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ADB Working Paper Series

Barriers to Innovation in Indian Small and Medium-Sized Enterprises

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Abstract

Innovation plays a critical role in shaping the industrial and firm competitiveness of any nation. Innovation is often discussed in the setting of developed countries, but the rise of emerging economies such as India has generated a new interest in understanding innovation in developing economies. This paper aims to study and present the current state of innovation in small and medium-sized enterprises (SMEs) in India. The focus of the paper is to bring out the key barriers SMEs face in the innovation process in the context of the existing government policy. India, being a developing nation, has its own set of unique situations and challenges that impede the innovation potential of SMEs operating in it. Many of these barriers are related to public policy, funding constraints, shortage of skilled research and development (R&D) workforce, and weak linkages between institutions and the firms, among others.

The paper also discusses the existing government policy framework and enablers to support SMEs' innovation in India. It presents the key findings and recommendations in the form of policy suggestions to the government while taking into account the key challenges and enablers highlighted in the study.

JEL Classification: G20, G28, O38

Contents

1. Introduction	3
2. Methodology	4
3. Current State of Innovation among Indian SMEs	5
4. Barriers to Innovation in Indian SMEs	11
5. Institutional Access and SME Innovation in India	14
6. Science, Technology, and Innovation in the Indian Context.....	15
7. Present MSME and Science, Technology, and Innovation Systems.....	16
8. Reasons for Perception of Government Policy as a Barrier	18
9. Enablers of SME Innovation	20
10. Recommendations for the Removal of Barriers to Innovation	21
11. Conclusions	23
References	24
Appendixes	
1. Barriers to Innovation Faced by Innovative Small and Medium Firms (%).....	26
2. Access of Institutional Support by Innovative Firms (%).....	27
3. Industry Policy Statements and Their Impact on Small-Scale Industries	28

1. INTRODUCTION

India is ranked very low in the global innovation index (81 out of 141 countries), which in a way reflects the low innovation capacity of Indian firms and Indian small and medium-sized enterprises (SMEs) in particular. The Government of India classifies SMEs as a part of the MSME (micro, small, and medium-sized enterprise) sector. According to the Ministry of MSME, there are ~49 million enterprises in the MSME sector that employed around 111.4 million people in 2014. The importance of the MSME sector to the Indian economy can also be understood by the fact that it contributed 37.5% to India's GDP in the fiscal year beginning in 2012 (FY2012). Out of this, manufacturing sector MSMEs contributed ~7% and services sector MSMEs contributed 30.5% to India's GDP in FY2012.

MSMEs also play a critical role in the manufacturing sector and the export performance of India. The share of the MSME sector in total manufacturing output for FY2012 is estimated to be 37.3%. However, the share of the MSME sector in India's total exports for FY2013 is 42.4%, which clearly shows the importance of this sector to the country's industrial and economic growth.

Given the importance of the MSME sector, it is critical to ensure that SMEs in India remain competitive both nationally and globally. One of the principal determinants of SMEs' competitiveness is innovation. Developing economies such as India face a formidable challenge in this regard due to limited government capacity to foster innovation support mechanisms. Modern concepts such as cluster development are often underutilized or ignored.

Government policy—which touches upon virtually every aspect of innovation including access to finance, technology, market knowledge, and building of R&D and educational institutions—remains one of the most crucial factors in SME innovation.

India updated its Science, Technology and Innovation Policy in 2013. It is important to note that the policy has provided a big impetus to build an innovation ecosystem and to enhance the role of the private sector to do the same. The Government of India, under the Ministry of MSME, runs various schemes and programs to support technological innovation in Indian SMEs. The support extended by the government includes financial subsidy and incentives to buy machinery, file trademarks, and gain access to tools training, and expert advice, among others.

The low innovation capacity of Indian firms, especially SMEs, has widely been discussed and debated. In spite of this, it is worthwhile to highlight that there are very few systematic studies that have tried to understand innovation in Indian SMEs. Considering this in particular, the paper tries to answer the following key questions:

1. What is the current state of SME innovation in India including different types of innovation activities, sources, and funding for innovation?
2. What are the key barriers that hinder SMEs in pursuing innovation and their likely impact?
3. How is the current science, technology, and innovation (STI) ecosystem and government policy placed in India to support SME innovation? Is government policy favorable or unfavorable?
4. Are there any enablers that support or help SMEs innovate?

The paper starts by explaining the methodology to showcase the current state of innovation and barriers being faced by Indian SMEs. It then discusses the existing innovation policy framework and presents the key challenges and enablers of SME innovation. It concludes by presenting key policy recommendations to improve the national innovation system and overall ecosystem for SME innovation in India.

2. METHODOLOGY

This paper has adopted a mix of empirical analysis and literature review methodology. Empirical analysis was used to assess the current state of innovation in SMEs in India along with the key barriers and enablers. A comprehensive review of public policies and government support programs was done in the context of the identified barriers and enablers to devise effective policy suggestions or recommendations.

The empirical data used in this paper is sourced from the Indian National Innovation Survey published by the Department of Science and Technology in 2014. The survey covers 9,001 firms across 26 states and 5 union territories of India. These 9,001 firms are taken from a wider database of 208,415 firms covered in a 2009–2010 survey of industries of India that was primarily focused on the manufacturing sector. As a result, the National Innovation Survey mostly includes manufacturing firms and hence does not adequately reflect the innovation scenario in primary and tertiary sectors of the Indian economy.

SMEs in India are mainly classified on the basis of investment in plant and machinery or equipment, and not on the employee count (Table 1).

Table 1: Definition of Micro, Small, and Medium Enterprises, India

	Manufacturing Sector (Investment in Plant and Machinery)	Services Sector (Investment in Equipment)
Micro enterprise	Does not exceed Rs2.5 million	Does not exceed Rs1 million
Small enterprise	More than Rs2.5 million but does not exceed Rs50 million	More than Rs1 million but does not exceed Rs20 million
Medium enterprise	More than Rs50 million but does not exceed Rs100 million	More than Rs20 million but does not exceed Rs50 million

Rs = Indian rupee.

Source: Government of India, Ministry of Micro, Small and Medium Enterprises.

The Indian National Innovation Survey, however, does not collect information or classify firms on the basis of the investments in plants and machinery. It classifies and defines the firms by workforce size. The firms with fewer than 100 employees are defined as small firms, those with 100–499 are defined as medium firms, those with 500–999 are defined as medium-large firms, and those with 1,000 or more employees are defined as large firms. Out of the total 9,001 firms, 88.1% were small firms, 10.2% were medium firms, 1.1% were medium-large firms, and 0.6% were large firms (Table 2).

For the purpose of this paper, only small and medium-sized firms (fewer than 500 employees) are considered to reflect upon the current state of innovation among SMEs in India. This means that only 8,846 firms are being considered out of 9,001 (Table 2). The data is segregated by small and medium firms to help identify key differences in the innovation behavior between the two. It is important to note that firms with fewer than 100 employees also include the micro firms. However, for the purposes

of this paper it is assumed that micro firms, especially in manufacturing, do not engage in significant innovation activities.

Table 2: Sample Size in Indian National Innovation Survey by Size of Firm
(employee size)

Firm Size	% of Sample	Number of Firms in Sample
Small firms (below 100 employees)	88.1%	7,928
Medium firms (100–499)	10.2%	918
Medium to large (500–999)	1.1%	96
Large firms (1,000 and above)	0.6%	59
Total firms	100%	9,001

Source: Government of India, Department of Science and Technology. 2014. *Indian National Innovation Survey*.

The Indian National Innovation Survey does collect information on barriers faced by SMEs pertaining to innovation by different types of firms. The small and medium firms (employee size <500) only are considered to study the barriers to innovation in order to truly reflect the SMEs characteristics and behavior. Simple percentages are used to illustrate the impact of various barriers on innovative small and medium firms. It is important to note that the majority of the data analysis discussed in the subsequent sections is focused only on the innovative firms. In the case of institutional access, though, all the innovative firms (small, medium, and large) are included because of data availability challenges.

