PROMOTING INNOVATION IN CLUSTERS

Foundation for MSME Clusters
(2013)

PROMOTING INNOVATION IN CLUSTERS

Foundation for MSME Clusters

February 2013

Website: www.msmefoundation.org

Foundation for MSME Clusters

USO House, 2nd Floor, USO Road, Off Shaheed Jeet Singh Marg,

6 Special Institutional Area, New Delhi - 110067

Acknowledgements

Research for this book was undertaken as a part of project titled 'Promoting Innovation Clusters (PIC) in India' funded by the National Science & Technology Entrepreneurship Development Board (NSTEDB), Department of Science & Technology, Government of India. Foundation for MSME Clusters (FMC) expresses their sincere gratitude to NSTEDB for the support. FMC also wish to express gratefulness to the consultative group for providing valuable insights and guidance at various levels. FMC's special thanks go to:

- Mr. Samir Mitra (National Innovation Council)
- Mr. Anjan Das (Executive Director, Confederation of Indian Industry)
- Mr. Jagat Shah (Founder & Chief Mentor, Cluster Pulse, Ahmedabad)
- Dr. R.K Singh (General Manager, Small Industries Development Bank of India)
- Dr. Philippe De Texis Du Poet (Head, Science and Technology, Delegation of European-_Union to India)

FMC is also grateful to Mr. Abraham Easo, Ms. Neha Kumar (Deutsche Gesellschaft für Internationale Zusammenarbeit, (GIZ), Ms. Saskia Anders (GIZ), Mr. Kunal Sood (Grant Thornton India), who generously extended their time, shared their knowledge and helped us with relevant data for secondary research. FMC thank all those individuals, organisations and other stakeholders, who gave us their invaluable advice and continuous encouragement during the entire course of this project.

FMC also like to extend appreciation to the team, whose knowledge and the expertise facilitated the successful completion of this book. The team is as follows:

Authors

- Dr. A.S. Rao (Adviser, Foundation for MSME Clusters)
- Mr. Mukesh Gulati (Executive Director, Foundation for MSME Clusters)
- Dr. Tamal Sarkar (Director, Foundation for MSME Clusters)
- Mr. Ranjan Singh (General Manager, Foundation for MSME Clusters)
- Mr. Keerthi Lal Kala (National Innovation Council)
- Mr. Sourabh Gargav (Manager, Foundation for MSME Clusters)
- Dr. Ashutosh Khanna (Associate Professor, International Management Institute)

Coordinator

- Ms. Saumya (Associate, Foundation for MSME Clusters)

Layouts and Designs

- Mr. Rahul Bhalla (Associate, Foundation for MSME Cluster)

February, 2013 **Foundation for MSME Clusters**

Foreword

Innovation, particularly technological innovation, is widely seen as the main source of growth. Long term resilience and growth of a relatively small group of nations emerges from those who have been able to differentiate themselves through leveraging from a robust innovation system. Also the economic competition resulting from the combined forces of globalization, liberalization and technological progress has made pursuit of innovation imperative for economies, industries and enterprises.

Policy makers around the globe are making concentrated efforts to design focused strategies for driving innovations. With an impressive growth rate and rising GDP in the past few years, India is at the right stage to galvanize its disparate efforts and policies on innovation towards a more concrete national level strategy, oriented towards shaping the future of the country. As we formulate policies that support innovations, it is important to note that the trend to follow the success stories from the developed countries and some of the more dynamic less developed countries might not work. Emulating foreign models in the Indian context is not so easy. India is a unique case and has huge diversity ranging from giant corporate houses to a range of micro and household units. This diversity is even more when it comes to MSMEs and MSMEs clusters. India has over 6,000 MSMEs clusters varying from traditional handloom and handicraft, industrial clusters like textiles, machine tools, and ceramics to more knowledge intensive clusters like Information Communication Technology (ICT), Pharmaceuticals and Bio technology.

With such diversified clusters, innovation has to be redefined in the Indian context. It is important to understand what constitute innovation in India. Usually it does not mean something new in absolute terms, but something new in terms of its application. An innovation may be well known in one cluster, but virtually unknown in another similar cluster for lack of dissemination. Therefore apart from the introduction of new products, processes, systems and business models, innovation in India would have to include low cost small and incremental improvements by way of technology diffusion, especially in industrial clusters. India needs a model which is both indigenously developed and suitably adopted from developed countries to achieve its societal as well as economic objectives.

Till the recent past, innovation promotion in the Indian context had not received much attention either in academic literature or from the policy makers. Now, with Prime Minister declaring 2010-2020 as the decade of innovation, National Innovation Council (NIC) having initiated its work in 9 clusters and ready to scale up further across the nation, Development Commissioner (MSME) devising scheme for development of innovation clusters, various other institutions and ministries like Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science & Technology, Ministry of MSME, Ministry of Textiles are likely to widen the scope of their schemes for encompassing innovation clusters, this book comes at an opportune time.

The book empirically analyses the factors than can facilitate the promotion of innovation in Indian enterprises. It provides a road map for promoting innovation in clusters which will be useful for the developmental and donor agencies working for cluster development as also the agencies implementing the policies and programmes of cluster development. The book fills important gaps in our understanding for promoting innovation in clusters in the context of where to do, what to do and how to do it.

As the book is derived from the learning of the project ‘Promoting Innovation Clusters (PIC)’ implemented by Foundation for MSME Clusters (FMC) during 2007-2012, the current volume of this book and must be viewed I compliment FMC and the authors for this very timely and good compilation. I would like to thank various experts, policy makers and all the others for their contribution and a special thanks to Dr. T. Ramasami (Secretary to the Government of India, Department of Science & Technology) and National Science & Technology Entrepreneurship Development Board (NSTEDB), Department of Science& Technology, Government of India for funding this project. I trust that this publication will provide valuable insights to practitioners, policy makers and through their efforts will help the new and small firms to compete better and grow further.

Y. K. Alagh
Chairman
Foundation for MSME Clusters

February, 2013

Preface

Innovation led economic growth and development is now accepted across the globe as key to future leadership and sustainability. This is irrespective of the state of the economy or the social issues prevalent in various countries. Several countries have taken initiatives to foster innovations through policy reforms and by reorganising governance structures, stimulating knowledge led entrepreneurship, setting up new coordination mechanisms, creating and supporting relevant institutions and introducing special medium to long term programmes supporting innovations.

While countries like USA, South Korea, Israel, Finland, France, Spain, Japan etc. have shown remarkable progress in knowledge and innovation led products, processes and management practices, the significance of innovation is now being increasingly sought and adopted by the transition economies as well. This is done to address their own contexts of growth, catch up with existing productivity benchmarks and ensure inclusive development. One of the challenges that still remain to be tackled is the development of local innovation systems to address very diverse yet specific economic contexts of growth, productivity and inclusiveness.

India has managed to craft development models in low-cost healthcare and information technology. It has been able to transform its agricultural performance by way of green revolution; its dairy industry by white revolution; and its oil seed production by way of yellow revolution. India has also made leaps in the information and telecom sectors through satellites and mobile technology and has managed to bridge the rural-urban divide by reaching to every nook and corner of the country.

But the innovation trajectory has not been so wide spread or spectacular in other sectors. Similarly, models to promote innovations have more or less remained tilted and influenced by the desire to imitate the western models, while it is well recognised and accepted that India now requires a range of models both indigenously developed and suitably adopted to achieve its current social and economic objectives.

How can different sections of the society ranging from farmers to small businessmen, students, and professionals achieve more to meet their rising aspiration levels? Is innovation the domain of only the cash-rich corporate world and the generously funded public institutions? Can small and micro businesses also innovate according to their potential and warranted scale? If yes, how do we foster such innovations? What are the appropriate conditions in which such innovations occur and prosper? Can we create such conditions? If yes, how can we do so?

There is no one set of correct answers applicable across a wide diversity of Micro, Small and Medium enterprises (MSMEs). This book, limiting itself to fostering innovations among a diverse typology of MSME clusters in the Indian context, endeavours to present to the reader, derivatives of the collective intelligence (or ignorance) of its authors, to answer this question. The book, building on the current levels of knowledge

on cluster based MSME development and a few cluster-based innovations fostering initiatives, presents the authors' view on what can and needs to be done to promote innovation in the present context of MSMEs clusters in India.

If innovation capacity is to become endemic to India's large MSME sector and thereby a backbone of India's industrial economy, it must permeate all the sub-sectors including the threatened handlooms and handicrafts sub-sectors, the more established textiles, leather and engineering sub-sectors, as well as the modern and emerging sub-sectors of biotechnology and information technology. This however cannot be achieved by the small businesses alone without partnering with knowledge institutions and other private sector players.

MSMEs provide the scope for embedding innovations in local eco systems through their local and sectored aggregates called industrial clusters. The need for such innovation clusters has been well articulated in the eleventh five-year plan (2007-2012): "...under an effective PPP model in areas where the trade and advantages have already been established and clustering processes are evident…"

Global experience shows that innovations are the result of a complex interplay of dynamics among various players such as government, enterprises, education and research institutions, financial institutions, individual innovators and consumers. Clusters provide a fertile ground for fostering innovations because of the presence of all the relevant stakeholders in close vicinity, thus ensuring relevant knowledge flows and spill-overs.

The future of Indian MSMEs economy will increasingly depend on its ability to generate new ideas, new solutions and improve processes through innovations for its social and economic growth. In a globally competitive world, India's challenge is to unleash its innovation potential to not only increase its capacity to provide new products and services but also develop new systems for enhancing productivity through adaptation, benchmarking and technology diffusion for a sustained and inclusive growth.

This book aspires to be a guide for cluster development practitioners, policy makers, entrepreneurs and academicians. A collective effort of practitioners, policy workers and academicians, this book build on the international experiences and select innovation centric interventions across a few MSME clusters in India along with ways to rapidly diffuse incremental innovations. It will act as an initial road map by offering a practical approach and a flexible framework for implementing an innovation promotion project in clusters, thus paving way for new frontiers of knowledge to develop innovative clusters.

Table of Contents

Abbreviations

ASCI	Administrative Staff College of India, Hyderabad
BDS	Business Development Service
BDSPs	Business Development Service Providers
BMO	Business Membership Organisation
BTP	Biotechnopreneur™ Programme
CAS	Chinese Academy of Sciences
CCMB	Centre for Cellular and Molecular Biology
CDA	Cluster Development Agent
CDPs	Cluster Development Programs
CITD	Central Institute of Tool Design
CNSL	Cashew Nut Shell Liquid
CSR	Corporate Social Responsibility
CURE	Commonwealth Universal Research Enhancement Program
DBC	Divided Blast Cupola
DFID	Department for International Development
DSR	Diagnostic Study Report
DST	Department of Science and Technology
FA	Facilitating Agency
FDI	Foreign Direct Investment
FI	Funding Institution
FMC	Foundation for MSME Clusters
GDP	Gross Domestic Product
GITCO	Gujarat Industrial Technical Consulting Organisation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICT	Information and Communication Technology
IDPL	Indian Drugs and Pharmaceuticals Limited
IFC	International Finance Corporation
IPR	Intellectual Property Rights
ITRI	Industrial Technology Research Institute
LSGI	Life Sciences Greenhouse Initiative
M&E	Monitoring and Evaluation
MITI	Ministry of International Trade and Industry, Japan
MLP	Mid-To Long-Term Science and Technology Development Plan,China
MNCs	Multi National Corporations
MoST	Ministry of Science and Technology

MoU	Memorandum Of Understanding
MSA	Master Settlement Agreement
MSMEs	Micro, Small and Medium Enterprises
NABARD	National Bank for Agriculture and Rural Development
NDA	Non Disclosure Agreement
NDDS	Novel Drug Delivery System
NGO	Non-governmental Organisation
NITEE	Network of ICT Entrepreneurs and Enterprises
PIC	Promoting Innovation Clusters
PLSG	Pittsburgh Life Sciences Greenhouse
R&D	Research and Development
REACH	An NGO in Jalandhar sports goods cluster that was set up by the local BMO
S&T	Science and Technology
SBC	Single Blast Cupola
SBI	State Bank of India
SBIR	Small Business Innovation Research
SEO	Search Engine Optimisation
SGFI	Sports Goods Foundation of India
SIDBI	Small Industries Development Bank of India
SISI	Small Industries Service Institute
SITRAC	Small Industries Testing and Research Centre
SSIs	Small Scale Industries
TAGMA	Tool ad Gauge Manufacturers Association
TDB	Technology Development Board
TDL	Technology Development Laboratory
TDM	Tools, Dies and Moulds
TEPP	Technopreneur Promotion Program
UK	United Kingdom
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
US/USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organisation

List of Tables, Maps, Boxes, and Figures

TABLES

MAPS

BOXES

FIGURES

Executive Summary

The Authors through this book intend to provide a concise overview of the methods and tools required for promoting innovations in clusters. The book is envisaged to act as a road map by offering a conceptual framework for using the methodology while implementing the project. Although the book does not provide a definite set of instructions, it outlines key instruments and offers cases of good practices and lessons learnt from them. The book is divided into following five chapters:

Chapter 1: Overview of Clusters in India

This chapter introduces the concept of clusters, stating that the phenomenon of clustering can be found in both developed and transition economies. In developed economies, like Europe and US, around 70-90% of the industry is clustered, thereby providing a significant employment and growth to the respective countries.

With an estimated over 6,000 clusters, India has probably mapped the highest number of clusters so far and has also been the pioneering country in various cluster development programmes. In the late ninety eighties (1980s), cluster development was based on select thematic areas like technology upgradation and quality improvement, and was supported by the then Ministry of Small Scale Industries (MoSSI) and financial institutions like the Small Industries Development Bank of India (SIDBI) and the State Bank of India (SBI). It was only in 2002-03 that cluster development programmes, especially in traditional manufacturing sector, gained noticeable momentum. In the past five years (2007-12) alone, since the Department of Science and Technology (DST) has initiated a programme exclusively for promoting innovation in MSME clusters, 24 cluster based public schemes and major programs have been supported.

Chapter 2: Global Models of Innovation Clusters

The chapter provides historical overview and analysis of innovation models and policies in USA, Europe and some Asian countries, especially China and Taiwan. These models are chosen because they all embodied technologically driven innovation and economic growth from which lessons could be drawn. Also, they cover a spectrum of large to small sized countries that have all emerged as more developed economies. The chapter starts with a macroeconomic view of the country represented through a number of innovation clusters and specifying the amount of public funds provided for promoting innovation.

While explaining patterns of innovation clusters, different models like the academic institution triggered innovation using Triple Helix in Europe, the model used in US with a special reference

to Pittsburg innovation cluster and Asian models, which majorly scaled up and built upon the US model of university centred innovation, are mentioned in detail. For drawing lessons, the chapter also pays special attention to identify type of sectors, products and technologies promoted along with the parameters of measurements and quantified outcomes of the various developmental initiatives that have promoted innovation.

Chapter 3: Technology Upgradation for Promoting Innovation in Indian Clusters - Case Studies

The chapter depicts evolution of the initiatives undertaken in India in the past 25 years for promotion of innovations; from technology upgradation that has taken place previously, to the current initiatives to explain the changing outlook in terms of innovation promotion. The evolution is classified into four different phases and is explained through the case studies.

The initial phase of evolution was about providing funds to individual enterprises for technology procurement. In the second phase, inputs were provided in the form of finance and other facilitation for the transfer of technology, like the one that was led by SBI's 'Uptech' programme. The third phase was about extending multiple inputs, which is the cluster development programmes mainly for productivity enhancement that were initiated by UNIDO, and finally, there is a new trajectory towards promoting innovations through multi dimensional inputs.

Chapter 4: Challenges and Opportunities in Innovation adoption: An Analysis in Indian Context

The chapter compares and contrasts the Indian models with that of the global models of promoting innovations with reference to differences in implementation, which includes scope and duration of interventions, choices of interventions typology beyond production technology and choice of sectors in terms of priorities of the nations.

A sustained and large investment of time, money, expertise and leadership is not only desired but fundamentally necessary for the creation of innovation clusters across India. The chapter highlights the major learning in terms of recognising and strengthening the role of knowledge generating institutions, creating and sustaining global pipelines and understanding the changing role of stakeholders in the pipeline.

Chapter 5: Proposed Implementation Framework at Cluster Level

The chapter is divided into three parts and explains the methodology for implementing a developmental or public funded project at cluster level. The duration of such a project is assumed to be of five years. The first part explains the process of conducting a diagnosis of the cluster and

preparing an action plan for the same. The second part explains the implementation procedure in detail, providing menu of activities and suggested stages of implementation- what to implement? and when? The final part explains the mechanism of monitoring and evaluating the project.

The chapter also mentions certain tools and templates, which can be used at various places like the one for formulating an action plan, for identifying key stakeholders, for implementing the plan and so on. These are also illustrated with examples in the form of boxes at relevant places.

Chapter 1

Overview of Clusters in India

Chapter 1
Overview of Clusters in India

Defining Clusters

"A cluster is a geographically proximate group of companies and associated institutions in a particular field, linked by commonalities and complementarities."

- Michael E. Porter

Often Micro Small and Medium Enterprises (MSMEs)[1] producing a range of similar or same products co-exist in typical geographical locations for decades and even for centuries in many countries. This phenomenon is referred to as clustering of MSMEs. Such clusters are found in plenty, both in developed and transition economies.

Clusters can be of large, medium, small and micro enterprises. But those comprising only micro firms are categorised as micro-enterprise clusters. These are the enterprises that generally produce handicrafts, handlooms or other products using simple and age-old technologies.

MSME clusters, on the other hand, include enterprises that are involved both in traditional manufacturing and high-technology products. In general, it has been observed that developed countries have both high-technology and traditional clusters; developing countries have relatively high incidence of traditional manufacturing; and less industrialized countries have mostly micro-enterprise clusters or clusters in making.

Presence of Clusters Globally

In France, the United Kingdom (UK) and the United States of America (USA), 75 to 95 per cent of the industry is clustered, while less than 15 per cent is dispersed. For instance, in USA, more than one third of aerospace engines are produced in three cities: Hartford with about 18 per cent of the total employment, and Cincinnati and Phoenix with another 18 per cent together. More than half of UK's 122 four digit industries[1] are localized *(World Bank, 2009)*. Italy has 199 clusters. Such industrial clusters are also found in Canada, Spain, Germany and in many other countries across the globe.

[1] Micro, small and medium enterprises-as per MSME Act, 2006
[2] A Standard Industrial Classification (SIC) code, introduced in UK in 1948 for use in classifying business establishments and other statistical units by the type of economic activity in which they are engaged.

Table 1 given below provides a list of select regions and countries with presence of clusters therein. It reflects the diversity of clusters across the world.

Table 1: Presence of Clusters in Various Countries

	International Finance Corporation Regions	Countries with Presence of Clusters	Number of Clusters		
			Innovation Clusters	Traditional Manufacturing	Micro Enterprises
1	Sub Saharan Africa	Kenya, South Africa	-	6	-
2	Middle East and North Africa	Pakistan, Palestine, Jordan, Lebanon, Bahrain, Kuwait, Qatar, Oman, Saudi Arabia, UAE, Morocco	15	86	39
3	East Asia and Pacific	China, Thailand, Japan, Philippines, Singapore, Malaysia, Taiwan, New Zealand, Australia	39	123	5
4	South Asia	Bangladesh, Sri Lanka, Nepal, Maldives, Bhutan (barring India)	2	29	122
5	India	1	10	1086	5173
6	Latin America and Caribbean	Brazil, Ecuador, Costa Rica, Venezuela, Chile, Colombia	2	18	-
7	Europe and Central Asia	U.K, Italy, France, Germany, Denmark, Switzerland, Finland, Austria, Netherlands, Spain, Portugal, Sweden, Andorra, Ireland, Belgium, Norway, Turkey, Israel	54	463	4

Source: Policy and Status Paper on Cluster Development in India, FMC, 2007

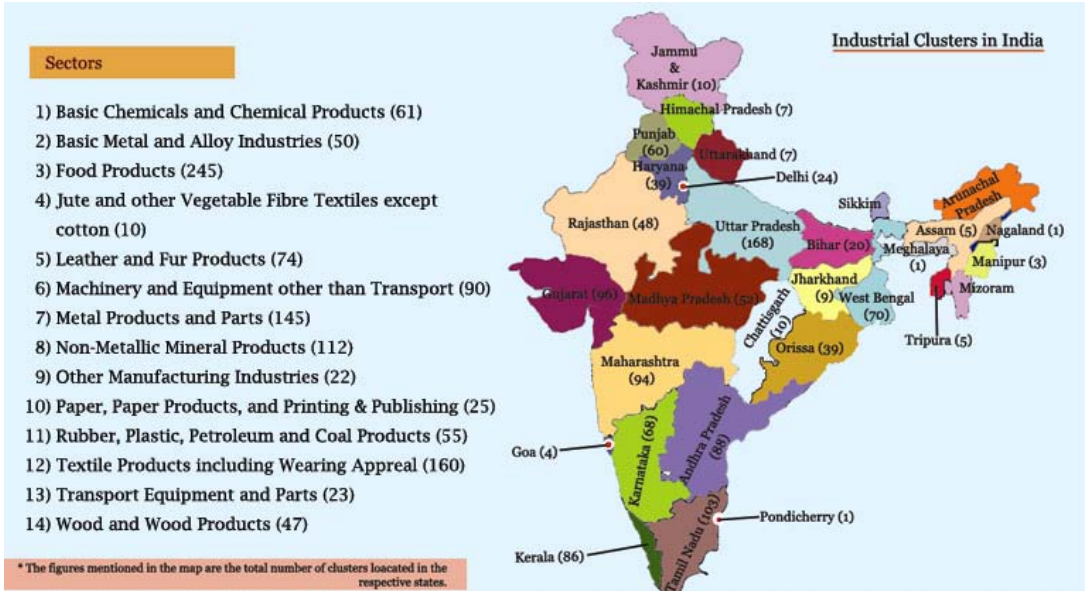
Presence of Clusters in India

With an estimated over 6000 clusters mapped, India has the highest number of clusters compared to any other country across the globe. As per the 4th All India census on MSMEs, conducted by the Ministry of MSME (Govt. of India) in 2009, there are 26.1 million enterprises, employing 59.4 million people. The census estimate MSME sector contribution to national industrial output and industrial export at 45 per cent and 40 per cent respectively and is responsible for 9 per cent of the country's gross domestic

product (GDP). The estimates provided by the Cluster Observatory (www.clusterobservatory.in) have taken into account only 1156 industrial clusters which include 694,379 enterprises, and a total of 15,692,736 employed persons.

The data for all typologies of clusters suggests that there are 4.33 million units in clusters, which is 77 percent of all industrial MSMEs with around 72 percent of employment, 61 percent investment, 59 percent output, and about 76 percent exports of the small scale industry sector in India. Map 1 given below illustrates the presence of industrial clusters in India.

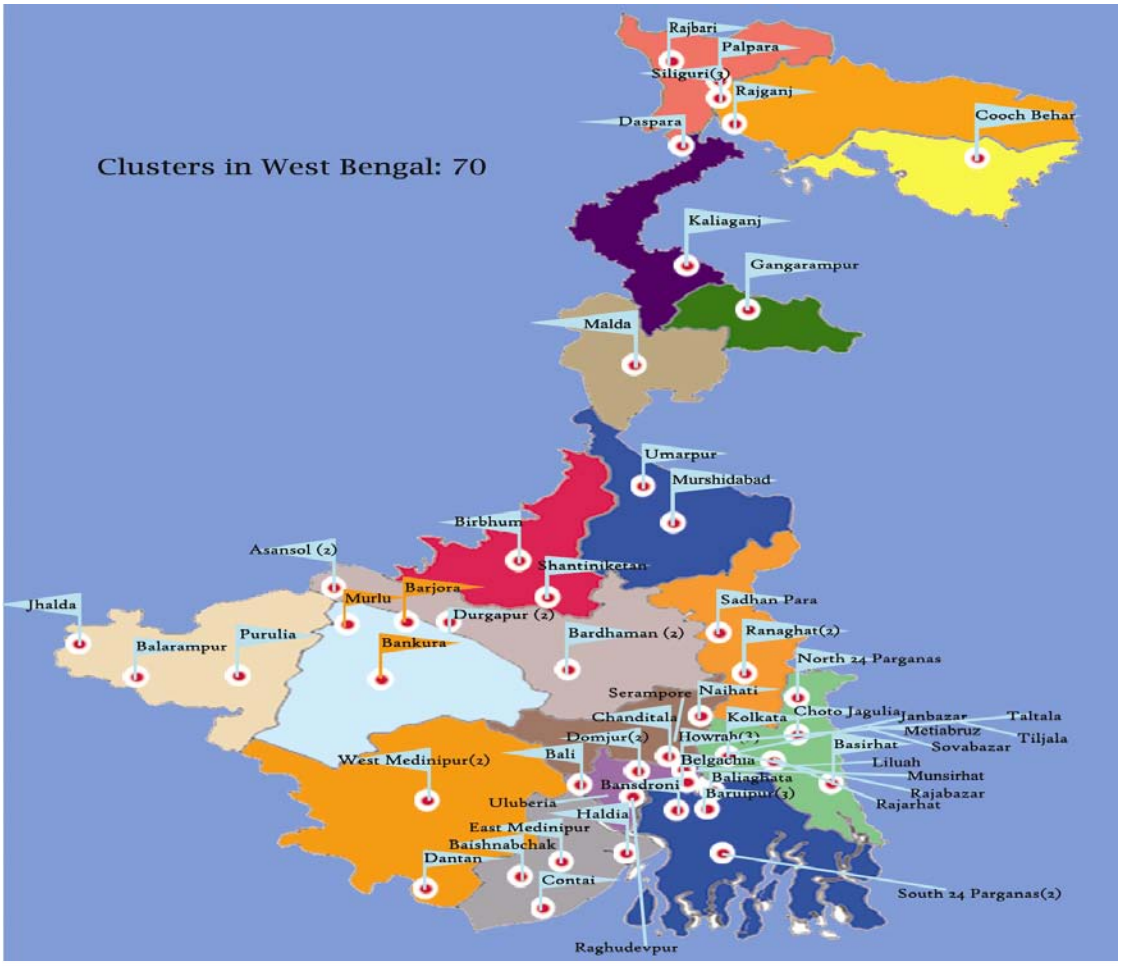
Map 1: Presence of Industrial Clusters in India



Source: www.clusterobservatory.in

Map 2 given below illustrates the typology of industrial clusters in West Bengal - one of the states in India. The 70 clusters in the state are also mentioned below the map, with the name of the place they are situated in followed by the product they manufacture.

Map 2: Presence of Industrial Clusters in West Bengal (India)



1) Asansol Clay Bricks
2) Asansol Refractory Bricks
3) Baishnabchak Horn
4) Balarampur Shellac
5) Bali Brass Metal
6) Bankura Brass Utensils
7) Bansdroni Electric Fans
8) Bardhaman Mustard Oil
9) Bardhaman Sadar Rice Mills
10)Bargachia Metal Parts
11) Barjora Fishing Hooks
12) Baruipur Agarbatti Sticks
13) Baruipur Fireworks
14) Baruipur Surgical Instruments
15) Basirhat Gauge & Bandage
16) Beliaghata Lamp
17) Birbhum Bakery Products
18) Chanditala HDPE Rope & Twine
19) Chhoto Jagulia Footwear
20) Contai Cashew
21) Cooch Bihar Sitalpatti
22) Dantan Agricultural Implements
23) Daspara Dal Mills
24) Daspara Footwear
25) Domjur Gold and Silver Jewellery
26) Domjur Imitation Ornaments
27) Durgapur Bricks
28) Durgapur Fabrication
29) East Medinipur Utensils
30) Gangarampur Rice Mills
31) Haldia Plastics
32) Howrah Garments
33) Howrah Machine Tools
34) Howrah Foundry
35) Janbazar Footwear
36) Jhalda Handtools
37) Kaliaganj Mustard Oil
38) Kolkata Leather
39) Liluah Steel Re-rolling
40) Malda Honey
41) Metiaburuj Ready Made Garments
42) Munshirhat Optical Lens
43) Murlu Roofing Tiles
44) Murshidabad Oil Crushing
45) Naihati Bari (Bori)
46) North 24 Parganas Bricks
47) Palpara Ceramic
48) Purulia Utensils
49) Raghudevpur Rubber
50) Rajabazar Footwear
51) Rajarhat Silver Ornaments
52) Rajbari Woolen garments
53) Rajganj Plastics
54) Ranaghat Powerloom Textiles
55) Ranaghat Gold & Silver Jewellery
56) Sadhan Para Brassware
57) Serampore Silk Printing
58) Shantiniketan Leather
59) Siliguri Lead Acid Battery
60) Siliguri Plastic
61) Siliguri Tea Processing
62) South 24 Parganas Readymade Garments
63) South 24 Parganas Weighing Scales
64) Sovabazar Hosiery
65)Taltala Mechanical Engineering
66) Tiljala Rubber
67) Uluberia Shuttlecock
68) Umarpur Plastics
69) West Medinipur Food Processing
70) West Medinipur Artificial Jewellery

Enterprises producing the product by which a cluster is known are called the *principal firms/ enterprises* or the *principal stakeholders* of the cluster. All clusters have a range of stakeholders. Though they are located mainly within the geographical limit of the cluster concerned, some stakeholders are located outside the cluster as well.

The principal enterprises of a cluster face the same or a similar set of challenges (e.g. product obsolescence, lack of markets etc) and opportunities (e.g. introduction of new products or expanding markets etc.) (*FMC, 2007*).

The principal enterprises obtain inputs from a range of supporting enterprises through backward and forward linkages. The supporting firms include raw material suppliers and manufacturers of machinery and its parts; intermediary buyers like traders, exporters and import agents; and technical and financial service providers like banks, technical institutions and private business development service (BDS) providers on quality, environment, design, energy, capital investment, etc. Various other interest groups such as associations or forums also influence cluster dynamics.

Cluster Development in India: Challenges and Vision Ahead

While clusters have existed for centuries and have proven to be advantageous over enterprises outside clusters, cluster based development of MSMEs in India is a recent phenomenon and is not more than two decades old. The cluster development phenomenon hinges on the basic principles of promotion of joint action, including competition among buyers and suppliers of BDS, for value chain and productivity improvements.

India is one of the pioneer countries in such targeted cluster development process. In the late 80s and early 90s, cluster development in India was focused on select thematic areas like technology, quality enhancement, etc. and was initiated by financial institutions like the Small Industrial Development Bank of India (SIDBI), the State Bank of India (SBI) and the Project 'Uptech' of the then Ministry of Small Scale Industries (MoSSI). Government involvement in promoting holistic cluster development traces back to the Abid Hussain Committee Report (1997) on SSI that laid the foundation of cluster development as a tool for SSI promotion.

However, it was only in 2002-03 that Cluster Development Programmes (CDPs), especially in traditional manufacturing, gathered noticeable momentum at the national level, when the Ministry of MSME, Government of India, took the lead. In the overall course of the last two decades of cluster development initiatives, 24 public schemes and programmes have been supported, only during 2007-2012, reaching out to an estimated 278 traditional manufacturing SME clusters.

While majority of such targeted CDPs have been planned to promote productivity, of late, a select CDPs have also targeted poverty reduction, responsible business behaviour, energy efficiency and BDS providers' markets. In contrast, CDPs in developed countries have focused primarily on promotion of innovation. It is only of late that with a programme 'Promoting Innovation Clusters (PIC) in India', the Department of Science and Technology (DST) under the Ministry of Science and Technology, Government of India, has taken up cluster based initiatives to promote innovations across three sectors viz: Life Sciences, Foundries and Information & Communication Technology during 2007-2012.

