

**IDENTIFYING INNOVATIVE CLUSTERS IN INDIAN
ECONOMY & ITS IMPLICATIONS FOR NATIONAL
INNOVATION POLICY**

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Under Guidance of

PROF. RAJAS PARCHURE

DR. VIJAY BHATKAR

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**IDENTIFYING INNOVATIVE CLUSTERS IN INDIAN
ECONOMY&ITS IMPLICATIONS FOR NATIONAL
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Number of volumes	Thesis (One)
Name of the Student	Manoj K. Singh
Name of Principal Supervisor	Prof. Rajas Parchure
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Month and Year of Submission	July, 2016

Prof. Rajas Parchure
Officiating Director,
Gokhale Institute of Politics & Economics,
Pune - 411004

CERTIFICATE

(FORM 'A')

CERTIFIED that the work incorporated in this thesis entitled "*Identifying Innovative clusters in Indian Economy & its implications for National Innovation Policy*" submitted by Manoj K.Singh was carried out by candidate under my supervision. It is an original contribution and has not been submitted elsewhere for the award of any other degree. Such material as has been obtained from other source has been duly acknowledged in this thesis. I recommend that the thesis should be considered for the award of the degree of 'Doctor of Philosophy'.

Date:

Prof. Rajas Parchure

Place: Pune – 411004

(Research Guide)

DECLARATION

I hereby declare that this thesis on the topic entitled “Identifying Innovative clusters in Indian Economy & its implications for National Innovation Policy” is submitted for the award of Degree of Doctor of Philosophy in Economics to Gokhale Institute of Politics and Economics, Pune – 411004

It is an original contribution and has been completed during my tenure as a research scholar at Gokhale Institute of Politics and Economics, Pune

This thesis has not been submitted by me elsewhere for the award of any Degree or Diploma – part or full. The information gathered by me for the thesis is original, true and factual. Such material as has been obtained from other sources has been duly acknowledged in the thesis. I hereby request, to consider the thesis for the award of the degree of ‘Doctor of Philosophy’.

Place: Pune

Date: July 12, 2016

Manoj K. Singh

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CHAPTER 1: INTRODUCTION

1.1 Economics of Innovation

“One of the most important achievements of contemporary economies and societies is the constant creation of new knowledge. Yet economic theory is still focusing on the problems central to a past epoch: universal scarcity. Economic analysis is still largely focused on the management of scarce resources, what the economists have termed the optimal allocation of factors. Yet the process which characterises today’s economy is the creation of new factors.” (DeBresson, 1996)

It is this shift in the focus of analysis from the allocation and management of resources to the creation of new factors that has made the study of innovative activities central and so much important to modern economics. Various studies (Mansfield et al., 1977; Bresnahan, 1986; Trajtenberg, 1990; Coe and Helpman (1993); Eaton and Kortum (1993) and Lichtenberg (1992); Caballero and Jaffe (1993) related to the growth and developments both at the firm and the national level have recognised the augmenting importance of innovation. The celebrated world leading Economists from Adam Smith to Robert Solow, Ricardo, Marx, Marashall, Schumpeter and Keynes all have recognised the importance of innovation and the role it plays in long term growth and productivity. Even the celebrated critic of the capitalist society, Karl Marx appreciated the importance of innovation and did mention in *the communist Manifesto* that “*The Bourgeoisie (i.e., capitalism) cannot exist without constantly revolutionizing the instruments of production. Conservation of the old modes of production in unaltered form was, on the contrary, the first condition of existence for all earlier industrial classes. The bourgeoisie, during its rule of scarce one hundred years has created more massive and more colossal productive forces than have all preceding generations together. It has accomplished wonders far surpassing Egyptian pyramids, Roman aqueducts and Gothic cathedrals...*” [Marx and Engels, 1847].

The term Innovation was coined by the German Economist Riedel (1839) and sociologist De Tarde (1890). However economics of innovation gained its importance only after the release of the *Locus Classic* "The Theory of Economic Development" by Schumpeter. Innovation thereafter became the central focus and the strings of debates & discussions started. In 1985 The concept of a '*system of innovation*' was introduced by B.A.Lundvall though the idea produced some familiarity to the Friedrich List’s conception of “The National System of

Political Economy” (1841), which according to Freeman (1995) might just as well have been called “The National System of Innovation” .Christopher Freeman coined the expression "National Innovation System". Today Research interests worldwide have gained momentum due to the emergence of the Knowledge based economies. (Freeman, 1987, Lundvall, 1988, Nelson, 1993) and the analysis of innovation practices and policies have become really important since OECD initiated this exercise in 1960s. The incredible growth records of the free-market economies do establish the importance of innovation more than ever. The importance of allocative and adaptive efficiency has always been discussed but the changes in the market, technological conditions, augmenting competition; shortening product life cycles have forced the firms to develop the learning economies and creation of new factors.

The “creation of new factors” or “new combinations” happens due to the interactions between the different economic agents, e.g. the firms, universities, Research and development labs and private and public institutions. Though Schumpeter did mention that the “changes in economic life are not forced upon it from without but arise by its own initiative from within.” (Ibid, P.63), Research efforts focused on National Innovation Systems, cluster analysis, clusters dynamics and cluster-based policy have gained global attention only since 1980s primarily due to the emergence of endogenous theories (Romer 1983, 1986).Economists’ curiosity worldwide grew up to study and analyze the knowledge flows in national innovation systems and how the different economic agents interact to create “new knowledge”.

The clustering of innovative activities has been a topic of interest to many of the celebrated economists. Marshall (1890) in his Principles of Economics talked about the “industrial districts “and how the interactions between people, suppliers and the skilled labor pool could benefit the localized industries.” Schumpeter (1912, 1928, 1935, 1939) talked about the bandwagon effect leading to the spatial clustering because of the imitators following the already proven innovations and the temporary monopolistic rents, i.e. entrepreneurial profit. The sectoral mega-clusters have been discussed by Porter "Nations, whatever their overall level of innovative performance, do not usually succeed across the whole range of industries, but “in clusters of industries connected through vertical and horizontal relationships” (Porter, 1990).

The Chains and Network based Cluster approach (The *Filiere* approach by Montfort,1983;Montfort & Dutaille 1983, Roelandt 1986; Witteveen,1997) demonstrate the

relationship within and between the networks & how the clusters emerge out of the various agents interactions & the cooperative networks .

Many of the observations worldwide suggest the increasing importance of innovative activities & the emergence of new technologies that seem to have supported the view point of the modern endogenous growth theories. The structural change due to the digital revolution in the US is one such example. The economy has witnessed the significant growth of some of the new innovating firms. Almost 40% of the top 200 R&D-performing firms in 2005/2006 were founded after 1980, while 32% of the top 200 R&D-performing firms in 1980 had exited by 2005 (Hall and Mairesse, 2009). The growing contribution by the ICT to the GDP in Indian economy is another example. This may exceed the contribution made by the agriculture industry by 2020 bringing about a significant industrial change. The microeconomics of creation and destruction today is quite visible.

Well did Schumpeter observe:

“The first thing to go is the traditional conception of the modus operandi of competition. Economists are at long last emerging from the state in which price competition was all they saw. As soon as quality competition and sales effort are admitted into the sacred precincts of theory, the price variable is ousted from its dominant position. However, it is still competition within a rigid pattern of invariant conditions, methods of production and forms of industrial organization in particular ... that practically monopolizes attention. But in capitalist reality as distinguished from its textbook picture, it is not that kind of competition which counts but the competition from the new commodity, the new technology, the new source of supply, the new type of organization which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives” Schumpeter, 1939

It is in these contexts that the study of economic linkages and how they influence innovative linkages become relevant and really important. Where and why in Indian economy the innovative activities are likely to occur? Do they occur in the industries having the greatest variety of economic, technological and scientific linkages? What is the strength of these linkages? Do economic linkages matter? What are the limiting factors? Can we estimate the direct and indirect impact of innovative activities? These are the questions that we need to

answer with reference to Indian Economy as they have direct really important and relevant policy implications.