The National Innovation Survey followed the guidelines for collecting and interpreting innovation as published in the Oslo manual (OECD 2005). The survey adopted the subjective approach, which is based on the firm's or production unit's identification of changes made in the product and process. The definitions of innovation, innovation activities, and innovative firms in the innovation survey have been directly adopted from the Oslo manual and are referenced below:

Innovation: *“An innovation is the implementation of a new or significantly improved product (good or service), process, new marketing method or new organizational method in business practices, workplace organization or external relations.”*

Innovation/Innovative activities: *“It includes all scientific, technological, organizational, financial and commercial steps which actually or are intended to, lead the implementation of innovation.”*

Innovative firm: *“A firm which implements an innovation is called as innovative firm.”*

3. CURRENT STATE OF INNOVATION AMONG INDIAN SMES

As per the Indian National Innovation Survey, innovative firms are defined as follows:

“Firms that report different changes in their production, organizational and marketing practices and are engaged in innovative activities.”

The different types of innovations reported by the survey respondents include product innovation, process innovation, product quality and standardization, savings or more efficient use of inputs, use of alternative material in production, and installation of new machines. Around 35.2% of SMEs are found to be innovative in the survey and are engaged in different innovation activities (Table 3). Medium-sized firms are found to be

more innovative than small firms, possibly due to their larger size and capacity to undertake innovative activities.

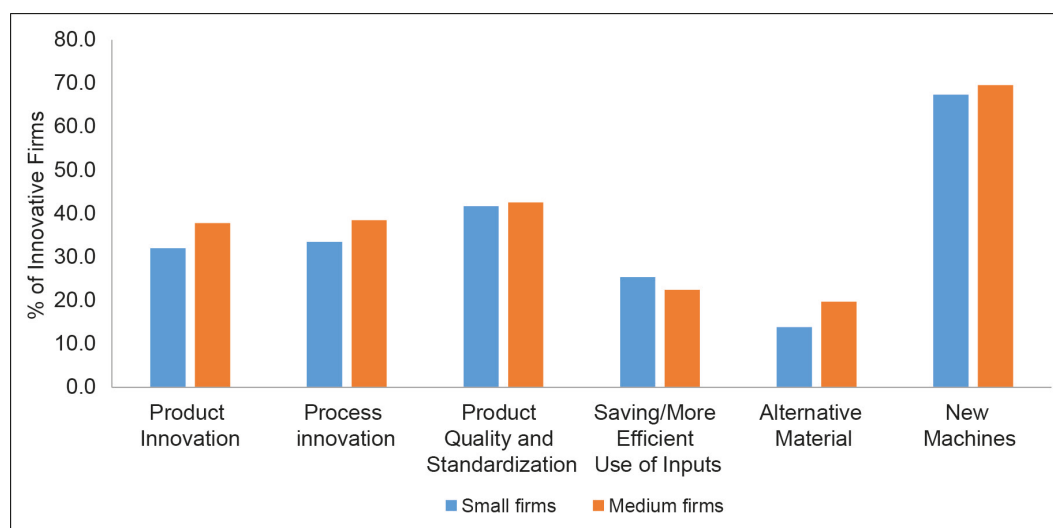
Table 3: Innovative Firms by Employee Size

Firm Size	Number in Sample	Innovative Firms	% of Innovative Firms in the Sample
Small firms (below 100 employees)	7,928	2,736	34.5
Medium firms (100–499)	918	376	40.1
Total SMEs	8,846	3,112	35.2

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

The majority of the innovative SMEs are found to be buying new machines, followed by practicing product quality and standardization as a part of their innovation process (Figure 1). It is also very evident from the fact that the majority of the firms in the Innovation Survey are manufacturing firms. Medium firms are found to be performing marginally better than small firms in almost all form of innovations.

Figure 1: Percentage of Innovative Small and Medium Firms Pursuing Different Innovations

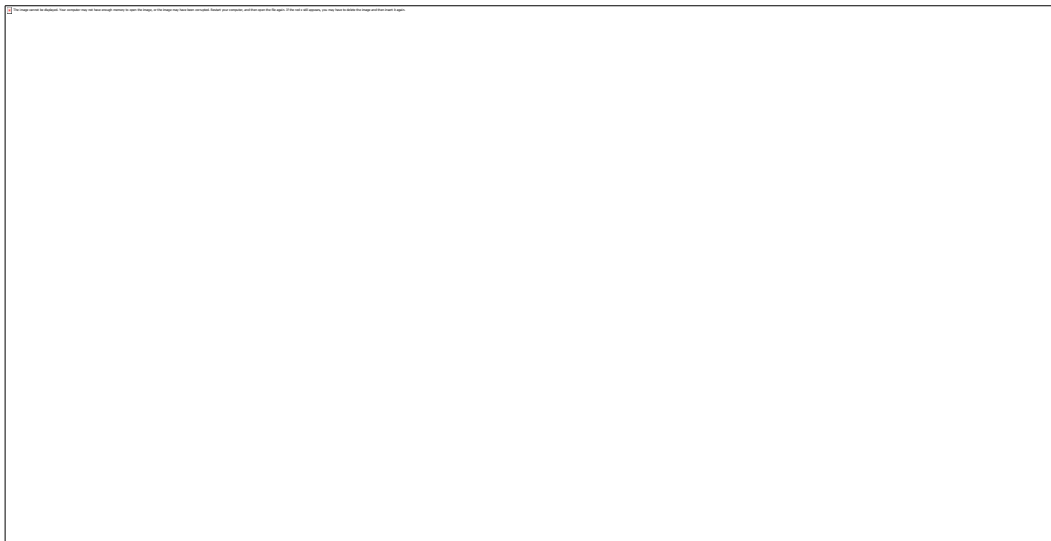


Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

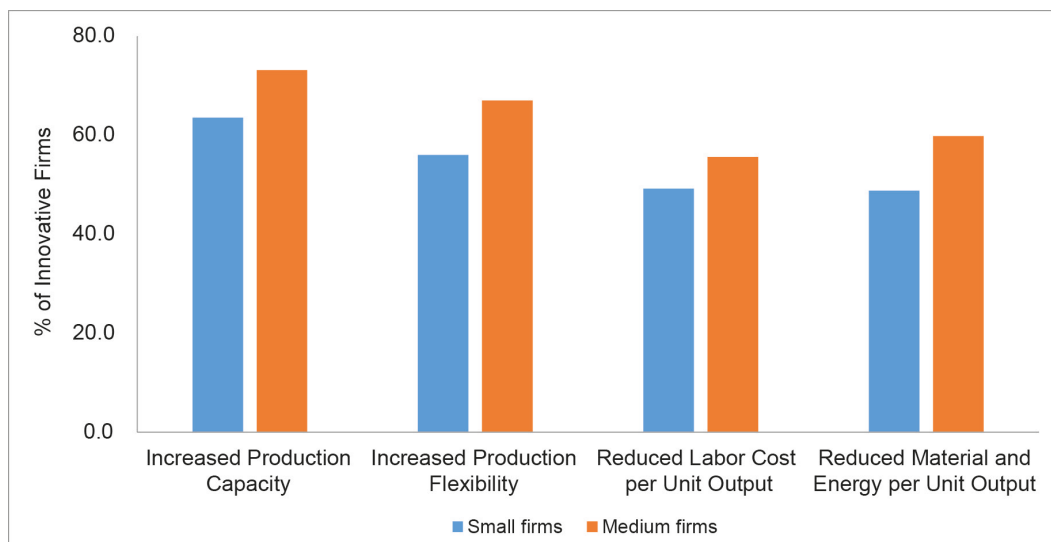
Firms undertake innovation in pursuit of some specific outcomes. These may include increased productivity, enhanced competitive position, reduced costs, and meeting regulatory compliance in a more effective manner, among others. Each type of innovation is generally linked to specific gains, which serve as the main motivation and reason for the SMEs to innovate.

More than 70% of the innovative small and medium firms gained in terms of increased range of goods and services and improvements in quality as a result of product innovation. However, innovative medium firms benefited more in comparison with innovative small firms for entering new markets or increasing market share (Figure 2).

Talking about the gains from process innovations, innovative medium firms are found to be better placed than small firms to increase capacity and flexibility in production and to reduce input costs. The highest impact of process innovation is however seen in terms of enhanced production capacity (Figure 3).

Figure 2: Product Innovation Outcomes—Percentage of Innovative SMEs

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

Figure 3: Process Innovation Outcomes—Percentage of Innovative SMEs

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

The above figures clearly point out that the gains from innovations for SMEs can be multifold and cross-sectional. For instance, any process improvement can result in more productivity and lower waste generation, resulting in reduced costs and environmental hazards. Hence, there is a clear business case for SMEs to be more innovative.