Chapter 2

Global Models of Innovation Clusters

Chapter 2
Global Models of Innovation Clusters

Proliferation of initiatives in support of innovation across the globe has been breathtaking in the past decade. All around the world, governments are looking for opportunities to foster economic recovery in the aftermath of one of the deepest economic crises of modern times. While the current global economic crisis has left few corners of the world untouched, it has also highlighted the long-term resiliency and growth of a relatively small group of nations, who have been able to differentiate themselves by leveraging a robust innovation ecosystem.

Innovation is evoked as the main avenue for achieving economic growth, competitiveness and ensuring sustainable development. Learning from international experience has become more important than ever as also the requirement to having a deeper insight into the internationally proven practices.

A few internationally proven models of innovation from USA, Europe and Asia are discussed below

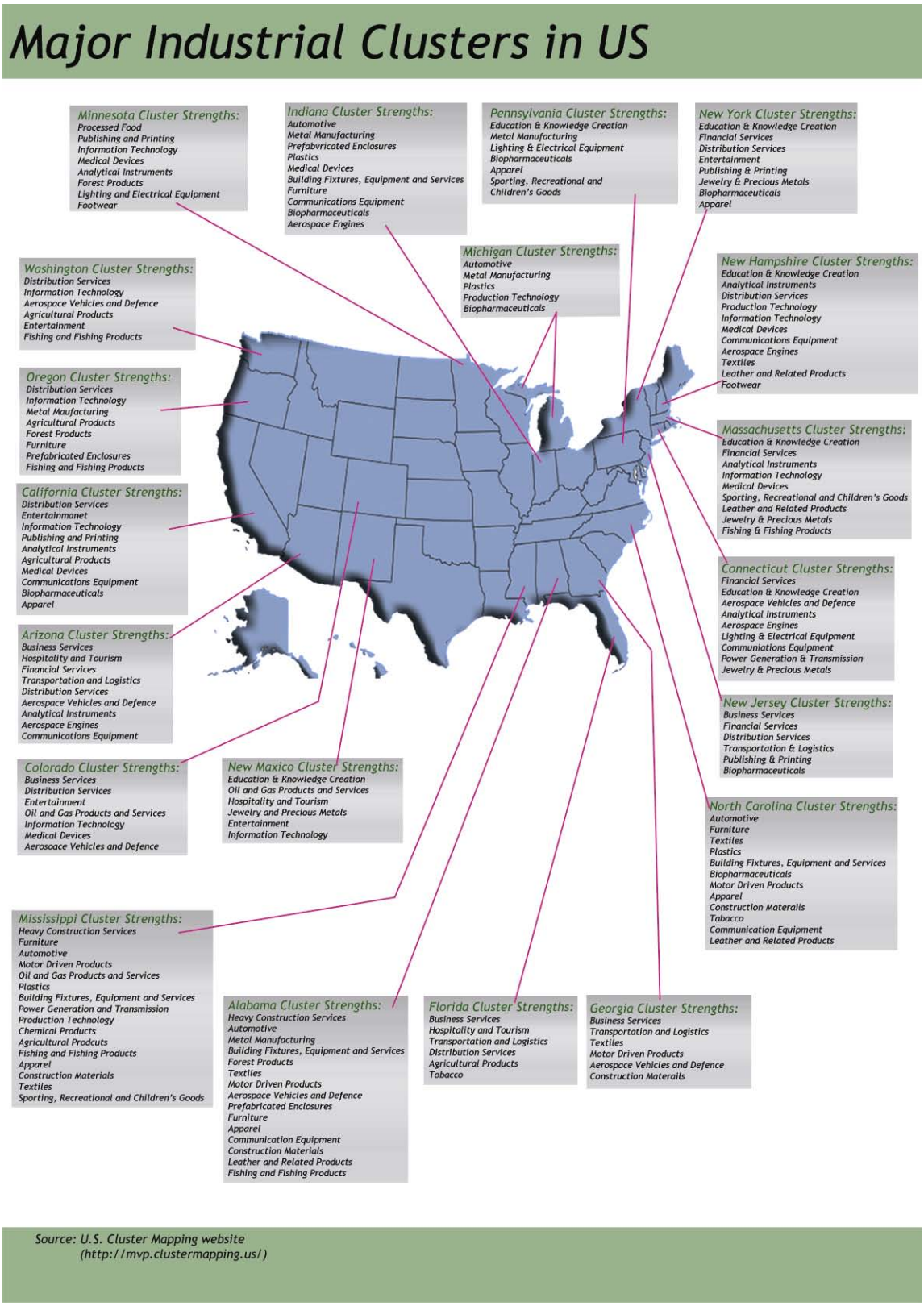
Regional Innovation Clusters and the US Model of Fostering Innovation

Regional and Federal governments in the USA have played a significant role in fostering innovation across the relevant sectors that are technology intensive and knowledge based. Local academic institutions and universities have been relied upon as springboards for creating knowledge with potential for commercially exploitable applications. Government institutes and special public funded schemes that helped leverage local advantages and are built around the presence of institutions were involved in the process; risk capital was provided to students who were willing to take up entrepreneurship with new ideas and also to professors who could mentor them. The locations are called *clusters* and the programmes instituted to create conditions for innovation fostering are called *regional innovation clusters*. The states that were low on innovation quotient chose to create such clusters through patient nurturing.

The US government, each year, spends about Rs.7500 billion on basic scientific research and development and out of that about Rs.5000 million is spent to support regional innovation clusters and associated business incubators (*Rao, 2011*).

Map 3 depicts the presence of clusters in the USA along with sectors and industries.

Map 3: Presence of Clusters in US



Business generation and employment creation - the main economic benefits realised from innovative clusters mostly spring from so called 'high impact' enterprises (high-tech start-ups and established companies alike) that sell goods and services outside their clusters to both national and international markets, drawing revenue back into the cluster. These 'traded' services boost regional economic growth and national economic competitiveness. As measured by patent rates, productivity rates and other innovation metrics, an innovation cluster creates new enterprises and new jobs in a helter-skelter, but on the whole, in a positive direction.

For example, in 1998, major US Tobacco companies and attorney generals of 46 states settled for what is called the Tobacco Master Settlement Agreement (MSA), wherein, manufacturers agreed to pay a minimum of Rs.10,300 billion over 25 years as their share to the state. In 2001, the state of Pittsburgh as a part of its tobacco MSA, dedicated a share of its revenue to the health related programmes. Thus, Pittsburgh Life Science Greenhouse (PLSG) was formed as a focused incubator to provide capital investments and enterprise formation. PLSG focused on bioscience companies with promising innovation in biotechnology, diagnostics, healthcare information technology, medical devices, and therapeutics (*Schneider, 2011*).

Diagnosis of innovation system showed that patent creation in the state was at par with better known regions, but research was not getting translated into funding start-ups. As a solution, three programmes were taken up to fuel growth in Life Sciences industries. The said three programmes were:

1. The Life Science Greenhouse Initiative (LSGI) for very early stage life science start-ups and regional workforces.

2. The Commonwealth Universal Research Enhancement Program (CURE), under this program research grants are awarded for clinical, health services, and biomedical research.

3. Funding of venture capital groups in the state to help finance the start-ups formed with the support of above programs as they begin to register sales and profits.

LSGI created three regional Life Science Greenhouses to increase Life Science commercialisation through accelerated company formation and sustainable growth. The Executive–in-Residence programme provided senior mentors to incubators. Workshops under Small Business Innovation Research (SBIR) advance programmes trained 100 small companies in writing applications to get the much coveted federal grants under SBIR. A federal department of labour programme to train workforce was implemented through PLSG and around 6,000 workers were trained. Finally, a full scale mobile laboratory went travelling across the region to provide state-of-art experimentation facilities to students all over. CURE of this state supported health research with Rs.3,250 million as

annual grants. The Pennsylvania state further created Rs.3,000 million funds to provide loans to venture capital (VC) firms to invest in underserved areas. Rs.3,000 million state funds along with a Rs.9,000 million private capital infused an additional capital of Rs.12,000 million in targeted areas to fund 280 start-ups (*Jordan and Kornblith, 2009*).

Factors that Determine the Success of a Cluster

There are two sets of factors that are crucial for the success of a cluster. The first set is about on-the-ground conditions that make a cluster successful, as the inherent regional characteristics enhance the chances of a cluster's success. The second set consists of governmental actions that improve the chances of a cluster's success, because it is also up to the government to leverage academic regional strengths to encourage success.

The on-the-ground conditions that make a cluster successful are first and foremost intrinsic to the cluster itself. Location of the cluster is prime, but other key conditions like a pro-innovation environment (including presence of research institutions and committed government, research and business leadership), management and workforce talent, risk capital and debt financing, and a regional innovation network of similar enterprises competing especially in pre-competitive research while cooperating with each other plays a very significant role in determining the success of a cluster. 'Clusters takes time', this means even when all the above mentioned ingredients are present, One has to be patient as cluster takes time to reach the level of being called 'a successful cluster'.

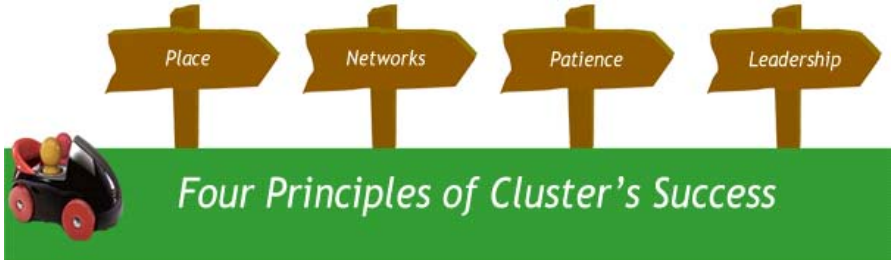
Box 1: Patience and leadership are necessary in the creation of all clusters

North Carolina's Research Triangle Park and San Diego's CONNECT cluster, two regions that focused on all the ingredients needed for success, including federal funding, took several decades to reach their current prominence among US clusters. They were piloted there by a coterie of forward-thinking government, and university and business leaders. Newer clusters that recognize the importance of patience, such as those budding around the Arizona State University in Tempe, the Washington, D.C. metropolitan region's many universities, and in rust belt cities in the Midwest such as Pittsburgh, are making headway (*Sallet, Paisely & Masterman, 2009*).

Ideal public policies to promote innovations should bolster local strengths, stimulate shared advantages, encourage creation and development of human networks, and always galvanize public education and research institutions. Through such steps, public policy will base economic

development on existing strengths, build regional infrastructure, convene businesses, finance non-profit organisations and workforce participants, and encourage universities, research centers, federal laboratories and community colleges to develop their own long-term strategies to help cluster stakeholders to link together more effectively. Government action that improves the chances of a cluster becoming successful must be carefully attuned to conditions on the ground, and must complement the existing conditions rather than force the cluster with artificial strategies, which could be ill-suited to local strengths.

Principles for the Success of a Cluster



In addition to above, some other pointers to a cluster's success are:

* Clusters cannot be instantaneously generated; many of the necessary regional ingredients need to be present. It takes years for clusters to evolve. Different regions have fundamentally different strengths like distinct R&D institutions, workforce and management pools, or availability of capital, etc.

* Innovative enterprises were once innovative ideas, many of which came from the scientists, professors, and engineers, who work at universities, corporate R&D facilities, and at government laboratories. The 'spill over' of ideas from these knowledge-creation institutions (and their intellectual property practices) to the local community and network of entrepreneurs is the central process that takes place in fertile innovation clusters.

* Without employees with the skills necessary to innovate, often, high-tech work and new and expanded businesses could never get off the ground. That is why a region that is to become a more successful cluster must not only have lots of entrepreneurs who can start enterprises, but also needs to have an availability of dedicated, talented, and skilled workers who have the energy and skills to convert ideas into commercialized commodities. Workforce development programmes thus are crucial to the development and sustainability of a highly skilled workforce, and is also a smart policy choice for regions hoping to nurture new enterprises.

* A promising idea doesn't guarantee the development of a profitable enterprise. Without adequate, consistent, and affordable capital, development and commercialization of ideas generated by knowledge creating institutions is difficult to realize. Angel investment, venture capital, and public financing are integral to the creation and growth of the small companies that are the bedrock of innovation clusters.

* Networks – be them physical or virtual - are integral to spurring the development of industry clusters. When companies, universities, workers, policymakers, and sources of capital are in close and frequent contact, clusters are strengthened. In the absence of such networks, clusters struggle to develop to their full potential.

* Policymakers who expect initiatives to sprout full-fledged industry clusters overnight will be disappointed and are likely to give up before their efforts actually yield promising results. The existing research shows that the evolution of clusters can take many years.

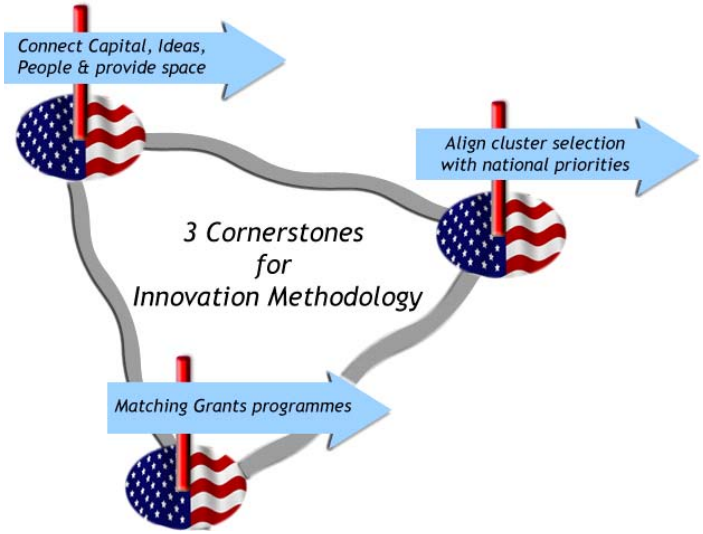
* Some clusters developed on their own over decades without any particular set of individuals or institutions consciously thinking about their development. New clusters, however, require strong and decisive local institutions and their leaders to begin to flourish. Stories of leadership have played out all across the country, from the optoelectronics cluster in Boulder, spurred by the leadership of the University of Colorado, the National Science Foundation, and local business leaders, to the Minneapolis medical devices cluster, sparked by the leadership of officials at the University of Minnesota.

USA's Innovation Promotion Programme Methodology

Three important highlights followed by the USA as a part of its programme for promotion of innovations are:

3 Cornerstones for Innovation Methodology

1) Connect Capital , Ideas, People & provide space
2) Matching Grants programmes
3) Align cluster selection with national priorities



1. Administering a competitive matching-grants programme with established criteria used to ensure the greatest impact of federal funding. Among them also figures an emphasis on local leadership from the private and public sectors, including universities and other research institutions.

2. Aligning the cluster selection process with national priorities such as energy- efficiency, advanced manufacturing, and new technologies when administering matching grants programme. Identifying comparative advantage in science, technology and innovation is also a part of the programme.

3. Finding sources of capital, connecting capital with ideas, connecting people with capital and ideas, and providing physical space necessary for innovation and commercialisation are other programme highlights.

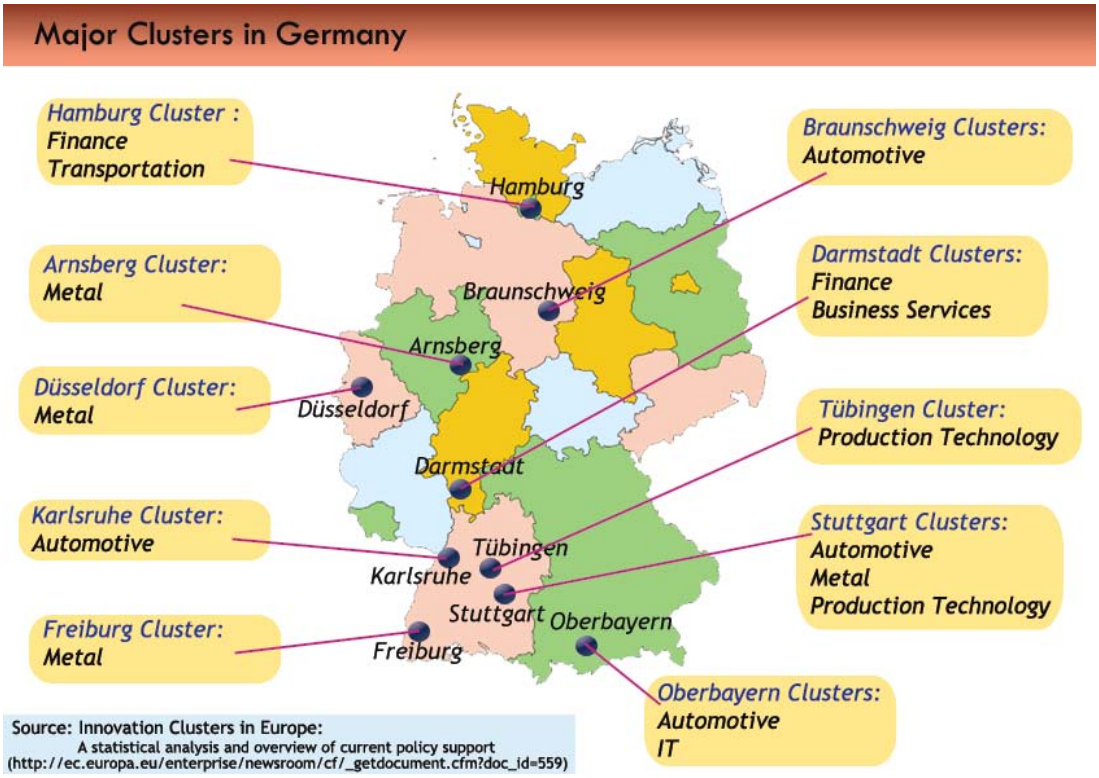
European Model of Innovation Promotion

Since the year 2000, Europe's goal has been to become the world's most dynamic and competitive knowledge based economy. It has seen a significant expansion in its knowledge based industries and the knowledge based employment over the past decade. Sustainable development and employment creation in Europe increasingly depend on excellence and innovations to drive its competitiveness. Recognizing this fact, Europe adopted a broad-based innovation strategy in 2006 and identified strengthening clusters as one of the major strategic priorities for successfully promoting innovation.

Clusters today are an important part of Europe's economic reality since they provide a fertile ground for firms to raise their innovation capacity and also act as an important driver for competitiveness and growth. European cluster observatory (www.clusterobservatory.eu) has identified around 2000 statistically significant clusters, defined as regional agglomerations of co-located industries and services, further suggesting that 38 per cent of European workforce is employed by companies in these clusters.

Since the early 1980s, public authorities responsible for economic development have used cohesion policy instruments to develop innovation strategies including the nurturing of clusters. This is also part of the European reform agenda for growth and jobs creation. Approximately €86 billion (25 per cent) of the total Cohesion Policy Fund, has been allocated in the current programming period (2007-2013) for research and innovation. *(COMMISSION OF THE EUROPEAN COMMUNITIES, 2008*)

Map 4: Presence of clusters in Germany



Considering the fact that the majority clusters in Europe are high technology clusters and the industry-university linkages are a critical requisite for innovation, Europe acknowledged the need to follow a modern, multi-actor and cooperative approach which favours innovation and helps enterprises to become globally competitive. This was the Triple Helix model of innovation.

Initially, the Triple Helix model, defined as a metaphor for academia, industry and government, was used. Here, industry operates as a locus of production, government as a source of contractual relations that guarantee stable interactions and academia as a source of new knowledge and technology (*Dolinšek & Poglajen, 2009*). However, for promoting innovation, the new Triple Helix model refers to a change in the typology of the relationships among these three actors. The simultaneous competition and collaboration among university, industry and government is important. In the changed model, the knowledge source need not be limited to one university. It could extend not only to several universities but also to other enterprises themselves. This also ensured that the funding support could go beyond pre selected institutions and enterprises based on the flexibly evolving, mutually benefitting relationships.

The emphasis was firstly on strong academic research where universities retain their traditional role of being a source of technology, gradually moving towards becoming a key actor in innovation promotion, and not just coming up with inventions. This resulted in the existing universities becoming entrepreneurial universities which are more market oriented.

The second pillar of the policy framework was the reliance on dynamic entrepreneurship and the availability of risk capital. It ensured that the linkages are established with the companies who are willing to spend more and more resources in research activities.

Finally, the third pillar was to have a supportive policy framework with support mechanisms at local, regional and national level. (*COMMISSION OF THE EUROPEAN COMMUNITIES, 2008*)

The Triple Helix model facilitates the cluster firms to benefit from the geographic proximity of various drivers of innovations, which in turn facilitate the flow of knowledge. The cluster firms interact more frequently with research institutions which are located in proximity and have an easier access to international networks and capital. This kind of exchange of ideas and innovation had been recognized as one of the main drivers of success of the Silicon Valley model and Stockholm Information and Communication Technology (ICT) cluster too.

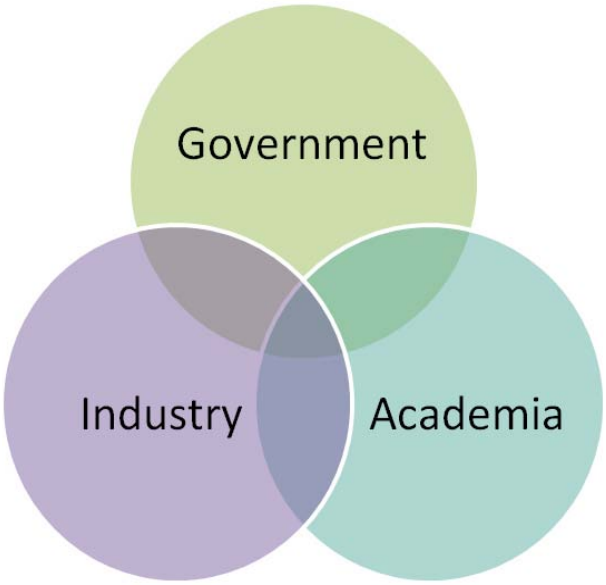


Figure 1: The Triple- Helix Model

Box 2: Clusters Change Over Time

Humber seafood cluster transformed from a commodity producer within an increasingly competitive global frozen seafood industry to a leading value-added fresh and chilled fish hub serving in Europe. While it remained a maritime cluster, the competitive advantage and R&D focus moved away from a focus on fishing and processing technology to global logistics as well as from being centered on the port to being linked to the airport.

Another example of clusters changing over time is the Marche Music Cluster in Italy, which transformed from traditional accordion production to the production of electronic home appliances (*COMMISSION OF THE EUROPEAN COMMUNITIES, 2008*).

Considering that Europe is a consortium of varied nations that strive to foster innovation, each region is expected to adopt an innovation system unique in itself which leverages on its indigenous strengths. In recent years, a large number of policy initiatives were implemented in Europe and almost all the nations have developed cluster specific programs at national and regional level to support innovation. The European Union (EU) has undertaken several initiatives to provide the nations' repository of knowledge platforms to foster alliances and methodologies that can be adapted to suit country specific requirements. Also, EU provides funding to its member countries to foster new research in the areas of health, ICT, biotechnologies, aeronautics, security, etc. Grant based assistance to initiate cluster based innovations is also provided by the EU. A few examples of policy initiatives are:

❖ **European Research Area Policy**. This is established for strengthening the research potential of European regions by encouraging development of research based clusters associating universities, research centers, and regional enterprises.

The European Research Area is composed of all research and development activities, programmes and policies in Europe which involve a transnational perspective. Together, they enable researchers, research institutions and businesses to increasingly circulate, compete and co-operate across borders. The aim is to give them access to a Europe-wide open space for knowledge and technologies, wherein optimum exploitation of transnational synergies and complementarities can be ensured.

❖ **European Cluster Alliance.** This policy aims at bringing together different ministries responsible for designing and implementing cluster policies.

The European Cluster Alliance is an open platform that was established to maintain a permanent policy dialogue at EU level involving national and regional public authorities responsible for developing cluster policies and managing cluster programmes in their countries. This policy dialogue aims at raising the level of excellence and efficiency of cluster policies in Europe which will result in the creation of more competitive world-class clusters in Europe.

❖ **The Europe INNOVA Initiative.** This initiative aims at joint development of new or better tools for use by cluster organisations to support innovative SMEs.

The initiative aspires to become the laboratory for the development, testing and promotion of new tools and instruments in support of innovation, with a view to helping innovative enterprises to innovate faster and better. The aim is to support all forms of innovation, taking into account the grave societal challenges of today.

❖ **European Grouping of Territorial Cooperation (EGTC)**. This is a community level cooperation instrument created on July 5, 2006 under EU council Regulation 1082/2006.

In order to overcome the obstacles observed in achieving cross-border cooperation, EGTCs facilitate cooperation at community level. EGTC implement territorial cooperation projects co-financed by the community or undertake territorial cooperation measures at the initiative of the member states.

❖ **European Cluster Observatory.** This provides information about services available under cluster initiatives.

The European Cluster Observatory is an online platform that provides a single access point to information and analysis of clusters and cluster policy in Europe. Launched in 2007, the Observatory is now offering a range of new services. It provides data and analysis on clusters and competitiveness, a cluster library, and a classroom for cluster education. It also produces analysis and reports on factors of regional competitiveness, transnational cluster networks, clusters in emerging industries and studies on better practices adopted by organisations involved in cluster development.

In terms of methodology, the principles used for innovation promotion are similar to the one used in case of USA. The role of cluster broker as a part of cluster management organisation that helps steer local initiatives, foster network formations, provide a range of services to enterprises and channel collaborative grants to joint projects has remained significantly important in its policy framework.

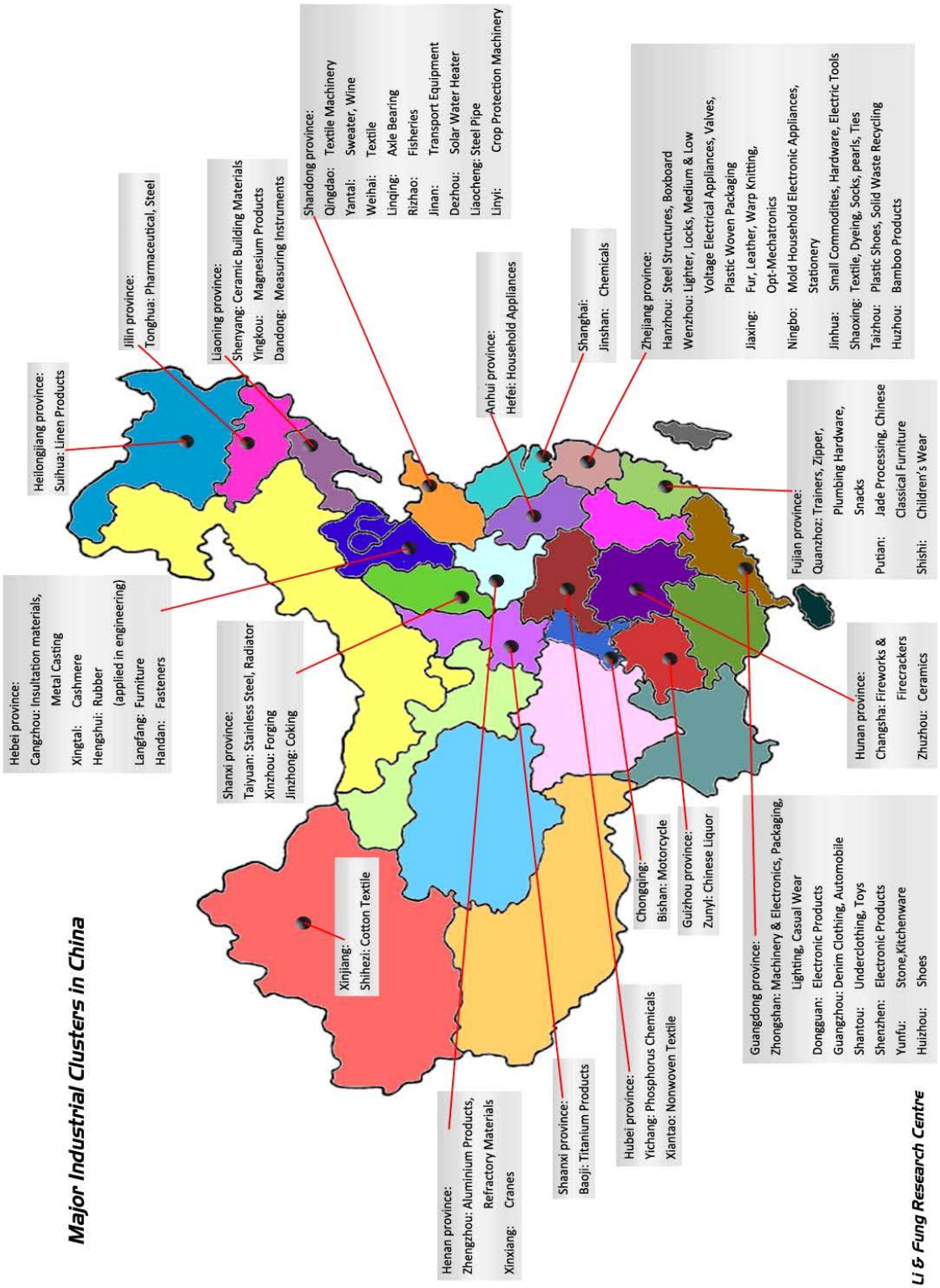
Asian Models of Innovation Promotion

The significance of innovation was well recognized, initially by developed economies, and later by the transition economies. A few countries like Korea, Taiwan, Japan have shown remarkable progress in the field of innovation, be it in terms of products, process or management.

China planned to focus on the indigenous innovation that is 'enhancing original innovation through co-innovation and re-innovation based on the assimilation of imported technologies' (*McGregor & James, 2010*) and Taiwan focused on exploiting scale economies through national innovation system that emphasized advanced manufacturing within key economic sectors, high tech and otherwise. Its main focus has also been on setting up of incubation centres, which helped Taiwanese start-ups SMEs to obtain the guidance and support they need in the areas of technology, knowledge, funding and so on.

Map 5 provides an illustrative list of major industrial clusters with sectors present in China

Map 5: Presence of Clusters in China



Source: Li & Fung Research Centre

With a population closing in on 1.4 billion people, China surpassed Japan to become the world's second largest economy in the year 2010. It is one of the world's largest investors in research and development. China's spending on R&D has climbed by 19 per cent per year since 1995 to reach Rs.1,500 billion in 2005, sixth largest worldwide (*OECD, 2007*) and in the year 2011, it grew to Rs. 6,950 billion, a 23% increase over year 2010. China's remarkable economic resurgence has made it one of the largest economies in the world, but its momentum could not have been sustained without de-establishing the 'harmonious society' promulgated by the nation's leaders. Being a highly populated country, there were signs of strain on natural resources and massive migration to cities, with deep inequalities between the provinces and also urban and rural populations. It is largely because of such pressures that the Chinese authorities turned towards innovation, both to address the problems that rapid economic progress generates and to raise the economy higher in the value chain towards a more sustainable growth model.

