

Chapter 1: Executive Summary

It has been widely argued in the research literature that large firms show a greater propensity to undertake innovative activities. Large firms are more active in R&D activities, technology in-licensing, employing qualified manpower, organizational and marketing practices. Cumulatively the large firms in India contribute approximately 70% of India's total R&D expenditure. A comprehensive study aiming at understanding the issues in innovation in the large firms will lay bear on the problems prevalent in the overall innovation ecosystem of the country. Against this backdrop, the objective of the present study was to understand the innovation behaviour and the critical issues associated with innovation of large firms in the country.

Methods:

This study primarily focuses on the large firms who have been continuously investing in R&D between 2009 and 2014. It is observed that 610 have maintained a continuous R&D spend (more than or equal to 5 years) during 2009-2014 period. The data of different economic variables on the firms have been collected from the PROWESS database of Centre for Monitoring Indian Economy (CMIE). Two linear econometric models have been developed based on the company level data obtained from PROWESS database. The first model involving the 610 large manufacturing firms has revealed that import of capital goods, R&D expenditure, royalty expenditure, export earning and age of the firm plays significant positive effect on size of the firm. The second model came out with the conclusion that net sale, import of capital goods, export earning, profit margin are the important determinants of R&D investment of the firms. It was also observed that young firms are more responsive to R&D investment. The results of the quantitative analysis are reported in consequent chapters.

However, it was felt that quantitative analysis of data alone is not sufficient to capture the state of affairs and innovation behaviour of large firms. Hence a qualitative approach to find out issues relating to innovation and to identify gaps in government policies was carried out. 52 individual cases were prepared to capture the state of affairs and issues concerning R&D investments. Inputs for the case studies were based on primary survey ASCI team carried out after visiting large manufacturing

firms and meeting R&D Managers/Vice President/General Manager or other R&D spokespersons. The primary research instrument for case study was the questionnaire prepared for the purpose. This was prepared in consultation with the Department of Science and Technology (DST) to capture information regarding product and process innovation as well as issues related to innovation in these firms. Different technological parameters mentioned in the questionnaire are derived from OSLO Manual, which is a benchmark for measurement of technological and scientific activities in Organization for Economic Cooperation Development (OECD) countries. The questionnaire was filled in during the course of visit to the R&D centres of the concerned large firms. Summary of the issues and recommendations derived from case studies are elaborated in subsequent chapters.

52 large manufacturing firms covered under the study are from 9 major sectors like Food products & Beverages, Chemicals & Chemical products, Pharmaceuticals, Rubber & Plastics, Non-metallic minerals, Basic metals & Metal products, Electrical equipments, Machinery & equipments, Other transport equipments and Others (Tobacco & Textiles). Sector specific issues and recommendations of these 9 sectors have been highlighted in a dedicated section.

Thus, the findings of the study are therefore based on:

1. Analysis of quantitative data collected from prowess database
2. Analysis of Indian as well as global R&D investment data available in public domain
3. Findings from case studies
4. Issues and recommendations suggested by critical stakeholders like R&D Managers/General Managers/Vice President of the concerned companies during interviews and discussions.

Findings from quantitative analysis:

- *610 large firms have maintained a continuous R&D spend (more than or equal to 5 years) during 2009-2014 period.*
- *Out of these 610 firms, 520 are Indian private firms, 56 are MNCs and 28 belong to PSU sector.*
- *Average net sale of 610 large firms has increased constantly over the years since 2009 to 2014. It has increased nearly 90% in 2014 compared to its initial period in 2009.*
- *R&D investment of Indian large firms has increased more than 100% over the time period (2009-2014) considered in the analysis*
- *Average R&D expenditure and average export by 610 large firms within the time period of 2009-14 are positively correlated*
- *Econometric model based on the panel dataset involving the 610 large manufacturing firms has revealed that import of capital goods, R&D expenditure, royalty expenditure, export earning and age of the firm plays significant positive effect on size of the firm.*
- *Another model identifying determinants of R&D investment of large manufacturing firms within a stipulated time period (2009-14) has revealed that size of the firm and the R&D intensity has a positive relationship for the given sample of large firms.*
- *Young firms are more responsive to R&D investment.*
- *Import of capital goods positively influences R&D intensity of the Indian industry.*
- *Export earning significantly enhances the need for an in-house R&D effort to support overseas operations.*
- *Firms having higher profit margins have better capacity to bear the risk of R&D activity.*

Findings from qualitative discussions:

Findings can be broadly classified into two categories.

A. General findings –

The findings (issues and recommendations) from the study have been segregated into four major baskets.