The changes implemented by the firms in pursuit of innovation are attributed to different innovation activities. Such activities pursued by SMEs can be of two types: research and development (R&D) innovation activities and non-R&D innovation activities. R&D-based innovation activities can be either intramural or extramural. Non-R&D innovation activities include acquisition of technology or new machinery, external knowledge, introduction of products to markets, and workforce training.

SMEs generally lack the financial capacity and staff to undertake structured and sophisticated R&D and hence are more likely to engage in non-R&D innovation. This is especially the case in developing economies such as India. More than 50% of innovative small and medium firms are engaged in non-R&D innovation. Medium firms are found to be more engaged in intramural R&D as compared with small firms. However, the performance in extramural R&D is dismal for both small and medium firms, showcasing the lack of access and interaction with research institutions, laboratories, and public and private universities (Table 4). This infers and also points toward the biggest challenges SMEs face to access the formal R&D innovations.

Table 4: Innovation Activities by Innovative Small and Medium Firms

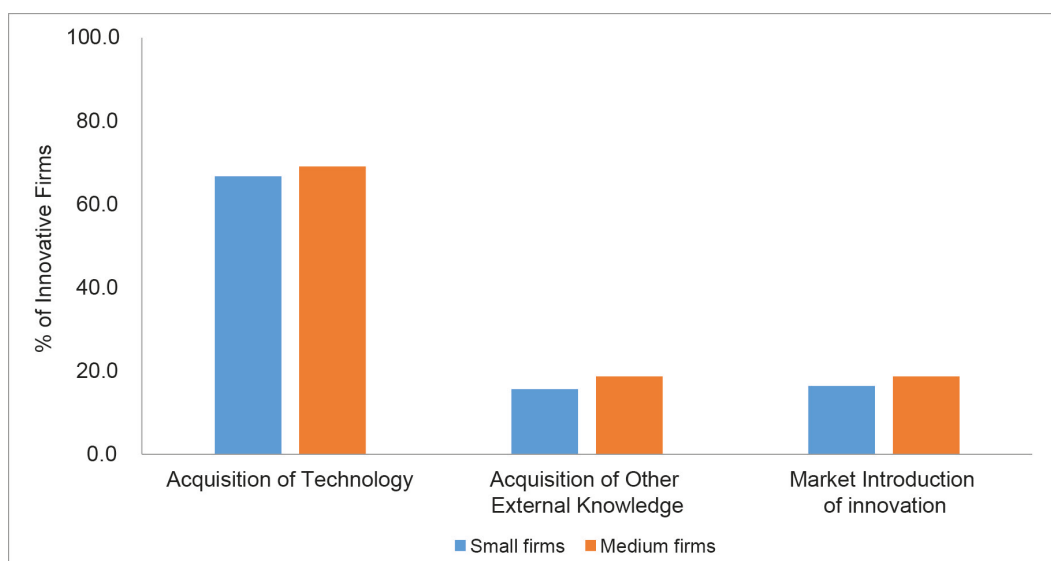
Firm Size	Non-R&D Innovation (%)	Intramural R&D (%)	Extramural R&D (%)
Small firms	65	33	11
Medium firms	54	45	12

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

It is evident from Table 4 that non-R&D innovations are the most common innovation phenomena among Indian SMEs. More than 66% of innovative small and medium firms are engaged in the acquisition of technology, mostly in the form of new machines. Manufacturing firms are more likely to invest in technology upgrades in their production process to help expand their market while reducing input costs. Medium firms perform marginally better than smaller firms in acquiring external knowledge and introducing innovative products and services to market. However, these forms of innovation are much less common than technology acquisition among the innovative SMEs (Figure 4).

In terms of non-R&D innovative activities, medium-sized innovative firms perform marginally better than small innovative firms (Table 5). The acquisition of external knowledge mainly comes in the form of patented technology, know-how, and trade secrets, among others.

Figure 4: Non-R&D Innovation Activities Conducted by Innovative SMEs



Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

There is a much lower but still significant percentage of innovative SMEs that are engaged in introducing their innovative products in the markets. There seems to be a close link between the acquisition of external knowledge and market introduction of innovations, as the former can be used to launch the new products. The acquisition of external knowledge tends to have a significant impact on SMEs as it is directly coupled with the overall product and market strategy of the firm. Much of the external knowledge apart from patented information remains informal in nature but does act like an invisible hand.

Table 5: Non-R&D Innovation Activities by Small and Medium Innovative Firms

Firm Size	Acquisition of Technology (%)	Acquisition of Other External Knowledge (%)	Market Introduction of Innovation (%)
Small firms	67	16	16
Medium firms	69	18	19

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

Nontechnological innovations can also be looked at from the perspective of organizational and marketing innovation.¹ Medium-sized firms again performed better in terms of pursuing both these types of innovation, which is most likely due to their better management expertise and ability to hire quality talent (Table 6).

Table 6: Nontechnological Innovation by Small and Medium Innovative Firms

Firm Size	Organizational Innovation (%)	Marketing Innovation (%)
Small firms	41	45
Medium firms	52	57

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

To understand the functioning of an innovation system completely, it is very important to ascertain the sources of the innovation. The source of a product or process innovation can be internal, external, or a hybrid, which typically includes collaboration with other firms, institutions, universities, and laboratories. The majority (~80% and above) of the innovative small and medium firms use internal sources to develop the innovation (Table 7).

Nearly one-third of the innovative small and medium firms use external sources and a very small proportion use collaboration with other enterprises and institutions to source innovations. It can be inferred that Indian SMEs mainly use indigenous methods to develop innovations and are relatively much less dependent on external sources. The miniscule use of collaboration with other institutions points to very low integration of public innovation systems and SMEs, and this remains an area of concern. It is a widely established fact that collaboration with other enterprises and institutions does

¹ Organizational innovation: A new method related to the firm's ongoing business activities which covers implementation of new or significantly improved management systems and change in the firm's operating structure including integration of different department and business activities. It also includes new or substantial changes in the firm's relationships with other firms and institutions through alliances, partnerships, or any other commercial agreement.

Marketing innovation: Business activities and initiatives taken by the firm to enter new markets. It includes new or significant improvement in designs, extension of the marketing function, and targeting or creating a new market altogether.

greatly help SMEs in coming up with new innovations, but this resource remains underutilized in India.

Table 7: Sourcing of Innovation and Technology by Innovative Firms

	Small Firms (%)	Medium Firms (%)
Source of Innovation		
Internal	79	84
External	36	39
Hybrid (with other enterprises, and with institutions such as universities and government labs)	2	1
Acquisition of Technology		
Domestic market	14	11
Acquired from collaborator	5	5
Foreign market	4	6

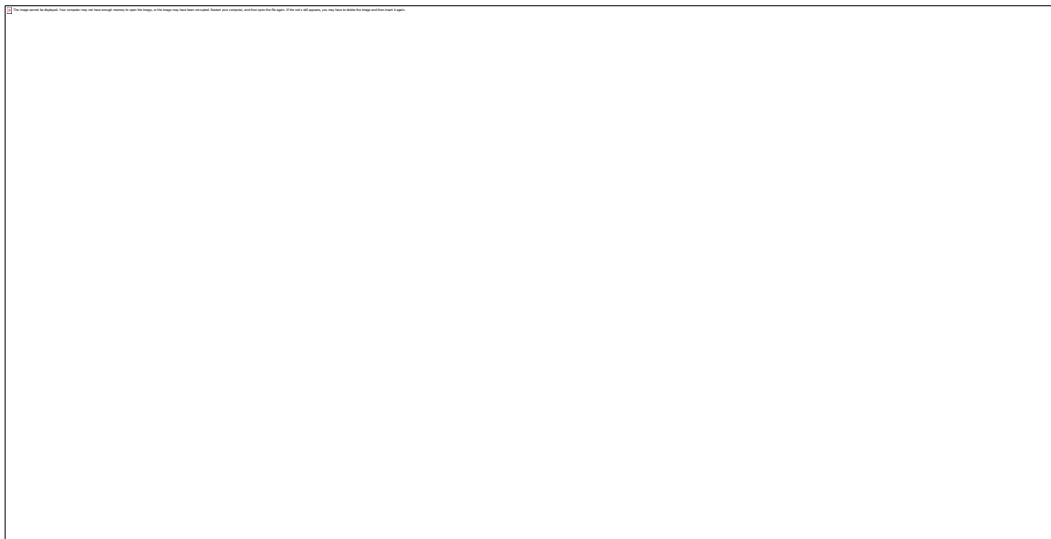
Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

Smaller firms tend to use more domestic sources to acquire technology than do medium-sized firms. Only 4%–6% of the innovative small and medium-sized firms source their technology from either a collaborator or a foreign market. This shows that SMEs in India do not have sufficient access to the foreign market and collaborators to acquire technology. It also suggests that Indian SMEs' exposure to global technological advancements and innovation systems remains very limited, unlike in the case of developed economies. The main limiting factors for Indian SMEs to acquire global technologies seem to be financial and human capacity constraints and lack of information.