Chinese leaders publically emphasized the importance of innovation as a fundamental driver of China's economic and social development. In 2003, President Hu Jintao and Premier Wen (head of a leading group on Science and Technology and Education) mobilized government, industry and academia to come up with a plan which three years later, that is in the year 2006, was launched under the banner of "indigenous innovation". Thus, the two heavy weights of science and technology in China, that is, the Chinese Academy of Sciences (CAS) and the Ministry of Science and Technology (MoST) were brought together to come up with a national Mid- to-Long term Science and Technology Development Plan (MLP).

As the home of China's most elite scientists and best-equipped research centers, CAS used its global network to summon ethnic Chinese scientists from top US universities and research centers to support the effort. Before long, some 2,000 scientists, bureaucrats and business managers were organized into 20 working groups to conduct specific studies and hammer out objectives and detailed plans. As the discussions evolved, the working groups seemed to gain extensively from the American science and technology system. China learnt a lot from the US where innovation had already evolved from being a big company endeavour to a collaborative exercise involving universities, research institutes, start-up companies and multiple pots of government money.

The group analysed American innovations from the past 40 years that were recognized by R&D Magazine as being among the top 100 innovations of the year. About 80 per cent of the top innovations in the 1970s came from corporations working on their own. In 1980s and 1990s, approximately two-thirds of innovations came from companies working in collaboration with universities and

The landmark document that launched the campaign carries the title MLP. The MLP describes itself as the 'grand blueprint of science and technology development' to bring about the 'great

government-funded research laboratories or programmes. The dramatic shift was attributed to shrinking technology cycles from global competition, and also to the reason that the complexity of new technologies are often beyond the internal R&D capabilities of even very large companies.

Following the pattern that was studied, the slogan and broad plans for indigenous innovation were officially unveiled in 2006. Indigenous innovation is a massive and complicated plan to turn the Chinese economy into a technology powerhouse by 2020 and a global leader by 2050.

The landmark document that launched the campaign carries the title MLP. The MLP describes itself as the 'grand blueprint of science and technology development' to bring about the 'great renaissance of the Chinese nation.' It calls for fostering open-minded scientists who take risks and work in collaboration with the best scientists across the globe. It encourages Chinese enterprises to establish overseas research and development centres. It calls for 'establishing the nation's credibility and image in international cooperation' and 'to perfect the nation's intellectual property rights system.' It also sets goals for expanded cooperation with foreign universities, research centres and corporate R&D centres.

China scaled up the US model of university centred innovation and essentially banked upon the repatriation for its knowledge transfers from advanced economies. Professionals with extended periods of working and research experience abroad – particularly in the US play a significant role. They have repatriated to take leading roles in several research institutes and businesses. Several domestic companies have staffed their R&D department with such repatriated students too. Several returnees have launched their own enterprises. Academia has also come to be intimately involved. The overwhelming majority of firms have developed ties with research institutes, some of them expanding over long geographical distances. While some of the ties are based on technology transfer and sponsored research, a significant amount of enterprises display capital relationships with academic institutions.

Clustering of economically relevant activities is viewed as an important ingredient of industrial development. Hence, policy makers and innovation researchers alike have tried to identify and establish the pre requisites for well performing clusters. One of the main features identified is the existence of a dense network of perdurable interactions among firms, and between firms and academia at a particular location. Follow-up studies have however insisted that network ties extending beyond regional boundaries are equally valuable for the capacity of firms to innovate.

With regard to the specifics of innovation, China now graduates more engineers and scientists than the USA. China accounts for 12 per cent of the world's global research and development spending,

making it the second largest in the world. Its investment in R&D has increased to 1.6 per cent of GDP and China plans to grow this figure to 2.5 per cent by 2020. China is said to be building over one hundred new universities. Science parks are springing up around the country.

China is all set to reinforce its capabilities to innovate both by trying their own approach and looking to advanced countries for inspiration. The Chinese indigenous innovation drive is compelling foreign technology companies to enter into a game changing situation. With announcements of its massive expansion, extraordinary infrastructure plans and a continental-sized consumer market that has just begun to really develop, China attracts the foreign manufacturers at its own terms. It is a market that no multinational corporation can ignore. But the price of admission is getting more expensive by the day as China opens its policy toolbox to ensure that foreign technology allowed into China is accessible for 'co-innovation' and 're-innovation' by Chinese companies.

Taiwan's Innovation Promotion Model

Taiwan is often heralded as one of the 'Asian Tigers' and an icon for rapid, sustained economic and political development. Taiwan became what is called a 'fast-follower' country by creating the unique capability to exploit scale economies through a national innovation system that emphasized advanced manufacturing within key economic sectors, high-tech and otherwise. Taiwan began this evolution by recruiting Multi National Corporations (MNCs) to set up facilities to take advantage of cheap labour. However, after they were established, Taiwan quickly transitioned through a series of policies and programmes designed to capture increasingly value-added segments of global industries. The results have been phenomenal. In addition to being one of the fastest growing countries for the past 60 years, Taiwanese companies have been world leaders in the design and manufacturing of semiconductors, computers, their components, and peripheral, and in other areas such as chemicals, bicycles, and services sector too.

Taiwan helped companies to gain an early understanding of global value chains combined with targeting specific, value-added market segments through import substitution regulations and by encouraging entrepreneurship (indirectly) to take advantage of such opportunities. Furthermore, the government too flexibly adjusted its policies the way markets and the needs of Taiwanese companies and the national innovation system evolved. Creation of institutions like Industrial Technology Research Institute (ITRI) as the lead high-tech institution for continuous industrial upgradation and facilitating spinoff of new, innovative business models based on technologies acquired from abroad, enhanced the competiveness and establishment (respectfully) of key Taiwanese industries.

In 1996, the government took the lead in fostering the development of incubation centers in the country. The creation of an SME incubation platform helped Taiwanese start-ups and SMEs to obtain the guidance and support they needed in the areas of technology, knowledge, funding and so on. Three core strategies were devised focusing on incubation centers: entrepreneurial knowledge, information, and financing support for start-ups. The goal was to build a start-up learning mechanism that would contribute to the development of a knowledge based entrepreneurial society.

One of the elements in the Challenge 2008 National Development Plan was the establishment of various types of innovation and R&D centers, with a sub plan for developing Taiwan into an 'Asia Entrepreneur Center'. The main objective was to build up a high quality incubation center network that would stimulate innovation activities among start-ups, strengthen competitiveness of Taiwanese industry as a whole and promote economic growth.

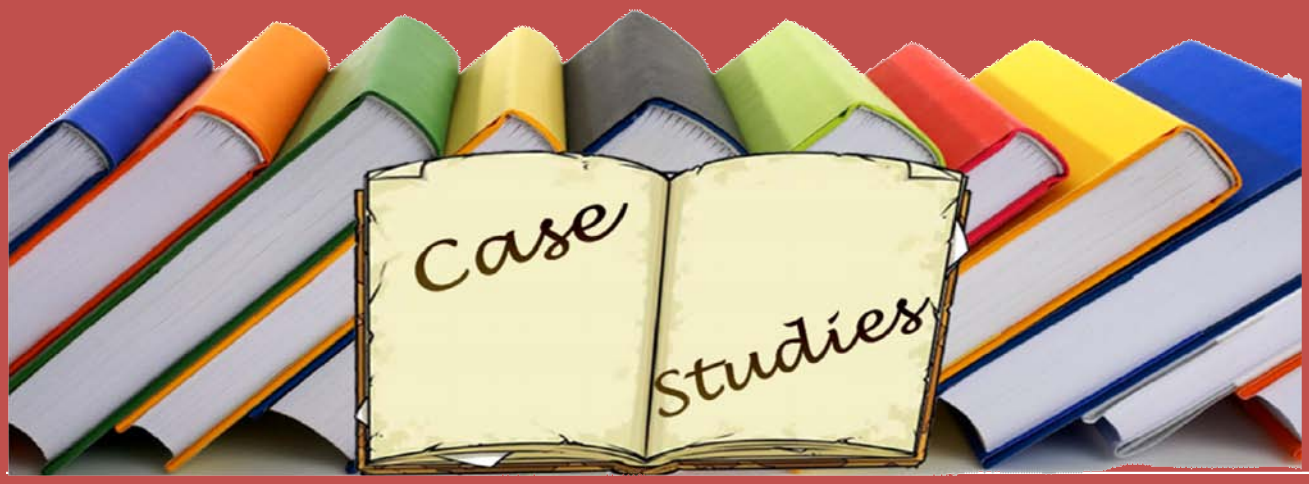
The majority of incubation centers are affiliated to universities. The Ministry of Economic Affairs of Taiwan has been encouraging research institutes and private sector to invest in such incubators, and has drawn up strategies for integrating the different resources and strengths of those incubation centers run by universities, those established by research institutes, those administered by government and those set up by private companies. Since 1996, the SME funds are used to encourage both public agencies and private sectors to set up SME incubation centers.

The incubation centers so developed moved in the direction of industrial specialization. Through the construction of the incubation platform, the Ministry of Economic Affairs aimed to promote the concept of strategic economic development. In addition, to enhance the effectiveness of business start-ups, the 'Incubation Centre Knowledge Service Environment Construction Project' was initiated in 2007. The Taiwanese government has taken a drive in transforming Taiwan into a hub for regional production of transport, telecommunication and financial activities. The country has witnessed a transformation from low technology based industries to high-tech industries. This is highly attributable to the policies that have been undertaken by the government.

Government programmes in Taiwan are guided by the maxim of spurring innovation (upgrading) within industry. The upgrading is not limited to firms within high-tech industries such as semiconductors and laptops, but is also focused on creating new technologies for more mature sectors such as bicycles, sewing machines, and services.

Chapter 3

Technology Upgradation for Promoting Innovation in Indian Clusters



Chapter 3
Technology Upgradation for Promoting Innovation in Indian Clusters - Case Studies

A variety of developmental initiatives have been undertaken in India in the past 25 years, depicting a clear evolution, starting from technology upgradation at enterprise level to innovation promotion focused at the clusters as local economic ecosystems.

The initiatives can be categorised into four phases. In the initial phase, i.e. in late seventies to early eighties, the initiatives were focused at enterprise level, by providing single input in terms of finance for technology up gradation. The programmes like, Technopreneurs Promotion Programme (TEPP) and those initiated by the Technology Development Board (TDB) from 1985 are classic examples of this phase. Both these programmes were initiated under the aegis of the Ministry of Science and Technology, Government of India.

In the second phase, programmes like the State Bank of India's (SBI) 'Uptech' started providing not only finance but other inputs in terms of technical capacity building of enterprises, enhancing efficiency and other technology oriented supports.

In 2002-2003, cluster development programmes, especially in traditional manufacturing, gained noticeable momentum at the national level, with the lead taken by the Ministry of MSME, Government of India. These initiatives introduced a collective approach with multiple inputs for the development of specific areas, which were termed as clusters. The cluster specific programmes were targeted at promoting productivity, poverty reduction, responsible business behaviour, energy efficiency and common infrastructure development. This can be termed as the third phase.

It is only of late, since 2007, that the programme for promoting innovation clusters was initiated by the DST and named 'Promoting Innovation Clusters (PIC) in India'. This is termed the fourth phase in the overall trajectory of developmental initiatives in India.

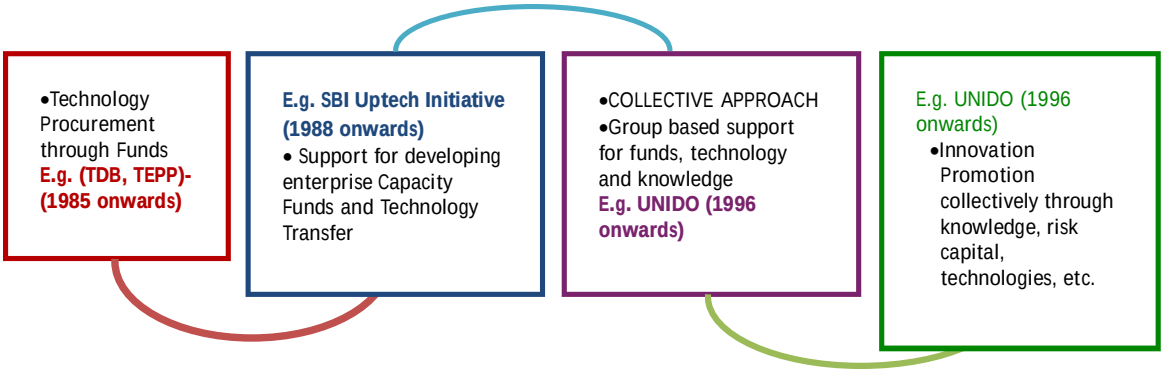


Figure 2: Evolution of Developmental Initiatives in India

The following section lists an inventory of initiatives undertaken in India in the past 25 years for different sectors of importance toward MSMEs. The phases are best described by elaborating varied success stories from across the country, depicting the evolution of innovations in Indian clusters.

Phase 1 - Technology Procurement through Funds

Phase one of the Indian developmental initiatives provided direct support to enterprises, by providing finance for technology upgradation. The support was provided to individual enterprises and proved a boon for many.

Two cases are mentioned here in this phase. One of the success stories is of a biotech firm which was supported by the TDB of the Indian government for commercialization of its innovation. The other case mentioned is about an individual artisan innovator who was supported for his innovation under the TEPP, once again of the Indian government.

While Shantha Biotechnics became a $500 million company, after inventing an affordable substitute for Hepatitis B vaccine, thereby changing the face of the industry, the individual artisan innovator and his timely innovation in the form of a motorized hammer changed the fate of the entire cluster.

Case 1: Shantha Biotechnics Vaccine Innovation Case - funded by TDB

In the early 1980s, over 100,000 Indians died every year from viral infection, 4 per cent of the population being the carriers, and over 40 million people were chronically affected. Sensing the gravity of the situation in India and worldwide, the World Health Organisation (WHO) recommended every child to be vaccinated for Hepatitis B. –Merck and GlaxoSmithKline had developed recombinant vaccines in 1986 and were the primary suppliers of the vaccine, priced it as high as Rs.1035 per dose (USD$23). With most Indian families living at Rs.45 (USD$1) per day and with multiple children, affordability of the dose was next to impossible. (*Chakma & Masum, 2010*)

Box 3: Shantha Biotechnics

Shantha Biotechnics, an Indian biotech firm started by K. I. Varaprasad Reddy with $1.2 million of angel funds, was acquired by Sanofi-Aventis of Paris for €571 million in 2009. Since developing a copy of the hepatitis B surface antigen subunit vaccine—one of the first recombinant products to be 'home grown' in India—Shantha has been on a tear, bringing 11 products to market. Much of the company's success can be attributed to the vision of its management, which brought its first product to market in only four years, reinvested revenues into internal R&D and built a state-of-the art manufacturing capability. This not only enhanced the company's ability to address local health needs, but also built its global reputation—all of which has subsequently proved good business.

Dr. K.I. Varaprasad Reddy discovered the extent of the issue after attending a WHO conference in 1992 and recognized the urgent need to develop an inexpensive vaccine as an import substitute. That is when Shantha Biotechnics Ltd. was founded with angel funds of Rs.54 million. Initially, the company was incubated inside Osmania University in Hyderabad and was later relocated. The company hired a team from the local talent pool. The initial investment was exhausted within two years (by 1995). It then sought an international investment and the Foreign Minister of the Sultanate of Oman, H. E. Abdullah injected another Rs.54 million in equity for a 50 per cent stake in the firm. This allowed Shantha to move into a new facility at the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad. The company took four and half years to develop and register Shanvac-B, a version of the vaccine produced in Pichia pastoris. Shanvac-B was launched at Rs.45 ($1) a dose and was an immediate success. Indian consumption of hepatitis B vaccine rose from a few hundred thousand doses in the early 1990s to tens of millions today with prices dropping to as low as Rs.11 ($0.25)[3].

The initial money that was raised by the company was spent on the development of the product and there were no funds left for commercialization. At the same time, the DST formed the TDB to facilitate Indian SMEs. Shantha Biotechnics Ltd. sought another opportunity and applied for the support in the form of a loan of Rs.175 million. After the loan and huge support from TDB, the company was able to take the product to the market within six months.

Rapid uptake of the vaccine was partly helped by a confidential partnership with a large pharmaceutical MNC, which provided manufacturing and regulatory acumen and also resold the vaccine.

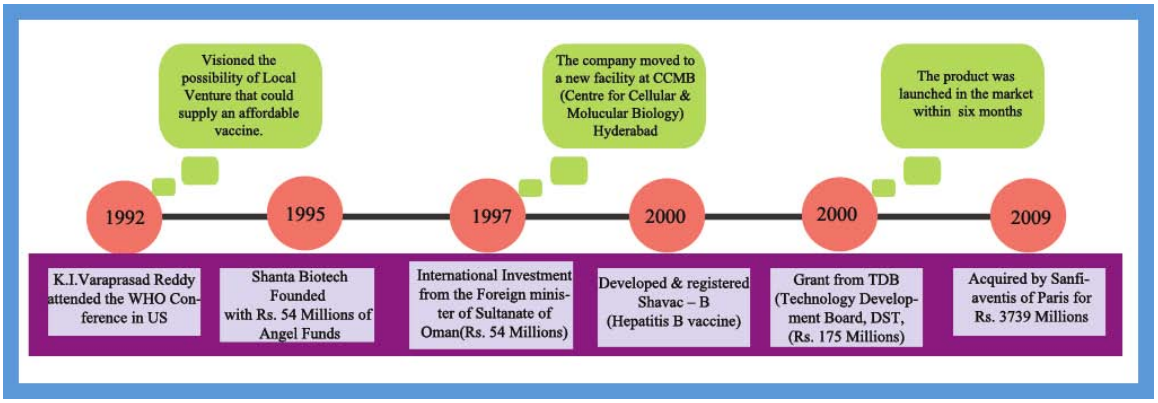


Figure 3: Shantha Biotechnic's Timeline

---

[3] Based on interview of Mr. Veraprasad Reddy published in Biospectrum, vol 2, issue 23 2007 pg 11

Shantha Biotechnic's ability to become a significant global vaccine manufacturer and achieve international valuation and market success has been made possible by establishing links with various input providers. The process so followed was: First, the company identified a therapeutic area (Hepatitis B) in which cost effectiveness could be achieved. Second, it persistently sought investments and partnerships from non-traditional and international sources like the Foreign Ministry of Oman, Oman International Bank, and Melinda and Gates Foundation. Third, it embraced collaborations with research institutes such as the US National Institute of Health in Bethesda, Maryland, and with competing MNCs for regulatory guidance. Fourth, after recruiting scientists, it established links with available support institutions for space and further funding. For instance, it approached India's premier research institute CCMB for space and TDB for commercialising the product. Finally, the company focused on innovation and reinvestment. By ploughing back significant profits toward R&D, Shantha Biotechnics was able to release new products every year or two. This initial focus on process and quality innovation may have delayed Shanvac-B's launch, but it allowed Shantha Biotechnics to become the first WHO-prequalified Indian firm for Hepatitis B vaccine, and opened the door to large international contracts, including contract research.

By focusing on an unmet medical need, providing a cost effective solution, establishing linkages with relevant institutions, partnering with non-traditional and international resources, reinvesting the resulting profits in R&D and state of the art manufacturing, Shantha Biotechnics was able to build one of India's first biotech successes.

Case 2: Revival of Kinhal Art Innovation – funded by TEPP

Kinhal, a small town in Koppal district of Karnataka, has been a flourishing centre of crafts for centuries now. It is the most well known for the exquisite carvings in wood called as the Kinhal art. This art was found and encouraged during the regime of King Krishnadevaraya of the Vijayanagar Empire in the year 1336. In fact, the famous mural paintings in the Pampapateshwara Temple and the intricate work on the wooden chariot at Hampi, are said to be the works of the ancestors of the Kinhal artisans of today. This traditional art is in existence till date but one finds this art in only a few families as the majority of artisans have migrated to others professions.

Kinhal Art Painting

The specialty of this craft rests in the art of painting, known as Lajawar painting. The paint is prepared by manually hammering the aluminium strips for four to five hours, till it gets in its molten form; the process is known as pounding. The desired colours are then added to the liquid metal and are later used for painting.

Usually two hammers of 15 kg each are used for this purpose. The peculiarity of the process of preparing the paint ensures that the paint does not erode for a long time, hence providing a lasting glamour to the work.

For those few who were carrying out this heritage art till date, the main problem was hammering the metal. Firstly, the younger generation found the heavy manual work not remunerative enough. As a consequence, the availability of manpower declined and the labour charges increased. Secondly, it was a time consuming process. Thirdly, the people engaged in the pounding often complained of chest pains, as the process was quite tedious. In light of the above limitations, the artisans were forced to use artificial paints which had tendency to fade earlier than in that of the traditional process, posing a threat to the importance of genuine and original Kinhal art.

Kinhal art had begun to lose its lustre due to the shift to commonly available lead based chemical paints, and thus was on the verge of extinction. However, a timely innovation in the form of a motorised hammer changed the face of the craft. An artisan innovator named Anjaneya Chitragar found a new technique by using the tin pounding machine to get the metal into a liquid form. After numerous trials, he was able to arrive at the right speed, correct volume and right turning while hammering. The innovation was funded under the TEPP of the Indian government, providing the innovator initial funds to support his innovation.

Innovation in the form of a motorised hammer made a paradigm shift by providing an improved livelihood for the artisan community at the cluster level and also by facilitating the survival of this ancient art at the national and cultural level.

Phase 2: Technology Transfer

Programmes like SBI's 'Uptech' initiated the phase two of the developmental activities in the country. The programme not only provided funds, but also extended hand holding support in procuring advanced technology.

Innovator with the Pounding Machine

SBI pioneered such initiatives and successfully completed its work in more than 20 clusters spread in various sectors. During the same time, in order to increase the competitiveness of the manufacturing sector, the Government of India also initiated a programme for establishing tool rooms in collaboration with various state governments, various ministries and international organisations.

The two cases mentioned in this section describe the success of SBI's 'Uptech' programme in the agro-pump sets cluster of Coimbatore and the establishment of various tool rooms by the Government of India in collaboration with the Government of Germany.

Case 1: Coimbatore – SBI 'Uptech' Programme

SBI is India's largest commercial bank and is ranked as one of the top five banks worldwide. It serves over 90 million customers through a network of 9,000 branches. It offers, either directly or through subsidiaries, a wide range of banking services. It was nationalized in 1955 and has been actively involved in non-profit activity called Community Banking Services (CBS) since 1973.

SBI was the first institution to start an explicitly stated cluster based development programme 'Uptech', mainly for its own clients. The programme aimed at upgrading technology and enhancing the efficiency and competitiveness in the SME sector. The project was started in 1988 and was the first of its kind in the annals of banking, not merely in India but also the world over, a fact acknowledged by the World Bank. The project initiated work in clusters through an elaborate process that primarily involved technology oriented interventions.

The range of interventions became much wider as the project was aimed at improving energy efficiency in various sectors like the agro-pump sets industry in Coimbatore, the rice-milling industry in Palakkad, the foundry industry at Agra, the foundry and auto components sector at Kolhapur, and the glass industry at Firozabad to name a few. The project intervened through a systematic process with the main focus on technology related interventions. The project was implemented in more than 20 clusters.

One of the initial clusters selected for intervention was the Agro and pump sets cluster of Coimbatore. Way back in the 1980s, Coimbatore accounted for 35 per cent of India's pump and motor production for agro and domestic use. The importance of pump sets in Indian agriculture, high magnitude of entrepreneurship and various studies undertaken by National Bank of Agriculture and Rural Development (NABARD), National Productivity Council (NPC), Small Industry Service Institute (SISI) etc., indicated the need to improve the efficiency of the pumping system in agriculture, which in turn resulted in selection of this cluster.

The bank team visited a large number of manufacturers, technical institutions, and local experts in order to capture the scenario, understand the challenges and get the relevant industry view. A baseline survey of a cross section of 50-60 firms was also conducted in order to have a categorized understanding of the different types of firms, their products and the possible intervention strategy that could be followed. The project was initiated with a two-fold approach: firm level and industry (cluster) level.

At the firm level, the interventions were not technology oriented per se, but were holistic, covering all areas of management like production, marketing, finance and organisation. The team mapped each firm's evolution and supported them to draw up a business plan for its strategic growth in the next few years. The main focus was on enhancing the firm's competitiveness through improved step-up in quality and productivity and through cost reduction. Studies were made on all foundry and machine shops' procedures like quantification, reduction in wastage, process improvements, cost reduction, energy audit and other areas of management. Drawings of components, job cards for machine operators and a few changes in the plant layouts were also introduced. In some units better inventory control and revised product mix alone gave rise to higher productivity and significant profits.

At the industry level, the focus was to explore and support activities beneficial to the cluster, like development of prototypes and personnel training. These activities also included meetings and brainstorming sessions on industry related topics like techniques of costing and pricing, new processes, planning for growth, concepts of mission, vision and strategy.

Cluster wide energy audits in five different types of furnaces were conducted. The project also funded Small Industries Testing and Research Centre (SITRAC), set up by the industrialists with a grant of Rs.1 million for two main purposes: development of energy efficient prototypes and training of shop floor personnel.

Another significant intervention was in the form of Divided Blast Cupola (DBC). DBC, an advanced technology, was effectively introduced with the help of Mr. Balraj Gill, a practicing foundry man in Delhi. The first exercise of modifying the basic cupola and erecting it took 6 months, with hard collaboration between the project team, technical expert and the firms where it was tried. The results were extremely successful. Seminars were held to disseminate the gathered information and learning with free discussions led by the firm's proprietors themselves.

Over a period of three years, SBI's 'Uptech' programme covered 40 units comprising of 27 pump sets manufacturing units, 11 jobbing foundries and 2 manufacturing stampings, leading to new investments aggregating Rs.60 million. The overall impact of the project was excellent. The highlights of this programme are mentioned below:

❖ Excellent improvement in performance with increase in sales from Rs.173.7 million to Rs.821.1 million with an increase in net profit from Rs.5.3 million to Rs.52.4 million in three years of project duration.

❖ In the units intervened under 'Uptech', the number of Bureau of Indian Standards (BIS) licenses for pump sets went up from 20 to 60.

❖ Four units obtained the International Organisation for Standardization (ISO) certification.

❖ Units with testing facility increased from 19 to 34.

❖ One of the units grew from a turnover of Rs.3.3 million to Rs.330 million in about ten years.

Coimbatore was the first cluster under the pioneering 'Uptech' concept and is considered as its best model for multi-dimensional modernisation, i.e., improvements at unit and cluster levels and training of workers simultaneously.

Case 2: Indo-German Tool Rooms for new dies and moulds - GIZ, Ministry of SSI[4]

India has been one of the best performing manufacturing economies growing at 6.8 per cent per annum over the past ten years. Share of the manufacturing sector in GDP is 15 per cent, contributing, in 2007-2008, about Rs.30 trillion to the country's revenue and 50 per cent in the exports. The sector employs about 12 per cent of the total workforce.

Growth and development of the manufacturing industries depend vitally on the availability of precision tools such as press tools, moulds, jigs and fixtures, and dies. These high quality tools and dies are manufactured on precise and computer controlled machines, which are usually not within the reach of small-scale enterprises. Moreover, small-scale enterprises lack personnel with requisite expertise. Also, the provision of proper tooling, skilled technicians and modern technology support, calls for high investments. Therefore, small-scale enterprises, who like to develop businesses, have to rely on institutions offering such services.

The idea to operate government tool rooms emerged in India in the late 60's. The first such tool-room, Central Institute of Tool Design (CITD) was set up in Hyderabad in the state of Andhra Pradesh, under the United Nations Development Programme (UNDP). It was a time when industrialization was making a significant headway and the government of India wanted to promote manufacturing in small scale industries.

---

[4] The above case is based on a study carried out by Grant Thornton
's industrial infrastructure and development advisory team for GIZ & Ministry of MSME

CITD started its operations in 1969. Its success triggered demands from other states for similar projects. Tool-Room projects needed huge investments and more expertise in design and manufacturing of tools, which is a niche area in mechanical engineering. The government, therefore, looked for assistance under bilateral and multilateral development programmes. Thereafter, the strength of the government tool-rooms grew. Projects were set up both under the central and the state governments in around 18 locations across the country.

Collaboration between the governments under Indo-Danish Tool-room Programmes concluded in May, 2001 and that under Indo-German Tool-room Programme in March, 2003. The collaboration provided technical and financial support of the government of Germany and Denmark and provisions of land and building from the respective state governments. The main objective of all such tool rooms was to train manpower for tool room industry and provisioning of tools, dies and moulds (TDM) to the MSMEs.

The performance of the government tool rooms has been mixed. In some places, they have had significant impact in introducing new technologies and training manpower and at other places, not much has been achieved. Collectively, the 10 tool rooms under the Ministry of Micro Small and Medium Enterprises (MoMSME) with a gross block of more than Rs.5,000 million produce tools worth Rs.130 million per annum (less than 0.001%) and trained about 15,000 persons in their long term programmes for the engineering industry. The investments and the output have not been satisfactory and neither has the impact in recent years.

As estimated by Tool and Gauge Manufacturers Association of India (TAGMA), the present total tooling demand stands at Rs.132,250 million. This demand is being met by a mix of captive tool rooms, commercial tool rooms and direct imports. Generally, tools required by manufacturing sector are either imported or outsourced to commercial tool rooms. It is beyond doubt that competitiveness of the manufacturing sector is critical for sustaining economic growth. Major growth oriented manufacturing subsectors depend heavily on their tool room capabilities for generating value.

During the early phase of industrialization in the country, development of infrastructure for TDM design, manufacturing, and training of tool makers were needed. Advanced equipment and expertise was required, hence the government of India, through technical cooperation, both under bilateral and multilateral programmes, established tool rooms. These tool rooms were mandated to produce TDM for MSMEs and train manpower for the tool room industry.

Over the years, significant capacity has been created in the private sector with mushrooming of commercial and captive tool room facilities. While these facilities have benefited from the tool rooms established under bilateral and multilateral cooperation by way of trained manpower and demonstration

of technologies, there is still a need for enhancing their capacities and capabilities to match the industrial growth.

Out of 1500 commercial tool rooms operational in the country, a majority are micro and small scale enterprises with obvious limitations. Further, the skill gap for the tool room industry is large and is increasing with the growing TDM demand. It is estimated that the tool room industry would need an additional 85,000 to 90,000 skilled tool makers over the next three to four years and this does not include the skill required in the downstream tool using manufacturing subsectors like Auto components, plastics, electrical goods, capital goods etc which would be in millions too.

Last but not the least, the micro and small scale enterprises in the manufacturing sector are not particularly aware of the need for precision tooling. Precision tooling requires a major capacity building effort. The regions where industrialisation is beginning to get a foot hold like Assam, Orissa, etc. would need the support of the government tool rooms in the region to produce TDM for the industries.

Phase 3: Collective Approach

Mid 1990s marked the beginning of phase three. This is defined as the phase providing multiple inputs. The initiatives undertaken in this phase were focused on single thematic areas like technology, quality and productivity enhancement, etc. and at Specific locations i.e., the select clusters. This phase provided multiple inputs in the form of technology, funds, intermediaries for handholding and facilitating the process as well. The initiatives were known as the Cluster Development Programmes (CDPs) and the three cases mentioned under this phase are classic examples of United Nations Industrial Development Organisation's (UNIDO) CDPs undertaken at Ludhiana Knitwear Cluster, Ganjam Cashew Cluster and Jalandhar Sports Goods Cluster.

