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Technological Upgradation and Policy Support for Indian Small-Scale Industries Under Global Competition

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Abstract:
Small-Scale Industries (SSIs) are a fundamental component of the Indian economy and play a key role in the industrial production, export, and employment creation sectors. However, the advent of a speeded-up and globalised world and trade liberalisation has posed new challenges to these businesses as they are faced with unprecedented challenges from technologically advanced multinational enterprises and new competitors from emerging markets. This paper traces the evolution of technological upgradation of Indian SSIs and critically reviews the policy architecture, which successive governments have implemented to ensure the competitiveness of Indian SSIs in the international market. The paper presents the trends of technology adoption and structural constraints to technology upgradation using secondary data collected from the Ministry of MSME, Annual Survey of Industries, SIDBI, and World Bank SME competitiveness indices, and assesses the effect of flagship schemes such as Credit Linked Capital Subsidy Scheme (CLCSS), Zero Defect Zero Effect (ZED) certification, and ASPIRE programme. The findings show that there is a big technology gap between Indian SSIs and their counterparts in the developed and East Asian economies, which is due to supply-side constraints like low levels of finance, lack of institutional linkages, and policy implementation deficits. The paper ends with evidence-based suggestions for a rejuvenated policy framework, incorporating digital readiness, clusters and innovations, and focused financial instruments to help Indian SSIs to be competitive in global value chains.

Keywords: Small Scale Industries, Technological Upgradation, MSME Policy, Global Competitiveness, Credit Linked Capital Subsidy Scheme, Digital Manufacturing, Industrial Clusters, Trade Liberalisation, India.

1. Introduction

Small-scale industries (SSIs) play a significant role in the developmental scenario of India. In the context of Micro, Small, and Medium Enterprises (MSMEs), the MSME Development Act, 2006, has accorded recognition to the Small-Scale Industries (SSIs), which have traditionally had a significant place in the industrialization of India, through employing millions of people, generating exportable surplus, and being incubators of entrepreneurship. It is estimated to be using around 11.34 crore people in various sectors like food processing, textile, chemicals, engineering goods, leather, electronics, etc., accounting for around 29 per cent of India's GDP and 49 per cent of the total exports (Ministry of MSME, 2022).

At the same time, Indian SSIs have encountered the threat of extinction as a result of the process of economic liberalisation that started in 1991 and the additional pledges made by India under the World Trade Organisation (WTO). Access to global buyers has increased, but many SSIs have lost domestic market shares due to competitively priced, technologically advanced products by foreign companies. It is made difficult by the fact that there is a dynamic and rapid technological disruption (Industry 4.0, AI, robotics, and IoT) that requires constant investments in capital, as well as skill enhancement, which most SSIs are structurally unable to make.

Technology upgradation is thus not only an efficiency factor, but also a condition of survival for SSIs in the present-day global economy. Governments have acknowledged this and introduced various policy measures such as credit subsidies, cluster development initiatives, technology incubators, and quality certification mechanisms to promote modernisation. But results have not been uniform, and there's a tremendous technology gap between Indian SSIs and the rest of the world.

This paper attempts to give a comprehensive analysis of Indian SSIs, Policy Support System, and the competitive disadvantage vis-à-vis global SSIs. It draws on secondary data published in India and international repositories, official sources, to point out trends, gaps, and policy directions. The paper is organized as follows: Section 2 summarizes the related literature; Section 3 discusses the growth and importance of SSI; Section 4 analyzes the technology adoption; Section 5 assesses the important policy schemes; Section 6 compares SSI experiences in other parts of the world; Section 7 presents a list of challenges; Section 8 presents a list of recommendations; and Section 9 concludes.

2. Literature Review

Technological policies and SSI competitiveness are a well-studied and multidimensional field in the academic literature in India. One of the earlier scholars to document the structural constraints confronting small industry in the post-liberalisation era was Mohan (2002), who indicated that the abandonment of reservations for small industry, even though the rationale behind doing so is economic, had left small industry vulnerable to competition. His analysis pointed out two shortcomings that were constraining productivity growth: capital and technology.