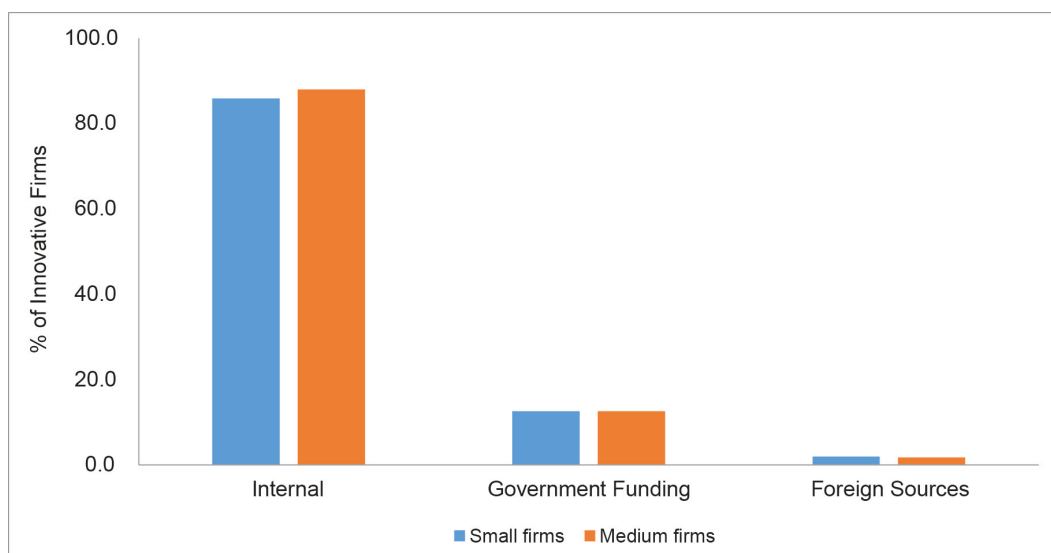
It is also interesting to see the sources that SMEs use or could use for getting advice, ideas, and general guidance to pursue different innovations. Medium-sized firms perform marginally better than smaller firms in making use of different information sources used in the innovation process. Sources of information for SMEs can be internal, external, market, and institutional, among others. Internal, external, and market sources emerge as the top information sources for innovative SMEs in India (Figure 5). Market sources include suppliers, customer feedback, other enterprises, consultants, and private labs and R&D institutes.

The other sources, such as conferences and trade fairs, journals and technical publications, and industry and professional associations, are used by ~30% or more of innovative small and medium firms. However, the institutional sources such as universities, colleges, and government and public research institutions are not frequently referred to as sources of information, reaffirming the weak linkage between Indian SMEs and the overarching institutional architecture of innovation support systems.

Financing for innovation remains a critical challenge for SMEs, especially in developing economies such as India. It can be inferred from Table 4 that due to financial constraints, SMEs do not pursue sophisticated R&D innovations and remain focused on non-R&D and incremental innovations. Funds for innovation typically come from three sources: internal (the firm's own financial resources), government, and foreign sources. More than 86% of the innovative small and medium-sized firms use internal financial resources to pursue innovation (Figure 6).

Figure 5: Information Sources for Innovative SMEs

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

Figure 6: Financing of Innovation by Source

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

Only about 13% of innovative small and medium firms use government funding for innovation. Government funding can come in the form of tax rebates, grants, and subsidized loans. The use of funds from foreign sources is miniscule, which once again reflects the weak linkages of Indian SMEs with the outside world. The funding challenges faced by SMEs remain unique, and large firms are better positioned to exploit the financial opportunities arising from government funding and foreign sources.

4. BARRIERS TO INNOVATION IN INDIAN SMES

To improve the innovation performance of SMEs, it is very important to understand the key barriers in the innovation ecosystem. The barriers to innovation are classified in six categories: people, financial, information, government policy, infrastructure, and

market constraints. The Indian National Innovation Survey captures the response of the innovative firms for different barriers and sub-barriers. The responses show the factors that firms typically consider to be barriers to pursuing innovation. The barriers are analyzed in the context of innovative small and medium firms; non-innovative firms as classified in the survey are not included.

People and Skills as a Barrier to Innovation

Development and implementation of any innovation demands skilled labor. The need for specialized skills in the form of scientists, technicians, or engineers is more apparent in the case of R&D innovations. Non-R&D innovations, such as organizational and marketing innovations, also require specialized skills and staff who are well versed in management and marketing practices. More than 85% of innovative small and medium firms see unavailability of skilled workers as a barrier to innovation, making it one of the foremost challenges in SME innovation (Appendix 1).

SMEs are generally unable to recruit a highly skilled workforce due to financial constraints and lack of adequate infrastructure. This includes internal management. The lack of the right internal management can adversely impact both the firm's innovation capability and its overall performance due to lack of direction, rising inefficiencies, and absence of market focus, among others. More than 38% of innovative small and medium firms perceive internal management as a barrier to innovation.

The situation demands more targeted capacity building programs focused on a company's internal management and its relevance to innovation. There also seems to be a need for a system where SMEs have access to a pool of skilled people for conducting specialized work while addressing concerns about trade secrets.

Finance as a Barrier to Innovation

The financial barriers mainly involve the availability of internal and external finance and the cost of innovation. More than 87% of innovative small and medium firms see limited availability of finance from both within the enterprise and external sources as a barrier to innovation. The cost of innovation is a key barrier for more than 75% of the innovative small and medium firms (Appendix 1). This clearly shows that financial constraints remain one of the biggest barriers to SME innovation.

SMEs in India face a multifold and vicious circle of financial challenges in pursuing innovation. Firstly, the cost of innovation itself is high; secondly, SMEs lack the financial resources to implement innovation; and lastly, access to finance from external financial institutions seems to be limited, creating further bottlenecks. Therefore, there is an urgent need to address this formidable challenge by bringing down the cost of innovation and increasing the availability of innovation capital through banks and other support mechanisms.

Information as a Barrier to Innovation

Timely access to valuable information is critical for SMEs to gain strategic advantage in pursuing innovation. The inability to access key market information can seriously impair a firm's performance. The information barriers refer to access to information on technology and markets. More than 75% of the innovative small firms and 86% of the medium firms face barriers pertaining to technology information and information on markets in India (Appendix 1).

This points toward another serious challenge, the need to upgrade Indian SMEs' access to information about markets and technology. The inability to access such information not only affects SMEs' global competitiveness and exports but also limits their domestic market share. There is a need for the government to take adequate steps, maybe in partnership with local industry associations, to disseminate key market and technology information while focusing on strengthening SME–market linkages.

Government as a Barrier to Innovation

Government policy and the government in itself exert a strong influence on the innovation capacity of SMEs. The government has a critical role to play in every sphere of innovation including access to finance and technology, capacity building and human resources, market linkages, availability of research facilities, and access to key information, among others, via different policies and schemes. It would not be wrong to say that the government is the single biggest factor governing the innovation ecosystem of SMEs, especially in the case of developing economies such as India.

Nearly 68% of the innovative small firms and ~75% of the innovative medium firms see government policy and meeting government regulatory requirements as a barrier to innovation in India (Appendix 1). The perception of the government as a barrier, rather than a facilitator, for such a large number of innovative SMEs is a very serious issue. The Indian innovation survey does not give any detail about the exact responses and reasons for this perception.

India is still ranked 130th globally in the World Bank's ease of doing business index for 2015, which reflects the burdensome regulatory environment in which SMEs operate. The high costs involved in meeting a large number of regulatory requirements tend to negatively affect the innovation capacity of the firms. The role of the government and the likely impact of its MSME policies on SMEs' innovation is discussed in detail in the forthcoming sections.

Infrastructure as a Barrier to Innovation

Availability and access to infrastructure is crucial for R&D-based innovations. The ability of a firm to use laboratories and research facilities inside and/or outside the premises exerts a significant influence on its capability to develop R&D innovations. Close to ~50% and ~60% of the innovative small and medium firms, respectively, do not have access to adequate infrastructure and test labs (Appendix 1) and see it as a barrier to innovation. The limited availability of shared testing laboratories and research facilities is also seen as a barrier to innovation by more than ~35% of innovative small and medium firms.

