

# Annual Report 2016-17

*Report of projects and papers completed, papers published, and external academic and policy advice given during the year*

## Planning Commission Unit, CDS

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### Contents

1. Research papers completed	1
2. Research papers ongoing	7
3. New Initiatives	8
4. Publications during 2015-16	10
5. Seminars/Conferences/Workshops attended (2015-16)	11
6. External involvement in academic and policy Advice	11
7. Personnel Associated with the Unit	14
8. Contact Address	14

## **1. Research papers completed**

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### **1.1 One Size does not fit all, An analysis of the importance of industry- specific vertical policies for growing high technology industries in India**

**Abstract:** India, currently (c2017) is one of the fastest growing countries in the world. But this growth is largely driven by its services sector. From around 2006 or so, the country has been striving to industrialize through the manufacturing route as growth driven by the manufacturing sector has a number of long lasting economic benefits. First of all, manufacturing sector has much more linkages with the other two sectors of the economy, namely the primary and tertiary sectors. Second, most of the innovations that are used in the primary and tertiary sectors emanate from the manufacturing sector. For these reasons and more, countries across the world including that of India are on a conscious drive to increase the size and technical content of its manufacturing sector. The manufacturing sector in turn consists of a number of disparate industries. One way of grouping them is in terms of their respective employment content and another way is to group them according to their technology content. Although the manufacturing sector in most developing countries are supposed to be dominated by labour-intensive or low technology industries, the current emphasis is on increasing the share of high technology industries. This emphasis on high technology manufacturing is for three specific reasons at least. First, high technology industries have very high levels of productivity, both capital and labour. So, even if their share is small, their contribution to GDP of the country is expected to be much larger. Second, high technology industries have much better linkages with downstream and upstream industries as most high technology manufactured products are based on an assembly of components. So their multiplier effects on growth in the region where they are located is supposed to be much higher. Third, world trade in manufactured products is dominated by high technology products (Mani, 2004, Lall, 1998) and if a country wants to increase its share of exports, it must encourage the production of high technology manufactures. Given the capital-intensive nature of production, use of very often-proprietary technology, high failure rates etc., the role of the state in high technology production is very well accepted. Even in advanced countries such as the USA or Japan, where the market is perceived to be more efficient in the allocation of resources, high technology production has been supported through concerted state intervention. For instance, the role of the state in the SEMATECH project in the USA or the VLSI one in Japan is now very well accepted as the main reason for the

supremacy of both the USA and Japan in semiconductor production. Having successfully achieved its original target, the programme is now moving towards the development of other high technology industries such as biomedicine, cyber security and alternative energy. The specific way in which the state intervenes in the development of high technology industries can vary in terms of its content. There are at least three ways in which the state intervenes. The first mode is a direct one in which the state establishes a state owned-enterprise (SOE) which then manufactures the high technology product. The second mode is for the state to establish a public R&D programme either exclusively or in partnership with the market, develop the high technology and then transfer it to production enterprises whether owned by the state or the private sector. The third mode is for the state to craft the eco system for high technology production by having explicit policies and instruments for this to be developed by both public and private sector enterprises. Most industrializing countries such as India have actually used all the three modes. Modes 1 and 2 were very popular in the pre- liberalization phase while Mode 3 is the preferred one in the post-liberalisation phase characterised by a paring down of state intervention in economic activities.

In the context, the purpose of the study is to analyse the growth of high technology manufacturing industries in India. Our hypothesis is that whichever mode is employed, each high technology industry requires a specific policy that is crucial for its sustained growth. In short, one size rarely fits all. Let us consider two different high technology manufacturing industries, namely aerospace and pharmaceutical. For the aerospace industry the most important instrument for its promotion will be public technology procurement, which manifests itself in the form of an offset policy. Such a policy assures a certain amount of demand for the new product, which encourages the manufacturers to be venturesome. On the contrary, for the pharmaceutical industry, the most important policy is the one on patents, as patents are extremely important for chemical industries in general and pharmaceutical in particular. However a policy for financing R&D and policies on increasing the quantity and quality of science and engineering human resource is important for both the industries. We refer to the former set of specific policies as vertical policies (VP) and the latter set as horizontal policies (HP). The study proposes to verify the hypothesis of the crucial importance of VP by taking three successful cases and one unsuccessful case from India's manufacturing industry. The three successful cases are aerospace, pharmaceutical and automotive industries, and the one unsuccessful case is the telecommunications equipment industry. The ensuing analysis underscores the importance of vertical policies that addresses certain specific dimensions that are crucial for a particular high technology industry to grow and flourish.