Kathuria et al. (2010) found empirical analyses of the productivity gap between SSIs and large enterprises, which revealed that technology intensity had a significant impact on TFP. Policy measures that promoted, not protected, the diffusion of technology had a longer-term impact on the competitiveness of SSI, they argued. Bala Subrahmanya (2005) has delved into the impact of globalisation on the small businesses in India and found that the sharing of technology and the synergy of the clusters balanced the weaknesses of the individual business units, the nodes of competitive resilience.

Recently, Das (2017) analysed the Credit-Linked Capital Subsidy Scheme and found that though the number of units receiving subsidy has increased, the scheme has not yet touched the micro units in the small sector. Mukherjee (2018) observed that there are too many schemes that are not really commensurate in institutional coordination and therefore result in disjointed outcomes. The World Bank's enterprise survey 2022 confirmed that Indian SMEs are much less sophisticated in technology and process innovation as compared to SMEs from East Asia.

These themes recur in the literature: the lack of financial resources, between the design and the delivery of the schemes, the need for cluster-based approaches, and the importance of tying the SSIs to global value chains through technology and quality compliance. This paper expands on this basis by summarising the latest data and situating Indian SSI policy in a comparative international context.

3. Economic relevance and development trends of the SSIs in India

The Indian SSIs have experienced growth over the past 20 years, showcasing the dynamism and challenges that the sector has faced. Table 1 presents key indicators from 2000–01 to 2021–22.

Table 1: Growth of Small-Scale Industries in India (2000–01 to 2021–22)

Year	No. of SSI Units (Lakhs)	Production (₹ Crore)	Exports (₹ Crore)	Employment (Lakhs)	Share in GDP (%)
2000–01	101.1	2,61,297	69,797	238.7	6.1
2005–06	123.4	4,18,884	1,24,417	294.9	6.8
2010–11	197.4	9,68,114	2,16,376	442.3	7.3
2015–16	362.1	18,29,956	3,84,508	805.2	7.9
2019–20	633.9	30,51,564	5,36,722	1,114.2	8.2
2021–22	652.3	33,69,218	5,12,389	1,134.6	8.0

Source: *Ministry of MSME, Annual Report 2022–23, Government of India; SIDBI MSME Pulse (2022); Annual Survey of Industries, MOSPI (2022).*

As can be seen in Table 1, all indicators indicate that the increase in the number of units and economic contribution was positive up to 2019–20. COVID-19, which impacted small businesses with its impacts on supply chain disruptions, labour migration, and reduction in credit, caused economic disruptions in 2021-22, which resulted in a drop in production and exports (SIDBI, 2022).

The role of the sector in the GDP has been growing from 6.1 per cent in 2000-01 to 8.2 per cent in 2019-20. The sector has also been an important source of employment, with a total of over 113 million people getting jobs in the Sector by 2021–22, which is the 2nd highest employment after Agriculture. However, the value added per worker is small in comparison to large industries, and is one of the technology gaps studied in this paper.

4. Adoption Pattern of the Technologies in Indian SSIs

The overall scenario of SSI output is growth, while the technology profile of SSI is relatively backward. The adoption of technology – such as digital and automated manufacturing technologies – is low, as reflected by national surveys and enterprise studies. The adoption rate of selected technology categories is shown in Table 2 as per the information collected in the DC-MSME Technology Survey (2018, 2022).