1.2 The Research aims and objectives

The research aims to map the innovative activities in economic space and identify the innovative clusters and the structure of the innovative interactions in Indian Economy. The project will be useful in enhancing the understanding vis-à-vis the innovative clusters' dynamics and how to sustain the growth or influence of these clusters in certain directions.

My focus of analysis through this work is to develop a theoretical construct to facilitate an empirical analysis vis-a-vis clustering of innovative activities in Indian Economy by using Innovation interaction matrices and the Qualitative Input Output Analysis (QIOA). It draws mainly from the work by Christian DeBresson who in his various surveys along with a team of innovation researchers tried to answer as to “how Innovation emerges from normal economic activity?” I aim to confront the following hypothesis by reconciling inter industrial analysis with the study of innovative activities:

- A. *Innovations cluster in part of the economic space (Schumpeter,1937)*
- B. *Varied linkages in everyday economic life tend to favour innovative linkages and clusters(Aitken 1985)*
- C. *Innovative clusters and linkages may contribute to increase the division of labour(smithian hypothesis)*

The objective is to demonstrate & identify the key locations of innovations and how they diffuse in the economy. This will also help us locate the innovative clusters, map the structure of innovative interactions in Indian Economy and establish patterns in clustering and innovative activity. The findings can be very useful for policy decisions and prescriptions to have the structural insight and develop the required Institutional support to promote learning and innovation. The outcome of the research can further be used to understand whether innovative activity happens to be a function of or depends on the prior economic interdependence as manifested by input output analysis and to understand the impact of Indian economic environment on the innovative activities and vice versa.

Innovation here refers to the innovative activities and not the proven innovations per se as it would be known only after the adoption and diffusion whether the innovation is incremental

or radical. *Clustering of Innovative activities refers to the clusters that emerge out of various important interactions between the users and producers.*

1.3 The Research Questions

The research questions addressed in the thesis are as follows:

- How does Innovation emerge from normal economic activity in Indian Economy?
- What is the structure of innovative interactions? Who are the main suppliers and users of innovative activities?
- Where do innovative acts exist in economic space and how their relative distribution in this space can be measured?
- What is the impact of economy on innovative activity?
- What are the constraints and incentives in the way agents interact and as such why innovative activities cluster?
- What are the policy implications?

1.4 The Methodology

The methodology for the research includes the Innovation Surveys, the compilation of innovative interaction matrices from surveys and Performing Boolean Transactions (Qualitative Input Output Analysis) to analyse the innovative linkages and the clustering of Innovative activities.

1.4.1 The Indian Survey

I have used the methodology of Christopher Freeman & Joe Townsend for the survey in observing the innovative activities (Freeman, 1969, 1974, 1982; Townsend et al., 1981). The unit of analysis in the methodology used for this survey includes the innovative Units and the innovative outputs. The Primary survey included meeting the R&D personnels, top management Executives and other concerned authorities to find about the innovative outputs. Also the Industrial experts in different industries were asked to identify significant innovations in the industries of their expertise and the subsequent validation was made. The secondary research included Printed Journals, Online Gateways and Databases, e-publications, Online Journals, Government and other regulatory body publications, Books in the context of Innovation, NIS, Clustering and Competence, Reference texts Industry Reports among others. The industry representative of the survey is shown in Table 1.1.

1.4.2 The Indian Innovative-Interaction Matrix

The Innovative-activity matrix is a standard square Matrix in which the rows produce the supplier industries of the innovating business unit and the columns show the user industries. The frequency in each cell tells us the number of times a business unit from a supplier industry has created that business unit's economically most important innovation for and with a business unit in a user industry. A variety of types of innovative businesses coexist within an industrial sector. It should be noted that the meaning of supplier and user happens to be different in case of innovative-activity matrix, as information flows both ways between supplier and the first user. Suppliers are known to innovate "with" as much "for" the initial user.

In the survey, efforts have been made to cover as much of the web of innovative interactions as possible. The information about the first three users and for the three main key component suppliers has been asked.

Innovation interaction Matrices reveal the dynamism of the economy. It tells us about the locations where the innovations happen and how they diffuse in the economy. One of the major advantages of the matrices is that they provide us with information we do not get from Input Output Matrices or the data related to the Research and Development and Patents. R&D does not account for non-formal forms of learning, and therefore accounts for only a fraction (around 10%) of innovative knowledge. Patented inventions represent technological *opportunities*, only a fraction of which (between 10 and 40%) are ever used commercially. Furthermore, R&D and patents only provide the source of origin, *i.e.* the supplier. Potential users of research results and inventions have to be conjectured. (Debresson, 1990)

The survey questionnaire (**Appendix 1**) has included the questions regarding the first three key component suppliers and the first three users, as understanding innovation will not be possible without looking into the producers- users interactions. Compiling the matrices thus obtained can be used for comparison to a detailed mapping of the economy and patented invention (Evenson, 1997) by adopting Leontief I/O tables as a reference template.

The lower left-hand corner (or the rows in a matrix) represents the supplier industries of the innovating business unit, while the lower right-hand corner (or columns in a matrix) represents typical user industries. The value of each cell represents the share of supplier

industry “i”’s innovative sales (for that business unit’s economically most important innovation) to industry “j”.