Case 1: Ludhiana Knitwear Cluster: A Case on Providing Multiple Inputs (Capacity Building, Strengthening Linkages, Introducing New Designs)

Ludhiana knitwear is over a 100 year old industry. Its origins can be traced to migrants from Kashmir, who settled in Ludhiana after a famine in 1833. These migrants were skilled in weaving fine woollen fabrics and embroidery. Their products were commercialised by local traders, both within and beyond Punjab, even as far as France and England.

Knitwear production multiplied during 1950-1980 and the real diversification took place during the 1980s. The cluster enjoyed a stronghold on the domestic market till the 1990s. However, in the mid 1990s it started facing market losses due to the introduction of Chinese and other branded products that had a better range and quality and at times lower prices.

Exports were also on a decline and the prospects of this traditionally sound cluster were threatened.

In 1997, when UNIDO initiated its work in the cluster, the industry was facing major problems like lack of market intelligence related to yarn diversification, product diversification, product finish, weak institutional linkages and low level of competitiveness. The industry had strong forward and backward linkages operating within the same municipal limit, but each segment was working in isolation. All the associations and networks were driven by individual agendas and the common perception was that one segment could gain only at the expense of the other. The individual segments hence were not willing to consciously offer any additional value to the market in terms of new yarns, new products, new machinery and new practices. It was a complex situation of isolation from the market realities, a reduced understanding of the evolving consumer tastes as well as an inability to offer value on a continuous basis. The situation demanded vision building and strong networking between various segments, institutions and service providers.

Acknowledging the problems faced by the cluster, the implementation strategy followed by UNIDO hovered around two main issues: one was the need for benchmarking of best practises both nationally and internationally and the second was promoting trust within the networks to generate business gains.

In order to meet the above challenges, UNIDO undertook a number of activities which are mentioned below:

- **Enhancement of Market Intelligence:** For enhancing market intelligence and new market avenues, a number of awareness generating and benchmarking exercises were carried out. A group of exporters undertook visits to Italy to see similar enterprises and also participated in the PittiFilati fair held there. They learned about the manifold possibilities of using numerous kinds of yarns, which were copied later by the local spinners and thereafter 45 new yarns were introduced in the cluster.

- **Creation of New Market Ventures:** For the new market ventures at the national and international levels, a number of awareness generation and benchmarking exercises were carried out to sharpen the thinking of exporters and sharing of knowledge. Participation in international fairs and specially organised buyers-sellers meet led to an increased sale of Rs.20 million by around 25 firms within a few months, thus giving a lot of encouragement.

- **Improvement in Productivity:** Various productivity improvement measures were also introduced in the cluster. The intervention was to demonstrate the usefulness of technical improvements in the field of production planning, energy usage and washing among others which can make the units more cost competitive. It led to an estimated savings of Rs.65 million in nearly 100 enterprises.

As the result of the initiatives taken towards vision building, trust building, capacity building and benchmarking of best practices both nationally and internationally, UNIDO was able to develop a sense of common identity among the various segments of the knitwear industry. Since then the industry has travelled a long way from being a traditional, conservative, and isolated cluster to becoming a dynamic and market savvy cluster. The interventions have successfully created buoyancy in the cluster resulting in the use of modern marketing tools to sustain itself against the emerging fierce competition. In 2005-2006 Ludhiana produced products worth Rs.31,000 million, out of which Rs.10,000 million worth of knitwear were exported.

The cluster today has around 14,000 MSMEs, accounting for 80 per cent of the country's wool and acrylic product's output, contributing to 1.5 per cent of the country's exports and providing direct and indirect employment to about 0.4 million people. Local manufacturers have developed their own national brands. Two industry associations have steered the setting up of a couple of new modern industrial estates to house hundreds of new enterprises.

Case 2: Technology change through Benchmarking in Ganjam Cashew Cluster

In 2006, SIDBI launched a programme to enhance the competitiveness of MSME clusters through strengthening of Business Development Services (BDS). The initiative was aimed at supporting micro, small and medium-sized enterprises and cooperatives to overcome barriers to increase profitability by improving their productivity and also gain access to high value markets. The project was co-funded by the Department for International Development (DFID, UK) and GIZ (Germany).

Under the aegis of the Project Management Division of the Small Industries Development Bank of India (SIDBI) which launched the aforesaid programme, ACCESS Development Services initiated a 32 months long intervention (Mar 2009 to Oct 2011) to introduce, penetrate, and diffuse BDS in Ganjam-Gajapati Cashew cluster of Orissa.

Ganjam–Gajapati cashew cluster is located in the southern part of Orissa, having 120 processing units with a turnover of Rs.1,600 million, while giving direct employment to around 12,000 people. These units have been supplying cashews to the domestic market for more than three decades now. However, they could not take their products to the international markets since they remained untouched by the advanced methods of processing.

Raw cashew is still processed to palatable cashew kernel through traditional methods of roasting, shelling and peeling, which yields low quality product with high wastages. During the project intervention, 38 entrepreneurs were exposed to Mangalore and Kollam cluster to learn best practices and advanced technology for processing. An automatic cutting machine was also introduced in the

cluster at an affordable price. Again, with the help of strategic Business Development Services Providers (BDSPs), numerous workshops and trial and demonstrations events were organized in the cluster to make entrepreneurs learn different modern and eco-friendly techniques for better quality and productivity. Introduction of the new practices and technology made a paradigm shift in terms of having a tremendous impact on the local economy of the cluster.

Box 4: Results of the Initiatives undertaken in the Ganjam Cashew Cluster

1. Significant quality improvement was achieved with 36 units converted from traditional roasting method to more productive boiling processing.

2. 20 per cent of the cashew units in the cluster started using advanced technology for cutting, peeling, grading, etc.

3. The units began to offer 18 grades of cashew instead of the earlier 8 grades.

4. The methods of steam boiling and hand-cum-pedal operated shelling combination have been found to be more cost effective and a better technique than the traditional method.

5. Steam boiling method amounted to savings of 29.66 per cent on labour costs and also an increased income from the sales of Cashew Nut Shell Liquid (CNSL).

6. It also resulted in improved productivity and reduced air pollution.

Case 3: Jalandhar Sports Goods Cluster: Shift from Hand Stitched to Machine Stitched Footballs

The origin of the sports goods industry in India can be traced back to Sialkot (now in Pakistan), which was the sports goods production centre during the pre India-Pakistan partition days. The sports goods industry cluster of Jalandhar is a classic example of a transplanted cluster, where a major segment of an existing cluster, entrepreneurs as well as workers, shifted to a new location due to political division of the country. The cluster mainly produces a wide range of items used for sports and leisure activities. The major range comprise of inflatable balls, cricket, hockey, boxing, tennis and badminton gear, field and track equipment, golf balls, protective equipments, chess, and hammocks.(*UNIDO EPR, 2005)*

Till the 1990s, the process of manufacturing in the cluster was predominantly manual and highly skill based. The cluster had a vertically integrated production system with jobs widely subcontracted. Most of the footballs were hand stitched in home based stitching units, making the cluster one of the

leading producers of hand stitched footballs for the major sports goods brands. Since football stitching was a family based work, skills passed from generation to generation. However in 1995, the cluster faced international media allegations of extensive child labour. This demanded Corporate Social Responsibility (CSR) compliance and the threat of losing the international markets prompted a complex multi-stakeholder response involving international and local actors.

As the cluster's leading football manufacturers were concerned that the industry might face an international boycott, a group of about 25 manufacturer exporters decided to form a not-for-profit organisation- Sports Goods Foundation of India (SGFI) - with the aim of addressing the child labour issue within the cluster. The work of SGFI was concentrated on two main areas: first, with assistance from Federation Internationale de Football Association (FIFA) and the Swiss accreditation firm SGS, SGFI developed a mechanism for child labour monitoring within the cluster that consists of both an internal and an external part. Second, with support from UNIDO, SGFI also developed a number of social projects for those involved in football stitching and their families. These projects included establishing tuition centers, schools for children who were earlier involved in child labour, organising health camps, savings schemes for women involved in football stitching, establishing a common machine-stitching facility, and forming a Non Governmental Organisation (NGO), REACH, that will work in the area of recycling of usable goods for the poor communities in central Jalandhar.

UNIDO worked in the Jalandhar Sports Goods Cluster between the years 2002 and 2005 under its CDP and subsequently from May 2005 to 2007 under its new global research project of CDP and CSR. In 2002, when UNIDO initiated its work in the cluster, the issue of child labour was still an important concern along with certain other challenges. There was absence of quality BDS providers; unit value of product was low; and there was an immense competition from lower-cost Chinese producers who were using newer and machine-stitched technology as opposed to the older and hand-stitched production of footballs found in Jalandhar. Globally, there was a gradual shift of technology from hand-stitched to machine-stitched footballs and more recently to thermo-molded balls.

The Chinese had an advantage as they were producing machine-stitched balls on patented production equipment that resembled a regular sewing machine where a supporting foundation and other devices had been added. Traditional sewing machines for garment production did not have the necessary strength to stitch footballs. However, by changing a few of the components inside the sewing machine and adding a stronger foundation, it was possible to use sewing machines to stitch footballs.

A common facility centre was set up with the aim of helping the cluster to upgrade its production technology. Six stitching machines were procured from China, while workers from SGFI's member companies received training in how to handle the machines.

One SGFI member received his order in 2007 for machine-stitched footballs from UK, and a number of SGFI members began to experiment with machine-stitching technology, forwarding their samples to international buyers. It subsequently led to several hundred machines being used by more than 25 manufacturers adopting the change.

UNIDO's Project on SMEs CSR and Cluster Development also aimed at promoting the concept of collective CSR among SMEs. The concept leveraged upon 'passive social responsibility' practiced by MSMEs and this contributed to the overall competitiveness of the enterprises and the cluster, making it a more successful and vibrant cluster than before. Since then, the cluster has upgraded technology for stitching of soccer balls on machines, hitherto hand-stitched, in order to keep up with the changing global trends and remain cost competitive. In the year 2009-2010, the manufacturers in the cluster employed 4,000 core workers inside their factories and outsourced the process of football stitching via a network of 1,000 contractors to 12,000 registered stitchers. There is also an increase in the exports as well, from Rs. 680 million in 2003 to Rs. 1,025 million in 2009, even though in dollar terms the increase is much more modest.

Phase 4: New Trajectory towards Innovation

The latest phase in the trajectory of India's developmental initiatives is centered on promoting innovation mainly at the cluster level. For the first time, a programme on promoting innovation using cluster development approach was initiated by the DST and the same was implemented by the Foundation for MSME Clusters (FMC).

Given below are a few cases which describe the usage of new techniques and implementation tools tried for the first time, in order to promote innovation in the clusters under the said cluster development programme in India.

Case 1: Conceptualisation of BioTechnopreneur™ Programme for Ahmedabad Pharmaceutical Cluster

Career paths of innovative ventures follow a variety of routes, with the most preferred route being directed toward those who have passed out of universities and are gathering practical experience on the job. Such practical experience may also come from undertaking scientific apprenticeship, doctoral research, etc. Other routes being experienced personnel of existing firms starting off with an idea, or persons coming directly with innovations post their university degree. Such innovative ventures or start-ups are a potential source of numerous minor and major innovations in various clusters including pharmaceuticals cluster of Ahmedabad in Gujarat.

However, the mechanisms for promotion of such start-ups are less in these otherwise leading clusters of India. There is a paucity of incubators that provide mentoring and entrepreneurial handholding to such firms. Also, many a times, start-ups themselves do feel the need of both mentoring and financial incubation, a combination which is usually not available in incubators.

FMC found that pharmaceuticals cluster of Ahmedabad has one of the well developed life sciences industry in India. In such developed clusters, magnitude of innovations or potential innovators is comparatively high. Once identified, these potential innovators organise themselves in two routes, i.e., either they drop the technology and join any large enterprise or they innovate and transfer it to the MNC or other large firms. Very few among these become successful innovators. Besides this, lack of enabling conditions for the promotion of start-ups, insufficient ideas, limited knowledge of Intellectual Property Rights (IPR) system, weak linkages with support funds, conventional management techniques and limited interaction with innovative systems abroad further add to the challenge.

To support these types of start-ups and develop the capacity of institution, FMC, Entrepreneurship Development Institute of India (EDII), and Gujarat State Biotechnology Mission, (GSBTM) under the government of Gujarat conceptualised a BioTechnopreneur™ Programme (BTP) to answer the complex issues associated with bringing innovation from the laboratory to the market.

Based upon the past understanding accumulated with innovators, it was decided to provide a better understanding of various processes starting from ideation to commercialisation of the product. When the issues in various processes of innovation were discussed with the multiple stakeholders like successful innovators, industry leaders, technical experts, technical institutions, venture capitalists, Institute for Entrepreneurship Development and Association of the Industries , they came out with various suggestions like creation of mentoring team, networks of angel investors to support start-ups, creation of a team of doctors for subsidized clinical trials, practical training courses for supporting, and so on.

The facilitating agency – in this case FMC - worked upon these areas and attempted to explore all the possible options discussed. It took one long year for creating a mentoring community.

The idea behind creation of the said community was to advise and show a roadmap to the budding innovators. Simultaneously the course was discussed with various stakeholders like Food and Drug Control Authority, Gujarat Industrial Technical Consulting Organisation (GITCO), technology transfer facilitating organisations, Entrepreneurship Development Institute of India, Centre for Innovation, Incubation and Entrepreneurship, Gujarat Venture Finance Limited (GVFL) and Colleges, and some other technical institutions. The discussions resulted in a pattern of practical course to guide participants through various functional realities for the development and commercialisation of a new product or service. After taking three rounds of final discussions, the course was broken down into three parts.

The Biotechnopreneur™ Program (BTP) is now a 10 month multidisciplinary class room and a practice oriented course. It is designed for highly motivated aspiring innovators with enthusiasm towards entrepreneurship, who wish to take their innovations forward as a business.

Teaching covers the latest knowledge on technology scouting and technology licensing, together with grounded business management and ethical, legal and regulatory issues associated with bringing scientific advance to the market. Extended support was also given through mentoring by pioneers in the field of technology scouting, entrepreneurship, regulation, financing and leveraging the grant and subsidies by the Government of India. The Course plan of the BTP is mentioned below:

- **Opportunity Identification:** Scouting technologies on offer from research organisations as well as commercial firms and carrying due diligence on shortlisted technologies
- **Preparation of Techno-Commercial Report:** Converting technology potency into business advantage.
- **Project Execution:** Start Implementing the Plan

BTP 2011-2012 trained a total of 16 participants, who were from different domains of Life Sciences. The participants were taken through phases of identification, grounding and execution. The programme started with classroom training sessions from the experts in the respective fields, followed by phase of mentoring and handholding, wherein individual mentors, who were experts in the respective fields, were allotted to participants. The mentoring and handholding was the unique feature of the programme. Besides that, the programme was graced with industrial visits as well. The participants were sensitised to scout the technology from places like the CSIR laboratories. At the end of course, 14 participants came up with their techno-commercial reports and project concept notes on different products.

EDII floated a proposal to GSBTM for BTP 2012-2013 (BTP-13) and GSBTM agreed to support BTP-13. In this way, the initiative was sustainable and will further strengthen the enabling environment for start-ups in the life sciences space.

Case 2: Formation of Network of Information and Communication Technology Entrepreneurs and Enterprises (NITEE) and its various focus areas in ICT Cluster – Delhi-NCR

Network of ICT Entrepreneurs and Enterprises (NITEE) was nowhere in the plan when the Delhi-NCR- Information and Communication based industry cluster was selected for innovation based intervention. In order to map the relevant stakeholders and understand their perspectives and common challenges, and plan collaborative activities and strengthen relevant linkages, numerous interactive sessions were held. Intensive meetings with more than 100 entrepreneurs (mostly between 0-5 years of existence) and service providers, almost all the multi stakeholder platforms and associations, various incubators, around 15 engineering colleges, three management colleges and relevant government departments were held in the form of individual (multiple sittings in most cases) and group consultations, spreading over a period of ten months.

As the group consultations continued, a group of entrepreneurs belonging largely to the domain of education and web applications identified the challenges faced by them and also outlined the ways to address them. A number of brainstorming sessions with entrepreneurs on their common challenges and how to strengthen industry institute linkages were organised.

One of the challenges was the lack of a common platform for industry interactions and representation. A common requirement of an interface between start-ups and small entrepreneurs to bring the cluster stakeholders together on a single platform came out strongly for communication and visibility purposes. It was then decided that a physical body to work towards addressing their critical issues like capacity building, advocacy, visibility, market development, etc. is required. This physical body was to be registered as a society, and an online cluster level portal was the first activity to facilitate the desired objectives.

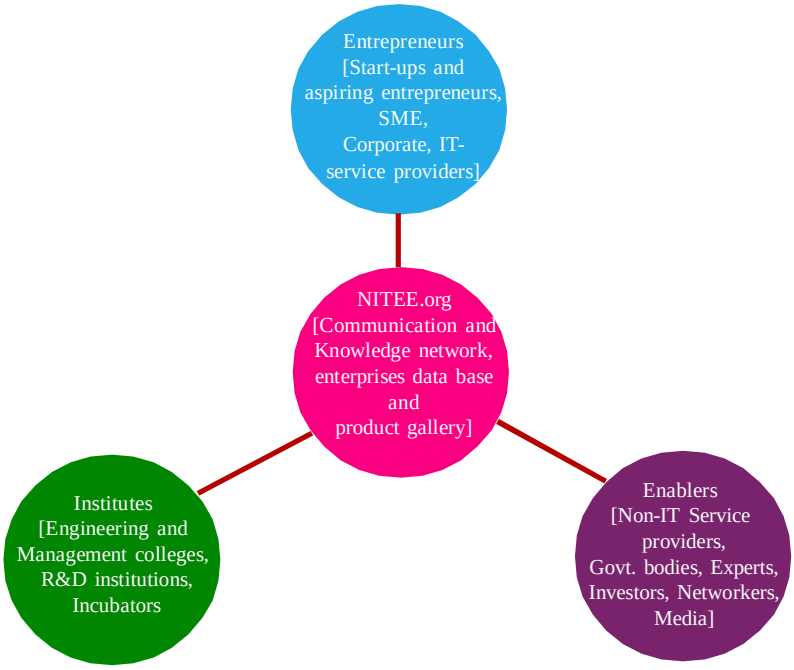


Figure 4: Formation of NITEE in consultation with cluster-stakeholders

It took more than five brainstorming sessions, multiple one-to-one meetings and smaller group discussions and numerous references spread over nine months to define the requirements of an online communication platform (www.nitee.org) along with the structure of the formal multi-stakeholder body called Network of ICT Entrepreneurs and Enterprises (NITEE). NITEE was formally registered on 15th June 2010 as a membership based organisation under the Societies Registration Act, 1860. NITEE had more than 100 paid members as on 31st March'2012.

Creation of a common platform created a framework for successful cooperation by ensuring communication and cooperation in a structured and organised way. The formal organisation and rules for cooperation provides the cluster its binding nature, ensures transparency and accountability of its members. For creating an organisation, the choice of legal and organisational form depends on the goals of the cluster. That is why NITEE was registered under the Societies Act with a vision of making the Delhi-NCR based ICT Industry cluster a vibrant and innovation driven cluster in India.

Keeping in view the critical importance of multi-stakeholder involvement in innovation, NITEE has the membership categories for aspiring entrepreneurs, business development consultants, institutions, and corporate, apart from start-ups and SMEs. Rules and regulations ensure that a governing body of 12 members coming from start-ups community, MSMEs, and corporate members is elected for a period of two years. Since registration, the informal group meetings were turned into

monthly meetings, which were held on monthly basis. These were for the collective action planning, review of the progress on the ongoing initiatives and networking among members. Minutes of the meetings were prepared and circulated among all members. By March 2012, NITEE has had 23 such monthly meetings. On an average 20-30 entrepreneurs participated in these meetings.

The major services that the organisation provides include capacity building of entrepreneurs by conducting learn-shops, linking them with relevant experts, business and knowledge network development, and enabling collaborative and participative ecosystem. It also enables common understanding and vision building through its regular mailers updating the members on important leads, monthly meetings, focused group meetings on action plans, brainstorming and conceptualising customised initiatives related to business development like common sales process, participation in exhibitions, quarterly get-togethers and so on.

Case 3: Design intervention reflecting knowledge flows among network partners leading to new designs in Samalkha Foundry Cluster

In a traditional manufacturing sector, usually the entrepreneurs are the triggering point for innovation. However, more often than not, their routine work is so stretched that they become oblivious of their own capacities to innovate, which otherwise can drive them toward further growth. In clusters with such situation, it is critical to remould the outlook of the entrepreneurs and their approach towards business management. Rather than concentrating on the age old techniques and methods of working, there is a need to expose them to the current market requirement for being sustainable.

In order to promote innovations under the PIC project, funded by DST of the Government of India, a design intervention was undertaken in the Samalkha Foundry Cluster in Haryana. The cluster has over 30 enterprises, all casting products like chaff cutter and cane crusher. Cluster's evolution commenced in around 1950 and since then the same model of chaff cutter and cane crusher was casted. It was found that most of the enterprises were operating at very low level of profit margins.

To address this issue, a design intervention was planned in order to experiment newer designs of chaff cutters. Such an activity often requires involvement of a variety of stakeholders. Hence, a network was created within the cluster, which involved all the relevant stakeholders. The network helped in permeating knowledge flows among the networked stakeholders. The knowledge flows were ensured by the following processes:

The network was created involving the following stakeholders:

- Entrepreneurs
- Fabricators
- Design experts
- Prototype developers
- Cluster Development Agents (CDA)
- Marketing experts

Figure 5: Network of Relevant Stakeholders

- The entrepreneurs were sensitized about the benefits of upgrading the design by sharing models of chaff cutters made in other parts of the country.

- Thereafter, an exposure visit was organized to understand the market requirement with support of marketing experts who had analysed the same. This helped them to understand the potential market and motivated them to improve the quality and design of the existing product.

- The design expert was identified. He then analysed the existing product and the requirement of organised buyer. A new design was developed by the design expert. The prototype of design was prepared by the prototype developer.

- After sharing the prototype with the entrepreneurs, it was discussed with the local fabricator. The design expert had explained the dimensions of the product and the expected design. The fabricator copied the same and developed the product.

- The new product was later shared with the entrepreneurs, design expert and the CDA. After approving the design, the sample was tested in a nearby village and then it was sent to the buyer.

In the whole process of product development, the CDA had to act as a catalyst, ensuring that the next step is moving as per the desired plan. He / she is the central point for interaction among the different stakeholders involved in this activity. The knowledge in the cluster essentially flows through the CDA and the interaction starts at the collective level through meetings and seminars.

Conclusion

In the past 25 years, India witnessed a wide variety of developmental initiatives starting from focus on individual enterprises to clusters, subsidy driven to capacity building, and inputs provided by public institutions to enable provision of multiple inputs. Majority of such initiatives, especially in initial three phases have focused on alleviating poverty by increasing business volumes, sustain employment or build efficiency of factors driven competitiveness. Little has been done to specifically promote innovations among MSMEs across clusters and the initiatives have at best remained limited to diffusion of tested technologies. Also, the focus on cluster had either been missing from schemes/ programmes so far or the scope of the initiatives has been on technology diffusion or reverse engineering. The recently supported programme specifically targeting innovation marked the onset of phase four.

The initiatives in all the phases have had significant success stories as also mentioned in the cases above. However, it is important to note that promoting innovations is a collaborative effort which makes it important to work at all level, hence it will require an approach which has a combination of all these phases. It is essential to work at the enterprise level by providing direct support, at cluster level through various projects and finally at the national level by providing facilitating platforms and relevant linkages. Some of the key learning from different phases in context of programmes targeting innovation promotion is mentioned below in detail.

- Initiatives in all the phases were focused at individual enterprises and also the MSMEs in clusters. The initial phases provided single and multiple inputs either directly or via intermediaries. The intermediary institution exited in the post project phase after enabling and capacitating cluster stakeholders to take the agenda forward on their own. On the other hand, initiatives for promoting innovation focused on strengthening local ecosystem to continue fostering innovations on a sustainable basis rather than having it as a onetime affair.

- Awareness creation for innovations and identification of potential investors is important. In Indian context where majority of innovations falls flat in the absence of required support from the investors, there is an urgent need to link potential investors with potential innovators. Awards, competitions, incentivisation and celebrations are the means to take the process ahead at cluster level and also at enterprise level. The cluster level focus is currently missing in the existing schemes and programmes. Most of the schemes are currently targeted at measuring individual patents, inventions and individual successes, whereas focus on creation of platforms is missing.

❖ Extensive coordination and support is required to help a potential innovator to move from the idea stage to market realization. This can be undertaken at cluster level that can help to provide coordination at every node of the innovation value chain, starting from ideation stage to commercialisation. Current schemes of assistance are currently targeted at specific inputs, whereas required coordination is missing. That calls for the schemes to be redesigned and help build a system that can self sustain.

❖ It is necessary to facilitate smooth flow of knowledge and enhance knowledge absorption capacity in the cluster. This includes improvement in industry-institute linkages, creation of relevant platforms for facilitating smooth flow of knowledge at cluster as well as national level. At cluster level coordinated partnership among the existing institutions, local association can be taken up for this purpose and government can support such platforms at the national level.

Chapter 4

in Innovation Adoption

- An Analysis In Indian Context

Chapter 4
Challenges and Opportunities in innovation Adoption

Drawing lessons from the US and European success, a new movement started across the globe to promote regional innovation clusters. Some factors like academia's linkages with industry, social capital of the cluster, access to cross-spectrum knowledge, and interventions by public authorities are considered more important than others to implement and promote innovations in clusters.

In this chapter, the unique characteristics of Indian clusters are examined, the challenges in adapting globally proven models, and also present the essential elements of strategy which would have better chance of realising success in the Indian context. The chapter is divided into four parts. The first part provides an overview of innovation clusters and states factors that determine innovation potential of such clusters. Knowledge flows in clusters is discussed in the second part. Innovation promotion programme implemented at pilot scale is summarised in the third part; and finally, in the last part, talks about the Indian context for promoting innovation in clusters.

An Overview of Innovation Clusters

It has been established in the previous chapters that clusters, which are groups of firms, related actors, and institutions that are located near one another, draw productive advantages from their mutual proximity and connections. Clusters arise and grow because the firms within them profit materially from the presence of powerful '*externalities*' and '*spill-overs*' that bring them important competitive advantages, ranging from the presence of a specialized workforce to supplier specialization and the exchange of leading edge knowledge.

Box 5: Ohio University

Since the European settlement, Ohio region for many centuries was the center of a continent wide trading empire. From the earliest settler days until relatively recent times, extractive industries have dominated the economy of Appalachian Ohio. Salt was such an important commodity to the Native Americans and lands containing salt licks were valued higher than the surrounding acreage. Iron ore was another significant natural resource with some hilltop iron ore beds reaching a depth of almost six feet. In addition to iron and salt, one of the first resources found in this region was clay. But it is another crucial mineral, coal that dominated the economy for several generations. Underground mining began in the early 1800s and thrived for more than a century. The arrival of the railroad in 1856 provided a way for coal companies to transport and sell their product easily, paving the way for rapid expansion. Around World War II, surface mining overtook underground mining as the primary way to extract the mineral. (cont.)

Currently the picture is different. The region is known for its high-tech cluster of industries. Ohio University, the harbinger of change, started the process as early as 1894 when a chemistry professor Wilbur Stine was awarded a patent for his improved design of the battery. One of Ohio University's biggest success stories in technology transfer is the discovery of growth hormone antagonists by Goll Ohio Professor of Molecular Biology John Kopchick. This innovation led to the development of a drug, now marketed by Pfizer under the brand name Somavert®, for patients with the growth hormone disorder acromegaly. Ohio University has received approximately Rs.1500 million in royalty income till date from this license.

The university's second major success story is Diagnostic Hybrids Inc. (DHI), a start up company based on faculty research. This time Ohio University licensed its IP to Diagnostic Hybrids and also invested in the company. Diagnostic Hybrids recently sold to publicly traded Quidel for Rs.6500 million, and Ohio University's equity sale was approximately Rs.2000 million.

Ohio University is home to 44 centers and institutes, and many support the commercialisation of faculty research and technology. These include: *Edison Biotechnology Institute, Avionics Engineering Center, Ohio Coal Research Center, Institute for Corrosion and Multiphase Technology, Nanoscale and Quantum Phenomenon Institute.* Since 1983, the Innovation Center has incubated more than 100 companies; helped create more than 1,000, assisted with 9 spin off companies from university invented technology and supported 27 start-ups created by the university faculty and staff.

The transformed Athens County is now home to a variety of small companies (784 start-ups between 1995 and 2000) specializing in biomedical research, renewable energy and gourmet food.

It was also found that the innovative companies active in a cluster environment are more innovative than the general sample of innovative European companies.

Box 6: Swiss Medical Technology

With the clock ticking on their watch industry in the late 1970s because of a glut of cheaper digital Japanese watches, the Swiss timepiece and mechanical engineering sectors desperately needed a shift. At such a time came an improved medical technology.

A combination of government technology development programs, a talented and well-educated labour pool, a supportive academic community and favourable tax rates have all combined to make Swiss Medtech one of the fastest growing industrial sectors in the country. The Swiss Medtech sector in 2008 comprised of about 700 companies, employing 49, 000 people in the production of products such as dental and orthopaedic implants, urinary infection diagnostics, surgical tools, sterilisation products for the healthcare sector, electrocardiographs, and precise ophthalmology measuring tools. Sales in the medical technology sector topped Rs.1332.32 billion in 2008, or about 2 per cent of the country's gross domestic product, the highest percentage of any country.

The sector has flourished because of highly educated and skilled people, world-class research, and the strong partnerships between universities, colleges of applied technology and the industry.

Medtech companies could also further benefit from the national, government-funded Commission for Technology and Innovation (CTI) Medtech, established to promote innovation and competitiveness. In the past 12 years, the commission has provided nearly 250 million Swiss francs to 235 projects.

Government, University, and Enterprises together shape the competitiveness of innovation cluster in a dynamic mode. A snapshot of the current scenario may not lend to deciphering the initiatives taken and routines followed for decades.

History of Government, University and Industry Cooperation

Modern industrial research took off with applied research in chemistry. The new chemical industry developed products like high explosives, which made the governments of countries like Germany take interest in new technologies.

The German university system gave the German industry a strong advantage over its competitors in other countries in term of access to university trained scientists. The industrial research and development laboratory evolved during late 90s. This was owned by a particular firm, staffed by university trained scientists and engineers and dedicated to advancing the mother firms' product and process technologies. Scientific and technical societies, whose members include the research and development scientists and engineers employed by business firms, university researchers and in many cases scientists and engineers working in government laboratory or agencies, also came into life during this period. Such societies held regular meetings, published journals, and in general, served to keep their professional members informed about the scientific and technical news in their fields.

World War II was a watershed in the history of government policies concerned with the development of science and technology. The central importance of science and technology to military strength was made dramatically visible in this war. Later, in most industrial countries, the respective governments took responsibility of funding the university research, generally at levels much more than the pre-war period. Governments funded universities, and enterprises received talented people and research knowledge from universities. Governments rarely attempted to pick individuals or support 'private R&D' with 'public funds'.

