some MSMEs may struggle to perceive the long-term value of technology compared to the immediate financial burden it presents. Without a clear understanding of how technology can drive efficiency, improve customer satisfaction, and ultimately lead to cost savings, many may choose to postpone or forgo adoption altogether. To mitigate these barriers, there is a need for greater support from government and financial institutions. Initiatives such as subsidies, grants, or low-interest loans can make technology adoption more feasible for MSMEs. Encouraging collaboration among MSMEs to share resources or knowledge can help distribute the costs associated with technology adoption. By pooling resources, smaller enterprises can benefit from economies of scale. MSMEs can also consider a phased approach to technology adoption. By implementing technology in stages, they can manage costs more effectively while gradually reaping the benefits of digital transformation.

### 4.3. Data security and privacy concerns

As Micro, Small, and Medium Enterprises (MSMEs) increasingly leverage digital platforms for their operations, they encounter heightened concerns regarding data security. The transition to digital solutions brings numerous advantages, but it also exposes these businesses to various security risks that can threaten their operations, reputation, and customer trust.

4.4. Rising cyber threats

The digital landscape has become a prime target for cybercriminals. MSMEs, often perceived as less secure than larger corporations, are increasingly vulnerable to attacks such as ransom are, phishing, and data breaches. These attacks can lead to significant financial losses and operational disruptions.

4.5. Lack of cyber security expertise

Many MSMEs lack the in-house expertise required to implement effective cyber security measures. Unlike larger organizations, they may not have dedicated IT teams or resources to develop robust security protocols, making them more susceptible to cyber threats.

4.6. Data privacy regulations

The increasing complexity of data privacy regulations, such as the General Data Protection Regulation (GDPR) and various local laws, poses additional challenges for MSMEs. Compliance with these regulations often requires substantial investments in technology and training, which can be daunting for smaller enterprises.

4.7. Customer trust at risk

Data breaches not only have financial implications but can also erode customer trust. With consumers becoming more aware of their data privacy rights, a single security incident can damage an MSME's reputation and lead to loss of business.

4.8. Integrating security solutions

While digital transformation can enhance efficiency, integrating security solutions into existing processes can be challenging for MSMEs. The need to balance security measures with usability is crucial, as overly complex systems can hinder employee productivity.

4.9. Cost of cyber security measures

Implementing adequate cyber security measures often involves considerable costs. Many MSMEs may find it challenging to allocate budget for advanced security technologies, such as firewalls, encryption, and threat detection systems, further exposing them to risks.

4.10. Building a cyber security culture

Developing a culture of cyber security awareness among employees is essential for MSMEs. Regular training sessions can help employees recognize potential threats and adopt best practices for data protection.

4.11. Collaborative security efforts

MSMEs can benefit from collaboration with industry associations and cyber security organizations. By sharing resources, knowledge, and best practices, they can enhance

their security posture without bearing the full financial burden individually.

4.12. Investment in cyber insurance

To mitigate the financial impact of potential cyber incidents, MSMEs can consider investing in cyber insurance. This can provide a safety net in the event of a data breach or cyber attack, helping them recovers more swiftly.

4.13. Estimated impact of technology on MSME growth (2024-2030)

4.13.1. Revenue growth

MSMEs adopting digital technologies are expected to see revenue growth ranging from 10% to 30% annually. According to a report by the International Finance Corporation (IFC), digital technology can increase the revenue of MSMEs by improving market access and operational efficiency.

4.13.2. Increased number of MSMEs

The number of MSMEs is expected to grow by approximately 10% per year, driven by increased access to digital tools and e-commerce platforms. A report by the World Bank estimates that digitalization can facilitate the creation of new enterprises, particularly in underserved markets.

4.13.3. Employment growth projection

Employment in MSMEs could increase by around 15% due to technology adoption, as businesses scale and require more personnel to manage digital operations. Research from McKinsey suggests that technological investments in MSMEs can lead to substantial job creation as these enterprises expand their operations.

4.13.4. Productivity enhancements projection

Productivity levels in MSMEs can improve by 20% to 50% with the adoption of modern technologies like automation, cloud computing, and data analytics. A study by the Asian Development Bank (ADB) highlights that technology adoption can lead to significant productivity gains in small businesses.

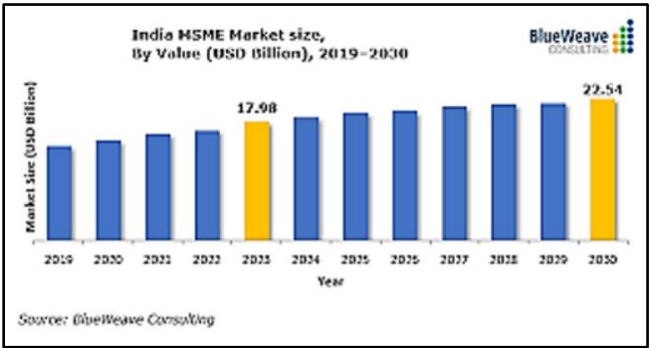


Figure 6: Projected MSME growth in 2030



#### 4.13.5. Market reach and customer engagement

MSMEs leveraging technology can expand their market reach significantly; potentially increasing customer engagement by over 40%. According to a report by Deloitte, digital marketing and social media can enhance brand visibility and customer interaction for MSMEs. The projected impact of technology adoption on MSMEs between 2024 and 2030 is expected to be transformative. The growth in revenue, the number of enterprises, and employment, coupled with enhanced productivity, can significantly contribute to the overall economy. Policymakers and stakeholders must facilitate access to technology for MSMEs to maximize these benefits. Digital technology growth and MSME sector is presented in **Figure 7**.



**Figure 7:** Digital technology and MSME growth

Source: <https://www.emerald.com/insight/content/doi/10.1108/jbim-09-2023-0512/full/pdf?title=what-drives-the-adoption-of-digital-technology-in-the-micro-small-and-medium-enterprises-sector-in-a-developing-economy>

## 5. Conclusion

In conclusion, technology and innovation offer substantial opportunities to address the myriad challenges encountered by Micro, Small, and Medium Enterprises (MSMEs) in India. By embracing advancements such as digital payments, cloud computing, artificial intelligence, and data analytics, MSMEs can significantly enhance operational efficiency, optimize processes, and access new markets, thereby bolstering their competitiveness on the global stage. However, realizing this potential requires a proactive approach to overcoming several critical barriers. Issues such as low digital literacy within the workforce, the significant initial costs associated with technology adoption, and mounting concerns regarding data security need to be effectively addressed. This situation necessitates a collaborative effort among the government, industry associations, and technology providers to develop supportive frameworks and initiatives that promote digital transformation. Investment in targeted training programs is essential to elevate digital skills among employees, enabling

them to fully leverage technological advancements. Additionally, the establishment of financial incentives can help alleviate the financial burden that often accompanies technology investments, making it easier for MSMEs to adopt new tools. Ensuring robust cyber security measures is also vital, as it protects businesses from the rising threat of cyber attacks and fosters consumer trust. Moreover, creating a culture of innovation within MSMEs will encourage them to explore and implement emerging technologies that can drive growth and sustainability. By fostering an ecosystem that prioritizes collaboration and knowledge sharing, stakeholders can empower MSMEs to successfully navigate the complexities of the digital landscape. Ultimately, these concerted efforts will pave the way for long-term growth and innovation within the MSME sector, contributing to the overall economic development of India.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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