Figure 1.1 The Methodology

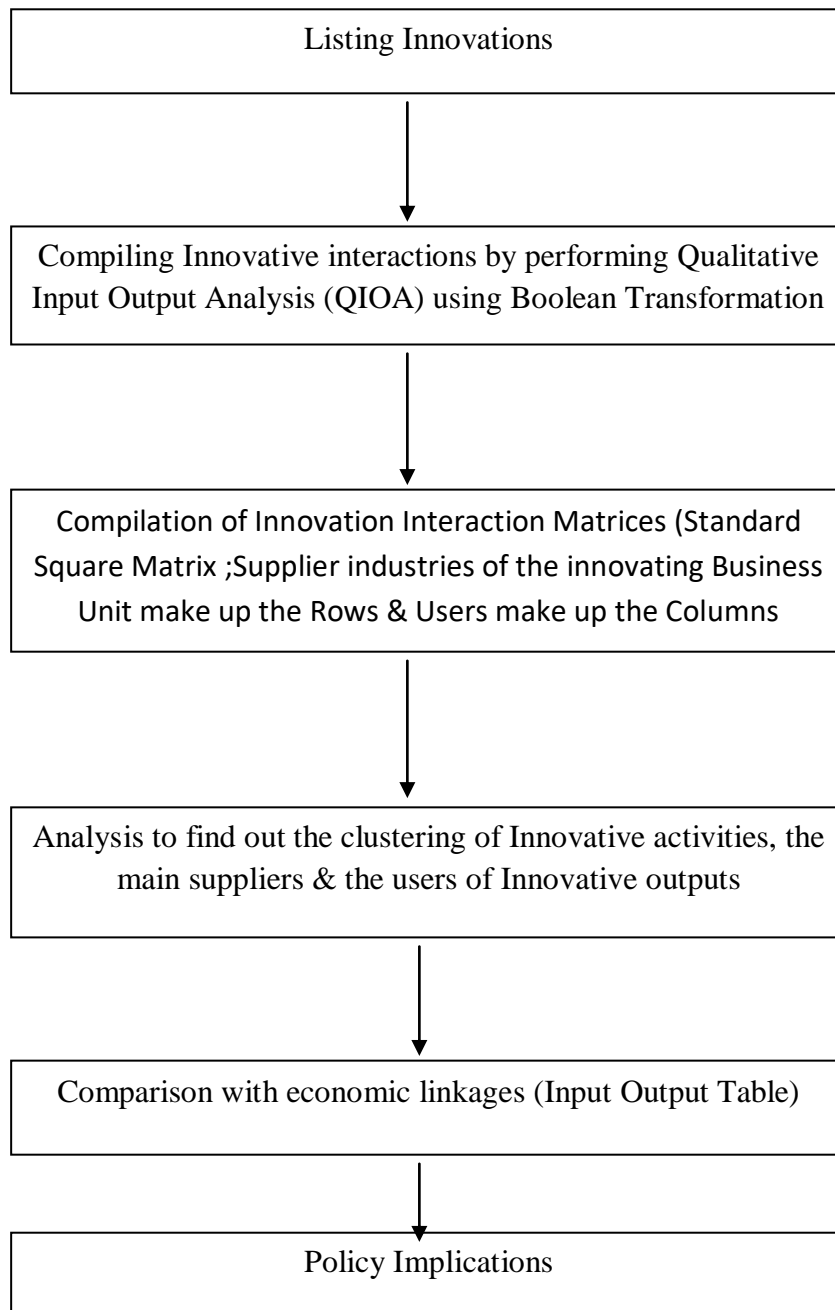


Table 1.1 Industry representative of the Survey

Serial No.	Industries
1	Aerospace/Defense (AE/D)
2	Agriculture (AG)
3	Automotive (AU)
4	Beverage (BE)
5	Biotechnology (BIO)
6	Cement (CEM)
7	Chemicals (CHE)
8	Coal (COA)
9	Construction (CON)
10	Dairy (DAI)
11	Electrical/Electronics (ELE)
12	Entertainment (ENT)
13	Financial Services (FS)
14	Glass & Ceramics (GLA)
15	Healthcare (HC)
16	Information Technology (IT)
17	Leather (LEA)
18	Metal (MET)
19	Oil & Gas (O&G)
20	Packaging (PKG)
21	Paper (PAP)
22	Pharmaceuticals (PHA)
23	Plastics (PLA)
24	Power (POW)
25	Processed food (PF)
26	Renewable Energy (RE)
27	Rubber (RUB)
28	Steel (ST)
29	Telecom (TEL)
30	Textile (TEX)
31	Transport (TRA)

1.4.3. Qualitative Input Output Analysis (QIOA)

We performed the Boolean transformation to find the linkages .The idea that potentially interesting properties of input-output matrices can be derived without knowing individual cell values in great detail seems to go back at least as far as Solow (1952,p.41):

“the particular nature of these properties [e.g.,indecomposability (a property of connectedness)] is illustrated by the fact that they can be investigated with no knowledge of the value of a_{ij} other than which.....are zero and which are not. To test whether an [A] matrix is decomposable, one needs only the matrix with a_{ij} replaced by ,say + and 0.”

Binary (Boolean)transformation as we know can be performed on either transactions (z) or coefficients (A) to generate matrices with a “1” in cells for which $Z_{ij} = 0$ (or $a_{ij}= 0$) ,and a “0” elsewhere.

For Example, let A=

$$\begin{pmatrix} 0 & .2 & 0 \\ .2 & .3 & .1 \\ .3 & 0 & 0 \end{pmatrix}$$

With a filter of 0, we have $W^{(1)} =$

$$\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}$$

Where $W^{(1)}$ denotes the Boolean Matrix associated with A ($= A^1$).Higher power of W reflect an indirect connections that exist among sectors.

CHAPTER 2 LITERATURE REVIEW

2.1 National Innovation System

Though the term Innovation was coined by the German Economist Riedel in 1839 and sociologist De Tarde in 1890, It was only after the release of "The Theory of Economic Development" by Schumpeter that Innovation became the central focus and the strings of debates/discussions started. The concept of the NIS however began to surface only in the late 1980s (Freeman,1987,Dosi et Al,1988,Lundvall,1992,Nelson,1993,Edquist 1997) at the same time when the new growth theory appeared (Romer,1986,1990;Lucas,1988).

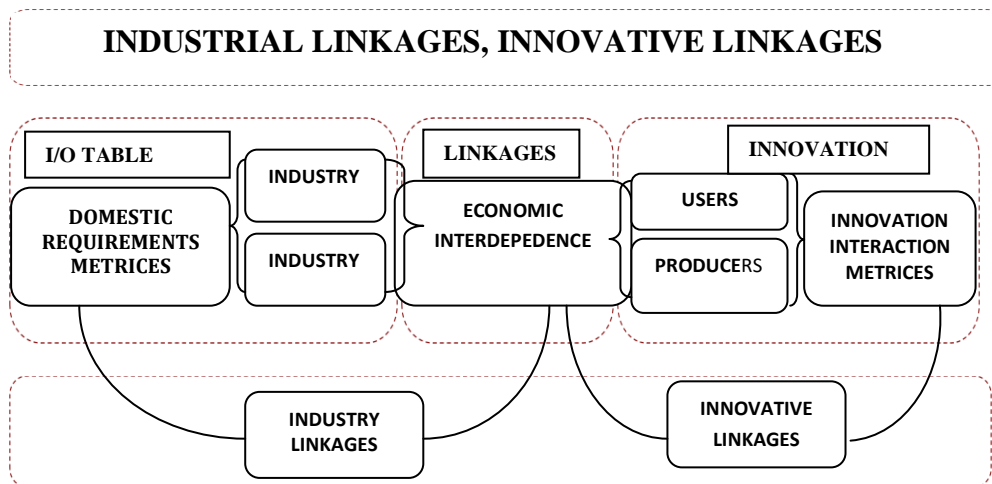
The concept of a '*system of innovation*' was introduced by B.A.Lundvall in 1985 "however, the idea actually goes back at least to the Friedrich List's conception of "The National System of Political Economy" (1841) which might also have been called "The National System of Innovation" (Freeman, 1995). Christopher Freeman coined the expression "National Innovation System". List focused on the development of productive forces rather than on allocation issues. He pointed to the need to build national infrastructure and institutions in order to promote the accumulation of mental capital and use it to spur economic development rather than just trust the invisible hand to solve all problems. While List's publications attempted to explain Germany's dominance over England in the 3rd Kondratieff wave in the late 19th century (Freeman 1988), the amazing development of the post-war Japanese economic growth and policy encouraged Freeman (Freeman 1987) to do a thorough analysis of its NIS.

The systemic approach to innovation now consists of various branches. Depending on the chosen level of analysis, the concepts of regional innovation systems (e.g. Braczyk et al. (1998), Ohmae (1995)), sectoral innovation systems (Breschi and Malerba (1997), Malerba (2002), Cooke et al. (1997)) and technological systems (Carlsson (1995, 1997), Carlsson and Stankiewicz (1995)) constitute three alternatives to the concept of national systems. In addition, related concepts like the concept of industrial clusters (e.g. Porter (1998)) have been introduced.