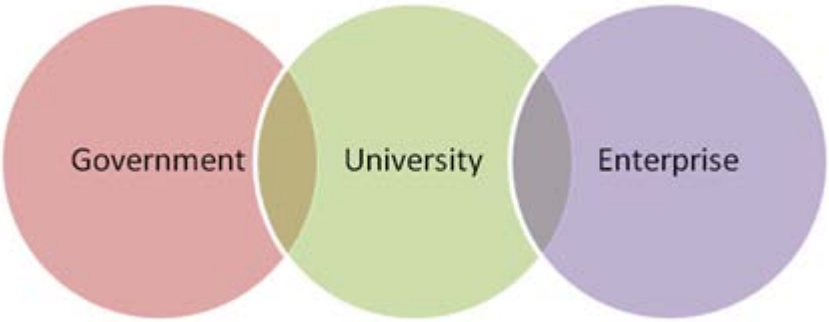


Figure 6: Government, University and Enterprise Cooperation

During the technology wars of the 1970's, in response to MITI initiatives of Japan, Europe and USA began supporting the industry directly. Initially, the support was extended to a consortium for research at pre-competitive stage with programmes like European Strategic Program on Research in Information Technology (ESPRIT) and Sematech.

Apart from universities, USA was already funding about 1,000 federal laboratories since 1846 with an annual budget of over $100 billion and they were mandated to transfer technology to the state and local governments as well as the private sector.

Through all this time, the initial government, university and enterprise cooperation process underwent a significant change. With government providing direct support to the industry and universities together, a new model known as 'Triple Helix Model' was established. The new model took root leading to proliferation of various spin-off ventures and incubators. This was because many large firms were locked in their existing structures and were unable to absorb new technologies coming from universities. It was the start-ups on the other hand, that lapped up the new knowledge to innovate.

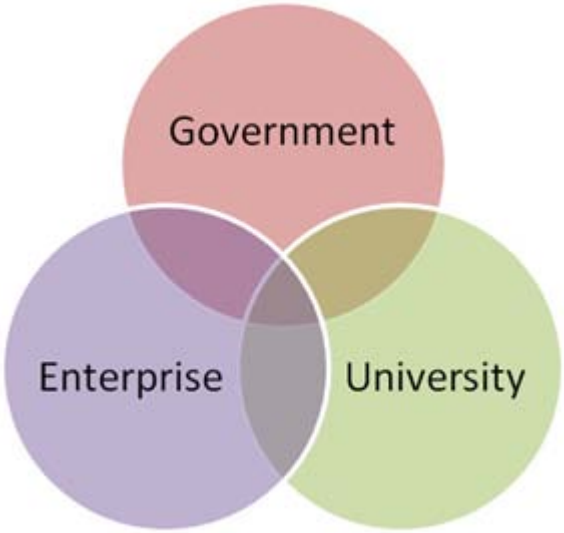


Figure 7: The New Triple Helix Model

The innovation cluster work currently derives strength from communities of science scholars, technopreneurs and venture investors. Government interaction with universities is determined by the community of science scholars embedded at the decision making levels. Most important are community of technopreneurs that is bonding the university to the enterprise creation.

It is usually observed that many technology incubators are located near or in the universities; and universities sponsored some of the initially established incubators in the US. Universities can boost the number of new firms appropriate for incubation via spinouts and unofficial start-ups. In addition to universities, research institutes and technology intermediaries can also be valued sources of start-ups. Universities and other research institutions can not only offer access to advanced R&D laboratories, equipment and other research and technical resources, but can also offer access to talent such as faculty, staff and students. The knowledge spill-over from these institutions (and their intellectual property practices) to the local community and network of entrepreneurs is the central process that takes place in fertile innovation clusters.

Clarysse et al. (2005) study of spin-out activity and entrepreneurial support strategies found three models, viz., the low selective model, the supportive model, and the incubator model, which is largely dependent on the entrepreneurial orientation and support structures of the particular university and region. As not all universities have a cultural fit with entrepreneurial endeavour, the low selective model is involved in changing this culture and often works with university researchers at the end of their contracts on very early stage ideas, requiring much support. Public funding is usually attracted due to the need for an enterprise to create jobs in areas with high unemployment. A more supportive model is similarly positioned but with more interventions like business plan competitions and a need for business support in specialised units like incubators. The third

'incubator model' typical of regions like Cambridge in UK, where the university and region largely embrace entrepreneurial culture, is more focused on the support of ventures complementary to regional expertise and with a global commercialisation perspective. In the third model, venture capital funding is often essential to enable ventures to fully develop to adopt a model without consideration of regional resources and competence risk failure, as often happens when regions expect to emulate activities in typical regions like the Silicon Valley or Cambridge, UK.

Fostering Social Capital of a Cluster

Social capital is defined as the network of strong personal relationships that provide the basis for trust building, cooperation and collective action. *Structural social capital* describes the impersonal configuration of linkages between people and units while *relational social capital* describes the personal relationships that people have developed through a history of mutual interactions and transactions. Key factors in this type of capital are trust and trustworthiness based on a history of successful exchanges. Myint et al. (2005) study on the effects of social capital on new venture creation at Cambridge high-tech cluster had the following important findings:

- A limited number of individuals, together, shaped the Cambridge high-tech cluster. At the centre of a high-tech cluster is a small pool of key individuals (investors, academics and serial entrepreneurs) who can determine performance of the cluster.

- There is a high level of relational social capital in Cambridge arising from the association of individuals who have worked together in other companies over the period of time. It is also noted that the high level of structural social capital arising from interlocking directorships is supplemented by the clustering of venture capital (VC) investments, membership of business angel groups, and networking organisations.

- Successful entrepreneurs tended to have multiple directorships or ownership stakes. *Alpha entrepreneur* is a lead entrepreneur different from other entrepreneurs by his / her networking behaviour and ability to build and use networks strategically in funding and growing a new venture.

- Structural social capital is critical for the efficient functioning of the cluster. Formal links between companies increase awareness of opportunities for strategic alliances (that take advantage of complementary expertise) and for outsourcing activities for greater efficiency. They also provide a channel for information on industry trends, government initiatives and grants, laboratory space and new business opportunities.

❖ Relational social capital is leveraged extensively in the formation of new ventures for evaluating promising business opportunities, for forming connections between investors and entrepreneurs, and for staffing new enterprises with experienced management teams.

❖ A vibrant cluster needs a pool of individuals who are physically located in close proximity so that they are better able to interact, build and maximise both structural and relational social capital.

Box 7: Cambridge High-tech Cluster

In 1978, Hermann Hauser co-founded Acorn with Andy Hopper, an academician, and Chris Curry. Bankers from Barclays Bank at that time, persuaded their regional office to lend money to Acorn in the critical stage of his business. Acorn's engineers designed a RISC chip in-house which was the origin of the ARM chip technology.

ARM was founded in 1990 by 12 engineers from Acorn. When Acorn was acquired by Olivetti, Hermann Hauser and Andy Hopper joined Olivetti and then Andy started the Cambridge-based Olivetti Research Limited in 1986 which became Olivetti and Oracle Research before it was bought by AT&T in 1999.

Hermann Hauser and Andy Hopper founded Virata (Advanced Telecommunications Modules Ltd) as a spin-out from Olivetti Research in 1993. Two years later, Charles Cotton, an ex-Sinclair Research employee joined to help launch the initial products of the company.

Charles Cotton now sits on the board of Level 5 Network which was founded by Andy Hopper and his team from AT&T Cambridge Laboratory when AT&T ceased in 2002.The other companies which were founded when AT&T Cambridge Laboratory ceased are Ubisense and Real VNC.

Once an organisation stops growing, the team splits but technology motivation still exists which leads to a series of new technology ventures.

Results of the extensive research conducted in 2002 in Denmark, Ireland and Wales showed that social capital is consistent with high performance, innovation and knowledge intensity (*Cooke and Clifton, 2002*). Firms with a greater innovation capacity tend to show higher trust in collaborators, exchange information outside the normal commercial links, rate higher external information, develop strategic contacts and consider cooperation as more beneficial than other firms. Social capital provides untraded benefits in the form of formal and / or informal partnerships, networks, and cluster based initiatives where mutual trust, credibility, reputation and exchange of personal favours can contribute to firms' profitability, turnover and innovation rate. Building social capital in a cluster might not

appear as a necessary condition, yet it seems to be an important requirement for innovation and improved performance.

The Role of Public Authorities

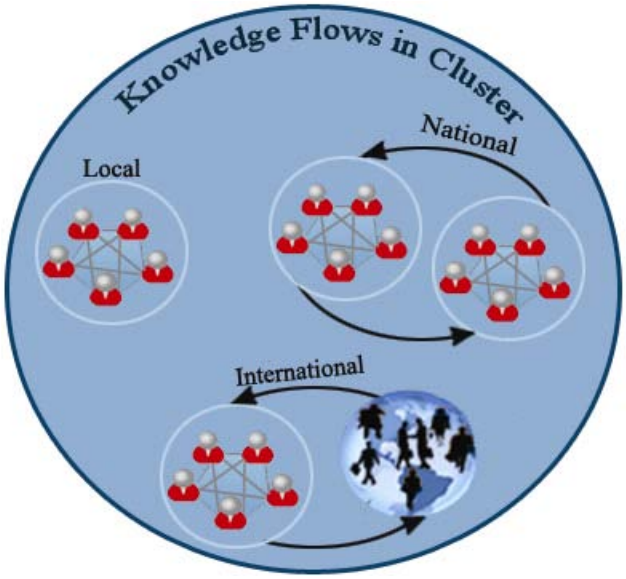
Since the 1990's description of Prof. Michael E. Porter on how clusters or locally based networks of firms in the same industry could constitute a source of competitive advantage, most advanced economies are increasingly using cluster policies. Some tools that governments put in practice are identification of existing or potential clusters in their region, providing clusters with strategic information such as benchmarking or trends, investments in technologies and capabilities that are beneficial to cluster firms, filling in gaps in the cluster with Foreign Direct Investment (FDI) or other sources, linking firms with training programmes provided by local universities and centres, fostering networking, service centres and associations, etc. Support to firms in clusters, either directly or through suitable supporting structures, is now accepted as a basic priority in the economic development and industrial policy of political agendas.

Proven European practices highlight the role played by their respective governments. Some of the important support activities are:

- Organising public events
- Supporting the improvement of the region through building of cluster reputation
- Facilitating transmission of information
- Directing financial support to finance specific projects
- Facilitating networking with universities and administration
- Facilitating networking with firms
- Facilitating transnational relation with other clusters or geographic areas
- Providing buildings or other infrastructure
- Supporting incubator development
- Tax reduction schemes on R&D and innovation expenditures
- Tax reduction schemes on non-R&D and non-innovation expenditures

Challenges that limit knowledge flows into the Indian clusters

Knowledge linkages surfaced with the Hub and Spoke Model of industrial districts, where one or more firms or facilities act as anchors or hubs to the regional economy, with suppliers and related activities spread around them like the spokes of a wheel. A single large firm (e.g. Boeing in Seattle and Toyota in Toyota City) or several large firms in one or more sectors (such as Ford in Chrysler and GM in Detroit) may act as hubs, surrounded by smaller suppliers. The large hub firms often have substantial links to suppliers, competitors and customers outside the district.



Global Production Networks, a research project funded by the UK Economic and Social Research Council, played a similar role with the De-risking Model of Supply. Global foreign buyers emerged as main carriers of knowledge flows in the Tirupur cluster of India. Spinning mills integrated into apparel and garments, and small producers moved from producing fabric to creating finished items such as home furnishing under contract from big retain chains like IKEA and Walmart. The integration into the global economy, through international networks and markets, corporate hierarchies, global production and technological organisation is also boosting the importance of enabling knowledge flows in clusters.

In recent years, a few studies have emphasised that geographically bounded clusters should be viewed as systems of knowledge accumulation rather than just production systems. In simple terms, '*combinations of internally organised capabilities with external knowledge resources, and the links between them*' is referred to as innovation/ knowledge systems. An application of '*innovation systems*' concept to a cluster would require an analysis of capabilities internal to the cluster (or firms in a cluster) and their linkages with external knowledge sources including entities like universities, R&D institutions, certification agencies, external firms, customers and so on. Basant (2011) reviewed the available literature on geographically bounded clusters to explore the determinants of knowledge flows in these clusters. The available evidence suggests that various dimensions of the cluster contribute to knowledge flows in the cluster itself. These cluster specific factors can include:

- Size of the cluster
- Extent of diversification
- Division of labour (and the associated buyer supplier relations)
- Nature of products (hi-tech v/s traditional)
- Levels of competition
- Nature of markets
- Location (developing / developed economy)
- Links with other clusters and non-cluster firms (global networks, MNCs, etc.) and so on
- Public policy and macro-economic environment

Knowledge can flow into firms from outside the system, between firms (and other institutions) within the system, or even internally within the firms themselves. All of these varied kinds of knowledge flows may contribute to the accumulation of those knowledge stocks and resources often labelled 'technological capabilities'. At one end of a complexity spectrum, these include the most routine production capabilities required simply to maintain the efficiency of an established production system of materials, labour and customer requirements as in the case of traditional manufacturing clusters. At the other extreme, the most innovative capabilities required to specify and design new products, develop novel machines and install new processes, establish new channels of supply and distribution as in the case of modern manufacturing and services clusters.

Knowledge systems and production systems obviously overlap, but they are not identical. Actors in one may not be actors in the other. Similarly, knowledge flows may be carried along the same channels as those concerned with market transactions over goods but it is also very clear that in some situations, goods- cantered linkages play little or no role in creating or diffusing knowledge.

In place of knowledge and production systems, some people refer to them as knowledge-using elements and knowledge-changing elements. The knowledge-using elements are involved, for example, in maintaining or expanding capacity using given modes of production, training workers in established operating procedures; and within a cluster context, the imitation of production techniques used by neighbouring firms. The knowledge-changing elements are involved, for example, in the management of innovation processes, in product design and development, or in the search for, the selection of, and adaptation and assimilation of new product or process technology (from outside the cluster).

Table 2: Sources of knowledge using and changing capacities		
	Sources of increase in knowledge-using Capabilities	**Sources of increase in knowledge-changing capabilities**
Intra firm sources	Learning by doing production. Improved process and practices derived from trial and error experimentation.	Learning by changing. Adaptation and improvement of existing technologies (reverse engineering etc.).
Intra cluster sources	Intra cluster mobility of skilled labour. Knowledge spillovers / diffusion between producers. Knowledge spillovers / diffusion between users and producers of machinery / material or production related services.	Creative collaboration between firms and cluster-based technology institutions. Training and skill development through cluster based / mediated initiatives Collaboration among cluster based enterprises for adaptation and technology development (machinery, product design) Links between enterprises and customers located in the cluster (MNC, large firms).
Sources outside the cluster	Externally linked technical advice and consultancy services. Customers' and traders' knowledge. Machinery and other input suppliers.	Collaborative testing or technology development with technology institutions or firms outside the cluster.

Knowledge generations and flow is associated with institutional setup of a cluster. Florian Taube and Amit Karna analysed organisational distance and geographic distance in their study of knowledge flows in the Bangalore information technology cluster.

In the first phase of the evolution of the Bangalore cluster, the ties were between the headquarters and the MNC subsidiaries in Bangalore. Ties are characterized as '*non-local and intra-organisational, separated by geographical distance*s.' In the next step, these innovation networks were seen to develop with the strengthening of internal networks within subsidiary teams. Innovation networks developed in the form of more local ties, however, remaining as *intra-organisational* as before, because the focus is still on the subsidiary. The next step of development of innovation networks was seen to be surpassing organisational boundaries. This phase witnessed a prominence of innovation networks that involved the subsidiary and the local stakeholders in the environment viz. suppliers, educational institutes, competitors and customers. In the final step, the innovation networks that were established by the MNCs and grew within the Bangalore region started going back to their roots, in the form of non-local ties. These ties that linked the innovation from subsidiaries to the headquarters, brought along the inter-organisational ties that the subsidiaries had developed.

In a different part of the world, Own Smith and Powell, from a study of Boston Biotechnology, concluded that '*decisive, non-incremental knowledge flows*' are often generated through networking pipeline rather than through undirected, spontaneous local broadcasting. Roman Marting analysing knowledge flows in Sweden, found that companies in the life sciences industry rely primarily on knowledge stemming from scientific research, and for recruitment, look to the higher education sector; and that knowledge flows occur foremost in globally configured networks. There is an overall agreement that the establishment of external knowledge networks is fundamental even in the most dynamic of clusters. The links with external sources of knowledge are not simply a way to overcome lock-in and avoid entropic death but also to maintain and accrue local endogenous existing dynamism.

Fostering Local Linkages, Creating Cluster Buzz and Building Knowledge Pipelines

Cluster Buzz refers to the information and communication ecology created by face to face contacts, co-presence and co-location of people and firms within the same industry and place or origin. This buzz consists of specific information and continuous updates of such information, intended and unanticipated learning processes in organised and accidental meetings.

Global pipelines are purpose-built connections between a given local firm and parties in the world outside. Partners can range from other firms, suppliers, customers, universities, to research centres. Establishing a global pipeline is expensive, yet, it is possible with a conscious effort on the part of partners at both ends of the pipeline, making the exchange highly targeted towards specific pre-defined goals.

Study of Finnish innovations showed that firms that develop international partnerships are likely to innovate better than firms that rely on national and local interactions, meaning that the transfer mechanisms of knowledge and innovation within close geographical proximity are either broken or less prominent than previously thought. Firms therefore cannot rely only on local interactions for new knowledge. The creation and engagement in pipeline is a must if they are to remain innovative and competitive.

Establishment of global pipeline with a new partner requires that a new trust is being built in a conscious and systematic manner. This process of building trust takes time and involves cost. Knowledge flows through pipelines are not automatic and participation is not free. Selection of external partners is not easy because information about the set of potential partners is usually truncated and knowledge of these firms and their capabilities is incomplete. Partners on both ends have to develop a joint interpretative context in order to engage in interaction. This can be accomplished through a set of procedural rules involving a sequence of transaction and interaction wherein small risks are followed by large ones and commitment progressively increases.

New and valuable knowledge can always be created in other parts of the world and firms that can build a pipeline for such sites of global excellence gain competitive advantage. Information that one cluster firm can acquire through its pipelines will spill over to other firms in the cluster through local buzz. In developed economies, pipelines to the outside world are regarded as key source for radical innovation, channelling new knowledge and practices to local firms. Local interactions represent a more genuine vehicle for incremental innovation. But the position in developing countries could be different, as we will learn from the Indian story in the next section.

Cluster's Knowledge Creation Capability

Arican (2009) defined a cluster's knowledge creation capability as the ability of the 'collectivity of firms' in the cluster to enhance knowledge creation at the firm level. A cluster that has a high level of knowledge creation capability is one where knowledge held by individual firms is effectively shared among cluster firms through inter-firm knowledge exchanges and amplified by individual firms' knowledge spirals, leading to enhanced knowledge creation by individual firms. Inter-firm knowledge exchanges are defined as formal or informal interactions between firms that involve either voluntary (e.g., alliances and licensing) or involuntary forms (i.e., knowledge spillovers) of knowledge exchanges. The attempt could be thwarted by following three types of Knowledge-creation failures:

- The first type of failure occurs when opportunities for inter-firm knowledge exchanges do not emerge. The lack of opportunities may be due to characteristics inherent to the clusters' industry(ies), such as low knowledge intensity or narrow breadth of knowledge demand.

- Another reason why knowledge-exchange opportunities disappear over time may be the emergence of a large number of weak firms in the cluster. A dynamic knowledge exchange environment is likely to attract entry by weak firms that want to exploit the knowledge assets within the cluster. This situation creates incentives for firms with advanced knowledge assets to move outside of the cluster in order not to lose their valuable knowledge to local competitors through unintentional spillovers.

- The third type of failure occurs due to ineffectiveness of inter-firm knowledge exchanges by cluster firms. It is crucial that cluster firms realize the important role that developing their own knowledge creation capabilities plays on increasing their cluster's knowledge creation capability. Only if cluster firms are capable firms can they use external knowledge effectively to create new knowledge inside the firm and then feed it back into the cluster, so that the enhanced knowledge creation process within the cluster continues. It is crucial for cluster firms to keep investing in developing absorptive capacity in different knowledge domains and improving the operation of their knowledge creation spirals so that they can utilize external knowledge to the fullest extent, and keep making contributions to the knowledge base of the cluster.

Indian Pilots for Promotion of Innovation in Clusters

There are currently 24 cluster based public support programmes targeting micro and small enterprises since the year 2000, across more than 1,200 industrial clusters (out of estimated 7,000 clusters including handlooms and handicrafts clusters) These cluster based support programmes have an estimated financial outlay of about Rs.70 billion over the 11th Five Year Plan (2007-12). This is a testimony to the potential that clusters can be provided in terms of public financial support to develop MSMEs in the country (*Rao, 2011*).

Most of these initiatives have focused on increasing business volume, sustaining employment or building efficiency of the factors driving competitiveness.

Traditionally, these can be achieved in a cluster through strong consortia of firms, pro-active industry associations, building vertical linkages, stimulating public-private partnerships, and delivery of specialised institutional services. Little has been done to specifically promote innovations among MSMEs across clusters under these initiatives and have at best remained limited to diffusion of

tested technologies. Certain schemes and programmes of assistance like TEPP of DSIR and provision of risk financing through institutions such as TDB focused at the enterprise level by supporting start-ups and innovators. There are some awards and recognitions showered on innovations and those that were championed by MSMEs as well. However, the cluster focus has either been missing from these schemes so far, or the scope of the initiatives at best has been on technology diffusion or reverse engineering.

There has been only one cluster approach based programme called 'Promoting Innovation Clusters' (PIC) by the DST, Government of India. This programme was initiated in November 2007 with a vision to promote collective research, development and commercialisation among MSMEs in clusters to promote production of high value goods and services using the innovation route. Investment in knowledge creation, acquisition, absorption and diffusion is critical for this purpose. The programme aimed at promoting innovations through fostering collaborative systems of learning and executing select activities in clusters by facilitating linkages among enterprises and knowledge providers / creators (i.e. institutions and consultants) to develop new and high value added products for national and global markets. It was an action oriented programme that built on the relevant practices around the world and FMC competence to foster cluster based MSME development.

The expected outputs and outcomes are given below:

- ❖ Pilot support initiatives implemented in select clusters to achieve innovations in traditional and modern sectors with a greater focus on the latter.
- ❖ Scaled-up initiatives to promote innovation in the targeted clusters with other public institutions and ministries.
- ❖ Create a knowledge-base on promoting innovation clusters for MSMEs in developing countries including methodology with case studies on best practices, training curriculum and innovation measures for clusters.

Under the programme, from 1st April 2009, the initiatives were undertaken in three sectors and in six locations which included two pharmaceutical clusters of Ahmedabad (state of Gujarat) and Hyderabad (state of Andhra Pradesh); ICT cluster of Delhi-NCR and three foundry industry clusters of Samalkha, Faridabad and Kaithal (all in state of Haryana). The main objectives in different selected clusters are given in Table 3:

Table 3: Strategic Objectives in Different Clusters under the DST- PIC Project	
Foundry clusters of Samalkha, Faridabad, and Kaithal	Diffusion of advanced technology and improved practices. Initiate pilots for new designs and upgraded production systems.
ICT cluster of Delhi-NCR	New enterprises' sustenance by building linkages and creating demand side platform among start-up enterprises.
Hyderabad Pharmaceuticals cluster	Strengthen industry-institution linkages to help transform to clean and green cluster
Gujarat Pharmaceuticals cluster	Breed a new generation of technopreneurs

Given below in Table 4 is the timeline for interventions undertaken in six clusters across three sectors during the project period including a few pre-project activities by FMC during the PIC programme.

Table 4: FMC's PIC Project
2008: A study to identify and understand innovation promotion among select 10 European and Asian countries, including with reference to innovation clusters. **2008:** Enterprise and network focused financial and coordination support for innovations across select clusters. **2009-12:** Action research to focus on select six clusters across ICT, pharmaceuticals and foundry. Focus on strengthening of local eco-system in the clusters. **2011-12:** Development of methodology for promoting innovation in clusters. **2011-12:** Development and delivery of training modules for select cluster stakeholders and implementing agencies to strengthen nine pilot cluster innovation initiatives being undertaken by National Innovation Council (NIC).

During the year 2010, the Office of Prime Minister of the Government of India constituted the National Innovation Council (NIC) to formulate a road map for stimulating innovation in the country and build a national eco-system for the same. NIC has since then, among other initiatives, stimulated pilot interventions across nine industry clusters to draw lessons from and suggest ways to scale them up, and steered by the Ministry of MSMEs and several other sector specific ministries.

Table 5: National Innovation Council (NIC) and Other National Initiatives
2010: Set up under the office of advisor to the Prime Minister. Main task is to formulate a road map for innovation for the decade (2010-2020).
2011-12: Industry innovation cluster pilots across nine locations.
2011-12: Initiated University Innovation Clusters (UIC) at Delhi University, Delhi and MS University, Vadodara.
2011: Ministry of MSMEs announces the likely launch of innovation clusters programme across 100 MSME clusters in India during the period 2012-17.
2012: Launch of National innovation toolkit.
2012: Development of select training material beyond the one meant for promoting innovation clusters.

The PIC project and various other initiatives provided a fertile ground for initiating a large variety of new instruments of intervention not attempted before in the Indian context. These initiatives have helped understand the challenges to promote innovation in clusters, bring out the priority areas and test new ways to stimulate innovation among clusters. The project mainly focused on strengthening the local ecosystem by strengthening some of the key stakeholders and their inter-relationships that could ensure continued assistance and support for existing and potential innovations.

Innovation in MSMEs Clusters - Indian Context

Innovation and MSMEs Clusters

MSMEs play a pivotal role in the economic growth and are relatively more adaptive to the changing global needs. In most developing economies, the share of MSMEs constitutes a significant volume of the industrial base. In order to remain competitive, it is important for MSMEs to learn to exploit new technologies and respond quickly to the changing market needs. The potential of MSMEs can be leveraged by providing relevant inputs through publically funded developmental projects. The public funded developmental initiatives are aimed at productivity enhancement, ensuring value addition and / or fuelling growth. Some of the initiatives may also aim at achieving largely public good, in the form of harnessing growth along with achieving equity, employment generation, mitigating environmental degradation or reaching out to the most vulnerable sections of the economy.

Public institutions, both in the developed and developing countries, have supported MSMEs to improve their competitiveness through a large typology of developmental initiatives funded mainly from the

public sources. Such initiatives can be justified from the standpoint of public good argument. It is inherently believed that MSMEs would continue to remain locked in their regular commercial activities without seeing the relevance to the bigger developmental picture. Enterprise level initiatives with long term returns, risky ventures and lesser appropriation of private benefits can be tackled through developmental initiatives steered through time bound externally driven projects.

Innovation potential of MSMEs is also hampered due to demand side problems that include lack of skilled human resource, paucity of time and other resources, financial barriers to innovation and so on. The commonality in weaknesses and challenges faced by MSMEs can be addressed better if they are producing a range of similar or same products and co-exist in close geographical locations. Such clustering enables the aggregation of common problems, common challenges towards growth and identification of possible solutions for the same. A majority of MSMEs in India are located in clusters, estimated to be around 7,000. A partial list of about 5,000 such clusters has been compiled through various public and private sources and is available at www.clusterobservatory.in .

MSME Clusters are known to give rise to collective benefits, favour creation of specialised service providers, and give rise to a positive competition, thus inducing innovation and higher productivity levels. MSMEs in clusters can build on an environment conducive for development of inter-firm co-operation, positive competition and collective learning. The potential advantages of clusters in perceiving the need and opportunity for innovation are significant. Yet, there are far more number of examples where enterprises have been locked in a vicious circle of negative competition based on lower prices, poor productivity and long term stagnation. Lack of mutual co-operation among enterprises across the value chain and with institutions within or outside the cluster can often be seen as the challenges for such stagnant and non-innovative clusters. An externally driven innovation project can lead to stimulation of a process where enterprises, raw material providers, machinery suppliers, service providers, universities and buyers may selectively collaborate among themselves or across such groups.

More than 7,000 MSME clusters across India reflect a high degree of heterogeneity in terms of what they produce, how they produce and the markets that they cater to. These clusters may be located in rural or urban areas; may be very small with a few dozen enterprises to more than 10,000 enterprises of a kind in a local geographical area. Some of the clusters may have been induced only recently in the last decade or two, while many others may exist with several centuries of legacy. From a developmental perspective, some of the clusters may have reflected high growth, while others may have stagnated and declined in the past. In innovation context, the clusters in India can be classified into three broad categories as illustrated below in Table 6.

Table 6: Typology of Sector in Innovation Context in India

	Emerging	Mature	Stagnant or Declining
Sectors	Green field areas such as Nano Technology, Bio Technology, Renewable Energy, Information Technology	Leather, Pharmaceuticals, Machine tools, Ceramics, Apparels, Light engineering, Foundry, Agro processing	Handloom, Handicrafts, Coir, and other rural micro enterprise based products
Relative Growth Rates	Positive (20-30per cent), more than the GDP growth rates in manufacturing and services sectors	Positive (10-15 per cent) in line with the GDP growth rates in manufacturing and services sectors	Marginally positive or declining
Clusters	Nascent clusters in Gurgaon, Hyderabad, Chennai beside Bangalore IT	Jalandhar sports goods, Kanpur leather, Hyderabad Pharmaceutical, Tirupur textiles, etc.	Chanderi, Kota and Patola handloom Sarees, SaraiTarin bone and hoof based handicrafts, Alleppy Coir, etc.
Estimated no. of clusters	~20 (0.3 per cent)	~1100 (15 per cent)	~6000 (84per cent)
Relative Contribution to industrial economy	Low	High	Low
Relative Contribution in employment	Low	Moderate	High
Main features	➢ A few large firms but mostly start-ups or young enterprises. ➢ In the early stages of growth and have high potential for further growth	➢ Predominance of Micro and Small enterprises with some medium and large firms. Few start-ups. ➢ Have a stable growth and scope for process improvements.	➢ Predominantly micro enterprises with negligible start-ups. ➢ Stagnation in growth as the sector may be on the verge of declining.

	➢ Relatively risky ventures and are knowledge based	➢ Less risky and based on factor based efficiency	➢ Highly dependent on hand made skills and mostly local resources.
Relative availability of innovation options	➢ Innovation possibilities are high with scope for radical innovations ➢ The innovation champions are comparatively more in number and easy to identify.	➢ Innovation possibilities are largely limited to incremental innovation for efficiency improvements ➢ The innovation champions are few and difficult to identify.	➢ The Innovation possibilities are currently few with a scope for small technological improvements and marketing models ➢ Innovation champions are almost negligible
Likely Purpose of the developmental project	Facilitate and support creations for growth and high value addition with or without thrust on inclusivity	To help improve the efficiency and productivity with or without thrust on inclusivity	To improve competitiveness for sustenance of livelihood with a focus on direct inclusivity

Considering the typology of sectors in the innovation context along with the availability of innovation options, the developmental projects may target different objectives as per the need and potential. The public institutions that undertake innovation promotion do so, based on their own mandates as well as the specific sectors, or as per their areas of work such as technology, labour environment, etc.