This points toward the acute shortage of research infrastructure, including testing laboratories, for SMEs in India. It is unlikely that SMEs would have sufficient financial muscle to invest in the development of quality in-house research and testing laboratories. Therefore, it is imperative for government and industry to facilitate the development of more shared research and testing laboratories, especially in key manufacturing clusters.

Market Factors as a Barrier to Innovation

Market factors have an important role to play in innovation. Market characteristics such as competition, protectionist nature, dominance and monopoly, and demand, among others, affect a firm's ability to innovate, especially product- and market-related innovations. Of the innovative small and medium firms, 50%–58% see protectionist

measures for introducing new products and processes and lack of new opportunities to enter niche markets as barriers to innovation (Appendix 1).

More than half of the innovative small and medium firms also face the barrier of uncertain demand for innovative products and services. Given the uncertain demand, SMEs would be reluctant to invest their resources in developing new products and would focus instead on improving their production and quality processes. Innovative products generally are aimed at a niche market that is often not clearly visible or present, and hence tackling these market-related challenges becomes very important. This also greatly hampers product and design innovation, which at times plays a critical role in elevating the exports and global market share of the SMEs.

The uncertainty in demand again points toward the weak market linkages and thin integration of Indian SMEs in the global value chain. The protectionist nature of the market, due to either a monopolistic nature or intellectual property rights (IPR) issues, presents a tough challenge for SMEs. IPR in general remains an area of concern and development among Indian SMEs. There is a need to focus on capacity building programs to train SMEs to identify market potential and devise an appropriate entry strategy while addressing the IPR issues.

5. INSTITUTIONAL ACCESS AND SME INNOVATION IN INDIA

Innovation does not occur in silos. It happens with close interaction between a firm that wants to pursue innovation and the support systems that assist the firm in securing technology, skilled staff, and knowledge and market opportunity. The whole innovation process works like an ecosystem involving firms and support mechanisms provided by government, foreign players, and other entities.

The strength of the innovation ecosystem often reflects the innovation capacity of the firms. Good institutional support is a critical part of the wider ecosystem for supporting SME innovation. However, it is important to understand that just offering institutional support alone will not foster innovation. It is equally crucial to ensure that the operating firms are aware of different institutional support mechanisms and are able to access them. “Institutional support” is primarily referring to the entities that are engaged in extending assistance to SMEs, such as government bodies, universities, R&D institutions, and banks. The role of institutional linkages is very relevant to India.

The Indian National Innovation Survey showcases the use of institutional support among innovative firms operating in different states and union territories. The data show a wide disconnect between the innovative firms and institutional support. “Innovative firms” here refers to all innovative firms covered in the Indian National Innovation Survey irrespective of their size. Educational institutions as an institutional source of knowledge are used by an average of 31% of innovative firms across different states and union territories in India. In about 20 of the 30 states and union territories, less than 30% of innovative firms access educational institutes as a knowledge source (Appendix 2). The situation is a bit better in the use of R&D institutions. Around 40% of innovative firms on average use R&D institutions as a knowledge source across different states and union territories covered in the survey. There is a huge opportunity to increase firms’ innovation capacity by promoting and increasing the use of institutional sources for gathering required information and knowledge on both technological and nontechnological aspects of innovation.

The situation is more challenging in terms of accessing institutional sources of finance and training by SMEs in India. Less than 20% of innovative firms access institutional sources of finance in India, except in the state of Madhya Pradesh. This reaffirms the formidable challenge of innovation financing for SMEs in India. Access to institutional sources for training is also in the same deplorable state, with less than 20% of innovative firms using it across all states and union territories covered in the survey (Appendix 2). On average, less than 7% of innovative firms access institutional sources for both finance and training across different states and union territories in India.

It is important to note that these percentages only reflect the use of institutional sources by innovative firms, which make up just one-third of the total firms. The state of affairs looks even more dire if viewed from the perspective of total firms. Clearly, there seems to be an urgent need to improve SMEs' access to institutional sources for their different needs. This can be done by both promoting existing institutions and opening new ones supporting SME innovation. The government policy needs to be cognizant of the current situation and frame the institutional support mechanisms accordingly.

6. SCIENCE, TECHNOLOGY, AND INNOVATION IN THE INDIAN CONTEXT

The use of the word “innovation” in the national science and technology policy lexicon is rather new. India's Scientific Policy Resolution 1958 sought the “cultivation of science and scientific research in all its aspects.” The focus was on “early and large scale development of science and technology” for the wealth and prosperity of the nation.

The 1983 Technology Policy Statement focused on the need for technology competence and self-reliance. It also mentioned technology acquisition and transfers, as well as a critical facet that was hitherto missing from policy debate in India—implementation.

The idea of innovation was inserted in the Science and Technology Policy 2003 with a view to strengthening the national R&D infrastructure and creating a “national innovation system.” Innovation implies science- and technology-based solutions that are successfully deployed in the economy or the society. Also mentioned was the need to develop and leverage India's traditional knowledge, as well as to generate and manage India's intellectual property resources. Monitoring for speedy implementation of the policy was also given weightage.

The most recent Science, Technology and Innovation (STI) Policy 2013 in India is the most comprehensive policy statement from the point of view of India's STI policy framework. It mentions the deepening of the science and technology system in India, and recognizes that the “instrument of policy” has not given due importance to innovation. India accordingly declared 2010–2020 as the “decade of innovation” and took the important step of establishing the National Innovation Council. It also alludes to the need to understand that science, technology, and innovation are not disconnected from each other—they need to be integrated for new value creation. In addition, the policy focuses on creating an innovation ecosystem that is inclusive, and it promotes mechanisms like “small idea—small money” and “risky idea funds” to support incubators. The policy also talks about “STI driven entrepreneurship” with viable and scalable business models. Another important point is the policy's focus on promoting academic and industry linkages. In terms of the manufacturing sector, it emphasizes high-tech exports while recognizing the low R&D intensity among SMEs.

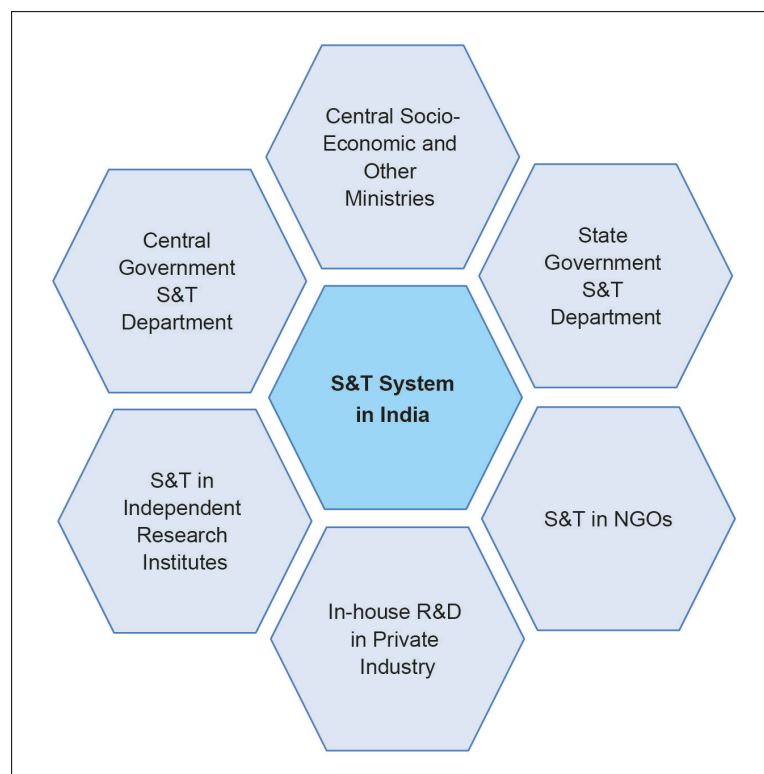
Several positive changes that were envisaged in the STI Policy 2013 have been realized. These include an increase in India's gross expenditure in research and development from under 1% of GDP in 2013 to 2% of GDP, which had been a national goal for some time before the policy was in place.² For this to happen, the policy expects private sector R&D investment to at least match public sector R&D investment, compared with a ratio of around 1:3 in 2013. India's considerable progress is reflected in global rankings; it ranks 9th in the number of scientific publications and 12th in the number of patents filed. While these show considerable maturity of the science and technology ecosystem, the fact remains that the Ministry of Science and Technology understands the technology landscape in quite broad terms. The major policy resolutions and their impact on small-scale industries are provided in Appendix 3.