2.2 Economic interdependence & innovative activities

Various attempts have been made to examine the relationship between economic linkages and innovative linkages. Standard Input Output Data provide for the economic linkages whereas Innovation interaction Matrices provide for the innovative linkages. Comparison of the Innovative Interaction Matrix with I/O matrices enables the policy strategists to locate the innovative activities and find out whether economic linkages drive innovative activities in a particular industry. Which are the active economic channels that support innovation? Where is innovation likely to happen? Is there innovative activity taking place in spite of the low level of the economic activity? In other words, the study of economic interdependence & innovative activities will help test the hypothesis whether *“Innovative activities are more concentrated than economic activities and that they cluster in industries that have a variety of economic and technological linkages.”*(DeBresson, 1995)

Figure 2.1 :Economic & Innovative Linkages



The study demonstrates & identifies whether & how industrial linkages impact clustering of innovative activities. The table 2.1 displays some of the surveys of the innovative activities undertaken. No such effort has been made for Indian Economy. The thesis sets the ball rolling in that direction. The thesis is an attempt to identify the innovative linkages and the clustering of Innovative activities in Indian economy.

Table 2.1: Surveys of Innovative activities

country	REPRESENTATIVENESS OF				
	Economy	IO Structure	Size of Business (employim	Regions	Survey
Italy	@	1976 domestic requirement matrix;75 disaggregated most integrated industries chosen	Different sizes	All regions adequately covered	35000 manufacturing business units surveyed with more than 20 employees.
France	@	1990 output domestic requirement matrix	Different sizes	Information available for Respondent's business establishments' locations allowing for the estimation of regional agglomeration	24,643 enterprises surveyed
China	@	40X14 innovative activity matrix; finally disaggregated 22x22 intra-manufacturing matrix	Large & medium sized	-----	15000 units
Canada	@	Disaggregated 40x132 innovative interaction matrix	Different sizes	Five regions; the Atlantic provinces, Quebec, Ontario the prairies & British Columbia	2000 innovative outputs from 732 firms #
Greece	@	Recent available I/O Table *	Very small businesses	The entire country	900 businesses

the Canadian survey is representative of both Canadian businesses and innovative outputs. The Business here refers to a division of a firm or a single-industry firm.;@ Please refer Fig no. 2.2 for the representativeness of Economy *the final version of the text “locating innovative activities in semi industrialized Economy-Greece”was presented in 1993.

The surveys by DeBresson et al for Italy, France, China, Canada and Greece merit attention here, as they explore the interdependencies between the innovative activities and the economy. The compilation of innovative- interactions matrices and their comparison with respective country's standard Input output tables enabled to find out the location of innovative activity within the Economy. The common features in these surveys that allowed the compilation of Innovative-interactions matrices and the subsequent IO analyses were as follows:

- The industries supplying and using innovative outputs can be identified or estimated.
- Suppliers include mostly the manufacturing industries.(the Italian and French Surveys being the population surveys cover all the manufacturing industries whereas The Canadian Survey covers the most economically representative industries)
- All user sectors are considered.

The surveys aimed at exploring the interdependencies between innovative activities and the economy; examine Schumpeter's hypothesis about clustering of innovation; locate these clusters in the national economic space; compare these locations across national economies and find out whether there are recurrent patterns in the relationships between national economies and the location of innovative clusters. These surveys also helped in some cases (Canada) identify precisely the locations of the supplier establishment and the first user of an innovative output, which enables to establish the geographical distance between partners in innovative endeavors.

The industries covered in these surveys have been shown in Table 2.2.

Table 2.2 : Industry representative of the Economy in surveys

Sector	Italy	France	China	Canada	Greece
Extraction	Petroleum	none	all	Gold Uranium, Iron ore Non ferrous Coal, Petroleum Asbestos gas	Agriculture
First transformation: materials	All	all	all	Petroleum refining Cotton yarn Wool yarn Man-made fiber Sawmills Iron steel Smelting & refining Aluminum Plastics Industrial chemicals Other chemicals Pulp and paper	Construction materials Plastics Chemicals paper
Intermediate Goods	All	all	all	Rubber Plastics Automotive Fabrics Knitting Paper products Wood products Foundries Metal stamping Wire&cable Non metal Minerals Soap	
Machines, equipment, capital goods	All	all	all	Automobiles Trucks Aircraft Railroad Ships & Boats Electrical Appliances Electric Industry Radio& TV Communications Mechanical Agricultural Office Machine shops instruments	Medical/Health Pumps Textiles Motors Generators Electric Industry Electrical Appliances Telecommunication Mechanical Agricultural Electronics Aerospace Shipbuilding

Final Goods	All	all	all	Meat Fish Dairy Beverages Leather goods Shoes Clothing Drugs	Silverware Furniture Sport goods Beverages Food Shoes Clothing entertainment
Utilities	None	none	none	Transportation Gas Electricity Water/health	None
Services	None	none	none	Banking	

2.3 Cluster analysis vis-à-vis innovative activities

2.3.1 Innovative Clusters

“whenever a new production function has been set up successfully and the trade beholds the new thing done and its major problems solved ,it becomes much easier to improve upon it...Innovations are not evenly distributed over the whole economic system at random, but tend to concentrate in certain sectors and their surroundings.”(Schumpeter, 1939; 100-1)

This section adds to the understanding as to why the innovations cluster in part of the economic space and how the various interactions between the users and producers direct such clustering. Various studies have emphasised on the interaction between the different agents involved in the Innovation process (Morgan, 1997; Lagendijk and Charles, 1999) and suggested the involvement of more than one firm or the economic agents in Innovation. Firms almost never innovate in isolation (DeBresson, 1996). Alfred Marshall with “industrial districts”, Joseph Schumpeter with “innovation clusters”, Eric Dahmen with “development blocks”, François Perroux with “development and growth poles”, economic geographers with industrial and “high-technology” agglomerations, all repeatedly called attention to the fact that most economic phenomena – and innovation in particular – are polarised in space. (DeBresson, 1996)

2.3.2 Concepts & Definitions

Ever since Porter published the competitive advantage of nations, the concept of clusters has received a lot of attention in the public debate about industrial policy (Porter, 1990). However

there seems to be no consensus about the definition of and approach towards clusters. The definition and the approach used vary from country to country based on their intent and objectives.

According to Jacobs and De Man (1995), roughly three groups of (related) cluster notions can be distinguished

1. **Regionally concentrated industry;**
2. **Sectors or groups of sectors; and**
3. **Production chains.**

According to the best-known taxonomy of innovating firms, clusters can be categorized as:

1. **Science-based** (e.g. pharmaceuticals, aerospace);
2. **Scale-intensive** (e.g. food-processing, vehicles);
3. **Supplier dominated** (e.g. forestry, services); or
4. **Specialized suppliers** (e.g. computer hardware and software) (Pavitt, 1984).

With augmenting importance of NIS, countries have used different approaches in identifying clusters of industries. In many cases, sectors have been grouped on the basis of the different types of knowledge flows, including:

1. **Embodied technology flows** (the purchase of products and intermediate goods from other sectors) and producer-user interactions;
2. **Technical interactions** as measured by the structure of patenting, citations of patents and scientific publications in other sectors, and joint research activities;
3. **Personnel mobility** or the level and flows of skilled workers

Another classification mentions about spatial clustering based on similarity or interdependence in a production network or in a composite of production networks;

- **Horizontal (similarity):** classical sector classification at a specific level of aggregation;
- **Vertical (interdependency):** composite of production chains (supply networks and outsourcing networks), the strategically important question being: who within the network is the main cause of innovation?

- **Lateral (similarity):** ‘related’ sectors with shared capabilities and the possibility of synergy;
- **Technological (similarity):** (overlap with the lateral dimension) related technologies and technological characteristics that could link sectors;
- **Knowledge (interdependency):** relationship to relevant knowledge infrastructure (education and research); and
- **Network quality (interdependency):** nature and quality of co-operation between companies.

The Table 2.3 evidences some of the surveys undertaken based on similarity and interdependency.