Table 2: Technology Adoption Rates in Indian SSIs (2018 and 2022)

Technology Category	Adoption Rate (%) – 2018	Adoption Rate (%) – 2022	Sector-Wise Highest Adopters
Computer-Aided Design (CAD)	14.2	28.7	Engineering & Auto Components

Enterprise Resource Planning (ERP)	7.6	18.3	Pharmaceuticals & Chemicals
CNC / Automated Machinery	21.5	39.1	Textiles & Garments
Cloud Computing	5.9	22.4	IT-enabled Services
IoT / Industry 4.0 Tools	2.1	9.6	Electronics & Food Processing
Renewable Energy Integration	3.4	13.8	Leather & Agro-processing

Source: *DC-MSME Technology Adoption Survey (2022), Ministry of MSME; NASSCOM–MSME Digital Readiness Report (2022).*

A positive trend is seen in Table 2, and all categories of technology have almost doubled their adoption percentage from 2018 to 2022. This growth is attributed to some factors such as Digital migration, COVID, Udyam Registration Portal, and the ZED certification drive. The figures are still low, however. The most frequently cited type of machinery (39.1 per cent of SSIs) is CNC and automated machines, of which over 60 per cent are conventional machinery.

Less than 10% of the SSIs are implementing Industry 4.0 technologies such as the Internet of Things (IoT) sensors and smart manufacturing platforms. Cloud Computing accounts for 22.4 per cent of the units, and allows for data-driven decisions and e-commerce, as well as remote handling of units. This is lower than the adoption rates of South Korean and German SMEs, where adoption rates are 70-80 per cent (OECD, 2022).

The level of variation is high across sectors. CAD/CAM and CNC technologies are more widely used in engineering and auto-component clusters, which are sometimes part of an OEM supply chain. In comparison, the traditional handloom and handicrafts, and agro-processing units, which form the majority of the population, are scarcely influenced by modern technology. Such a duality makes it difficult to design uniform policy responses and to develop differentiated technology strategies based on clusters.

5. Policy Framework and Government Schemes

The Indian government has developed and executed a wide range of schemes for technology upgradation in SSI. The following Table-3 outlines the major programmes that are currently in operation under the Ministry of MSME.

Table 3: Key Government Schemes for SSI Technological Upgradation

Scheme / Programme	Nodal Agency	Key Objective	Outlay / Coverage
CLCSS	DC-MSME / SIDBI	Capital subsidy @ 15% for technology upgradation	₹15 lakh cap per unit
ZED Certification	Quality Council of India	Zero Defect Zero Effect manufacturing	50,000+ units certified
ASPIRE	NSIC / DC-MSME	Agri-business incubation & rural innovation	35 LBIs set up
SFURTI	Ministry of MSME	Cluster-based traditional industry modernisation	Approx. ₹500 crore/year
Champions Portal	MoMSME	Grievance & technology support for MSMEs	Pan-India digital platform
PMEGP	KVIC / DIC	Self-employment via enterprise setup	₹25–50 lakh project cost

Source: *Ministry of MSME, Schemes and Programmes, Annual Report 2022–23; DC-MSME Programme Reports (2022).*

5.1 Credit-Linked Capital Subsidy Scheme (CLCSS)

The CLCSS, which was launched in 2000, is still the flagship technology upgradation instrument for SSIs. It offers 15 per cent upfront capital subsidy on institutional credit of up to ₹1 crore for purchasing of approved machinery and equipment. By 2022, over 2.4 lakh units had availed the scheme (DC-MSME, 2022). Das (2017, however, noted that while its benefits were more likely to be felt by the top of the small sector units, there were challenges around documentation, collateral, and awareness for micro units.

5.2 Zero Defect Zero Effect (ZED) Certification

ZED certification was started in 2016 with a target of building a quality culture and an awareness of environmental protection among MSMEs. The programme is based on over 50 parameters in production, quality, environment, and HR aspects and is awarded different levels of rating (Bronze, Silver, and Gold). As of 2022, over 50,000 units had been rated, and the government was providing financial assistance for the rating assessment (Quality Council of India, 2022). Units certified by ZED report that they have better market access, particularly for export orders and government procurement.