## **1.2 Innovation policy instruments at firm level, Review of India's policy with respect to R&D tax incentives and Intellectual Property Rights**

**Abstract:** Right through her independence, India has been trying to achieve economic growth with technological self-reliance. In order to achieve this goal, the country has been adopting a mix of industrial and innovation policies. During the period up to and including the early 1990s, the state attempted to give shape to this goal by intervening directly by generating a whole host of industrial technologies through state-owned undertakings and other public research institutes. During the period since the 1990s, coinciding with the economic liberalization policies the state has replaced this with incentivizing the innovation system of the country. This is because the state wants the private sector enterprises to be at the core of the innovation system. Key to incentivizing the private sector was two specific policies, namely the R&D tax policy and the policy on Intellectual Property Rights. The paper undertakes a critical review of the very recent changes to these two policy instruments.

## 2.1 Diffusion of automation technologies and their potential and actual effects on manufacturing employment in India

**Abstract:** It is generally believed that in the western world especially productivity increases have been largely due to information technology (IT) and the beneficiaries have been owners and the investors in capital, not those working on the shop floor.. As India has now embarked on a major manufacturing strategy to increase the size and composition of her manufacturing sector, the relevant question to ask is will it leads to employment creation on a significant scale. The belief in official circles especially that it would has been dampened or constrained by the pace of automation that has been happening. There is every indication that the rate of diffusion of automation technologies is fast diffusing in Indian manufacturing. According to estimates from the International Federation of Robotics, the number of robots sold in India is increasing from 1917 numbers in 2013 to almost 6000 by 2018.

Country	Number of Robots installed (2015)	Stock of operational robots (as on 2015)	Robot density (number per 10, 000)	Industries employing
China	57096	189400	36, Automotive, 305	Automotive: 36 %; Electronic/electrical: 29 %, metal 12%
India	2126	11800	2 ; Automotive: 58	Automotive: 71% Metal: 8
Indonesia	1152	5200	39, Automotive: 342	
Malaysia	852	5700	28, Automotive industry: 275	
Singapore	1228	7400		
Brazil	1266	9600	10, Automotive industry: 106 All other: 4	
South Africa	358	3450	22,	

There are essentially four demand and supply side factors that can increase the rate of automation technologies in Indian manufacturing. These are:

- First, a late manufacturing country such as India can skip stages and start with the latest manufacturing technologies
- Second, with increasing globalization and with increasing pressure on manufacturing companies to be more productive and thereby competitive internationally, the pressure on adopting productivity enhancing technologies are much more now than ever before
- Third developments in artificial intelligence and machine learning the nature of tasks that machines can do has seen a quantum jump. For instance industrial robots are now much more intelligent and can perform a wide variety of operations which earlier they could not do.
- Fourth, the declining cost of automation and their increasing supply is still another factor that can hasten the rate of diffusion.

### **Major research questions**

1. What has been the rate of diffusion of automation technologies in Indian manufacturing over the period since increasing globalization of India's economy?
2. What has been its effect on manufacturing employment? What is the relationship between the rate of diffusion of automation and the intensity of manufacturing employment and also what are the likely trends in this relationship in the years to come when the size and composition of manufacturing is bound to increase and become more sophisticated.

### **2.2 Emerging medium high technology industries in emerging Asia, The case of Automotive Industry (joint with Professor Patarapong Intarakumnerd, National Graduate Institute for Policy Studies, Tokyo, Japan)**

**Abstract:** Asia is becoming the centre for manufacturing in general and high technology manufacturing industry in particular. One of the fastest growing manufacturing industry in Asia is the automotive industry. The study analyses the growth of this industry across a diverse set of emerging Asian countries such as China, India, Thailand, Indonesia and Vietnam.