Table 2.3: Interdependency/Similarity based surveys

Name	Method	Foundation	Data	Output
Schmookler,1966	Compilation of intermediary technology flow matrix	Interdependency		
Scherer,1982	Compilation of intermediary technology flow matrix	Interdependency	1974 R&D expenditures & 1976-77 patent data,USA	Technology flow matrix,41 rows(suppliers) x 53 columns(users)
Montfort& Dutailly,1983	Linking supplier to its main user and user to its main supplier	Interdependency	1981 I/O Table, 90x90 sectors, France	19 clusters
Roelandt,1986	Linking supplier to its main user and user to its main supplier	Interdependency	1977 I/O-table,24 x 24 sectors, the Netherlands	6 clusters
Christian DeBresson,1984,1986	Compilation of triangularized innovative-interaction matrix	interdependency	1945-1979 survey data,Canada;I/O –tables	40x132 innovative interaction matrix

Shiqing Xu, DeBresson & Xiaoping Hu, 1992	Aggregate compilation of innovative-interaction matrix	interdependency	Stratified random pilot survey in 1992 of 1500 enterprises; 40 x 14 innovative activity matrix	22 x 22 intra manufacturing matrix ; location of innovative activities in China.
Sergio cesaratto, sandro Mangano & Silvia Massini, 1993	Linking technological behaviour & interdependence	interdependency	Survey data 1981-1985, Italy (2701 business units); I/O table	6 types of clusters based on the taxonomic approach
Philippe Kaminski, DeBresson & Xiaoping Hu, 1993	Triangularized French domestic requirement matrix with location of innovative activity	interdependency	1986-1990 survey data, the 1990 output domestic requirement matrix, France	5 industries dominate the innovative activity matrix
Nikos Vernardakis	Compilation of the industry shares of inventive and innovative activities in Greece			Weak economic linkages; the minimum threshold to sustain innovative activities not yet reached.
Hanel, 1994	Compilation of patent weighted intermediary technology flow matrix	Interdependency	1978-1989 patent data and I/O-tables, Canada	Patent-weighted intermediary technology flow matrices
Van Der Gaag, 1995	Linking supplier for its main product with products main user & linking user for its main product with	Interdependency	1991 make & use tables, 230 sectors x 650 product groups, the Netherlands	9 clusters

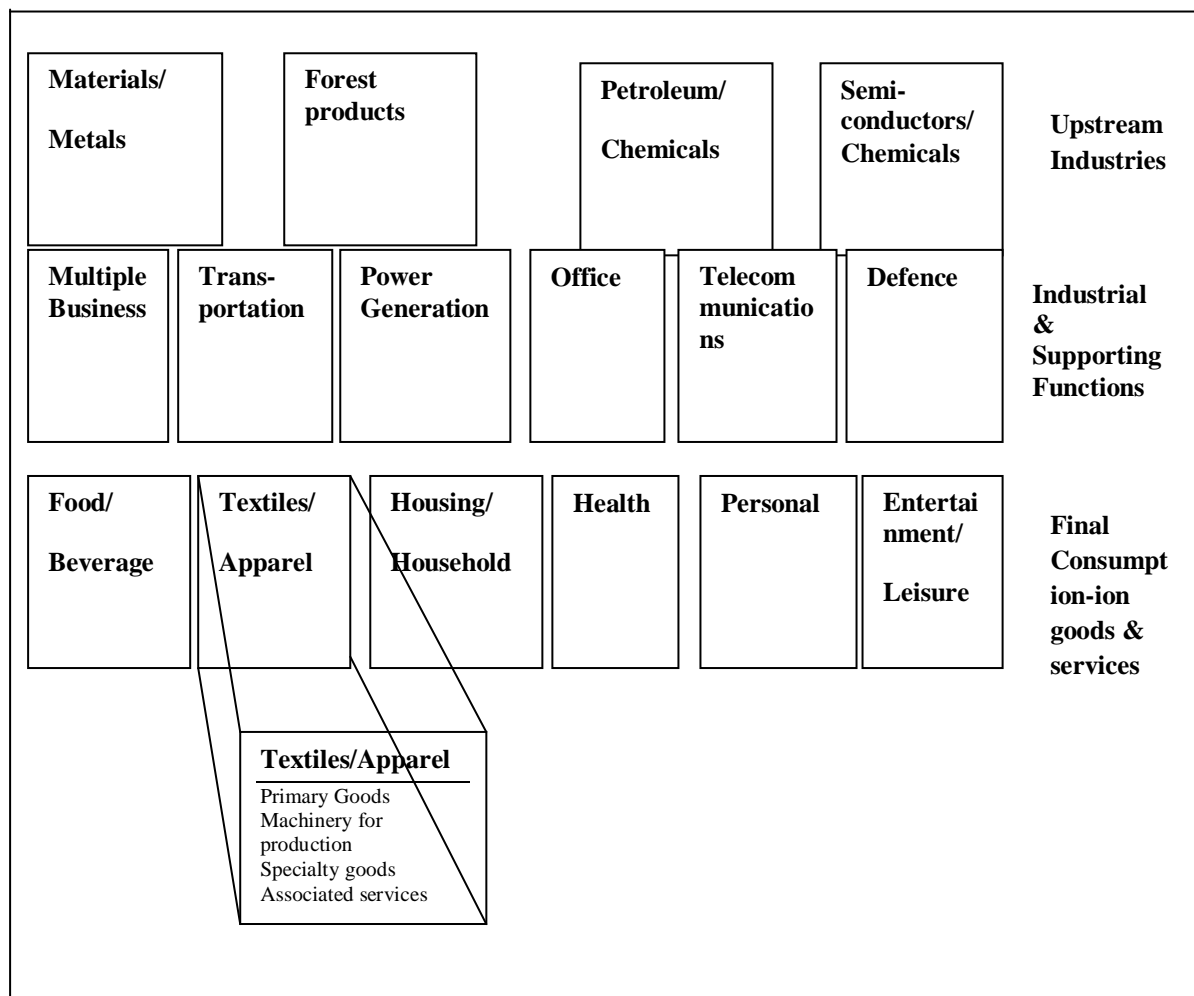
	products main supplier			
DeBresson et al,1994	Compilation of Innovation interaction matrices	Interdependency	1981-85 survey data, Italy	43 x 66 Innovation interaction matrix
DeBresson et al,1994	Compilation of triangularized Innovative activity matrix	Interdependency	1981-85 I/O-tables and survey data, Italy	30 x 66 triangularized domestic requirement matrix
Feser & Bergman, 1997	Linking industries that have similar buying & selling patterns	similarity	1987 I/O-table 478 x 478 sectors, USA	23 clusters
Witteveen 1997	Linking supplier to its main user and user to its main supplier	Interdependency	1993, I/O – table, 213 x 213 sectors, the Netherlands	10 clusters
Bergeron et al 1998	Constructing technology-industry table, linking industries & technologies united by proximity	similarity	1985-1990 patents by French firms in USA	12 techno-industrial clusters

Well did Rolandt & Den Hertog (1998) state that “Clusters can be characterized as being economic networks of strongly interdependent firms (including specialized suppliers), knowledge producing agents (universities, research institutes, engineering companies), bridging institutions (brokers, consultants) and customers, linked to each other in a value-adding production chain. The cluster approach focuses on the linkages and interdependence between actors in the network of production when producing products and services and creating innovations.”

2.3.4. Sectoral Mega Clusters

The cluster analyses gained momentum with Porter talking about the sectoral mega clusters and the roles they play in building the competitiveness of the nation. His approach incorporates standardised model of sixteen possible clusters, sub divided in three industry groups (upstream, support, consumption) at four different levels (goods, machinery, input, services), per group and level dependent on similar framework conditions. Each nation's cluster chart is constructed by identifying the industries that establishes its success in significant exports or Foreign Direct Investment. He introduced the sectoral approach linking the sectors in mega clusters.