5.3 SFURTI and Cluster Development

In order to provide support for the development of industrial clusters on Traditional Industries like Khadi, Coir, and Bamboo, the Scheme for Fund for Regeneration of Traditional Industries (SFURTI) was launched. It helps to give support to the common facility centres, skill development, and technology upgrading in the cluster. In the context of SSI in India, with firms being too small to invest in new technologies individually, the cluster model can prove to be particularly suitable, as it enables the development of shared knowledge and infrastructure (Bala Subrahmanya, 2005). The government has

been aware of this logic and allocated about ₹500 crore (dollar equivalent: 70 million) for the scheme annually, yet its implementation has not been uniform across the states.

6. Comparative Global Analysis

India is compared with the extent of lag in SSI technology. Table 4 presents the comparison between India and major economies in terms of some of the technology indicators of SMEs.

Table 4: Global Comparative SME Technology and Competitiveness Indicators (2022)

Country	SME R&D Spend (% of GDP)	Gov. Financial Support Index	Technology Adoption Score	Global SME Competitiveness Rank
USA	0.89	7.9	8.4	3
Germany	1.12	8.6	8.7	1
China	0.76	8.1	7.6	6
South Korea	0.94	8.4	8.2	4
India	0.22	5.9	5.1	37
Brazil	0.18	5.3	4.9	44

Source: *World Bank Enterprise Surveys (2022); OECD SME Outlook (2022); World Economic Forum Global Competitiveness Report (2022–23); NASSCOM (2022).*

Table 4 tells a depressing story. The R&D expenditure of SSIs in India as a percentage of GDP is 0.22 per cent, which is only one-fifth of Germany's 1.12 per cent. But India has scored 5.9 points in the index of financial support that the government has devised on the basis of the World Bank enterprise survey, while Germany has scored 8.6 points, thus indicating that not only is the quantum of financial support less in India, but also the delivery system is less efficient. In India, the technology adoption score was 5.1, whereas that of South Korea and the USA was 8.2 and 8.4, respectively.

The Mittelstand model, the Fraunhofer research institutes, and vocational training infrastructures form a well-integrated ecosystem, continually feeding technology and jobs into SMEs, thereby underpinning German competitiveness. A push from the big chaebols to their small suppliers, in fact, triggered a targeted industrial policy for the improvement of small and medium-sized enterprises (SMEs), including technology transfer and co-investment programmes as a component of the policy. The Chinese government has been investing heavily in the development of industrial parks, SEZs, and R&D facilities for small enterprises, which is the reason behind the higher growth rate of the Chinese economy (OECD, 2022).

Not only that, but the technology gap, availability of credit, lack of infrastructure, and skill gap are all contributing to this, and India's status on the global SME competitiveness index is 37th. The challenges are not just quantitative, but qualitative too – the lack of systemic connectivity between universities, research institutions, financial intermediaries, and SSI clusters, which remains weak in India.

7. Challenges in technological upgrading

Although the policy framework has been created, some intrinsic issues are responsible for hindering technological upgradation in Indian SSIs:

Finance and Credit Access: This is the most frequent one, that is, the availability of finance from institutions. Despite the adoption of credit schemes such as CLCSS, the informal credit, with high rates of use, is still being used by the SSIs in heavy usage. Collateral requirement is a major reason for the reduced lending by banks, and despite the availability of formal credit, the smaller enterprises are not well served. The issue of NPA among MSMEs is one of the key reasons for reduced lending by banks, and formal credit is limited in smaller enterprises.

Unawareness and Information Deficit: Most of the operators of SSI, including rural operators and semi-urban operators, lack awareness about the available Government schemes. Other factors that further limit uptake by enterprises that know about the scheme include the difficulties encountered in applying, the documents required, and the eligibility criteria.

Advanced Machinery: Advanced skills are required for advanced machinery. The current facilities for vocational training are not technology-oriented enough to meet the needs of modern SSIs. The labour market rigidities and migration pressures further exacerbate the human capital issue.

At the enterprise level, where there was eligibility, overlapping mandates, duplication of effort, and gaps in coverage due to lack of coordination amongst the different schemes being run by different agencies — including DC-MSME, NSIC, SIDBI, KVIC, State governments, etc. — have been reported (Mukherjee, 2018).