Worldwide, a wide variety of approaches have evolved as described in Chapter 2. Similarly, India has also witnessed evolution of developmental approach starting from enterprise focused to ecosystem focused; subsidy driven to capacity building; and inputs provided by public institutions to enabling for provision of multiple inputs. European Union and several countries therein have also advocated, experimented, and scaled-up developmental initiatives that targeted the breaking of impasse towards promoting cooperation and fostering joint actions among local enterprises and institutions or service providers linked to them. Such initiatives have been heavily publically funded for a duration ranging

from three to ten years with an objective of strengthening local ecosystem for innovation promotion and linking it up with knowledge sources within and outside the regions and countries. More than 50 countries are known to have undertaken cluster based developmental initiatives both in developed as well as developing economies.

The next chapter, (Chapter 5), draws upon the available literature and a few pilot initiatives undertaken by FMC over the period 2009-2012, across three sectors, viz. cast iron foundries, pharmaceuticals and ICT. The initiatives undertaken have targeted clusters which are among the mature and emerging sectors. The experiences drawn from said initiatives, discussions held with several developmental practitioners and policy makers provided sufficient ammunition to describe a window of options and a framework for promoting innovation clusters in the Indian context. The variety of interventions undertaken across different sectors and clusters helped develop a methodological framework and training modules with emphasis on what works in the clusters and how.

Chapter 5

Proposed Implementation Framework at Cluster Level

Chapter 5
Proposed Implementation Framework at Cluster Level

This final chapter of the book explains the framework for implementing a project to promote innovations among MSMEs at cluster level. This chapter is once again divided into three sections, all of which deal with explaining and detailing various steps involved in the proposed implementation framework. The first section elaborates upon a diagnostic study report and an action plan; the second section explains the need for trust building, social capital and implementation of action plan; and the final section emphasizes and chalks out monitoring and evaluation processes.

But before the methodology is explained in detail, it is important to understand the background and context to the overall approach. The background explores the concept of innovation in the context of several similar MSMEs in clusters. It also explains the importance of cluster development approach while promoting innovation in the cluster.

Promoting Innovation in Clusters - Overview to the Approach

Cluster development approach is built on a paradigm where a single enterprise is not seen in isolation, but is seen as a part of the local ecosystem. It is believed that an enterprise needs support from relevant institutes, service providers, suppliers, universities, and other enterprises along with public policy support to enable it to undertake innovation for growth. Innovation promotion is thus built around fostering collaborative activities that strengthen cooperation and collective learning, both within and also outside the cluster. The approach rests on the belief that once the local ecosystem and its constituent linkages are strengthened; there is a greater likelihood of the cluster's sustenance in the long run. Cluster development approach therefore relies on promotion of joint action, selective cooperation and building of formal and informal platforms for mutual learning, within and across the clusters.

Defining Stakeholders in the Context of Innovation Clusters

Mutual dependence of MSMEs among themselves and on service providers and institutions is known. *Stakeholders* are all the entities from within or outside the cluster that have a stake in the growth or decline of a particular cluster. It is therefore necessary to visualise the potential role of such stakeholders in order to undertake meaningful intervention for promoting innovations in clusters. Initiation of pilots and/or scaling-up of such pilots necessarily involve R&D institutions, machinery fabricators, raw material providers, Business Membership Organisations (BMOs), regulatory government bodies, leveraging resources from public institutions, linking up with service

providers, and involving training and educational institutions. Understanding potential contribution that different but relevant stakeholders can make varies with different initiatives drawn from the action plan basket.

For example, adoption of new machines from Israel has significantly led to a transformation of the Surat and Navsari diamond cutting and polishing clusters in Gujarat during 1980s. Local machinery manufacturers reversed engineered the machinery imported from Israel, to provide locally adaptable low-cost machines, now used in the entire cluster.

Promoting innovations and scaling-up existing transformative successful pilots therefore, may require working with one or more of such stakeholders as relevant. A list of potential stakeholders that should therefore be mapped and interacted with is given here under.

Typology of Stakeholders

- **Principal Firms:** The firms producing the product or service by which a cluster is known are called principal firms or principal stakeholders of the cluster. They generally represent their interests through respective BMOs, as also called industry associations. Principal firms of a cluster face same or similar challenges, such as product obsolescence, lack of markets, lack of technology upgradations etc. Similarly they also have common opportunities to capitalise upon, if positive and transformative actions are undertaken.

- **Forward Linked Enterprises:** All the commercial enterprises involved on the market side of the business operations of the cluster are grouped herein. Buyers, traders, commission agents, exporters, buyer representatives, customers and consumers are different stakeholders under this group. An implicit demand for three dimensional visualisation of the commercial and housing space among the consumers has led several architects and builders to demand virtual tours compared to two dimensional drawings or three dimensional static models. The demand coming from the consumer side, i.e., the buyers, has led to the scope for introducing a new product by ICT enterprises.

- **Backward Linked Enterprises:** Input providers to the principal firms of a cluster are grouped herein. They include raw material providers, machinery suppliers and fuel suppliers. For example, new materials and their usage may have a significant bearing on the product that the cluster actors may want to offer to the market. Significant material changes that the local enterprises in sports goods industry have not been able to cope up with, have led to the rapid decline in manufacturing. Therefore, any developmental intervention targeted to develop new products would necessarily require an understanding and potential contribution that the raw material providers can bring in from within India and abroad. This may also have to be

complimented with provision of relevant new machinery, necessary equipment and knowhow for their usage.

❖ **Business Service Providers:** The services provided by business service providers are on a purely commercial basis and therefore they are mainly from the private sector. These include labour contractors, security services, testing services, quality testers, designers, transporters, commission agents, etc.

❖ **Business Development Service Providers (BDSPs):** BDSPs could be public or private enterprises or individuals and could either work for commercial or financial institutions, R&D, technical and academic institutes. For example, academic institutions may be targeted for tapping the creative ideas available among their students and faculty members that may have an industrial interest. Similarly, Science and technology institutions and R&D institutions of government such as Central Food Technological Research Institute (CFTRI), Mysore, has developed several technologies, some of which have helped MSMEs in their commercialisation and growth plans.

❖ **Regulatory Authorities:** The regulators may not directly promote innovation but working with them may be a pre-requisite for creating conditions to promote innovations. In the Indian context, enforcements or the lack of these by the regulatory authorities have come under severe criticism. These include authorities for enforcement of pollution control, energy efficiency, working conditions and labour welfare. Principal firms in an Italian leather cluster, Arzignano developed new models of cost sharing for setting up of improved technology for pollution control among the polluting leather making firms. The local municipality, a public authority worked with the pollution control enforcement authority and the industry to achieve the same. This town Arzignano is an industrial town and a commune in the province of Vicenza, Veneto, Italy. It is located 23 km from Vicenza, in the Valle del Chiampo, situated in north of Italy and makes leather and leather products. The oldest among the enterprises which were still active in Arzignano during the year 2002 was founded in 1830. It was only in the post-war period, that leather manufacturing gained the central role in the local economy. In the year 1956 only 27 enterprises operated in Arzignano, but by 1961 this number had already grown to 70. In the late 1980s more 600 enterprises were localized within the district while more than 750 were active in the year 2002. For details please refer to http://www.unido.org/fileadmin/import/userfiles/russof/fit-cada.pdf

Governance of the Developmental Project

Project governance plays a vital role in the successful implementation of the overall project. It can be defined as a means for ensuring that the right project is undertaken and that it is delivered or implemented correctly on the ground. Usually, there are three levels of project governance, as explained under:

❖ **Funding Institution (FI):** Generally, funding is drawn from various ministries or international donor institutions. For example, Ministry of MSME, Ministry of Science and Technology, Development Commissioner Handloom, Development Commissioner Handicrafts, UNIDO, GIZ, USAID, DIFID, UNDP, International Finance Corporation, Asian Development Bank and European Commission. The FI conceptualises the overall project by defining its strategic thrust, providing required guidelines and laying out the relevant procedures. The FI also commits the substantial part of the funds for the project. However, there is an increasing tendency to leverage funds from other sources like public institutions, private sources and beneficiaries. The FI approves yearly action plan, evaluates on strategic level and provides strategic guidance from time to time. It also plays an essential role by linking the project with other projects and leveraging with other schemes.

❖ **Facilitating Agency (FA):** As mentioned earlier, a cluster has a range of stakeholders, who carry out various commercial and regulatory activities in their own field related to the cluster. Yet, they do not often carry out activities collectively to achieve outcomes as per a coherent plan. This problem is more so when it comes to promoting innovation in the cluster. One of the significant reasons behind it could be that the stakeholders might not interact with each other frequently. Available platforms such as industry associations that can enable interaction might either be inactive or may not exist or might lack planning and implementation capacities. Also, generally, the initiation of required activities needs high initial investments, whereas gains can only be realised in the long run, making the initiation a risky venture for the enterprises. The situation calls for an external agency which can provide funding, relevant knowhow, and necessary linkages to plug the gaps. The external agency can act as a link between different stakeholders in understanding their common challenges, suggesting possible means to address them and help in implementing joint initiatives. On behalf of the FI, FA is delegated to work at the micro level and is responsible for the effective implementation of the project. This includes strong coordination, regular monitoring of work, recruitment of the project staff and facilitating work with multiple implementing arms.

Following are the major functions of FA:

- Selection of clusters (Often, the FA may be asked to work with pre-identified clusters)
- Preparing and allocating human resources for faciltating the development process
- Conducting the diagnostic study
- Trust building
- Action plan formulation
- Implementation of developmental initiatives
- Regular Monitoring and evaluation

❖ **Cluster Development Agent (CDA) and Team:** The CDA can be considered as a driving force behind the growth of the cluster. On behalf of the FA, the CDA is empowered to conceptualise or help conceptualise the overall developmental strategy for the cluster and has to facilitate its implementation. The CDA:

- Ø is a representative of the programme-implementing agency in the cluster
- Ø can be an individual or team, depending on the need of the cluster
- Ø works as a link between different cluster stakeholders and ensures the formulation and execution of an action plan in accordance with the vision and strategy of the cluster
- Ø can be an entry point into the cluster for any developmental intervention
- Ø does not have any business interest in the cluster other than facilitating its development
- Ø is mandated to work with the cluster for a fixed tenure till the conclusion of the project

Roles and Responsibilities of the CDA

As mentioned earlier, a CDP can be divided into three stages and the CDA's role in all three stages differs considerably. Following is the role of a CDA as related to three stages in cluster development project:

Figure 8: Roles and Responsibilities of the CDA

Figure 9: Governance of the Developmental Project

Diagnostic Study Report and Action Plan

1. Undertake or coordinate the diagnostic study of the cluster and identify relevant cluster specific innovation related issues and opportunities.

2. Initiate the process of trust building with cluster stakeholders

3. Prioritise issues on the basis of criticality to the cluster stakeholders

4. Help cluster stakeholders develop a shared vision that could lead to a greater level of innovation promotion in the cluster and in the process thus, enhance competitiveness of the cluster.

5. Establish/strengthen linkages among the principal firms and other cluster stakeholders including support institutions.

6. Assess the present involvement of cluster stakeholders in innovation promotion and management, and their potential to contribute to the overall process

7. Initiate the process of preparation of 'Action Plan'

8. Formulate Cluster specific 'Action Plan'

Trust Building and Implementation

1. Facilitate trust building among the cluster stakeholders

2. Implement those components of the action plan that the CDA is required to take care of directly, and co-ordination of other components that cluster stakeholders are required to implement

3. Provide necessary hand-holding and capacity building support to cluster stakeholders in building suitable governance structure and setting up of its formal systems

4. Coordinate inflow of necessary knowledge and arrangement of necessary funding support required to address the identified challenges.

Monitoring and Evaluation

1. Document the process involved, activities undertaken, resources spent, outputs and lessons drawn

2. Provide support to monitor and evaluate the entire cluster development project / process.

For operationalisation of the activities, the FA and the CDA have to work with multiple implementing agencies. These agencies can be of two types: the ones which are funded through the project and those that are hired on a contract or collaborative basis, these agencies will have a bigger

developmental role. Secondly, at times, BSPs become the implementing arm. In such a case, the commercial gain is the dominating feature.

Diagnostic Study Report (DSR) and Action Plan

Purpose of Diagnostic Study

Having identified a cluster for intervention, it is important to identify the key problem areas, their root causes, relevant stakeholders and potential ways of addressing them. The documentation of relevant information and the key findings is consolidated in the form of a diagnostic study. It is important to note that no single study, no matter how detailed it is, can be expected to provide all relevant answers. A diagnostic study, therefore, is expected to provide sufficient understanding about the actionable agenda, likely institutions to be engaged with and expected goals to be achieved. The involvement of stakeholders is important for achieving a practical and relevant actionable agenda that the stakeholders is be expected to own during implementation. It also provides a baseline for future monitoring and evaluation.

Specific Objectives of DSR are to:

- Understand socio-techno-commercial environment in which the cluster operates and its current performance level.
- Identify the principal and support stakeholders.
- Identify potential innovators and their motivation.
- Assess risk taking ability of the cluster enterprises and support firms.
- Study past successes and failures along with their causes.
- Ascertain the entrepreneurial strength and institutional competence to promote innovation.
- Extent of interface with relevant institutions and stakeholders within and outside the cluster.
- To draft a vision and a strategy for the project.
- Provide an implementable action plan.
- Identify the most effective leverage points for intervention in terms of key challenges and explore the potential.
- Build an understanding about the project and its goals among cluster stakeholders. Thus, building initial trust between the project staff and stakeholders.
- Identify ongoing activities that can be complemented and supplemented through the project.

Who formulates a Diagnostic Study?

The CDA is the key person who is vested with the task of carrying out the diagnostic study. However, depending upon the complexity and size of the cluster, the CDA should be supported with a team comprising of in-house and external experts, who bring in interdisciplinary knowledge and expertise. It is often considered useful to bring in sector specific understanding from the marketing and technology perspectives that help the team to benchmark the cluster and identify key challenges, besides possible ways to address them.

National and international experiences can help significantly in this regard. The external expertise is also helpful in steering brain storming among relevant stakeholders and institutions to understand key challenges and generate ideas and options for future actions. The experts will also support validation with stakeholders and help kick start the implementation of the identified initiatives.

Steps Involved In a Diagnostic Study

Figure 10: Steps Involved in a Diagnostic Study

Step 1: Cluster Overview

Initial step in the diagnostic study involves gathering relevant data to be able to cull out the fundamental information about the cluster. The aim is to understand and outline major characteristics of the cluster. This involves drawing a cluster profile with respect to:

- Products and services the cluster is known for.
- Major markets that it caters to.
- Social cultural and economic environment in which the cluster is placed
- Location, connectivity, areas, population, employment.
- Historical evolution of the cluster.
- Significant turning points in the history of the cluster.

Tools

A significant tool that can be used for this is the *cluster overview template*.

Sources of Information

Possible sources of information for this particular step will be both primary and secondary. Primary sources in the form of questionnaires, formal and informal interviews, observation while capturing information from internet, relevant studies carried out in the past, national statistical data, sectoral reports and so on will constitute secondary sources.

Step 2: Analysis of Cluster's Stakeholders and Institutions

Unlike the first step, where the broad overview of the cluster was developed, step two is the detailed analysis of the environment cluster operates in. The environment is also known as the cluster ecosystem. This step entails understanding on the cluster in terms of:

- Stakeholders, their relationships and respective roles
- Understanding local, national and international institutional linkages.
- Understanding and analyzing other relevant support programs and initiatives available in the cluster.
- Comparing the cluster with other similar clusters at national/ international level in terms of growth, value addition and innovation abilities.

The significant tool to be used for this step is 'Stakeholders co-operation matrix'. The possible sources of information will be the data obtained in step 1.

Step 3: Analysis of Major Business Operations

This step in the study is the first attempt to single out the elements which will form basis for identifying challenges, setting goals and formulating strategy in the later stage. The analysis entails understanding major business operations and how business is being organized in the cluster, relevant supply chain and knowledge chain linkages, key business operations and significance of new product and technologies in the cluster. The analysis includes following components:

- Understanding major business operations and how business is organized in the cluster
- New products and technologies and their significance in the cluster.
- Understanding sources of knowledge in the cluster

Possible sources of information will be based on the data and analysis carried out in the previous steps. Significant tools to be used in this step are:

1. Value chain analysis
2. Product life cycle analysis
3. Cluster map

Step4: Identifying Key Challenges and Future Direction

This section deals with appraisal of the information collected as per aforesaid steps in order to identify challenges and set goals for the cluster. This entails:

a) Identification and prioritisation of the identified challenges

b) Cluster's vision and strategy formulation

c) Setting long and short term objectives for the cluster

The significant tool that can be used for this step is SWOT analysis as given in Table 7 below

Table 7: SWOT Analysis

		Current situation-Internal Analysis		Projections – External Analysis	
	Key challenge areas	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
Marketing, competition and sales	Existing markets				
	Market analysis (target group, trend analysis, competition)				
	Customer service				
	Cluster positioning in the market				
	Market entry strategy				
Products and services	Product mix				
	Design				
	Quality				
	Product finish				
	Differentiation/cost/ leadership				
	Life cycle phase of the products or services				
	New products/services development, registration and marketing rights				
Processes	Logistics – distribution cost				
	Usage of raw material				
	Procurement				
	Availability of testing, common facilities				

	Certification				
	Efficiency of existing technology used, technology transfers				
	Infrastructure				
	Business operations				
	BDS Providers and Industry BDSPs linkages				
Innovation Ecosystem	Innovation Value Chain				
	Intellectual property environment				
	Regulatory compliance status of the cluster (cGMP, FDI approved facilities, clinical trials/animal testing facilities, accreditation bodies etc)				
Human resource	Availability of relevant talent pool including skilled manpower to work with state-of-the-art technologies, innovation projects, new processes, new business models etc.				
	Application of best practices				
Finance	Trends in turnover, costs, earnings				
	Volume of orders				

	Important events- strategic investments, new customers attracted				
	Financial situation- loans, liabilities, receivables				
	Availability and effectiveness of risk finance, VCs, angel investors, equity investors. early stage finance				
Innovation Web	Industry-Academia linkage and Industry-Industry linkage				
	Industry-Government Cooperation				
	International Cooperation and access to Global Technology Repository				

Step 5: Formulating an action plan

Action plan is essentially a one year framework which will be planned and re-planned at the start of every year depending upon the previous year's learning. Generally innovation promotion interventions will have a timeframe of 5 years. Thus the strategic plan for 5 years will have two levels: overall developmental plan for the entire project period and detailed yearly action plans. The action plan is obtained by deriving concrete activities from the objectives set at the end of DS and assigning them to specific institutions responsible for implementation.

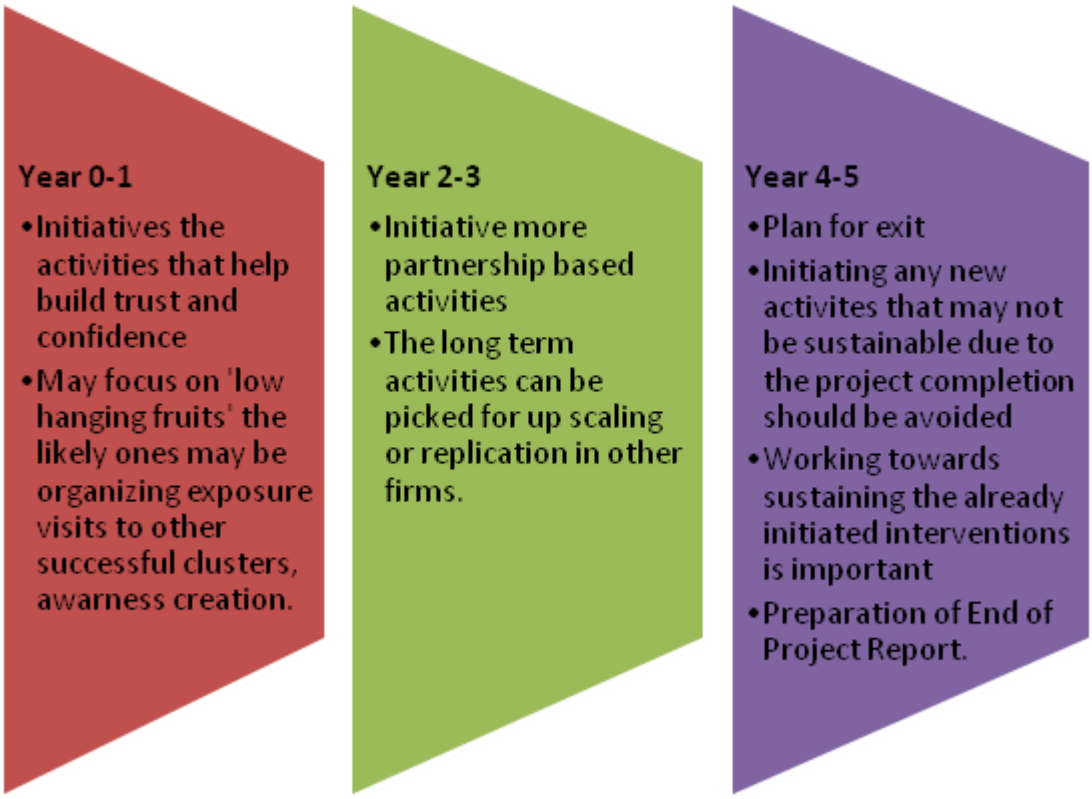


Figure 11: Five year frame work for the Action Plan

The main purposes of an action plan are as follows:

- Prioritization of the activities as what to implement first and what later.
- Providing clarity to CDA and other stakeholders once it is shared.
- Coordination of work becomes easy and effective.
- It gives an insight and helps in deciding the ways of generation and allocation of resources.
- It creates a baseline for monitoring and evaluation. The team can trace back to evaluate the progress.

The action plan also provides a reflection of the expected outputs and outcomes. Therefore drawing up an action plan becomes necessary step for the implementation stage to follow.

Resource Mobilization

Resource mobilization is a logical necessity for implementation of activities. While some part of the resources do come as a development fund from the implementing agency (as provided by funding agency), the project expect stakeholders and their interest groups (Business Membership Organisations- BMOs) to contribute substantially and mobilise funds from other public (schemes) or private sources.

Types of resources can be broadly divided into three categories:

- Human resource
- Physical resource
- Financial resource

Trust Building, Social Capital and Implementation

What is trust?

In clustering behaviour, *trust* is a level of understanding among stakeholders that facilitates a joint initiative, ensuring that all relevant information for the same is shared and that appropriate efforts are made for achieving its objective. It could be called functional trust to help distinguish with absolute trust. The more complex an activity is, higher the level of involvement (sharing and dependence) of different stakeholders, and higher the level of functional trust it require among stakeholders.

What is Social Capital?

Since enterprises in the clusters often live in close proximity to each other for many years, an inter-relationship is established between the owners of these enterprises based on their shared values and sense of belongingness. These relationships have accepted practices, ways of behaviour, unwritten or formal agreement and codes of association. The strength and stock of these inter-relationships is called the *social capital* of the cluster.

Social capital as defined by Putnam (1995) as “features of social organisation such as networks, norms and social trust that facilitates coordination and cooperation for mutual benefits.”

Trust and social capital are therefore closely related to each other. Thus, accumulated trust turns out to be social capital. Without shared values, people cannot be expected to trust each other. For instance, social capital could manifest itself in the presence of networks of cluster firms and other stakeholders and the efficacy of such networks.

Why focus on trust building?

Enterprises can benefit from being located in close proximity to each other. Such positive effects are called passive external economies. It is called 'passive' because the positive effects accrue without any planned efforts by the entrepreneurs and other cluster stakeholders. It is called 'external economies' because the effects are due to factors beyond the boundaries of an individual enterprise. However, passive external economies are not sufficient for realising the full potential of a cluster. The other benefits of clustering are often due to explicit joint actions undertaken by stakeholders and are referred as 'active external economies', since these relate to benefits arising from the active role of entrepreneurs and other stakeholders for undertaking joint business actions. The entrepreneurs and stakeholders break down those business activities that would be too risky for them to handle individually and undertake some of these jointly. It often helps to minimise the risk of failure for some such actions among individual enterprises.

In strong and overachiever clusters, stakeholders often address some of the challenges and opportunities by jointly agreeing on priorities, strategies, activities and implementing the same. Such cooperation does not always happen spontaneously on its own, since most enterprises perceive other enterprises as their competitors and are hesitant to discuss and act upon their common challenges and opportunities. Intense competition is often observed to control different kinds of resources and also to access infrastructure (e.g. physical, communication, information, or technology available and accessible to the cluster). The competition helps secure efficiency in factor use and most importantly breeds specialisation, essential to achieve high-growth path as also to stimulate innovations.

In the context of a development project aimed at infusing innovation, trust building therefore becomes an important part of methodology that ensures identification and implementation of cluster action plan. During implementation, it helps to resolve conflicts that may come in the way of new product development or diffusion of new technology or rapid adoption of a better process that can help several cluster enterprises.

Trust Building - with whom?

The process of innovation promotion at the cluster level does not occur solely within the enterprises. It requires a network of linkages with raw material suppliers, business service providers, research institutes, public authorities and various other stakeholders present within and also outside the cluster. Successful handling of such linkages can result in a clear competitive advantage. That is why, before moving on to the process of trust building, it is important to understand the different actors among whom trust building should be initiated. The trust can be between:

- CDA and cluster stakeholders
- Among stakeholders
- Between two or more clusters at the national level
- Between two or more clusters at the international level

Ways and Means of Building Trust

The stakeholders in a cluster often interact and meet for various business purposes. Such interactions facilitate the process of trust building. However, the degree of interaction might differ along with the level of trust. The primary reason for this could be that regular platforms such as industry associations that can enable this interaction are either non-existence or inactive and lack relevant capacities. Innovation promotion intervention requires an effective mechanism to facilitate interactions among stakeholders. Therefore the objective here is:

- Creating new platforms for sharing ideas and facilitating dialogue among cluster stakeholders.
- Strengthening existing ties by re-activating the existing platforms like various networks and associations.

The platforms facilitate cross fertilisation of ideas, smooth flow of knowledge and relevant dialogues between various stakeholders. They make it possible to form different partnerships and participations. Innovation promotion intervention is often ambiguous in nature. The clarity of roles and responsibilities comes at a later stage. For instance, for a new product development in a cluster the answer to questions like "Who will design? Who will fabricate? How much iteration will be required? How many trial runs are sufficient?" and so on, are less likely to be available initially. Therefore, the formal instruments in the form of Memorandums of understanding (MoU), agreements, etc. help in defining the intent and possible roles while keeping it flexible. The flexibility provides a scope for evolution and facilitates understanding among stakeholders regarding their responsibilities and obligations, and expense and benefit sharing. The platforms can be broadly of two types. They are either formal or informal.

a) Formal Platforms

A formal platform can establish credibility, make continuity of work more probable and enable dialogue to be better integrated into the existing framework. The various forms of formal platforms are:

- Industry Associations
- Industry Institution Interface Cells

- Vendor Development Platforms
- Cooperation agreements
- MoUs
- Non Disclosure Agreement (NDA)
- Virtual platforms (website of the cluster)
- Online forums

b) Informal platforms

Although strategic alliance and any mutual agreement require formal rules between stakeholders, the mutual ties are not primarily the result of a formal facet of cooperation. Informal platforms and networks are also important for binding stakeholders and facilitating mutual interactions. Informal platforms can include:

- Clubs
- Coffee shops
- Social networking sites
- Blogs
- Virtual platforms
- Social gatherings

Some of the specific activities for trust building can be:

1. Exposure visits
2. Events
3. Cluster ramp show
4. Celebrating cluster day
5. Becoming a member of industrial associations
6. Use of digital networks
7. Website of the cluster
8. Recognition
9. Conflict resolution
10. Real problem solving

Breakdown of Trust

Despite a seemingly good progress made over time, trust may often break down due to several reasons within or outside the control of the CDA. Breakdown can be encountered anytime, and often the key to avoid this is to anticipate the possible reasons in advance and prepare accordingly. Trust may breakdown due to:

- Communication failures
- Incompatible task and goals
- Conflicting perceptions
- Role conflict and ambiguity
- Ego problems, status struggles or threat
- Competition for resources
- Role incompatibility

Situations of trust breakdown require deft handling of the situation, and seeking support from neutral intermediaries if necessary and if feasible. Some of the options available to resolve any trust breakdown are:

a) Opening communication: Organising face-to-face meeting of the relevant entities for the purpose of identifying and resolving the matter by open discussion.

b) Compromise: Finding out a median solution that may partially meet the requirements of conflicting individuals. This could also mean re-working the rules for cooperation.

c) Arbitration tribunal: Intermediary stakeholders who enjoy the trust of all parties can be involved in the discussions.

d) Enabling authoritative command: Imposing a solution by the use of power and status of someone that cannot be avoided.

e) Altering the structural variables: Changing the structure of the group and / or the interaction patterns of the relevant individuals / entities.

f) Expansion of resources: Increasing the resources to meet the altered needs of the group members.

g) Working on the fall back strategy in advance and a continuous and smooth flow of information among stakeholders is also useful in handling such contingencies.

Indicators of Trust Building

The emergence of trust in a cluster can be monitored. Several developments provide useful insights to judge the evolution of such a process. The important indicators of trust building could be:

- Cluster stakeholders start having formal or informal interactions on the intended subject matter during social and official gathering.
- Stronger cooperation among stakeholders resulting in greater and more transparent flow of information.
- Increased level of participation of members in different networks and associations in decision making and execution.
- Creation or revival of focused new or existing platforms in the cluster.
- Increased level of stakeholder commitment: A willingness to commit their resources, financial or non-financial for common activities.

Implementation

Implementation refers to the operationalisation of a range of activities that leads to the realisation of objectives identified during the DSR, and in the process strengthens the governance mechanism of the cluster. In order to effectively execute the planned interventions on the ground, implementation process requires prior understanding of the DSR, identified challenges of the cluster, relation between the challenges and planned objectives, and so on. That is why it is strongly recommended to go through the check list and make sure the person (CDA or the team) who will be responsible for implementation is well versed with the points mentioned below before initiating implementation process.

Checklist for the CDA stating that s/he:

- Has full knowledge of the major challenges identified through DSR.
- Has clarity of the identified challenges and their prioritisation.
- Is fully convinced with these challenges and has access to enough information to be able to convince others in the cluster.
- Has primary knowledge about all the relevant stakeholders in the cluster.
- Has developed an action plan in consultation with the stakeholders wherever required.
- Has divided the action plan till the sub-activity level and is able to relate the main activities with the identified challenges based upon their criticality.

This chapter deals with nuances of implementation of action plan for promoting innovation in clusters and in the process, following areas are covered:

- Short term and long term objectives of implementation
- Need for steering implementation
- Implementation in cluster development while promoting innovation - The multi stakeholder concept.
- Activity implementation
- Stages of implementation.

Short Term and Long Term Objectives of Implementation

Implementation of any action plan requires listing a number of activities to be completed within a given timeframe, subject to resource availability. Each activity of an action plan needs to have a clear short-term objective. Improving sales or the creation of linkages with buyers, for example, are the immediate objectives of organising a fair. The peculiarity of a cluster's action plan is that over and above the achievement of the stated objectives, each activity should lead to creation of an efficient and lasting governance mechanism, which is that the cluster stakeholders must eventually be able to initiate and manage further development themselves. The intermediaries that are required to build governance capacities must therefore be involved at the earliest possible stage, and stakeholder empowerment must be a continuous process, through delegation of responsibilities, creation of governance support mechanisms wherever needed, appropriate sequencing of activities, and transparency in implementation.