Figure 2.2: Mega Clusters

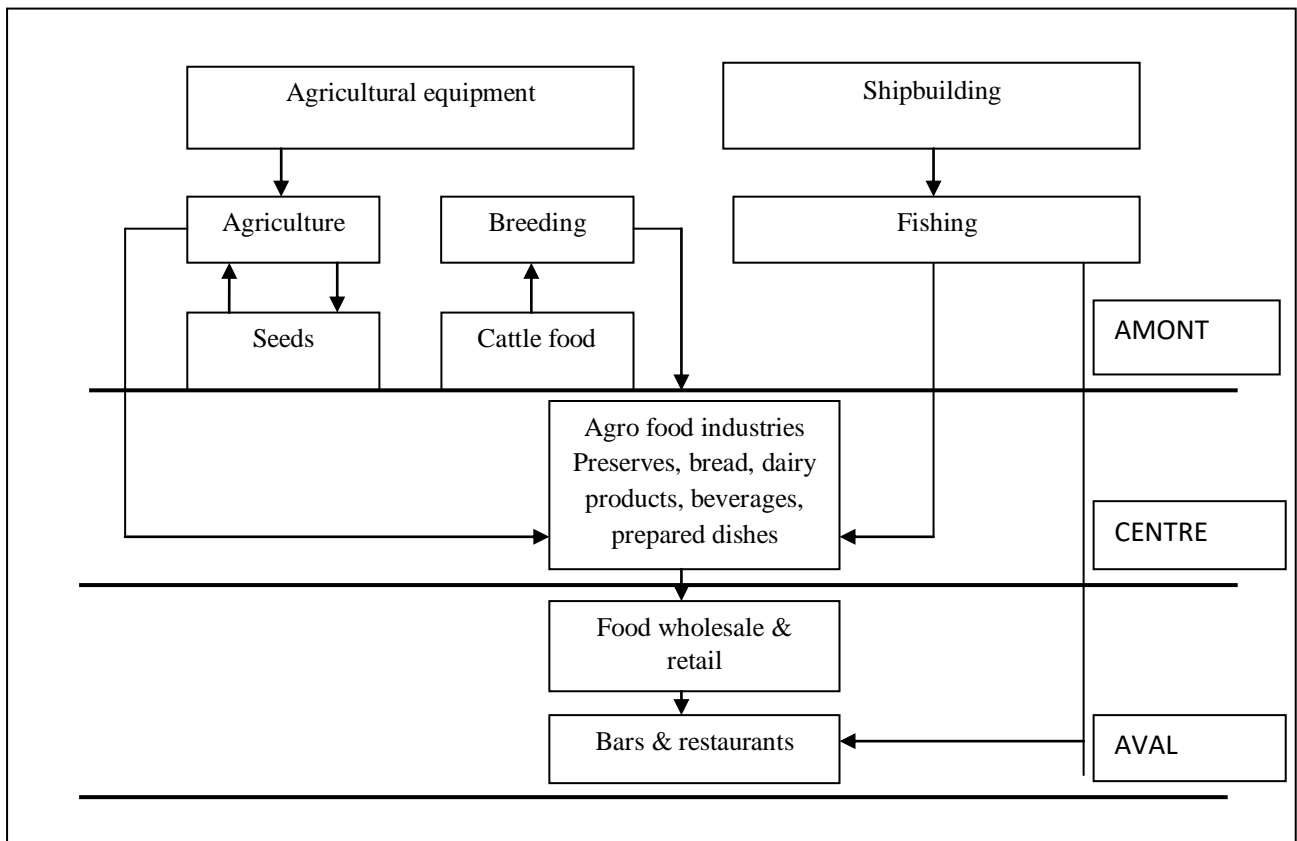


Source: Porter, 1990

2.3.5 Chains and networks

Monfort analysis of “filieres” in France is another good example of clustering of the activities because of the increased interactions and the cooperative networks in the value chain. He found nineteen French ‘filieres’ (Montfort & Dutailly, 1983). Montfort bases analysis on significant intermediary supplies as in input-output tables, and divides his analysis in an upstream (‘amont’), a centre (‘centre’) and a downstream (‘aval’) part.

Figure 2.3: The French Agro Food Filiere



Source: Montfort, 1983

CHAPTER 3 AN ENQUIRY INTO THE ECONOMIC GROWTH AND DEVELOPMENT: THE INNOVATION PERSPECTIVE

3.1 The Growth Theories

Until the 1970s the growth strategies of developed countries focused on *accelerating the rate of capital accumulation and technological adoption. Import substitution, state owned enterprises, control over the financial sector, central planning.* However the second half of the 1980s saw a shift in the views and new growth theory emerged in the 1990s. Upto then the Solow model dominated in which growth is a function of accumulation of capital, accumulation of labour and the productivity growth. This model views long run growth as entirely determined by exogenous factors, independent from structural characteristics of the economy such as openness, scale, saving rate and the most important the policies influencing such variables. Solow however himself estimated that technological change explained more than half of per capita output growth in the first half of the 1990s in the USA.

Romer and many others succeeded in creating models in which technological progress was endogenous to growth. In his magnum opus "The theory of Economic Development", Schumpeter had also mentioned the view related to economic development in which "changes in economic life are not forced upon it from without but arise by its own initiative from within." Advances in the modeling of non competitive equilibria (Romer 1983, 1986) allowed the development of a new set of endogenous growth models in which national policies could influence not just the level of income but also the countries' steady state growth rates (Grossman and Helpman 1992; Aghion and Howitt 1998)

In the working paper "Endogenous Innovation in the theory of Growth" Gene M. Grossman & Elhanan Helpman examine whether the neo classical model-with decreasing returns to capital, and exogenous technology-fully explain the cross country variation in per capita incomes and national growth rates. Paul Romer (1986, 1989a) was not in agreement due to the following reasons:

- 1) The growth rate of the world's technological leader should not have been rising as it did because this could happen in neo classical model only with the steady acceleration of the pace of exogenous technological progress; and,

2) Countries did not appear to be converging to a common level of per capita income, as neoclassical model suggests, if they share similar savings behaviour and technologies.

Gene M. Grossman & Elhanan Helpman questioned the standard procedure of changes in output into parts associated with the growth of various inputs, and a residual. The residual, which depending on the particular study may be large or small, is often taken to measure the contribution of advancing technology to growth. He observed

“Unfortunately, there are problems with this interpretation. For suppose that $Y = AKCL$, where Y is output, K is capital, L is labor and A represents the state of technology. As a matter of arithmetic, it is of course true that the percentage growth in Y will be equal to the sum of the percentage growth in A , a times the percentage growth in K , and times the percentage growth in L . But can we conclude from this that the growth in A measures the full contribution of technological change to the expansion in output? Evidently not. After all, technological improvements typically raise the productivity of capital and thereby induce additional investments. In such cases, the resulting capital formation ought not to be considered as an independent spur to output, but rather as a facilitator of the growth that is due ultimately to the innovation.”

In another study, Prof. Abramowitz measured the growth in the output & the growth in inputs of labour and capital of the American economy between 1870 and 1950. The findings were surprising as the measured growth of inputs (i.e., in capital and labor) between 1870 and 1950 could only account for about 15% of the actual growth in the output of the economy. There was an unexplained residual of no less than 85%. Various other economists in the late 1950s and 1960s attempted similar exercises with different time lines and methodologies, different sectors, but they also found the residual to be very large. Solow himself discovered a very large residual – 85%. It was precisely the size of this residual that persuaded most economists that technological innovation must have been a major force in the growth of output in highly industrialised economies. (Rosenberg).