**2.3 The growth diffusion of platform economy in India (Joint with Martin Kenney, University of California, Riverside)**

**Abstract:** Through highly efficient matching of different users and/or harnessing large ecosystems of complementary technologies products or services, companies with platform business models have grown dramatically across the globe over the last decade. A recent survey has identified 176 platform companies worldwide with a market valuation of US\$1 billion or more. India has apparently 8 platform companies, some of which have become household names, such as *Flipkart*, *Snapdeal* or *Olacabs*. The purpose of the study is understand the composition of these new and emerging type of industry which is the most obvious manifestation of the so called new economy and its effect on overall economic growth, employment creation and innovation.



## 4. Publications during 2016-17

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### Books

Franco Malerba, Sunil Mani, Pamela Adams (eds.) 2017. *The Rise to Market Leadership: New Leading Firms from Emerging Countries*, Cheltenham, UK and Northampton, Mass: USA: Edward Elgar.

Mani, Sunil .2016. *NIS Diagnosis and STI Strategy Development to Achieve National Sustainable Development Goal*, UN ESCAP-APCTT.

### Journal Articles

Mani, Sunil and JanakNabar. 2016. 'Is the Government Justified in Reducing R&D Tax Incentives?', *Economic and Political Weekly*,51(30), 22-25.

Mani, Sunil. 2016. 'New IPR Policy 2016', *Economic and Political Weekly*, 51(38), 28-32.

### Chapters in Books

- Mani, Sunil. 2017. 'Policy Spree or Policy Paralysis: An Evaluation of India's Efforts at Encouraging firm-level Innovative Activities', in Kuhlman, Stefan and Gonzalo-Ordonez-Matamoros (eds) *Research Handbook on Innovation Governance for Emerging Economies*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 316-344.

### Other Publications

- 'One Size does not fit all, An analysis of the importance of industry- specific vertical policies for growing high technology industries in India,' *Discussion Paper* of the National Graduate Institute for Policy, Tokyo.
- 'Innovation policy instruments at firm level, Review of India's policy with respect to R&D tax incentives and Intellectual Property Rights, *Discussion Paper* of the National Graduate Institute for Policy, Tokyo.

## **5. Seminars/Conferences/Workshops attended (2016-17)**

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### **Seminars presented at CDS**

- Sunil Mani, *One Size Does Not Fit All- An Analysis of the Importance of Industry-specific Vertical Policies for Growing High Technology Industries in India*, (19 August, 2016)

### **Seminar papers presented outside CDS**

- Presented a seminar on 'Dimensions of India's Innovative Activity, Trends in Policies and Outcomes since 1991' at the 72<sup>nd</sup> GIST Seminar, GRIPS Innovation, Science and Technology Policy Program, National Graduate Institute for Policy Studies, Tokyo, Japan on 21<sup>st</sup> April, 2016.
- Presented a paper at the 123rd GRIPS Forum on 'The High Tech Innovator vs. The Frugal Innovator, Comparing China and India on Innovation Activities' at National Graduate Institute for Policy Studies, Tokyo, 9<sup>th</sup> May, 2016.
- Presented 'One Size Does Not Fit All: An Analysis of the Importance of Industry-specific Vertical Policies for Growing High Technology Industries in India,' at Innovation Forum, Hitotsubashi University Institute for Innovation Research, Tokyo, 25<sup>th</sup> May, 2016.