7. PRESENT MSME AND SCIENCE, TECHNOLOGY, AND INNOVATION SYSTEMS

Present STI System

At present the science and technology ecosystem in India is defined in quite broad terms. The science and technology system in India comprises the broad institutions shown in Figure 7.

Figure 7: Present Science and Technology System in India



NGO = nongovernment organization, R&D = research and development, S&T = science and technology.

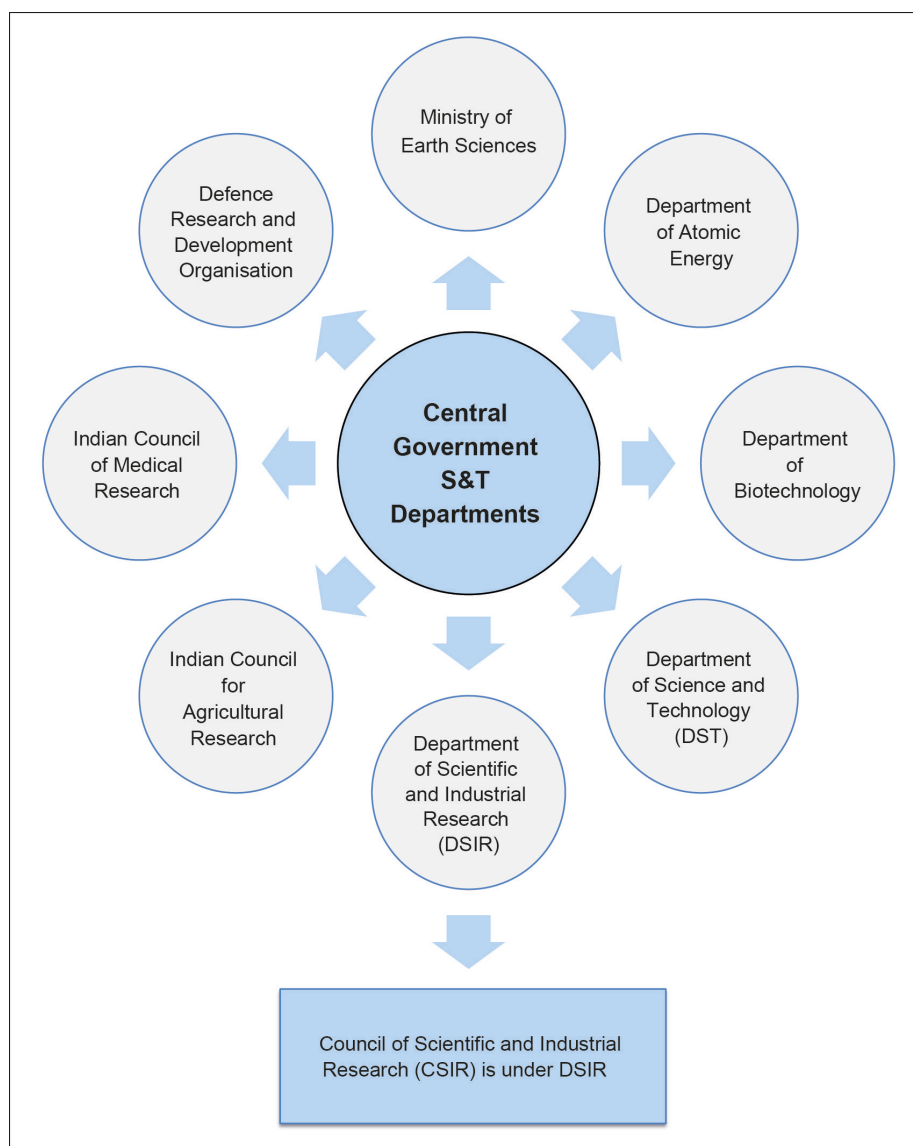
Source: Government of India, Department of Science and Technology. S&T System in India. www.dst.gov.in/st-system-india

² The policy does not indicate specifically the year in which the 2% target is to be achieved, but it implies that it should be reached by 2018.

Among these central departments, the Department of Science and Technology has the primary task of formulating science and technology policy and promoting thrust areas for research. It is also entrusted with science and society programs as well as with international collaborations. The Council of Scientific and Industrial Research with its 40 institutions and laboratories is the major organization coming under the Department of Scientific and Industrial Research. The council's major aim is to strengthen and support R&D through industrial programs and other activities. Apart from these, the research infrastructure for scientific research is present in a large number of universities.

Under the Department of Science and Technology in FY2014, the Technology Information, Forecasting and Assessment Council (TIFAC) did some work pertaining to bringing innovations from lab to market. TIFAC has also done MSME cluster mapping and completed 22 technology gap analyses so far. The Department of Scientific and Industrial Research also launched a new program, Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM), during India's Twelfth Five Year Plan and the department supported 17 projects in FY2014.

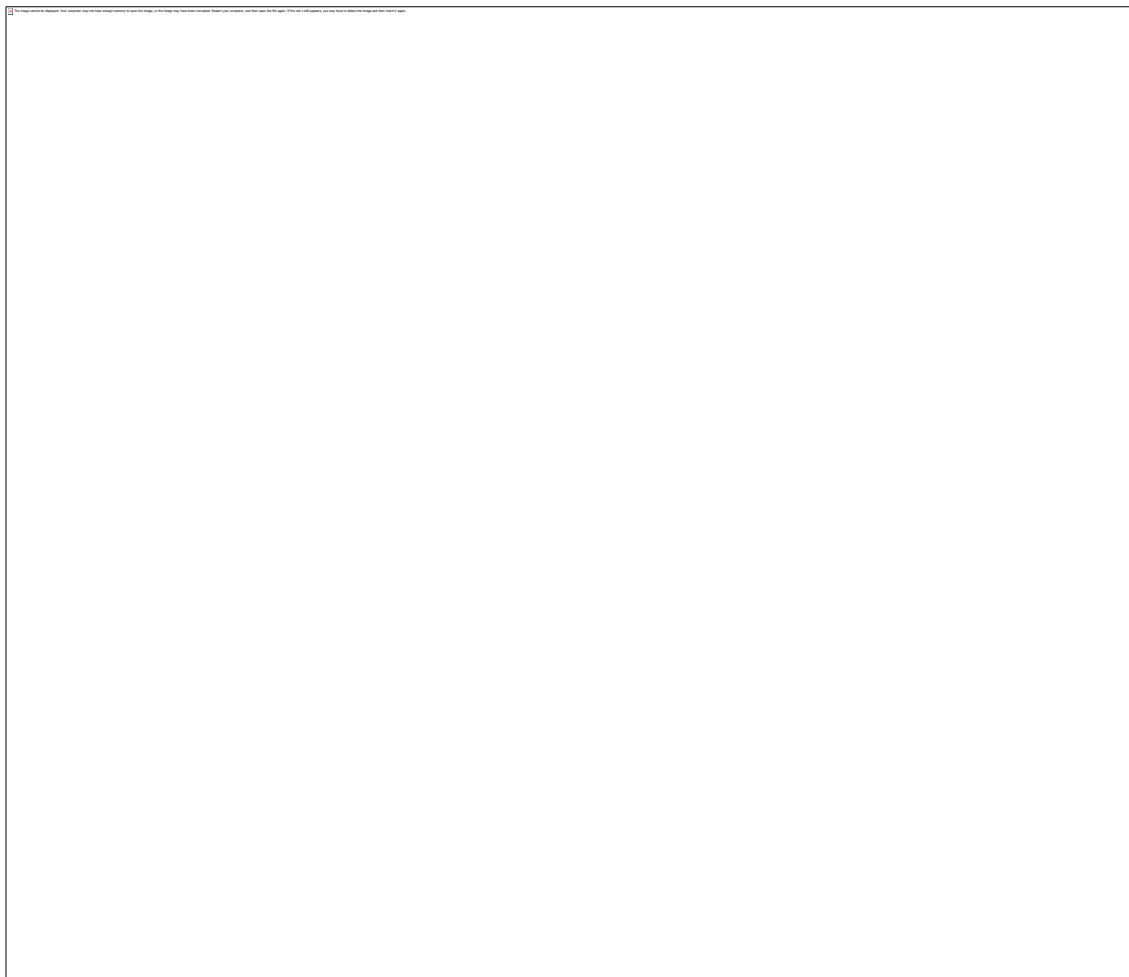
Figure 8: Central Government Science and Technology Departments



Present MSME System

The Government of India looks at small and medium enterprises (SMEs) under the Micro, Small and Medium Enterprises Development Act 2006, which seeks to develop and enhance the competitiveness of MSMEs as a whole. In the act, for the first time the concept of “enterprise” included both manufacturing and services firms. Also described in the act for the first time is the concept of “medium” enterprises. The MSME ecosystem is administered through the Ministry of Micro, Small and Medium Enterprises, which has, broadly speaking, two major divisions. These include the Small and Medium Enterprises division and the Agro and Rural Industries division. A description of the present MSME system is given in Figure 9.