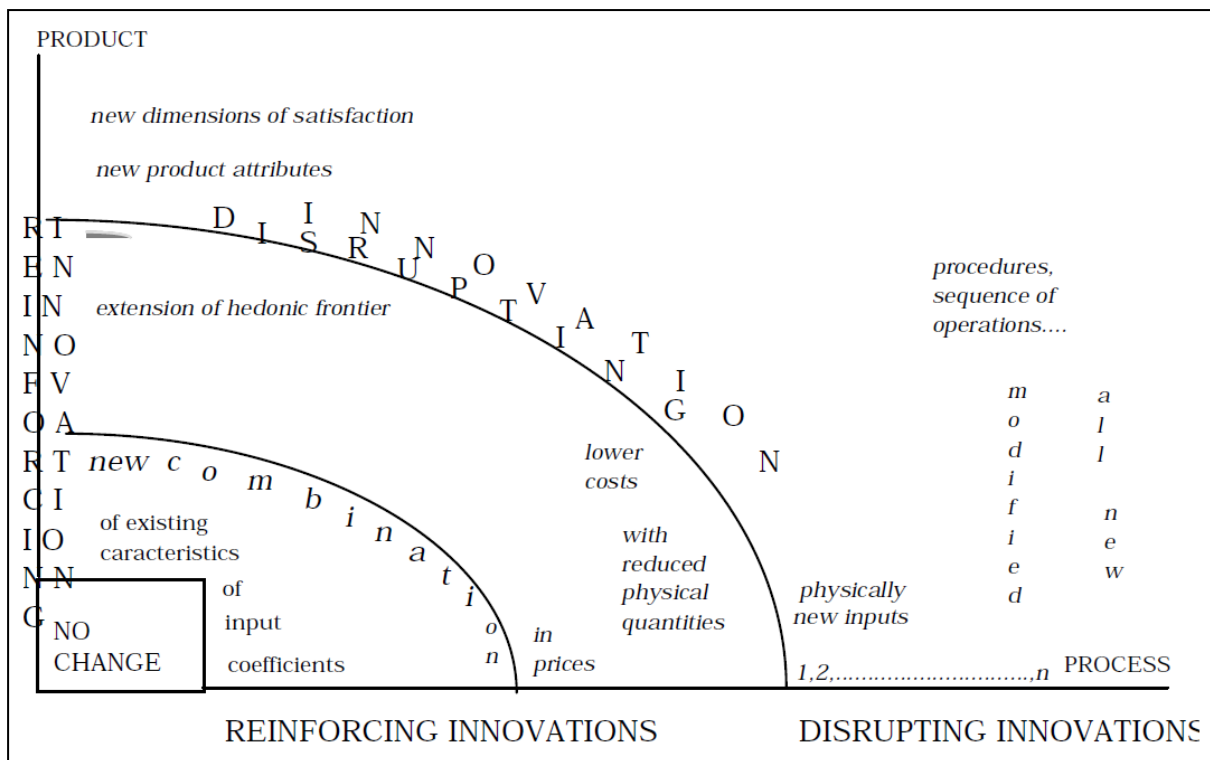
That Innovation leads to growth and economic development has also been illustrated by the well known economic historians like Landes (1969) who described the role of new technologies in industrial revolution. Rosenberg (1972) provided a comprehensive survey of

the relationship between technological advances and the economic growth of USA. Fogel (1964) admitted that the single innovation of the railroad added 5% to US GNP by 1890.

3.2 The impact of Innovation on the Economy & the Impact of economy on the innovation

In economics, the concept of innovation has been derived from the theory of production (Frisch, 1930), i.e, as a change in production function or technique.

Figure 3.1: Innovations



Source: DeBresson

Luecke and Katz (2003) defined innovation as the successful introduction of a new thing or method .Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services. **“Luecke and Katz (2003)**

Joseph Schumpeter defined economic innovation in *The Theory of Economic Development*, (1934) . Well did he observe:

“The first thing to go is the traditional conception of the modus operandi of competition. Economists are at long last emerging from the state in which price competition was all they saw. As soon as quality competition and sales effort are admitted into the sacred precincts of theory, the price variable is ousted from its dominant position. However, it is still competition within a rigid pattern of invariant conditions, methods of production and forms of industrial organization in particular ... that practically monopolizes attention. But in capitalist reality as distinguished from its textbook picture, it is not that kind of competition which counts but the competition from the new commodity, the new technology, the new source of supply, the new type of organization which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives” Schumpeter, 1939

Thus Schumpeter defined Innovation as

- *The introduction of a new good*
- *The introduction of a new method of production,*
- *The opening of a new market,*
- *The conquest of a new source of supply of raw materials or half-manufactured goods,*
- *The carrying out of the new organization of any industry*

The economists worldwide have studied Innovation from different perspectives.

Table 3.1: Innovation studies

S.No.	Study of Innovation	Economists
1	The new sequence of operations	Ragnar Frisch (1930,1965);Nicolas Georgescu-Roegan (1971); Leontief (1989); Egidi (1986) ; Foray(1987)
2	Techno-economic & hedonic advance	Lancaster;Trajtenberg(1990)
3	Measuring the new factor proportions	Frisch (1930);Leontief
4	Innovation induced investments & business cycles	Schumpeter, 1912; Kuznets, 1930; Rostow, 1960; Clark 1961;
5	The location of innovative actors & interactions in the economy	Schmookler,1966.Walsh et al,1979) Schere (1982c) Aitken (1985), Bengt -Ake Lundvall (1988,1992)
6	The Entrepreneurial functions	Cantillon(Universal and common entrepreneur), Chamberlin, Lancaster,Hicks

		Substitutor Hicks factor induced innovator, Schmooklers' demand induced innovator, Menzer, Kirzner, Brenner, Schumpeter (Heroic)
7	Organisational interactions & Innovation	Von Hippel, 1989, Lundvall, 1985: the importance of supplier-user relationship. Innovative achievements are the result of "multiple cooperating visible hands"; DeBresson and Amesse, 1991; Teubal et al: Creation of market for the new technology
8	Inter industrial analysis	Myers & Marquis, 1969; Utterback, 1975; Rothwell et al, 1974; Teubel, 1987; Von Hippel 1976, 1989; Lundvall, 1988 emphasised the first users role in the process of innovative creation
9	Division of labor, Structural change & economic growth	Stigler (1951). Rosenberg (1965), Richardson (1975) Leontief (1936) and Sraffa (1951) Grossman & Helpman (1989), Romer (1990), Aghion and Howitt (1992) Becker and Murphy (1992)
10	The Keynesian Theory & structural Change	Freeman, Clark and Soete 1982) Freeman (1984) Rosenberg (1976, 82) Schmookler (1966) Luigi Passinetti (1981) Garegnani (1992) Nell (1994)
11	National System of Innovation	Freeman 1987; Anderson & Lundvall, 1988; Lundvall, 1988, 1992; Nelson, 1988, 1993
12	Micro Economic theory of technical advancement	Scherer (1967b) & Barzel (1968), Kamien & Schwarz 1972a, 1974a, 1974b, 1976b, 1978a, 1978b, 1980b) Loury (1979), Scherer (1967b) Olivera (1973), Lee & Wilde (1980) Dasgupta & Stiglitz (1980b), Reinganum

3.2.1 The impact of Innovation on the Economy

There have been studies that aim to quantify the growth impact of specific innovations through the growth accounting framework. The innovations contribution to growth is assessed through (i) capital deepening measured by the growth of capital inputs associated

with a particular innovation and (ii) TFP growth in the sector that produces the goods underlying the innovation. (Oliner & Sichel,2003;Crafts 2004)

Crafts (2004) studied the impact of steam technology on British economic growth during the late 18th and 19th century, and Oliner and Sichel (2003) examined the impact of ICTs on US growth in the last quarter of the 20th century.