- Presented a paper 'Has India become more Innovative since the onset of Economic Liberalisation?' at the 41<sup>st</sup> Policy Platform Seminar, Science, Technology and Innovation Governance Program, University of Tokyo, 1<sup>st</sup> June, 2016.
- Presented a paper titled 'Role of Vertical Policies in Promoting High Technology Industries in India, The Indian Case,' at the APL Lunch Seminar, Institute of Developing Economies, Makuhari, Japan, 23rd June, 2016.
- Delivered two lectures on 'Measuring Innovation and Role of State in Technology Generation' in the workshop on Economics of Science, Technology and Innovation Policy, held at Science and Technology Policy Institute, King Mongkut's University of Technology, Bangkok, Thailand, during 15-16<sup>th</sup> August, 2016.
- Delivered two lectures on 'International Technology Transfer and FDI Spillovers' in the workshop on 'Economics of Science, Technology and Innovation Policy' held at Science and Technology Policy Institute, King Mongkut's University of Technology, Bangkok, Thailand, during 28-30<sup>th</sup> September, 2016.
- Gave two lectures on measuring innovation and role of state in technology generation at the first workshop on "Economics of Science, Technology and Innovation Policy workshop, Science and Technology Policy Institute, King Mongkut's University of Technology, Bangkok, Thailand, August 15-16, 2016
- Gave two lectures on international technology transfer and FDI spillovers at the second first workshop on "Economics of Science, Technology and Innovation Policy workshop, Science and Technology Policy Institute, King Mongkut's University of Technology, Bangkok, Thailand, September 28-30, 2016
- Presented the first draft of the paper on " Human resource management and coordination for innovation activities – Cases from India's automotive industry " at the International Workshop on Human Resource Management and Coordination for innovation activity", Economic Research Institute for Asia-Institute of Developing Economies, Tokyo at Bangkok, November 26, 2016
- Presented the final draft of the paper on " Human resource management and coordination for innovation activities – Cases from India's automotive industry "

at the International Workshop on Human Resource Management and Co-ordination for innovation activity", Economic Research Institute for Asia-Institute of Developing Economies, Tokyo at Bangkok, February

- Gave a set of 10 lectures on "*Innovations and Technology policy*" to the post graduate programme in management, Indian Institute of Management, Kolkata during January 25 to February 9, 2017.
- Presented a paper on "*From surgical strike to a cashless economy, An evaluation of the still unfolding saga of demonitisation in India*" at St.Xavier's College, Palaymkottai, Thirunelveli on February 15, 2017.
- Participated in a workshop on *national consultation on Comparative Assessment of Development of Indian States*, held on March 11, 2017 at New Delhi.
- Presented two lectures on "*Measuring innovation*" at the Training Programme on Design and Evaluation of Innovation Policy, organized by United Nations University- MERIT, CTIER & CCI, Pune on March 20, 2017.
- Presented a paper on "*Dimensions of India's innovative activity*" at the first Southern Social Science Congress under the aegis of Southern Regional Centre – Indian Council of Social Science Research at Hyderabad during March 24, 2017.
- Gave a lecture on "*Innovation in India*" at R Sankar Memorial SPECTRUM 2017 held at S N College, Chempazhanthy, Trivandrum on March 28.

## 6. External involvement in academic and policy Advice

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- Member, Editorial Advisory Board, Research Policy (Elsevier)
- Member, Editorial Board, International Journal of Technology and Globalization (Inderscience)
- Member, Editorial Board, International Journal of Technological Learning, Innovation and Development (Inderscience)
- Member, Editorial Board, International Journal of Development and Social Research
- Member, Governing Board, International Centre for Free and Open Source Software.
- Member, Planning Group for developing training resources for Economics teachers by the National Council of Education Research and Training (NCERT), New Delhi.
- Member, Advisory Steering Committee, Centre for Science, Technology and Innovation Indicators, Human Sciences Research Council, Republic of South Africa.
- Member, Apex committee for identification and prioritisation of areas and activities for the Patent Facilitating Centre of Technology, Information, Forecasting and Assessment Council (TIFAC)
  
- Visiting Professor, National Graduate Institute for Policy Studies, Tokyo, Japan.
- Honorary Visiting Professor, University of Toulouse Jean Jaures, Toulouse France.
- Part Time Visiting Faculty, Indian Institute of Management Calcutta, Kolkata.
- Visiting Research Professor (Long Term): Bocconi University, Milan, Italy.
- Visiting Professor, University of Toulouse Le Mirail, France.

## 7. Personnel Associated with the Unit

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