Need for Steering Implementation

Many a times a lot of one's thoughts and plans are left at the idea level; implementation is the process of moving one's ideas from concept to reality. However, translating an action plan into concrete outcomes is a dynamic process. In clusters, it is the responsibility of the CDA to steer implementation. Action plan can only give a broad structure of ideally what is to be done. Even if we freeze the activities and sublet almost all the work to the local stakeholders, a CDA's work does not end. A cluster has a range of stakeholders who are intended to carry out various commercial activities. However, quite often, they do not carry out activities collectively to achieve specific outcomes as per a coherent plan. One significant reason could be that the platforms such as industry associations which can facilitate such initiatives are either non-existence or lack implementing capacities. On behalf of the FA, the CDA has to be closely involved at each and every step to facilitate the distributed work and to achieve the set objectives. It is essential for the FA to steer implementation because:

❖ There are various activities that have to be carried out for the first time. In order to initiate such activities, the CDA will help in creating awareness, raising appropriate resources and providing relevant linkages.

❖ Each activity is carried out with the help of suitable stakeholders and at times there are certain actors missing in the cluster value chain. The CDA then helps in linking with missing actors. This completes the value chain and helps open the gates for specific activities involving the same.

❖ Activities generating benefits are to be up-scaled in the later phase of the project. Facilitating the acceleration of already completed successful interventions is also the work of the CDA.

Box 8: Multi stakeholder concept: Different phases of an activity

The activity can have different phases as explained below:

- Idea generation: who has initiated the idea for implementing a particular activity?
- Funding: who is funding the activity (fully, partially)?
- Stimulator: who is the driving force for implementing the activity?
- Implementer: who is implementing the activity on the ground?
- Beneficiary: who is the direct and indirect beneficiary?
- Evaluator: who is evaluating the successful implementation of the work?

Under the PIC project funded by DST (2009-2012) a business plan competition named Metamorphosis was organized for promoting innovative ideas in the Hyderabad life sciences cluster. The activity was completed in collaboration with various stakeholders at each stage.

i. Idea generator- FMC
ii. Funder- FMC
iii. Stimulator- DSIR
iv. Implementer- FMC, ISB, IKP
v. Evaluator- Students, Innovators
vi. Beneficiary- Technology owners, ISB, IKP

Similarly, in the Ahmedabad Pharmaceutical cluster, a mentoring program was organised as a part of the innovation tool kit. The varied stakeholders involved here were:

i. Idea generator- Key stakeholders
ii. Funder- FMC, GSBTM, Participants
iii. Stimulator- FMC, GSBTM
iv. Implementer- EDI
v. Evaluator- GSBTM, Technical expert, External expert
vi. Beneficiary- BioTechnopreneurs™

Implementation in Cluster Development while Promoting Innovation

The implementation stage in any cluster development project is in many ways the most critical, as it is during this stage that the planned objectives are achieved. The main purpose of implementation is to achieve the desired results, attain the pre-defined purposes and contribute effectively to the overall objective of the project. It encompasses all the processes involved in executing an action plan and implementing the range of varied activities on the ground. The activities should essentially lead to the establishment of an effective governance mechanism, resulting in institutionalisation in order to empower the cluster to carry out initiatives even without the CDA.

Implementation in the cluster development is an ever evolving organic process where multiple stakeholders are involved in each phase of an activity. This is termed as the multiple stakeholders' concept.

The multiple stakeholder implementation states that for implementing an activity, a variety of stakeholders is required. An activity can have different phases (explained in the Box 8) like the idea generating, funding, implementing, stimulating, evaluating and reaping benefits. Any stakeholder can be involved in any phase at a given point of time. The stakeholders here are not bound to perform a specific task. Often there is swapping in roles, i.e., the primary stakeholders in one activity might be secondary in another. Their collaboration, partnerships and formation of varied networks is not a pre-requisite for the work to start; rather it is considered as one of the outcomes of the project.

Activity Implementation

Considering that the cluster development project aims at implementing a variety of activities, a few are implemented in sequential manner and others might run in parallel. With an intervention which has multiple parallel activities running at the same time, there is a need to understand the following:

- Activity sequencing
- Framework for activity implementation
- Menu of possible categories of activities
- Innovation value chain across activities
- Resource requirement

Activity Sequencing

Innovation promotion intervention cannot follow a concrete set of pre-defined activities. It is less likely that a 'one size fit to all' approach will work, since a particular activity might work for a select cluster and not for another, depending upon the context and modalities of the cluster's ecosystem.

That is why one has to essentially choose from a menu of possible activities. The key is to keep the process flexible and implement multiple and parallel activities. Sequencing of activities can however be generalised as follows:

- ***Awareness creation***

  For initiating any new activity, there will be a need to create awareness about the intervention concerned. Awareness can be regarding the availability of a more efficient technology (either existing or new, or both), a better performing cluster, new mechanisms to increase productivity, and so on.

- ***Undertaking pilots***

  These activities are those which are undertaken for the first time, implying that there is no history of the similar initiatives in the cluster history. For instance, if stakeholders are aware of an efficient technology in the form of DBC, then a few pilots at enterprise level can be supported in the cluster for technology upgradation.

- ***Up-scaling***

  This refers to the up-scaling of those interventions which have been successful in the initial phase or at pilot level, ensuring concrete and visible outcomes. If the pilots of converting SBC into DBC were successful, they can be replicated across the cluster in various units.

- ***Institutionalisation***

  This means establishment of a mechanism for the successful initiatives so that cluster stakeholders are able to run on their own, once the project concludes and the CDA exits. Conversion of SBC into DBC might require collaboration among individual enterprises, fabricators and association. Ensuring the mechanism of their collaboration can facilitate the institutionalisation.

Process of addressing the identified challenges has to begin at different levels. Some activities might have to be started directly with scaling-up, for others with demonstrating or piloting and for others, may be with the awareness stage.

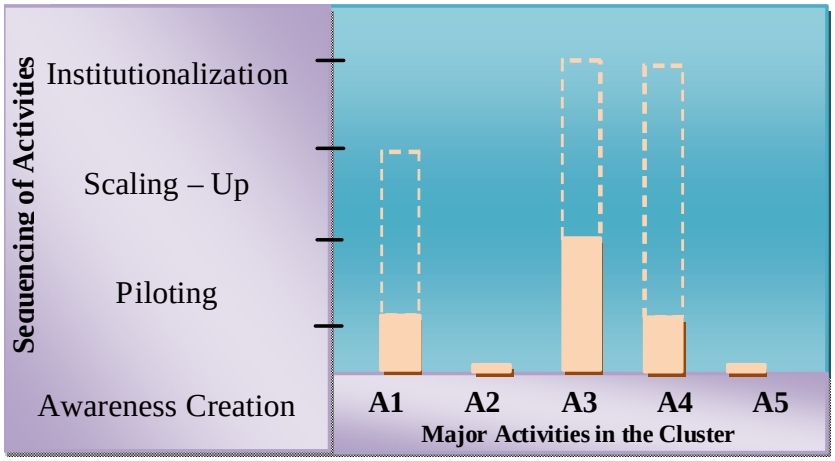


Figure 12: Activity sequencing and Major activities in the cluster

Framework for Activity Implementation

Framework for implementation consists of nine broad areas across which possible categories of activities can be chosen. These areas form a road map for transforming a production and services cluster to become an increasingly innovation oriented cluster. Planning activities in line with these areas can help gain clarity of exactly what can be implemented and for what purpose. The main features of a production and services cluster and innovation cluster are given below:

Table 8 : Main Features of Production and Services Cluster and Innovation Cluster

Production and Services cluster	Innovation cluster
1. Factor based efficiency and incremental improvements are the key to growth and value addition. 2. Contribution of new products and services is low in the overall cluster volume. 3. Industry institution linkages are generally weak. 4. Sharing of knowledge is minimum and if it does happen, it is limited to the cluster. 5. Availability of start-ups is less. **6.** Systems and infrastructure required to stimulate new ideas and their incubation do not exist.	1. Rapid up-scaling of factor based efficiency with continuous improvements is the key to growth and value addition. 2. Contribution of new products and services is significant in the turnover of the cluster. 3. Strong industry institution linkages exist. 4. Strong knowledge pipelines are available ensuring smooth flow of knowledge within and outside the cluster. 5. Magnitude of start-ups is high. 6. Systems and infrastructure to stimulate new ideas and their incubation is embedded in the cluster growth.

Explained below are the nine intervention options that can be used during implementation of a project.

Table 9: Typology of Intervention Areas

S.No.	Typology of Intervention areas	Explanation	Menu of Possible Activities
1	Cluster buzz	It refers to the creation of excitement, galvanising, showcasing the results, outcomes, recognition to the relevant stakeholders	Award and competitions, Media linkages, dissemination of success stories, usage of social networking lead to a positive enthusiasm about the cluster and its potential.
2	Knowledge support	Refers to the relevant support from the academic, and R&D institutes available within and outside the cluster	Promote Industry Institution linkages, setting up of interface cells, ideation workshops and provision of risk sharing mechanisms help undertake

			common R&D projects, generate new ideas and ensure mutually rewarding relationships between industry and institutions.
3	Global pipeline of entrepreneur ready technologies	Identification and sourcing of appropriate technologies as per industry requirements. Development of global pipeline for relevant technology and knowledge transfers.	Support R&D centres to identify current and future technology requirements of the industry, stimulate identification and sourcing of appropriate technologies to help build a strong pipeline of entrepreneur ready technologies
4	Talent recruitment	Important factor especially for knowledge intensive industries. Identification of talent pools as per the current and future requirements, strengthening linkages that facilitate recruitment of talent in the industry and other cluster stakeholders are included here.	Identification of talent pools as per the current & future requirements, scoping sources of talent and strengthening linkages that facilitate recruitment of talent in the cluster.
5	Technology adoption	Technology adoption is an enterprise level decision. The enterprise selected for adoption should be a lead player with ability to influence decision of others.	Enabling technology adoption (usually a high end one) by helping build local capacities of the technology seekers, financial stimulus to individual enterprises, workshops, seminars, trainings for service providers.
6	Technology diffusion	Diffusion is a cluster phenomenon, depends on the first adopter profile, buzz in the cluster and consultant's capability. Support at this stage is not for enterprises adopting technology but for consultant involved in the process. Speed of diffusion is a major parameter in innovation cluster.	Stimulating flow of and supporting dissemination of existing technologies through creation or strengthening of intermediaries' capabilities that create awareness and enable faster take up of those technologies through awareness programmes, preparation & dissemination of technology usage guidelines and organisation of workshops & seminars that provide a platform for a rapid technology diffusion

7	Start up dynamism	An innovative cluster will have a high magnitude of start-ups for which various forms of support are essential.	Help build a mentoring group, facilitate linkages between mentors and start-ups; support linkages of start-ups with risk capital providers and other knowledge institutions and/or individuals
8	Market interface	Depending upon life cycle of the cluster products, new markets, potential of new applications can be explored.	Stimulate understanding of potentially new applications of the products/ services through ideation and BDS provision, support new ways to explore new markets may be by creating new market interfaces
9	Creation of New Platform	Platforms are required for common branding, facilitating joint activities, linking with a common platform or network, mergers, acquisitions, strategic partnerships for scaling up and so on.	Facilitating joint activities, linking with a common platform or network, mergers, acquisitions, strategic partnerships for scaling up.

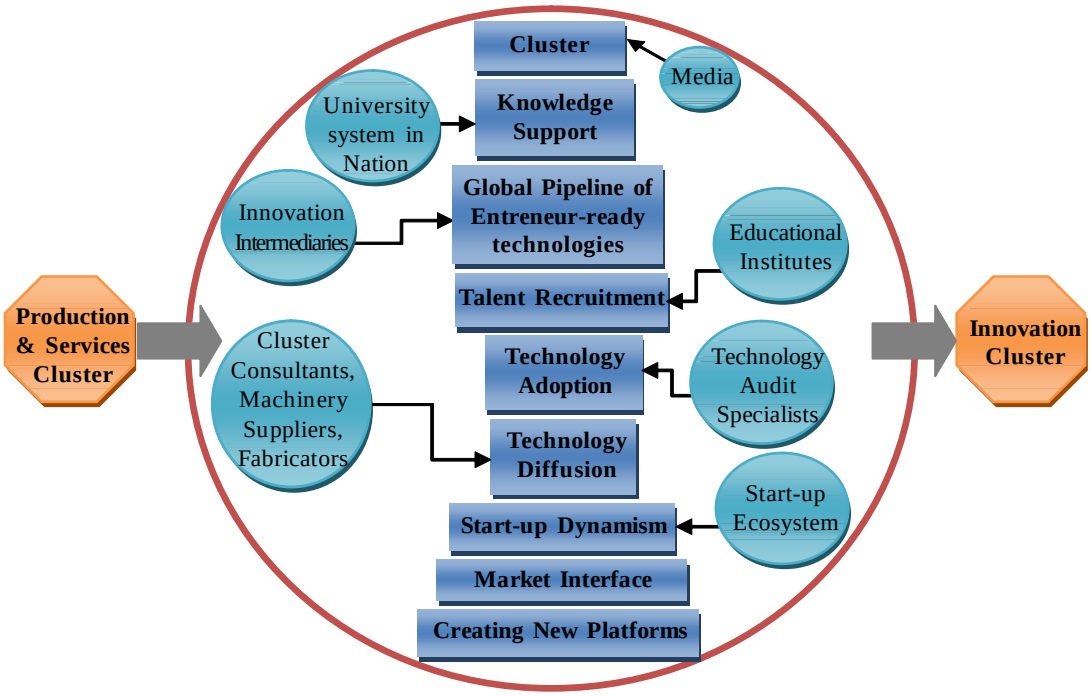


Figure 13: Production and Services Clusters to Innovation Cluster

Innovation Value Chain across the activities

Considering innovation as an activity, which when implemented in a cluster, strengthens the bottom line of the principal firms, either by creating or adopting a new idea. The process of innovation in a cluster can follow one or multiple value chains. Such value chains can operate at any point of the product value chain of the cluster, i.e. inbound logistics, operations, outbound logistics, marketing and sales and service.

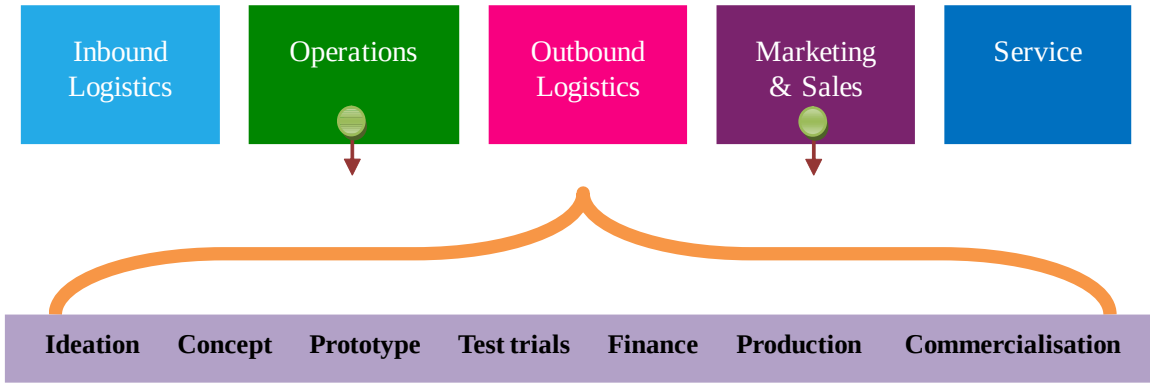


Figure 14: Innovation node lying on the product value chain

The innovation value chain at any of this juncture may be decoded as follows and can be a function of the product of the cluster as shown below:

An innovation value chain of a pharmaceutical cluster (pharmaceutical product) may have the following nodes:

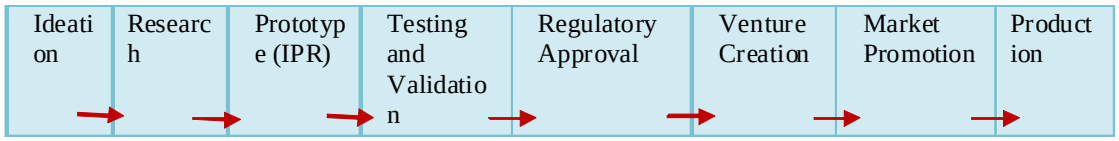


Figure 15: Innovation value Chain of a Pharmaceutical Cluster

An innovation value chain of a foundry cluster may have the following nodes:

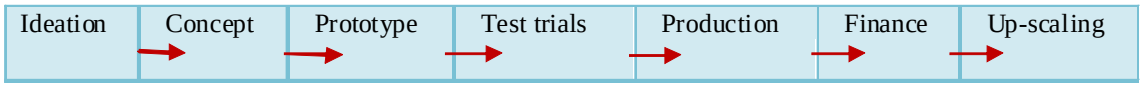


Figure 16: Innovation value Chain of a Foundry Cluster

Hence, promoting innovation in a cluster can be a two-stage process of:

a) Triggering any node of the innovation value chain at any point of the product value chain

b) Strengthening stakeholders who can promote innovation at a particular node of the innovation value chain or innovation gatekeepers at the appropriate node of the product value chain.

However, not all nodes or sub-nodes or even the complete part of the innovation value chain may be promoted through a particular activity.

Table 10: Interventions along the Innovation Value Chain under DST – PIC Project

As per the challenges identified in the cluster, following is an indicative list of a few interventions that were carried out across the innovation value chain.

Sl. No.	Innovation value chain	Ideation	Research	Prototype	Test Trial	Production	Finance	Commercialisation
1	Technology upgradation (SBC to DBC)	■	■	■	■	■	■	
2	New product development	■	■	■	■			
3	Support to individual innovators / innovations	■	■	■	■	■	■	■

Stages of Implementation

The fact that implementation take place in stages underscores an understanding that, bringing a change in the cluster is a process not an event. Therefore, activities to a concerned particular stage need to be matched in order to increase the likelihood of moving successfully through the implementation stage and also for moving ahead to the next stage. The implementation process involves following main stages:

Awareness creation: This stage is necessarily the conceptualization stage, where the main tasks include compiling and freezing the action plan in consultation with the stakeholders, establishing

working relationships with the stakeholders, mobilising resources and carrying out initial activities. If the project is in its first year the majority initial activities should concentrate on the creation of trust among relevant stakeholders. Once functional trust is achieved, more demanding and result oriented activities can be introduced. But if the project is in its second or third year then the activities will be based on the new action plan made on the basis of previous year's action plan and the newly acquired experience.

Piloting and scaling-up: The stage is characterized as an ongoing process. It may so happen that certain activities will be in the pilot phase, some moving towards the completion stage and others aimed for institutionalisation. As mentioned earlier, the CDA will necessarily have to carry out a multiple parallel activities together subject to the criticality of the purposes and available resources. Apart from procuring and deploying resources and focusing on effective execution of planned activities, the monitoring and review of the progress will also be done in this stage, as the CDA might have to revise the action plan in the light of newly acquired experience.

Institutionalisation: In this stage the successfully implemented activities are taken up further for up-scaling and their eventual institutionalisation. It is important here to identify potential professional implementers (BDS providers, institutes in the cluster) and help them create a good relationship with the stake holders in order to facilitate the process of institutionalisation.

Post project scenario: This is the final stage and by now the intervention should be effectively approaching its conclusion. In this stage all the responsibilities are to be handed over to cluster stakeholders. The stage should ensure that the mechanisms of institutionalisation is in place, relevant skills required for institutionalisation are effectively transferred and the requirement of any recurrent costs is secured.

Key points to remember during implementation stage:

- ❖ Always connect all the activities to a predefined specific purpose
- ❖ There are certain activities which might not relate to a specific purpose directly but might be important to execute for laying a ground or building greater trust. Have this clarity while executing such activities
- ❖ While pilot testing of few activities might not work. Plan alternatives in advance and be ready to change course of action, merge or even drop an activity
- ❖ There can also be a few activities which directly lead to enhancing institutionalisation capacities

Box 9: Change in course of activity in Samalkha Foundry cluster

Samalkha was mostly using first generation moulding technology of Single Blast Cupola (SBC). Globally, enterprises have upgraded to technologies like Divided Blast Cupola (DBC), electric induction furnaces, etc., in increasing order of sophistication. Prevailing processes were leading to higher rejection rate, lower productivity and sub-optimal quality. Improved techniques were widely available in high-end clusters.

The issue was discussed and it was decided to introduce 'match plates' to be used as a pattern for moulding machines. The activity was planned to be completed in six months with a budget of Rs 25 million. Initiation of the activity required awareness creation, so an exposure visit was organised to the Coimbatore cluster. After the visit, unit owners were motivated to try hand moulded plates. But the trials failed owning to the reason that the unit owners were so enthusiastic to replicate what they had learned through the exposure visit and in the process showed lesser interest to the technical expert's advice.

The course of activity had to be changed and the second time around, a few samples were ordered from Agra in Uttar Pradesh. The plates were tried again but in vain. Third time, plates were ordered from Goraya and this time the initiative went a step ahead as the first lot of plates made was ok but their trials failed. Finally, the plates were ordered from Ahmedabad, Gujarat and this time however, the plates made were ok, the trials were also successful, but the attempts of replication failed.

The activity initially planned for six months took one and half years with an Rs.5 million increase in the budget. The course had to be changed often but with every change the activity was moving a step ahead. Numerous trials did generate the desired result, though much later, and increased the level of trust among the key stakeholders, the CDA and the technical expert.

Exit strategy

It is advisable to formulate and plan the exit strategy well in advance. The time to plan may vary for different projects but ideally it should be prepared six months before the end of the project. Exit strategy is like a reminder for the CDA to consciously withdraw from the field and delegate the majority responsibility to the local stakeholders. During this stage, the focus should be on identifying the critical gaps which can affect the sustainability and bridging them. This can be achieved by strengthening the linkages, identifying and planning the future.

Conclusion

Promoting innovation in clusters in the 21st century, an era of rapid and radical changes across the globe, in the light of globalisation and fast moving economies, the usage of ICT tools for implementation will surely be an added advantage. The purpose of such tools could vary, starting from awareness creation, information sharing to monitoring and evaluation, providing recognition and even institutionalisation. The modern ICT solutions, internet in particular, offer numerous possibilities for supporting and enhancing efficiency of implemented activities and clusters at large. Three central areas of application of ICT in cluster could be: information, communication and cooperation and coordination. Some of the available tools that can be used are:

a) Cluster's Website: The website ensures word wide presence of the cluster. This can be created at a comparatively low expense, although great importance should be given to professional design and search engine optimisation (SEO), to ensure that the website is easy to locate for potentially interested people. The use of websites is essentially limited to external presentation. However the functionality can be supplemented by regular communication and information sharing.

b) Collaborative Software or Groupware: It is the software which supports cooperation in a group over time and space. It can be used as a tool or platform for storing and providing information and also for internal communication and coordination. Most groupware have a web based interface with the following functions:

- Documents
- Messages
- Announcements
- Events
- Links
- Tasks
- Calendars
- Surveys
- Discussion board

Groupware comes in both commercial and freeware form. Some of the best known groupware packages are:

- Simple Groupware (http://www.simple-groupware.de)
- OpenGroupware.org (http://opengroupware.org)
- eGroupWare (http://www.egroupware.org)

- PHPROJEKT (http://www.phprojekt.com)
- MS Share Point (http://www.microsoft.com/windowsserver2003/technologies/sharepoint)

c) Social Media: These are the virtual networks like twitter, LinkedIn, facebook communities, blogs, various online forums, etc. It can come in handy for awareness creation and information sharing. It can also be an effective tool for recognising and rewarding individuals and associations.

Monitoring and Evaluation (M&E)

The process of M&E needs to be done for each stage of cluster development, i.e. Diagnostic Study, Trust Building, Action Plan and Implementation. It should be done both through formal processes as detailed below, as also through critical informal tools of cluster visits and unstructured informal discussions with stakeholders. It is critical to record that the presentation of data post M&E will depend on the level at which it is being discussed. While the one given below are for discussion at the cluster and project level, separate summary parameters need to be created, depending on the project's need for policy level monitoring and evaluation. Not the least, entire process is time consuming thus require trained staff and financial allocation.

Monitoring

Monitoring is the process of gathering data for ongoing CDP during its lifetime and comparing it with corresponding targets as laid down in various formal documents like CDP methodology document, project document, action plan prepared, implementation strategy chalked out by the project implementation team, etc. Monitoring is generally carried out on a continuous basis during the project lifetime by the project team. Also, groups of cluster stakeholders, like Cluster Coordination Committee, can do policy or directional level project monitoring for feeding into the mainframe monitoring system of the agency[5]. Frequency of monitoring depends on the stage of the project.

Depending on the stage of CDP that is being evaluated, it includes measuring parameters like:

- Appropriateness of the methodology for diagnosing the problem set
- Status of system put in place for implementation
- Status of linkages among stakeholders
- Status of implementation in consonance with action plan

[5] The exact monitoring system needs to be detailed at the beginning of the project and role of the project team and committees formed for this purpose can be detailed depending on the project goals.

- Degree to which activities are translated into anticipated outputs, e.g. network formation, linkage creation, promoting innovation network, etc.
- The immediate effects of these outputs on key impact indicators like technology transfer, technology creation, technology marketing, infrastructure created, systems put into place, etc.

Evaluation

Evaluation takes place both during the lifetime of a project and after. During the project life span, it is a function of the stage of the project and during that time it is at best carried out twice, once preferably mid-way through the project; and once after project is completed. The evaluation process works on the following areas, depending on the stage of the CDP:

- Efficiency: Achievement of overall learning with respect to activity review, degree to which project activities and outputs (the means to achieve output and impact) have led to tangible changes on key impact indicators like technology transfers, technology development and commercialisation, etc.
- Views of the stakeholders on the project
- Status of project implementation beyond project scope, for e.g., contribution towards overall innovation atmosphere, say, for other industries in the region or say the policy level impact on innovation promotion.

Given below is the process of monitoring and evaluation for different stages of CDP.

M&E of Diagnostic Study (DS)

Monitoring of DS

Step 1: Preparedness of the DS team needs to be assessed. The team must have a representation of the project implementing agency and a technical person who understands the industry. Questionnaire should be reviewed, sample must include all types of stakeholders and interview pattern should be such that each interviewee feels confident enough to voice his / her views. These need to be monitored before commencing the study.

Step 2: DS should be reviewed mid-way to ensure that the results are micro in nature and would lead to an implementable action plan. Samples surveyed should be reviewed and representativeness should be ensured.

Evaluation of DS

Step 1: With the help of an expert ensure that:

- The proposed action plan is matched with SWOT. Further, SWOT is in consonance with Analysis of Major Business Operations (AOBO).
- The parameters for evaluation are detailed and placed in a logical framework.
- The action plan is representative of all types of primary stakeholders.

Step 2: Validation of DSR by cluster stakeholders, both factually and for their acceptance to ensure their commitment to the action plan.

M&E of Trust Building

Monitoring of Trust building

The process of trust building can be monitored through a cooperation matrix (Table 11). A cooperation matrix represents associations and networks on the vertical axis while horizontal axis is represented by the same associations and various technical and financial stakeholders. Each non-diagonal cell represents the linkage between support stakeholders and the respective networks of principal and support firms. Diagonal cells represent the level of linkage of either a network or an enterprise. The process can be monitored by considering two situations – status of linkage in current period (situation B) as compared to situation in another period (situation A). For trust building purpose a periodicity less than a quarter is not meaningful.

Table 11: Cooperation Matrix

Type of network	N1		N2		N3		Venture Fund		Academia	
	A	B	A	B	A	B	A	B	A	B
Association of firms (N1)										
Network of start-ups(N2)										
Network of mentors (N3)										

Types of networks and associations can be local BMOs, group of mentors, e-group of students, research scholars (likely innovators), network of start-ups, etc. Support stakeholders can be technical and financial institutions, a venture capital fund, a state level innovation promotion agency,

individual innovators willing to promote the local innovation atmosphere, local academic institutions, and so on. The necessary scoring for each cell can be as given in Table 12 below.

Table 12: Necessary Scoring for each Cell

Scores	Characteristics
0	No linkage, no impact on cluster
1	Poor linkage, very little impact on cluster
2	Fair linkage, some impact on cluster
3	Good linkage and significant impact on cluster
4	Very good linkage and very good impact on cluster

Ordinal or Likert scale, whatever tool be used for necessary scoring purpose would attempt to classify degree of linkages and the degree of their impact according to whether they have more or less of a characteristic. CDA or FA needs to know that this would help in the measurement of degrees of difference but not in gauging specific amount of differences. Though the scoring method would help FA to measure degree of difference regarding status of linkages in the given context, chances are low that the quantum and magnitude be established. Also, it is quite possible that different users of this matrix would have different understanding of what constitutes "good linkage" or "significant impact". And therefore, CDA or FA needs to define "good linkages" and "significant impact" in the specific context of the cluster they are operating in.

Evaluation of Trust Building

The process of trust building refers to creation of social capital. Social capital is embodied in various formal and informal networks created and technical and financial institutions, service providers introduced or energised and their level of maturity. This can be measured by making a comparison of their active numbers and their maturity level. This process of trust building takes place either directly, that is through introductory handshake activities (without any direct results), or indirectly, that is through implementation, and together they result in sustainability of the cluster to implement joint activities even beyond the project life span.

The process of trust building can be evaluated with the help of 'Sustainability Index'. Sustainability index worked out during mid-term evaluation will provide vital directions for taking corrective measures. Sustainability index calculated at the end of the project suggests the chance that the cluster, through its various networks, technical and support institutions and BDSPs, will continue to

promote joint actions and passive cooperation within itself. Thus, if sustainability index is 30, we can broadly say that there is a 30 per cent chance that the cluster will continue to promote CDP activities in the cluster.

Sustainability Index

Sustainability of efforts should show higher capacity in governance as described below:

- ❖ Cooperation among firms in the form of networks, joint activities, consortia, and associations.
- ❖ Cluster management and administration units that may have been created and are thriving.
- ❖ New support institutions and private entities that have joined the cluster, or have been created in it.
- ❖ Emergence of specialised support service providers (if missing before the intervention) and their active involvement in the development process.

Presence of intermediaries in sufficient numbers and their capacity will vary over the period of intervention. Even at the conclusion of a programme of say three year duration by an implementing agency, the intermediaries might not mature fully.

To assess the preparedness of the intermediaries who will ensure self-governance in the cluster, one can use a tool called the sustainability index. Sustainability index measures the degree of sustainability of operations by the cluster itself at any point of time. The sustainability index can be constructed at regular intervals during implementation.

As mentioned above, the intermediaries can be grouped into

a) Networks or associations,

b) Support institutions and service providers

c) Brokering institutions

In a demand driven methodology, the importance of networks or associations will be the maximum, as demand from their side will make other intermediaries move. The support institutions and the service providers will have to address those needs promptly to keep the momentum of business cooperation going. The brokering institutions will need to coordinate such mechanisms and create an atmosphere of smooth operations.

Thus, the highest weightage can be allotted to networks or associations (60 per cent), followed by support institutions and service providers (30 per cent) and brokering institutions (10 per cent) to demonstrate their importance in the sustainability index. Also, in each group, one can divide a total weightage of 100 among various group members as per their perceived importance with respect to criticality and cluster coverage. A weighted value of each member of a group can be derived by assigning a weightage pattern as given in Table 13. The sum total of weighted index of each group can then be further weighted by 60 per cent for the group of networks or associations, 30 per cent for the group of support institutions and service providers and 10 per cent for the group of brokering institutions. The gross value of the sustainability index will indicate the preparedness of the cluster with respect to self-governance.