1. Issues & recommendations related to government policy: The companies raised several issues pertaining to the government policies like delay in new product registration, unavailability of single window system for product approval, absence of centralized R&D facility etc.

a) Issues and recommendation related to ease of doing business / government policies

- Longer time required for new product registrations, regulatory clearances, longer approval process for airworthiness certification, third party validation tests and unavailability of land are some major impediments to innovation
- Bureaucratic work culture, problem of corruption, lack of domain expertise is evident in every step of the licensing approval process
- The whole price fixing method for sugarcane needs a revision. Due to regulation on sugarcane price, companies have to purchase sugarcane on a higher price and sell the sugar at a lower price resulting in a huge loss. Pricing policy for sugarcane should be determined judiciously so that it does not affect the companies.
- A single window system is required, which should ensure simple and transparent process for product approval, manufacturing license, IP registration and IP protection. A single window approval system like Industrial Entrepreneur Memorandum (IEM) may be introduced for production and sale of new products in the chemical industry.

b) Simplification of taxes and benefits (including import & export)

- **A simple tax structure like GST** is need of the hour that would bring relief in the form of clarity. It would cutback in prices by removing cascading effect of taxes.
- Import duty should be exempted on life-saving drugs.

c) Government responsibilities toward skill development

- Creation of state of the art ‘Centre of Excellence’ through industry-academia-government partnership is recommended in order to meet a huge unmet need of industry and building competitiveness among the engineering students.
- A dedicated engineering curriculum towards manpower creation in the specializations like packaging or rubber is needed.

d) Absence of R&D infrastructure

- Creation of sector specific state of the art R&D centres equipped with modern facilities and infrastructure is highly recommended to promote innovation in high-tech sectors
- Model pilot plant should be established along with the R&D centre in Public Private Partnership (PPP) mode.

e) Other issues and recommendation

- Drip irrigation can be promoted for effective supply of fertilizer to the soil
- A separate ministry is recommended for pharmaceutical industry
- A proper evaluation system is required where R&D projects of a DSIR certified lab is judged based on critical parameters like proper utilization of funds, risk involved with the project, timeliness, exclusiveness, cutting edge technology development, patent filing, standard of ethics and so on
- Creation of ‘futures group’ is recommended in the cable industry to identify the emerging areas of R&D.

2. Issues & recommendations related to the industry: Other than policy related issues, key stakeholders have mentioned issues specific to industry (dearth of skilled manpower in R&D, unavailability of raw materials, absence of industry to manufacture machineries etc.).

- Dearth of skilled manpower in R&D is one of the major impediments to innovation in India. CSR fund can be effectively utilized in skill development. Industry should bring the concept of sponsoring skill development trainings/course in specialized areas.
- Strong initiatives from the Government are required to establish an industry dedicated to manufacturing of high-end products to counter imports that currently dictate the industries like pharmaceutical.
- Sector specific consortium of companies may be formed to carry out research in the areas of national importance.
- Low scale of production capacity is hampering R&D in India

3. Issues related to absence of collaborative research environment in the country: Absence of collaborative research environment is affecting innovation in the country. Recommendations were suggested to bring in three major stakeholders – Industry, academia & research institutes – under a single platform.

- The longer gestation period and massive investment required for R&D are the reason why companies restrain them from new product development and shows interest only in process development. It is highly recommended to establish a common platform involving the private industry, public sector units and the academia to encourage collaborative research projects for new product development in the country. Central Government should be in the focal point of this collaboration. Government should bear at least some risk (say 50%) of high-end projects carrying national importance.
- Cross country collaborative research should be promoted.

4. Other issues: This part deals with the issues specific to industries like Silk, Tea, and Consumer electronics etc.

- Government should take action by enforcing stringent rules against ‘dumping’ in the sectors like steel or silk and rubber.

B. Industry specific findings -

This part deals with findings from the discussions with the companies from nine major industries.

- Issues like Government regulation on sugarcane price, unavailability of proper ethanol policy, longer time for approval of Food Safety and Standards Authority of India (FSSAI) and deduction in tax benefit for R&D are hampering innovation in **food product & beverages industry**. The companies in this sector have requested the Government to establish centralised R&D centres and pilot plants in PPP model.
- Innovation in **Chemical industry** is facing obstacle due to lengthy product approval procedure, unavailability of centralised R&D facilities, absence of collaborative research environment and dearth of raw materials etc. Establishment of single window system for product approval, building R&D facilities in PPP model and creating industry-academia-government research collaboration are some of the major steps the government should look into. A consortium of companies may be formed to carry out research in the areas of national importance.
- The companies in **pharmaceutical industry** urged the government to come up with single window system for product approval, IP registration and IP protection. Strong IP creation policy at university level, exemption of import duty on lifesaving drugs, building state-of-the-art testing laboratories, creation of centre of excellence through industry-academia partnership are major areas Government could focus on to foster innovation in the pharmaceutical industry. The companies also pointed out that National Pharma Pricing Authority (NPPA), which sets the price of essential medicines, comes under Ministry of Chemicals and Fertilizers, which often creates

confusion in the process of product approval, licensing and other modes of operation. Hence, a separate ministry for Pharmaceuticals Industry is need of the hour.