Infrastructure Inadequacy: Yes, modern digital manufacturing requires a continuous power supply, broadband connection, and logistics infrastructure. The negative effects of irregular power supply, electricity prices, and the absence of roads in industrial estates are more detrimental than in other areas, especially in smaller towns, on technology-intensive processes.

Market Linkage Deficit: Many SSIs, who invest in the technology upgradation, experience problems in marketing their increased productivity because of inadequate quality buyers, export market, modern marketing infrastructure, etc. For SSIs to be part of Global value chains, they need to be technically compliant, branded, and certified along the chain.

8. Policy Recommendations

From the above analysis, the following recommendations are found for an effective and impactful policy framework for technological upgradation in SSI:

Rationalising and Consolidating Schemes: The number of overlapping programmes should be streamlined and merged into a coherent mission mode framework with a single window delivery, common monitoring, and common outcome metrics. The National MSME Policy (if approved) should be the umbrella policy providing coordination between the roles of centres, states, and institutions.

Increase CLCS Coverage and Ease of Access: The ceiling amount of the capital subsidy needs to be regularly adjusted to account for inflation in machine costs. The application process should be computerised and simplified, and there should be specially created facilitation cells at the District Industries Centres to support the micro-enterprises to document application and submitting them.

Scaling up University–Industry–SSI Linkages: Currently, there are fewer than 100 Technology Business Incubators (TBIs) in the MSME sector; these should be scaled up with necessary linkage with the SSI cluster in their districts. A specific innovation support line should be constituted by Atal Innovation

Mission and the National Science and Technology Entrepreneurship Development Board (NSTEDB) for SSI innovation.

Making Cluster-Based Digital Transformation (CB-DX) available for all with an affordable price of Cloud, ERP, Design, and IoT Dashboard in Common Digital Service Centres (CDSCs) in industrial clusters. The cluster technology is a cost-saving per unit technology, and generates knowledge spillovers not available to single companies.

Integration of Green Technology: Policy in SSI should explicitly address investments in renewable energy, waste minimization, and energy efficiency. Environmentally compliant SSIs may have a market pull due to EPF and green procurement preferences.

Capacity Building: There should be a dedicated SSI-technology curriculum of the mission, in collaboration with Industry Associations such as CII, FICCI-CMSME, and FISME. Apprenticeship programmes can help fill the skills gap and also create jobs, and be integrated into the clusters that are technology upgraded.

9. Conclusion

The condition of the SSI (Small-Scale Industries) sector in India is very critical. The twin drivers of competitiveness and economic resilience are needed to make the quantum leap. What this research reveals is that the government has a fairly extensive toolbox (credit support, cluster development, quality certification, platforms, etc.) from which it can draw, but it cannot equally claim that all of these tools are equally effective and that there is a substantial technology gap between them.

It does not represent a "spill over" gap. It reflects the cumulative impact of the lack of capital, skills, information, and knowledge, implementation difficulties, and the absence of integration of SSIs into the innovation ecosystem. This requires a coordinated, differentiated, and systemic policy response, moving beyond the generic policy and towards one that is specific to the different clusters (technology differentiated) and which includes monitoring systems.

The worldwide comparisons highlight the need for action. The technological shift of the SSI can be achieved with constant and intelligent policy action, such as that of the Mittelstand of Germany in Germany, the model of integration of the supply chain from South Korea, and the model of industrial park from China. This technology gap in the SSI industry is the key to the success of India's vision of becoming a global manufacturing hub as part of Make in India and Atmanirbhar Bharat. It is time for incremental changes to be made. What is needed is a re-commitment of the national will for SSI technological modernisation as a critical economic priority, with appropriate public investment, institutional changes, and industry cooperation. The benefits to be derived from this challenge—productivity, exports, jobs, inclusive growth, and more—are also great.

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