Table 13: Sustainability Index for an imaginary pharmaceutical Cluster 'X'

	Weight	Score		Weighted Score	
		Jun-03	Jun-06	Jun-03	Jun-06
Networks/Associations of stakeholders					
Association of firms	30	3	4	5.4	7.2
Association of start-ups	20	0	7	0	8.4
Association of mentors	10	0	4	0	2.4
Network of service providers	10	0	7	0	4.2
Network of Pharma students all over India	10	0	3	0	1.8
Likely networks	20	0	0	0	0
Total	***100***	***3***	***25***	***5.4***	***24***
Support Institutions					
Local pharmaceutical college	5	5	6	0.75	0.9
Local R&D centre	10	3	10	1.8	3
Local medical devices college	5	2	2	0.6	0.3
Associations of venture capital fund	10	6	7	3.6	2.1
Local venture capital fund	10	0	5	0	1.5
Local BDSPs	10	0	5	0	1.5
Likely future service providers and institutions	50	0	0	0	0
Total	***100***	***16***	***35***	***6.75***	***9.3***

Brokering Institutions					
Cluster Innovation Centre	100	0	3	0	3.0
Total	***100***	***0***	***3***	***0***	***3.0***
Grand Total	**300**	**19**	**63**	**12.15**	**36.3**

The weights for inter group and also intra group can be changed as per the need for the cluster. It is important that the weights which are once given for a cluster are not changed, or if changed, then the sustainability index needs to be recalculated from the beginning. Also, the scorer needs to be pragmatic in giving scores, a situation may arise when the need is improving but not the scope to give a higher score.

M&E of Action Plan

Monitoring of an Action plan

Monitoring of an action plan is to be done by simplifying an activity. Any activity, however simple, can be broken down into even simpler sub-activities. This can be explained as follows. Let there be an activity (numbered 2.5 in action plan of a year) creating a new design and linking with a buyer. This activity can be divided into various sub-activities.

- Identification of new buyers
- Identification of a designer
- Discussing with them the desired products and costing
- Agreement on cost sharing
- Creating networks
- Development and selection of designs
- Creation of production plan
- Creating linkages through the first set of orders
- Do a follow-up support
- Disseminate learnings

Thus activity 2.5 can have ten sub-parts. Similarly let us assume that activity 3.1 (mentioned in table 14 below) has seven sub-parts out of which 1, 2, 3 were completed lets say by September. Similarly assumption can be made that activity 4.1 has six sub-parts and one to four have been completed by September, and sub-part five will be completed by October and sub-part six will be completed by

November or December. Again assuming that activity 5.1 has eight sub-parts, part one and two will be done simultaneously and will be completed by February and March. Accordingly, following activity timeline detailing emerges.

Table 14: Activity Timeline

		OCT	NOV	DEC	JAN	FEB	MAR
2.5	Creation of new design and brochure	1,2	3,4	5,6	6,7	8	9,10
3.1	Workshop on Technology Up-gradation of Furnace	4,5	6,7				
4.1	NDA for Special Purpose Vehicle (SPV)/ association	5	6	6			
5.1	Workshop on Importance of pollution abetment					1	2

In the absence of such detailing monitoring of an activity cannot be done objectively and hence it is required to be done on a monthly basis.

Evaluation of Action Plan

Evaluating the action plan will help not only in understanding the progress of activities, but also in verifying realisation of the immediate output as per the annual action plan, identifying the successful implementing agencies and their respective areas of operation (implementing agency and activity name), and the participating and non-participating institutions (support institutions involved). Various new activities will surface (fall outs) and previously identified joint activities or proposed areas of primary cooperation will drop out as they turn out to be of little use. This will help to identify and help prepare the cluster for likely problems or problems being faced. It will also help in coverage and spread (direct beneficiary) and indicate impact on the overall development indicators (impact on start-ups). In particular the outcome of activities on identified start-ups and likely innovative community will help give added attention towards covering such under privileged groups, for identified activities as per action plan.

Table 15: Evaluation of Implemented Action Plan									
S.No as per Action Plan	Activity name	Direct beneficiary	Implementing agency	Support institutions	Outcomes (so far)	Problems faced	Impact on start-ups	Impact on innovation community	Fall out
1									
2									
3									
4									
5									
	Un-planned activity	Direct beneficiary	Implementing agency	Support institutions	Outcomes (so far)	Problems faced	Impact on start ups	Impact on innovation community	Fall out
UP1									
UP2									
UP3									

Note: UP = Unplanned. There are 5 planned and 3 unplanned activities in this quarter, for instance.

Evaluation of the action plan can be done annually. Based on inputs as given in the table above, the action plan for the next year can be made more practical and with higher realisation of planned activities.

M&E of Implementation

M&E of Output and Outcome

M&E of implementation will highlight both on the anticipated outputs and key impact indicators as given below in table 16. The sources of such indicators are all primary data collected during relevant events, speeches of leaders, project reports submitted to support institutions, group record books (if there is high trust), record of local innovations, local publications, cases studies, results of competitions, follow-up with BDSPs, etc. Above all, the CDA/BMO secretariat should prepare the data books and update it on a regular basis. Validation of such data may be further authenticated based on an interaction with the cluster stakeholders. For monitoring, the process needs to be done every month, and for evaluation, it needs to be done annually.

Table 16: Monthly/Annual/Mid-term/End of Project Output/Outcome table		
Activities (for this month only)	**Number**	**Number of firms benefited**
Output		
Exposure visits		
Training		
Innovation awards done		
Firms linked to schemes		
Start-ups created		
Start-ups linked		
Networks created		
Business plan competitions done		
Total		
Outcome		
Technology transfers done		
Persons benefited		
Technology developed/promoted		
Technology marketed		
Productivity increased		
Pollution reduction		
Total		

M&E of Expenditure

Apart from monitoring output and outcome, there is also a need to monitor the desired levels of expenditure as detailed in table 17. Monitoring of the expenditure needs to be done on monthly basis. Evaluation of the same can be done annually or during project's mid-term and also at the end of the project.

Table 17: Monthly/Annual/Mid-term/End of Project Expenditure Table					
S.No.	**Activity**	**Amount Spent (Value in Rupees), Period**			
	Planned	Promoting Agency	Cluster Stakeholders	Support Institutions	Total
1					
2					
3					
4					
5					
UP1					
UP2					
UP3					
	Total				

Note : 1. UP = Unplanned, 2. There are 5 planned and 3 unplanned activities in the quarter, for instance.

M&E of Systems in Place

Similarly, one also needs to monitor as to whether the system that is to implement the project is in place or not. This monitoring also needs to be done on monthly basis, and its trend value can be used for evaluation purposes. These are detailed in table 18 below:

Table 18: Monthly Systems Table			
	Activity as per action plan	Time Plan (Month) (M)	Activity Completed as per time plan (Yes/No)
1.			
2.			
3			
4			
	Total		
	Percentage of activities done as per time plan		A<25/B<50/C<75/D>75

Note: A<25%, B<50%, C<75% and D>75% of activities completed

Views of the stakeholders on the Project[6]

The process of monitoring called in for simultaneous informal interaction is to validate the formal data and also to understand the mood of the stakeholders during the project's life span. The same can be formalised to get very important stakeholder feedback at the time of evaluation – both mid-term for corrective action and also end of project for lessons learnt. Two issues can be evaluated here:

Stakeholders' views on cooperation or joint action framework

The following parameters may be evaluated at this juncture:

- Evaluation of the cooperation group
- Evaluation of the cooperation process, project structure
- Evaluation of project management
- Description of satisfaction
- Description of missing aspects
- Proposals for optimisation
- Desirability of continuing

This checklist will provide a quantitative evaluation of the cooperation project and its progress, and also with a qualitative description of the level of satisfaction. The qualitative comments in particular can help the cluster team with ongoing optimisation of its services. In Table 19 provides scores to

---

[6]The entire section has been taken from Cluster Management – A Practical Guide, Part B: Tools, by Gunter Scheer and Lucas Bonzallinger for GTZ (now GIZ)

detailed parameters for each of the above principal parameters. The scores for the same can vary between 1 and 4.

Table 19: Stakeholder Satisfaction Table				
	1	**2**	**3**	**4**
1. How do you rate the cooperation group in terms of the following characteristics?				
Composition				
Number of businesses				
Size of businesses				
Professionalism of businesses				
Willingness to cooperate, culture of cooperation				
Innovation potential				
Network's openness to new partners				
2. How do you rate the cooperation process to date or project progress of the cooperation group?				
Identification of issues and goals				
Choice of partners				
Allocation of tasks				
Distribution of resources				
Rules for collaboration				
Creation of trust between businesses				
Aid with implementation (consulting, coaching, moderation)				
Number of cooperation projects				
Quality of results to date of cooperation				
Speed of implementation in networking				
Network management, project management				
Balance of give and take (with reference to own organisation)				
3. How do you rate the project management (project team)?				
Technical competence				
Project management				

Strategic orientation				
Ability to communicate				
Content of events				
Organisation of events				
Competence in resolving problems and conflict				
Consulting competence				
Creativity				
Social capital				
Networking competence				
4. What has particularly pleased you about the cooperation group to date? (Give your criteria and then score)				
5. What has not pleased you to date? What do you feel was missing? (Give your criteria and then score)				
6. What are your most important suggestions for optimising the future course of the group? (Give your criteria and then score)				
7. Do you have any other comments?				
8. Does continuing the cooperation project make sense for your own business?				

Score: Absolutely, yes! = 1
Yes, but only subject to the suggested changes being made. = 2
Still unclear – I need time to get a real feel for the benefits. = 3
Not in any circumstances! = 4.

Project Evaluation (by Participants/ Stakeholders)

The questionnaire is aimed at people filling various roles within the project, and covers eight questions on the different aspects and phases of a project (launch, process, and achievement of objectives).

Table 20: Survey on satisfaction with the project					
What was the nature of your involvement in the project?					
	1	**2**	**3**	**4**	**5**
How satisfied were you with the project launch, goal formulation and project plans? *Comments if any:*					
How satisfied were you with the distribution of tasks and authority and the information flow? *Comments if any:*					
How satisfied were you with the assignment of the team and its way of working? *Comments if any*:					
How satisfied were you with the support from the project management? *Comments if any:*					
How well were the project goals and sub-goals achieved? *Comments if any:*					
How do you rate the project in terms of the time and money spent and the expected or achieved results? *Comments if any:*					
What improvements should be made in implementing further projects? *Comments if any:*					

Grading system: 1 = Excellent, 2 = Good, 3 = Satisfactory, 4 = Could be better, 5 = Not sufficient

Immediate Impact

Immediate impact needs to be differentiated from impact assessment study of projects, generally carried out after a gap period once the project is completed. The process of immediate impact

monitoring can also be done by discussing the changes that might have occurred during the process of implementation. This can be gauged by:

- Interacting with other clusters in the area and getting their views on the innovation process and thoughts on the developments.
- Interacting with state or central level policy makers for gauging their benefits in project promotion.

Impact can also be measured across the broad categories of activities decided to be implemented during the project. An indicative list of the broad categories and their respective impact parameters is given below in Table 21:

Table 21: Impact Assessment Parameters

S.No.	Typology of Intervention areas	Possible Categories of Activities	Parameters for measuring outcomes and impact
1	Cluster buzz	Award and competitions, Media linkages, dissemination of success stories, usage of social networking leading to a positive enthusiasm about the cluster and its potential	• Awareness at national and international level regarding the cluster and its activities • Number of success stories disseminated in the form of articles, PPTs, case studies, reports and so on
2	Knowledge support	Promoting Industry Institution linkages, setting up of interface cells, ideation workshops and provision of risk sharing mechanisms help undertake common R&D projects, generate new ideas and ensure mutually rewarding relationships between industry and institutions Promote strategic BDS	• Mechanisms for undertaking collaborative industry relevant projects established • Expenditure by industry in R&D or collaborative projects • No. of new products, prototypes ready • No. of new prototypes identified and supported
3	Global pipeline of entrepreneur ready technologies	Support research to identify the current and future technology requirements of the industry, stimulate the identification and sourcing of appropriate technologies that help build a strong pipeline of entrepreneur ready technologies	• Easy accessibility to latest knowledge from around the world • Number of international journals, newsletters subscribed by the cluster associations / institutions • Number of national / international relevant

			seminars, events attended • Innovators, researchers, scientists, industry and students linked with the existing global knowledge pipelines
4	Talent recruitment	Identification of talent pools as per the current and future requirements, scoping the sources of talent and strengthening linkages that facilitate recruitment of talent in the industry and other cluster stakeholders	• Number of mentors identified and linked • Number of students linked and hired by the industry • Number of academic, technical institutions linked with the industry
5	Technology adoption	Enabling technology adoption (usually a high end one) by helping build local capacities of the technology seekers, financial stimulus to individual enterprises, workshops, seminars, trainings for service providers.	• Number of participations in technology transfers events • Number of industry relevant technologies identified • Number of technologies transferred
6	Technology diffusion	Stimulating the flow of and supporting dissemination of existing technologies through creation or strengthening of intermediaries' capabilities that create awareness and enable faster take up of those technologies through awareness programmes, preparation and dissemination of technology usage guidelines and organisation of workshops and seminars that provide a platform for a rapid technology diffusion	• Number of enterprises which adapted new or existing technologies • Amount of business generated by increased efficiency after the technology adaption
7	Start up dynamism	Help build a mentoring group, facilitate linkages between mentors and start-ups, support linkages of start-ups with risk capital providers and other knowledge institutions and / or individuals	• Increase in the number of start ups, angel investors relevant BDSPS, venture capitalists

8	Market interface	Stimulate understanding of potentially new applications of the products / services through ideation and BDS provision, support new ways to address explorations of new markets, thus creating new markets and new market interfaces	• Increase in cluster's turnover • No. of leads generated in the new markets, No. of new markets captured • Share of new markets' business in the cluster's turnover
9	Creation of New Platform	Facilitating joint activities, linking with a common platform or network, mergers. Acquisitions, strategic partnerships for scaling-up.	• Number of new platforms created- formal and informal both • Number of business partnerships, mergers. • Number of leads generated after participating in the joint event or while sharing a common platform

Bibliography

- AIMA & Accenture, 2010, India's Quest for Inclusive Growth: Achieving High Performance through Inclusive Business Models- A Research Report, Accenture

- Altenburg, Tilman. & Meyer-Stamer, Jörg., 1999, How to Promote Clusters: Policy Experiences from Latin America. World Development, Vol. 27, No. 9, pg. 1693-1713

- Anderson, Thomas., Serger, Sylvia., Schwaag, Sörvik., Jens, Hansson., Emily Wise., 2004, The Cluster Policies White Book, IKED, Sweden

- Annual Report, 2011-2012, Department of Science and Technology, Government of India

- Arikan, Anda T., 2009, Inter-firm knowledge exchanges and the knowledge creation capability of clusters, Academy of Management Review, Vol. 34, Issue 4, pg.658

- Arthurs, David.,Cassidy, Erin., Davis, Charles H., Wolfe, David.,2009, Indicators to support innovation cluster policy, Int. J. Technology Management, Vol. 46, Nos. 3/4, pg. 263-279

- Asheim, Bjørn., Coenen, Lars., Vang, Jan., Moodysson, Jerker., 2005, Regional Innovation System Policy: a Knowledge-based Approach, LUND University, SWEDEN

- Aubert, Jean Eric., 2010, Innovation Policy for the Developing World Success stories and promising approaches, Vol. 12,Development Outreach (pg 7-9), World Bank Institute, Washington DC

- Basant, Rakesh., Chandra, Pankaj., Upadhyayalula, Rajesh S., 2011, Knowledge Flows and Capability Building in the Indian IT Sector: A Comparative Analysis of Cluster and Non-Cluster Locations, Working Paper No. 2011-10-02, Indian Institute of Management, Ahmedabad

- Basant, Rakesh., 2002 Knowledge Flows and Industrial Clusters- An Analytical Review of Literature, Indian Institute of Management, Ahmedabad

- Bathelt, Harald., Malmberg, Anders. and Maskell, Peters., Clusters and Knowledge: Local Buzz, Global Pipelines and the Process of Knowledge Creation, DRUID Working paper 02-12, (87-7873-128-3)

- Bell Martin, Albu Micheal., 1999, Knowledge System and Technological Dynamism in Industrial Clusters in Developing Countries, Vol. 27, No. 9, pg. 1715-1734, World Development, Elsevier Science Limited, Great Britain

- Boosting Innovation the Cluster Approach (1999) OECD

- Breschi, Stefano & Malerba, Franco.,2001, "The Geography of Innovation and Economic Clustering: Some Introductory Notes," Industrial and Corporate Change, Oxford University Press, vol. 10(4), pg. 817-33.

- Brinkley, Ian & Lee, Niel., 2007, The knowledge economy in Europe, The Work Foundation

- Macaulay , Linda A., Miles, Ian, Wilby, Jennifer., Leng Tan,Yin., Zhao, Liping., Theodoulidis, Babis., 2012, Case studies in Service Innovation, Springer New York, USA

- Myint, Yin M., Vyakarnam, Shailendra., and New, Mary J., 2005, The Effect of Social Capital in New Venture Creation: The Cambridge High-Technology Cluster (http://www.cfel.jbs.cam.ac.uk/research/publications/downloads/myint_effect_2005.pdf~~f~~)

- Cecilia, Gabriela., (——) Cluster Policy And Entrepreneurship Promotion In Transition Countries In See: The Case of Romania (http://www.upm.ro/proiecte/EEE/Conferences/papers/S621.pdf)

- Smart specialization in Europe: European specialization data by region (2011), Center for Strategy and Competitiveness, Stockholm School of Economics, Stockholm

- Chakma, Justin., Masum, Hasan., Prempaldas, Kumar., Heys, Jennifer., Singer, Peter A., 2010, Case Study- India's billion dollar biotech, Nature Biotechnology, Vol. 28, Issue 8,pp783

- Chaminade, Christina & Vang, Jan., 2006, Innovation policy for Asian SMEs: Exploring cluster differences, Paper no. 2006/03, Lund University, Sweden

- Clarysse et al. 2005, Spinning out new ventures: a typology of incubation strategies from European research institutions, Journal of Business Venturing 20, pg. 183-216

- Cluster Navigators Limited, 2001, Cluster Building: A toolkit(A manual for starting and developing local clusters in New Zealand), Cluster Navigator Limited, New Zealand

- Competitive Advantage-The Cambridge Cluster Report 2008, Library house, Cambridge

- Conlé, Marcus., Taube, Markus., 2010, Working Paper on Anatomy of Cluster Development in China: The case of health biotech clusters, University of Duisburg-Essen, Mercator School of Management, Disburg Working Paper on East Asian Studies No. 84/2010

- Connell, David., Probert, Jocelyn., 2010, Exploding the Myths of UK Innovation Policy: How 'Soft Companies' and R&D Contracts for Customers Drive the Growth of the Hi-Tech , Centre for Business Research, University of Cambridge

- Cooke, P. and Clifton, N., 2002, Social capital and SME performance in the United Kingdom, Centre for Advanced Studies, Cardiff University

- Crescenzi, Riccardo & Rodríguez-Pose., Andrés, Storper., Michael, (——) The Territorial Dynamics of Innovation: A Europe-United States Comparative Analysis, London School of Economics, UK

- DAMVAD, 2011, The impacts of Innovation Networks in Denmark - An impact study on behavior and possible economical effects of Innovation Network Denmark, Danish Agency for Science, Technology and Innovation, Denmark

- Davis, Charles H., Arthurs, David., Cassidy Erin., Wolfe, David., 2006 .,What Indicators For Cluster Policies in the 21st Century, Ottawa

- Dehgan, Alex., 2010, Transforming Development through Science, Technology and Innovation- A White paper for Discussion, USAID

- Delgado, Mercedes., Porter, Michael E., Stern Scott., 2010, Clusters and Entrepreneurship Journal of Economic Geography, pg. 1-24

- Dutz, Mark A., 2007, Unleashing India's Innovation, The International Bank for Reconstruction and Development / The World Bank, Washington DC

- Ecotec Research & Consulting, A Practical Guide to Cluster Development-(A Report to the Department of Trade and Industry and the English RDAs, England Regional Development Agencies, UK (http://www.bis.gov.uk/files/file14008.pdf)

- END OF PROJECT REPORT – PROJECT US/GLO/04/116 - Thematic Cooperation between UNIDO and Swiss Agency for Development & Cooperation (SDC) in the area of SME Cluster Development and Corporate Social Responsibility (CSR)

- EU-Japan Centre for Industrial Cooperation, Seminar Report, 2011, EU-Japan Clusters Policies Towards SME's Innovation, European Commission, Brussels

- European Commission, 2008, The Concept Of Clusters And Cluster Policies And Their Role For Competitiveness And Innovation: Main Statistical Results And Lessons Learned- Commission Staff Working Document, European Commission, Brussels

- European Commission, 2008, Towards world-class clusters in the European Union: Implementing the broad-based innovation strategy , European Commission, Brussels

- Etzkowitz, Henry., Dzisah, James., Ranga, Marina., Zhou, Chunyan., 2007, The triple helix model of innovation- University-industry-government interaction, Techmonitor Jan Feb 2007, pg.14-23

- Feller, Andrew., Shunk, Dan, Callerman Tom., 2006, Value Chains Versus Supply Chains

- Gilles Duranton, 2011, "California Dreamin': The Feeble Case for Cluster Policies," Review of Economic Analysis, Rimini Centre for Economic Analysis, vol. 3(1), pg. 3-45

- Giuliani, Elisa., 2002, Cluster absorbtive capability: An evolutionary approach for industrial cluster in developing countries (Paper presented at DRUID Summer conferenceon 'Industrial Dynamics of old and new economy- who is embracing whom?, Copenhagen

- Gordon, Ian R., McCann Philip (——)Clusters Innovation and Regional Development (http://www.cepr.org/meets/wkcn/2/2334/papers/gordon.pdf)

- Hertrog, Pim den (——) The Role of Cluster Policies in Economic Growth and Competitiveness (with an illustration from the Dutch Horticulture cluster), (http://www.adiat.org/es/documento/35.pdf)

- Herzberg, Benjamin &Wright Andrew (——) The PPD Handbook- A TOOLKIT FOR BUSINESS ENVIRONMENT REFORMERS (http://siteresources.worldbank.org/INTEXPCOMNET/Resources/PPD_Handbook.pdf)

- Immelt, Jeffrey R & Govindarajan, Vijay & Trimble., Chris., 2009, How GE is Disrupting itself? , Harvard Business Review

- INNO Germany AG, 2010, Clusters and clustering policy: a guide for regional and local policy makers, European Commission, Brussels

- Innovation clusters in Europe: A statistical analysis and overview of current policy support- Enterprise and Industry Directorate-General, EUROPEAN COMMISION

- Innovation Index OREGON 2007, Oregon Economic and Community Development Department

- Innovation Nation, Department for Innovation, Universities & Skills, Crown copyright2008(http://www.bis.gov.uk/assets/biscore/corporate/migratedD/ec_group/18-08-C_b), UK

- Innovation Readiness of Indian SMEs: Issues and Challenges, 2012, FICCI

- INNOVATION, STRATEGY, and STRUCTURE - Organizations, Institutions, Systems and Regions at Copenhagen Business School, Denmark, June 15-17, 2011

- International Trade Department, 2009, CLUSTERS FOR COMPETITIVENESS:A Practical Guide & Policy Implications for Developing Cluster Initiatives, World Bank, Washington DC

- Jayaraman, T., 2009, Science, Technology and Innovation Policy in India under Economic Reform: A Survey (http://www.networkideas.org/ideasact/jan09/PDF/Jayaraman.pdf)

- Jordan, James F., and Kornblith, Paul L., 2009, Pittsburgh's Targetted Incubator: Taking innovations to next level, Science Progress, Issue 2, pg 22-28

- Journal of Competitiveness, January 2011, volume 1, Issue 1

- Karlsson, Charlie., 2007, Clusters, Functional Regions and Cluster Policies, Paper No. 84, CESIS (Electronic Working Paper Series).

- Lämmer-Gamp, Thomas., Meier zu Kôcker, Gerd., Christensen, Thomas Alslev., 2011, Clusters are Individuals- Creating Economic Growth Through Cluster Policies for Cluster

- Maastricht Economic and social Research and training centre on Innovation and Technology (UNU-MERIT), European Innovation Scoreboard 2007- Comparative Analysis Of Innovation Performance , European Commission, Brussels

- Manufacturing Competitiveness –Shift Focus to Development of Private Sector Tool Rooms-Case Study by Grant Thornton, The case is based on a study carried out by Grant Thornton's Industrial Infrastructure and Cluster Development Advisory Team for GIZ and MoMSME Management Excellence, The Danish Ministry of Research, Innovation and Higher Education, Denmark

- Leitao, Joao., 2006, Open Innovation Clusters: The Case of Cova da Beira Region (Portugal), MPRA Paper No. 488, (http://mpra.ub.uni-muenchen.de/488/)

- Li and Fung group, 2010, Update on Industrial Clusters in China , Industrial Cluster Series, Issue 6, Li and Fung Research Centre, China

- Maastricht Economic and social Research and training centre on Innovation and Technology (UNU-MERIT), European Innovation Scoreboard 2007- Comparative Analysis Of Innovation Performance , European Commission, Brussels

- Manufacturing Competitiveness –Shift Focus to Development of Private Sector Tool Rooms-Case Study by Grant Thornton, The case is based on a study carried out by Grant Thornton's Industrial Infrastructure and Cluster Development Advisory Team for GIZ and MoMSME

- Mc Gregor, James., (——) China's Drive for "Indigenous Innovation" – A web of industrial policies (http://www.uschamber.com/sites/default/files/reports/100728chinareport_0.pdf)

- Menzel, Max Peter., Fornhal, Dirk., 2007, Cluster Life Cycles-Dimension and Rationale of Cluster Development, Jena Economic Research Paper No. 2007-076, Germany

- Mills, Karen G., Reynold, Elizabeth G., Reamer, Andrew., 2008, CLUSTERS AND COMPETITIVENESS: A new federal role for Stimulating regional economies, Blueprint for American Prosperity, Brooking, Washington DC

- Ministerial report on the OECD Innovation Strategy- Innovation to strengthen growth and address global and social challenges- Key Findings (2010) OECD

- Moreno, Rosina., Paci, Raffaela., Usai, Stefano., 2005, Innovation clusters in the European regions, UniCA Eprints, Italy

- Myint et al.,2005, The effect of social capital in new venture creation: the Cambridge high-technology cluster, Strategic change, Vol. 14, Issue 3 pg.165-177

- National innovation Council, 2010, Creating a road map for a Decade of Innovation- working paper, Delhi

- National innovation initiative summit and report, 2005, Innovate America, Council of Competitiveness, US

- National Knowledge Commission, 2007, Innovation In India, National Knowledge Commission, Government of India New Delhi

- Nevejan, Caroline , 2003, INNOVATION IN INDIA-a travel report

- Nishimura, Junichi., Okamuro, Hiroyuki.,(——), R&D Productivity and the Organization of Cluster Policy: An Empirical Evaluation of the Industrial Cluster Project in Japan, Danish Research Unit for Industrial Dynamics Working Paper No. 10-06 (http://www3.druid.dk/wp/20100006.pdf)

- OECD, 2007, Reviews of Innovation Policy: China, Paris

- OECD, 2010, OECD Studies on SMEs and Entrepreneurship-SMEs, Entrepreneurship and Innovation, OCED

- Hill, Sydney, 2008, Open innovation: Nine Sigma uncovers solutions to the tough engineering problems

- Pavese, Karin Ezbiansky; Hayter, Chris; Satinsky, Daniel, (——) Innovation Roadmap – International Best Practices and Lessons for Russia

- Policy and Status Paper on Cluster Development in India, 2007, Foundation for MSME Clusters (http://msmefoundation.org/folder/Publication/48.pdf)

- Porter, Michael E., Kramer., 2011, Creating Shared Value- How to reinvent capitalism- and unleash a wave of innovation and growth, Harvard Business Review (http://www.hks.harvard.edu/m-rcbg/fellows/N_Lovegrove_Study_Group/Session_1/Michael_Porter_Creating_Shared_Value.pdf)

- Potter, Jonathan & Miranda, Gabriela(ed), 2009, Clusters, Innovation and Entrepreneurship, OECD

- Putnam, R., 1995, Bowling Alone: America's declining social capital, Journal of social democracy, Vol. 6(1), pg 64-68

- Rao, AS., 2011, Managing white spaces in building Innovation Clusters

- Rosenfeld, Stuart A., 2002, Creating Smart Systems- A guide to cluster strategies in less favored regions- European Union-Regional Innovation Strategies- Regional Technology Strategies Carrboro, North Carolina, USA

- Sallet, Jonathan., Paisley, Ed., Masterman, Justin., 2009, The Geography of Innovation: Federal Government and the growth of regional Innovation Clusters, www.scienceprogrss.org, Washington DC.

- Sánchez, Begoña., 2011, Theory and practice of cluster policies- "Making Cities and Regions Fit for Innovation: Research Needs and Policy Perspectives" JIIP Symposium, Brussels

- Scheer, Gunter., Zallinger, Lucas Von., (——) Cluster Management – A Practical Guide, Part A: Overview, Developed for the Economic Development and Employment Promotion Programme implemented , Deutsche Gesellschaft für Technischle Zusammenarbeit (GIZ) GmbH

- Scheer, Gunter., Zallinger, Lucas Von., (—) Cluster Management – A Practical Guide Part B: Tools, Deutsche Gesellschaft für Technische Zusammenarbeit (GIZ) GmbH

- Schneider, Mary-Jane., 2011, Introduction to public health (3rd Edition), Jones & Bartlett Publishers, LLC

- Solvell, Orjan., Lindqvist, Goran., Ketels, Christian., 2003, The Cluster Initiative Green Book, Ivory tower, Stockholm

- Laffite, Pierre (——)The European Cluster Memorandum- Promoting European Innovation through Clusters: An Agenda for Policy Action, European Commission, Brussels

- The International Bank for Reconstruction and Development, 2010, Innovation Policy – a guide for developing countries, World Bank, Washington DC

- Thomsen, Peter Lund., Khara, Navjote., 2011, Making A Last Minute Save? Value Chain Struggles, Work Organization, and Outcomes for Labor in the Football Manufacturing Industry of Jalandhar, India, CBS Working Paper Series, CBS Center for Business and Development Studies, Frederiksberg

- Thomsen, Peter Lund., Nadvi, Khalid., 2010, Global Value Chains, Local Collective Action and Corporate Social Responsibility: a Review of Empirical Evidence, Business Strategy and Environment, Vol. 19, Issue 1, pg. 1-13

- TIP Case Studies in Innovation, The OECD Working Party on Innovation and Technology Policy (TIP) (http://www.oecd.org/science/innovationinsciencetechnologyandindustry/2495364.pdf)

- Transgrud, Robin (——) American Cluster Innovation: Cluster Profiles from the 50 States, Institute for Strategy and Competitiveness, Harvard Business School (http://www.isc.hbs.edu/pdf/ClusterProfiles_WorkInProgress_VerDec2008.pdf)

- UNIDO, 2003, Development of clusters and networks of SMEs: The UNIDO programme- A guide to expert consortia, UNIDO, Vienna

- World Bank, 2009, World Development Report 2009: Reshaping Economic Geography, The World Bank, Washington DC

Website: www.msmefoundation.org