- **Plastics & Rubber products manufacturers** raised their concern about absence of dedicated curriculum toward skilled manpower creation and unavailability of model pilot plant adjacent to R&D centre. They have also suggested that model pilot plants can be established in PPP model.
- The companies in **metals & metal products industry** mentioned that improper rules against dumping, lack of research collaboration with internationally reputed institutions are hampering innovation in the industry.
- The companies under **electrical equipment manufacturing** stated that less number of testing facilities for CE certification is a serious issue with the companies in this industry. Dumping of electrical goods from Chinese market is a threat to Indian manufacturers. Government may create futures group of companies to focus more on cutting age innovation in the industry.
- **Machinery & equipment manufacturers** mentioned that creation of state of the art R&D centres and centre of excellence across the country is need of the hour to foster innovation in the sector. Core-engineering curriculum has to be restructured and should incorporate latest trends and technologies in the syllabus.
- The companies in **transport equipment manufacturing industry** raised their concern related to long wait time for new product registration and delay in regulatory clearance. The industry recommended that state of the art R&D centres should be established across the country in PPP model to promote innovation in the sector.

Key takeaways from the qualitative discussions:

Industry Name	Key issues	Key suggestions
Food products & beverages manufacturing	<ul style="list-style-type: none"> • Government regulation on sugarcane price • Absence of proper ethanol policy • Deduction in tax benefit for R&D • Lengthy FSSAI approval process 	<ul style="list-style-type: none"> • Government could establish centralised R&D centres and pilot plants in PPP model
Chemicals & Chemical Products Manufacturing	<ul style="list-style-type: none"> • Lengthy product approval procedure • Unavailability of centralised R&D facility • Absence of collaborative research • Dearth of domestic raw materials 	<ul style="list-style-type: none"> • Single window system for product approval • Building R&D facilities in PPP model • Creating Industry-Academia-Government collaboration to foster research • Consortium of companies to focus on research areas of national interest
Pharmaceutical Products Manufacturing	<ul style="list-style-type: none"> • Lengthy product approval process • Ambiguity in IP registration & protection 	<ul style="list-style-type: none"> • Single window system to bring transparency in product approval, IP registration & protection • Exemption of export duty on life saving drugs • Building state-of-the-art central laboratories

		<ul style="list-style-type: none"> • Foster collaborative research through Industry-academia collaboration • Create a separate ministry for pharmaceutical industry
Plastics & Rubber products Manufacturing	<ul style="list-style-type: none"> • Absence of dedicated curriculum toward skilled manpower creation • Unavailability of model pilot plant adjacent to R&D centres 	<ul style="list-style-type: none"> • Building model pilot plant in PPP model • Promotion of synthetic latex over natural rubber
Metals & Metal Products Manufacturing	<ul style="list-style-type: none"> • Improper rules against dumping • Lack of collaboration with foreign institutions in research 	<ul style="list-style-type: none"> • Imposing stringent rules against dumping
Electrical Equipment Manufacturing	<ul style="list-style-type: none"> • Less number of testing facilities for CE certification • Dumping of electrical goods from Chinese market 	<ul style="list-style-type: none"> • Stringent dumping rules • Creation of future groups to bring cutting edge innovation in manufacturing
Machinery & Equipments Manufacturing	<ul style="list-style-type: none"> • Lack of collaborative research in machinery manufacturing 	<ul style="list-style-type: none"> • Creation of state of the art R&D centres • Creation of centre of excellence • Restructuring core engineering curriculum to get industry ready manpower
Transport Equipment Manufacturing	<ul style="list-style-type: none"> • Long wait time for new product approval • Delay in regulatory clearance 	<ul style="list-style-type: none"> • Creation of state of the art R&D centre in PPP model

<p>Other Sectors – Tobacco & Textile Products Manufacturers</p>	<ul style="list-style-type: none"> • Absence of modern technologies in the industry • Import of cheap textile from China hampers the growth of domestic market 	<ul style="list-style-type: none"> • Development of R&D infrastructure • Imposing proper duty structure to scale down import from China
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Some facts from the study

- *Around 80% of the firms covered under primary survey suggested coming up with a **single window system** for product approval. The companies feel that single window system can eliminate the hassles and ease the process of product approval.*
- *60% of the firms recommended building **model pilot plant in PPP model**.*
- *Around 50% of the firms suggested creating **centre of excellence** through industry-academia-Government collaboration.*
- *Around 25% of the companies raised their concern about unavailability of industry ready skilled manpower and recommended creating an **industry specific engineering curriculum**.*
- *Dumping is a big issue for industries like metal products, electrical & electronic products manufacturers. 30% of the companies recommended imposing high **penalty on dumping** from China.*