Figure 9: Ministry of Micro, Small and Medium Enterprises



8. REASONS FOR PERCEPTION OF GOVERNMENT POLICY AS A BARRIER

Despite this overarching framework for MSMEs and STI, several problems are seen within the government policy context:

According to the Fourth All India Census of Micro, Small and Medium Enterprises,³ roughly 96% of MSMEs are unregistered, which results in their exclusion from most programs and schemes of the government. Most MSMEs are unregistered because of long delays in the registration process. This may partially explain why MSMEs view government policy as a barrier rather than an enabler. The government is working toward easing this and has created a simplified procedure for registering an MSME unit online through the Udyog Adhaar Scheme.

Second, within the central government's policy on STI, the thrust of the institutions is still very much on high-end technical and technological research, which may be of use to multinational and public sector enterprises but does not find consonance with the demands of the MSME sector, especially the unorganized sector. Though both the Council of Scientific and Industrial Research and the Indian Institute of Science have worked with MSMEs, the scale of operations is far less than what is required. The case is similar with technology business incubators. A few have been operational but there is much more potential to be harnessed in terms of industry interactions and improvement of functioning as well as establishing new technology business incubators.

Third, within the government policy pillar is the low collaboration within as well as among government departments, universities, and MSME entities. Within the government departments, the goals of the research institutions and the unorganized MSME sector often do not match. The national labs often end up producing patents and high-end technical inventions that the unorganized MSME sector is simply incapable of buying or sourcing. At present too much focus is put on R&D. The majority of the innovations in SMEs are non-R&D innovations, which institutions often ignore. And even when MSMEs have the buying capability, usability can be an issue.

Fourth, another major point hindering innovation is that within the government policy framework, some of the previous institutions are simply defunct, which in turn causes the policy and implementation to flounder. Two examples that come to mind from a policy viewpoint are the National Innovation Council and the National Manufacturing Competitiveness Council. Both of these institutions have seen resignations and no new appointments have been made since the new government was elected. The functioning of these institutions is important for innovation to take root in the MSME policy. The challenge of innovation within MSMEs is also with respect to continuity in government policy. These institutions must see new appointments and new members to carry out their crucial role on the innovation and policy front. There is also a need for greater government transparency and accountability for addressing the sector's issues pertaining to innovation.

Fifth, access to financing is again to an extent determined by the government policy. A recently established institution for solving the problem in the MSME space is the MUDRA Bank, but it is too early to talk about the relative merits and demerits of its functioning. In the case of access to finance, the Reserve Bank of India issues guidelines to the banking sector for lending to priority sectors. MSME is a priority sector precisely because it is employment intensive. The Reserve Bank of India's directive to the banking sector includes implementing the recommendations of the Prime Minister's task force on the MSME sector submitted in 2010. It mentioned the need for the banks to achieve 20% year-on-year growth in credit to micro and small enterprises, 10% annual growth in the number of microenterprise accounts, and 60% total lending to the MSE sector to be channeled to microenterprises. The public sector banks have also been advised to open specialized branches for MSMEs. As of March 2014, there were

³ The census took FY2006 as the base or reference year. The data was collected until 2009 and the results were published in 2012.

2,887 specialized branches for MSMEs. Also, collateral-free loans are mandated for MSMEs up to a limit of Rs1 million. Cluster financing is also available. The problem thus does not seem to pertain to policy in this regard but to its implementation. If MSMEs find it difficult to avail themselves of loans, it is due to either a lack of awareness among MSMEs or the fact that banks find loopholes in these directives. Another major point within the MSME ecosystem for promoting technology development and access to finance is that seed and angel funding is still not as mature as later stages of venture capital and private equity in India, which inhibits growth of start-ups.

Sixth, as noted in the National Innovation Survey Report (CSIR 2014), another major challenge on the government policy front is that MSMEs' access to institutional facilities that support innovation, like institutional finance and institutional training programs, is generally very low, indicating a disconnect between the innovation infrastructure and the production system.

Seventh, another major challenge within the government policy pillar pertains to the regulatory architecture and the transaction costs for MSMEs. According to the list given in the Ministry of Labour and Employment's annual report for 2014–2015, there are presently 44 central laws pertaining to labor regulation in India. In addition, there are some 160 state-level enactments containing supplementary provisions (Papola 2013). Most times it makes the functioning too problematic and the transaction costs are very high. This leads to a perception of government as an inhibitor rather than a supporter. For example, the laws pertaining to the factory sector (defined in India as a firm having more than 10 workers) often require considerable legal documentation and process. That is how the government policy causes MSMEs to remain small and outside the registration ambit. It also acts as a hindrance to the growth of innovation in MSMEs as economies of scale bring addition resources for innovation.

9. ENABLERS OF SME INNOVATION

Innovation has many enablers that are related to both internal and external environments. The internal environment covers the company's operations, market strategy and vision, skills, creativity, and quest for innovation, among others. The external environment includes industry factors, policy environment, support mechanisms, availability of skilled labor, etc. The intensity of the effect of internal and external environmental factors on innovation is likely to vary depending on the stage of economic development of the country, industry maturity and sophistication, and direction of government policy.

The data from the India Innovation Survey suggest that the internal environment of SMEs is the key enabler of innovation. The majority of the innovative SMEs use internal sources for pursuing innovation. The acquisition of new machines as the most dominant form of innovation can be seen as a result of SMEs' internal push and motivation to improve productivity. Among non-R&D innovations, the significant use of organizational and marketing innovation showcases the entrepreneurial spirit among Indian SMEs. To add to that, internal financing remains the major source of innovation financing among SMEs in India.

These facts and observations infer that the intrinsic zeal to innovate and remain competitive in the market plays a major role in innovation for India's SMEs. The role of internal factors becomes even more crucial in a scenario where government policy in itself is seen as a major barrier to SME innovation, as it is in India. This also

suggests that innovation may always persist in some form or other independent of the external environment.

On the external front several challenges are observed. These include access to requisite information, policy gaps between requirements and what is offered, and the magnitude of the challenge from the government's viewpoint. Enablers on the government policy front include designing systems and schemes that enable upgrading of the existing firms or cluster of firms and helping them compete in the domestic and international economy. These schemes have to be routed through institutions that have the scale to enable proper institutional support to MSMEs. Platforms like the National Innovation Foundation, which seeks to map innovations and work with innovators to help them scale up their innovation, thus is a good model for addressing this anomaly by bringing together the investor and the innovator on the same platform.

10. RECOMMENDATIONS FOR THE REMOVAL OF BARRIERS TO INNOVATION

The creation of an action plan for SMEs is required to achieve broad innovation objectives. Detailing the contours of overall MSME innovation policy is critical. Several barriers and the policy context act as reasons for the perception of government as a barrier to innovation. Below are several recommendations for embedding innovation in the country's SME ecosystem, clustered under five broad categories.

People and Skills

- Change the laws and regulations that cause negative impacts for the overall growth of the MSME sector and its innovation, such as specific labor regulations pertaining to factories.
- Promote capacity development programs and vocational education and training that have innovation as part of their curriculum.
- Utilize the architecture of SMEs presently in place to train people on innovation and how to avail themselves of the benefits of innovation schemes.
- Because management skills are largely missing, establish a dedicated SME university for skill development, which has courses for education on issues pertaining to innovation in SMEs.

Finance

- Ensure credit flow is maintained through government schemes and market mechanisms through the banking channels in the country. The schemes need to expand to meet the demand of the sector.
- Ensure adequate support mechanisms exist for entrepreneurs who are willing to establish small enterprises. The Start-up India plan is a step in the right direction.
- Create an innovation fund under the Ministry of MSME, which can help provide financing to SMEs, especially for supporting innovation.
- The recently started MUDRA (Micro Units Development & Refinance Agency) should have a dedicated fund for innovation in SMEs.

- The definition of innovation has to be clearly defined and low-interest loans should be provided by the banks for innovation activities. The Reserve Bank of India can issue guidelines in this regard.

Support for Marketing Activity

- Set up industry associations and tie up the marketing side of SME clusters with government to create value across the value chain.
- Utilize existing centers for providing access to information on Indian and external markets for innovative products and on how SMEs can benefit from this information. Reports can also be made publicly available to inform people of the potential of a particular product market in India and abroad.
- Sponsor dedicated days when SME owners can discuss their products with experts and consultants who can help them better understand consumer demand and emerging trends.
- Move toward demand-driven and market-driven models of SME innovation rather than just R&D-focused innovation models. What is required for innovation is not just R&D but a gamut of activities, such as finding linkages to suitable markets.
- Promote cluster development mechanisms in line with successful cluster development programs elsewhere. This will help boost the marketing side of innovation.

Government Framework and Institutional Access

- Establish a center of excellence for innovation in the Ministry of MSME or its attached offices to help promote a culture of innovation.
- Ensure that adequate numbers of policies are in place; the scale and benefits of the policies may be reviewed from time to time keeping in view the requirements of the sector.
- Reduce the information asymmetry between different government departments and enable collaboration at all levels—from the ministry and department level down to the institutional, cluster, and firm levels. This means more collaboration between government research departments, the private sector, people engaged in production processes, and entrepreneurs at the grassroots level.
- Set up more institutions, such as the National Institute for Micro, Small and Medium Enterprises and the Entrepreneurship Development Institute in Ahmedabad, that can help in scaling up current programs for greater scope and depth in helping individual firms and clusters.

Technological Development and National Innovation Architecture

- Look at institutions and programs that can help promote science, technology, and innovation in the existing context.
- Cluster development programs: Develop R&D centers for particular clusters. The government has already carried out a large number of cluster requirement studies. A common facility or center can support R&D as well as capacity building for members of the cluster. Clusters can also be virtually connected to other clusters and avail themselves of information on intellectual property rights.

- Take measures for upgrading of machines, funding of technology by banks, and technology development by national labs and align innovation requirements of SMEs with the Department of Scientific and Industrial Research.

11. CONCLUSIONS

Despite the numerous challenges, the SME sector in India has performed well. There are distinct barriers to innovation, the most important of which seems to be government policy. This leads to the adage that “entrepreneurs grow not due to the government in India, but despite the government.” However, a deeper analysis leads one to conclude that the government is trying to facilitate the growth of SMEs by promoting various schemes and programs to facilitate innovation in the sector through its distinct institutions. The Science, Technology and Innovation Policy 2013 has had an impact but the institutional functioning of the government, Council of Scientific and Industrial Research labs, and individual firms often does not match. The scale of operations in both the public labs and the private research institutions need to be ramped up for greater reach and support to SMEs. Another major finding is that some programs, like the Cluster Development Program, can be expanded to provide greater access to more individual firms within the cluster. Modernization and technology upgrading along with innovative methods of capacity building and marketing of products are necessary. A holistic and separate innovation policy for the SME sector can also be made to promote innovation. The policy, institutions, and supporting framework have to be improved to remove SMEs’ perception that government is limiting their success. Over time, this can be done with the proactive participation of experts and policy makers to benefit India’s SMEs.

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APPENDIX 1: BARRIERS TO INNOVATION FACED BY INNOVATIVE SMALL AND MEDIUM FIRMS (%)

	Innovative Small Firms	Innovative Medium Firms
Financial		
Finance from own enterprise	87	89
Finance from outside source	69	70
Innovation cost	75	77
People and skills		
Availability of skilled labor	89	86
Management/People	38	46
Information		
Technology information	76	87
Information on markets	76	87
Government		
Government policy	68	74
Meeting government regulatory requirements	68	74
Infrastructure		
Availability of infrastructure/test labs within enterprise	48	58
Available facility sharing of test labs/research labs	35	45
Market		
New opportunities to enter niche market	50	58
Protection barriers for new products/processes	50	57
Uncertain demand of innovative goods/services	53	57

Source: Authors' calculation based on Indian National Innovation Survey, 2014. Figures are indicative.

APPENDIX 2: ACCESS OF INSTITUTIONAL SUPPORT BY INNOVATIVE FIRMS (%)

	Educational institution as source of knowledge	Research and development institution as source of knowledge	Access to institutional source of finance	Access to institutional source for training
Andhra Pradesh	6.1	15.5	14.1	0.5
Assam	71.7	79.3	5.7	7.7
Bihar	19.0	19.0	1.0	20.0
Chhattisgarh	29.6	29.6	0.0	20.0
Delhi	19.8	20.9	6.6	2.2
Goa	12.2	36.6	8.5	3.7
Gujarat	89.6	87.5	2.3	16.7
Haryana	11.0	11.3	1.4	3.4
Himachal Pradesh	25.9	25.2	6.2	16.0
Jharkhand	3.3	4.8	1.5	15.1
Karnataka	4.3	18.6	0.4	3.9
Kerala	4.8	16.3	0.0	1.2
Madhya Pradesh	76.0	80.0	30.0	0.0
Maharashtra	59.6	62.3	17.7	12.3
Meghalaya	80.0	70.0	0.0	0.0
Nagaland	33.3	33.3	0.0	0.0
Odisha	18.1	33.0	0.0	10.0
Punjab	37.7	47.2	5.7	7.6
Rajasthan	15.3	12.9	8.1	0.8
Sikkim	63.8	76.6	0.0	18.6
Tamil Nadu	2.6	4.5	1.3	0.1
Tripura	45.9	80.0	0.0	0.0
Uttar Pradesh	67.6	75.7	18.9	2.7
Uttarakhand	30.0	30.0	6.7	0.0
West Bengal	22.9	28.0	14.3	9.9
A & N. Island	0.0	60.0	0.0	0.0
Chandigarh	25.0	25.0	0.0	0.0
Dadra & N Haveli	17.1	47.4	1.1	1.3
Daman & Diu	6.0	18.1	1.1	5.3
Puducherry	16.4	22.6	0.6	6.9

Note: In 2011, the Government of India approved the name change of the State of Orissa to Odisha. This document reflects this change. However, when reference is made to policies that predate the name change, the formal name Orissa is retained.

Source: Government of India, Department of Science and Technology. 2014. *Indian National Innovation Survey*.

APPENDIX 3: INDUSTRY POLICY STATEMENTS AND THEIR IMPACT ON SMALL-SCALE INDUSTRIES

Industrial Policy Resolution, 1948	The policy resolution mentioned the factors that could help build local self-sufficiency and improve small-scale industries (SSIs). These included factors like provision of raw materials, cheap power, technical advice, organized marketing of their products, and, if necessary, safeguards against intensive competition by large-scale manufacturers, as well as worker education in the use of the best available technique.
Industrial Policy Resolution, 1956	The policy stressed the role that cottage, village, and small-scale industries could play in the development of the national economy. Also mentioned were the advantages that SSIs offered like large-scale employment, equitable distribution of resources, and restricting unplanned urbanization.
Industrial Policy Statement, 1977	Increased the items reserved for production by SSIs from 180 to 500 and called for establishment of district industries centers, which would assist in the development of household industries as distinct from SSIs. Also stressed (i) development and application of appropriate policies in India, and (ii) development of indigenous technology as far as possible.
Industrial Policy Statement, 1980	The policy emphasized the need for creating ancillary units and redefined the investment limits for small-scale units. Also stressed the need for better access to finance for small enterprises, continued the reservation under the 1977 resolution, and extended marketing support to SSIs.
Post-1991 period	The period saw several changes in the way MSMEs function. These include coming to terms with the fact that SMEs have to remain competitive in the face of increasing competition. Technological prowess of SMEs started to increase due to the increasing competition. Some important legislation during the period focuses on removal of items from the list of those reserved for production solely by SSIs, among others. The liberalization of industrial policy along with the liberalization of trade and opening of sectors paved the way for greater de-reservation of items previously reserved for SSI's. Several papers and committee reports suggested that a policy of de-reservation should be followed.

SSI = small-scale industries.

Source: Government of India, Ministry of Micro, Small and Medium Enterprises. India's Industrial Policies from 1948 to 1991. www.dcmsme.gov.in/policies/iip.htm