Table 3.2 Growth contributions from steam technology and ICTs in Britain

	Steam technology in Britain				ICTs in the US			
	1700-1800	1800-30	1830-50	1850-70	1879-1910	1974-1990	1991-95	1996-2001
Capital deepening	0.004	0.02	0.02	0.06	0.09	0.41	0.46	1.02
TFP	0.005	0.001	0.02	0.06	0.05	0.27	0.41	0.77
Total contribution	0.01	0.02	0.04	0.12	0.14	0.68	0.87	1.79

Source: Oliner and Sichel (2003) and Crafts (2004)

The estimates expressed in terms of annual percentage contributions to labour productivity growth illustrate the delayed and long lasting impact of steam engine. The estimates for ICT suggest a higher overall contribution to growth than from steam technology, especially in the second half of the 1990s. The growth impact of ICTs also took time to materialize, though the delay is much shorter in comparison.

The above estimates are bound to underestimate the true growth impetus from the new technologies. Above all, the estimation approach only captures TFP growth in the technology-producing sectors. It ignores possible productivity spillovers in other sectors of the economy. In the case of steam technology, Crafts believes such spillovers may have been significant after 1850. At the same time, cyclical effects may bias the estimates presented in table-1 and may, in particular, cause an overestimate of the ICT contribution in the second half of the 1990s (Gordon, 2000).

Unfortunately, it is difficult to understand the precise impact of innovation on growth performance and different innovations, as the simultaneous impact of various technologies make it difficult to isolate the contribution of a single innovation. Also the adoption of

technology takes time. There exists certain issues like these, However Innovation drives economic growth & development cannot be denied.

A report published in 2015 by WIPO” *Breakthrough Innovation and Economic Growth*” explores how radical breakthrough innovations have made their impact on global economy citing the case study of six breakthrough innovations as follows:

- Airplanes – from hobbyists gliding in the 19th century to a reliable mode of transportation in the first half of the 20th century
- 3D printing – the creation of 3D objects through successive layering of material, aided by digital technology
- Antibiotics – from the discovery of Sulfa drugs in the 1930s to the birth of the modern pharmaceutical industry
- Nanotechnology –technology at the scale of one-billionth of a meter, with applications in electronics, health, materials, and other fields
- Semiconductors – from amplifying radio waves for better communication in the early 20th century to ever more potent computer chips driving the ICT revolution
- Robotics – from the first robots spurring industrial automation to today’s autonomous machines with artificial intelligence

The report illustrates the following impact of Innovation leading to the long run economic growth.

- **Capital Deepening**-The introduction of new technologies can encourage the firms to undertake new investments as they see better returns. Firms throughout USA increased their relative ICT capital stock as they saw the ICT boom.
- **Growth in labour force and human capital:** Introduction of new technologies, business processes and other Knowledge based activities demand better educated, healthier and skilled labour force.
- **Firm productivity growth:** Microeconomics of creation and destruction is quite visible in knowledge based economies. Innovation can cause entry and exit of the firms changing the industrial landscape. The introduction of Nano car by Tata set up the supply chain for the other automotive companies. Subsequently India witnessed

low-priced cars in the market by other companies. Meanwhile Reva-an electric car manufacturing company merged with Mahindra Electric and launch of E-20 became one of the pioneers in electric cars. Thus innovation brings growth enhancing efficiency gains and redeployment of production factors, the spillover effect of which can impact the dynamics of the economy.

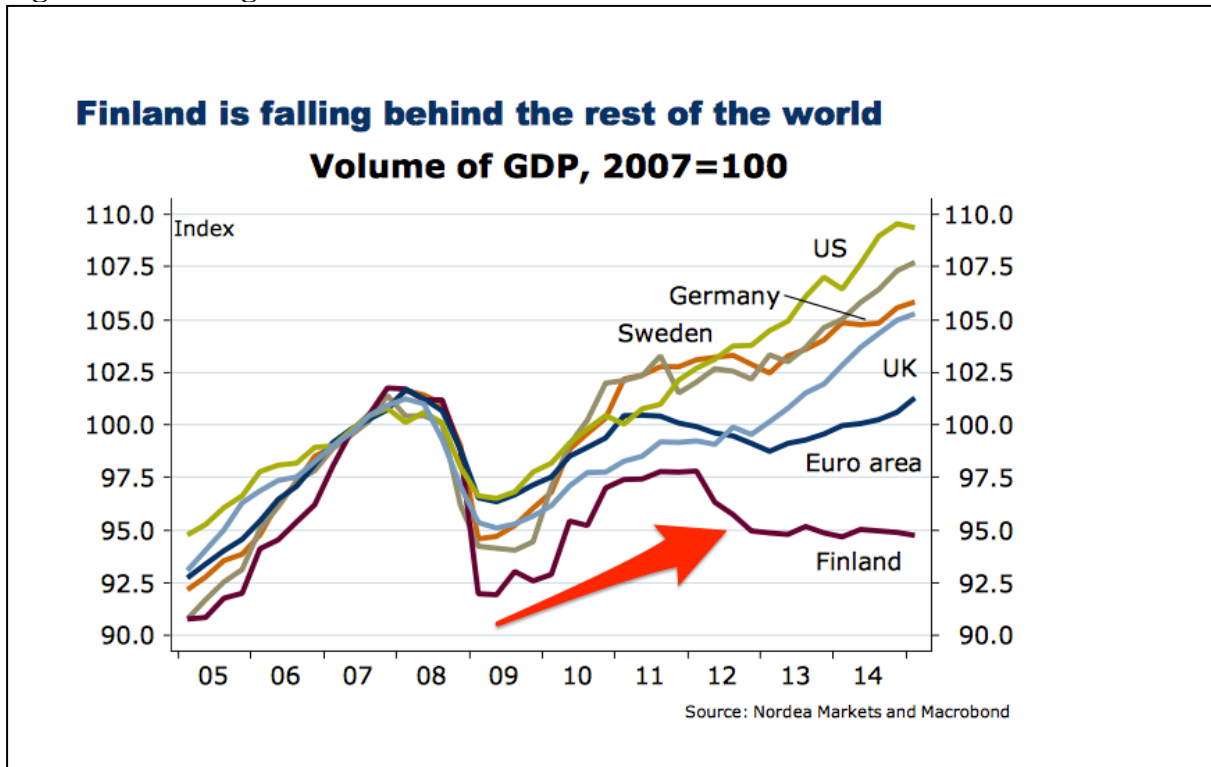
- **Transformation of economic structures:** technological progress has prompted a substantial shift away from agriculture and industry toward the service sector. The GDP contribution of IT & ITES combined may be higher in India as compared to the contribution that of agriculture.

Table 3.3: Company revenue as Percentage of GDP

Largest companies* in each domicile (Revenue as percentage of GDP)		
Company	Domicile	Revenue as percentage of GDP,2011
ArcelorMittal	Luxembourg	161
Essar Energy	Mauritius	132
Royal Dutch Shell	Netherlands	56
China Mobile	Hongkong	34
Glencore	Switzerland	29
Statoil	Norway	24
PTT	Thailand	23
Hon Hai	Taiwan	20
Nokia	Finland	20
MOL Group	Hungary	19
Source: Bloomberg; IMF; The Economist		<i>*listed firms in 53 countries</i>

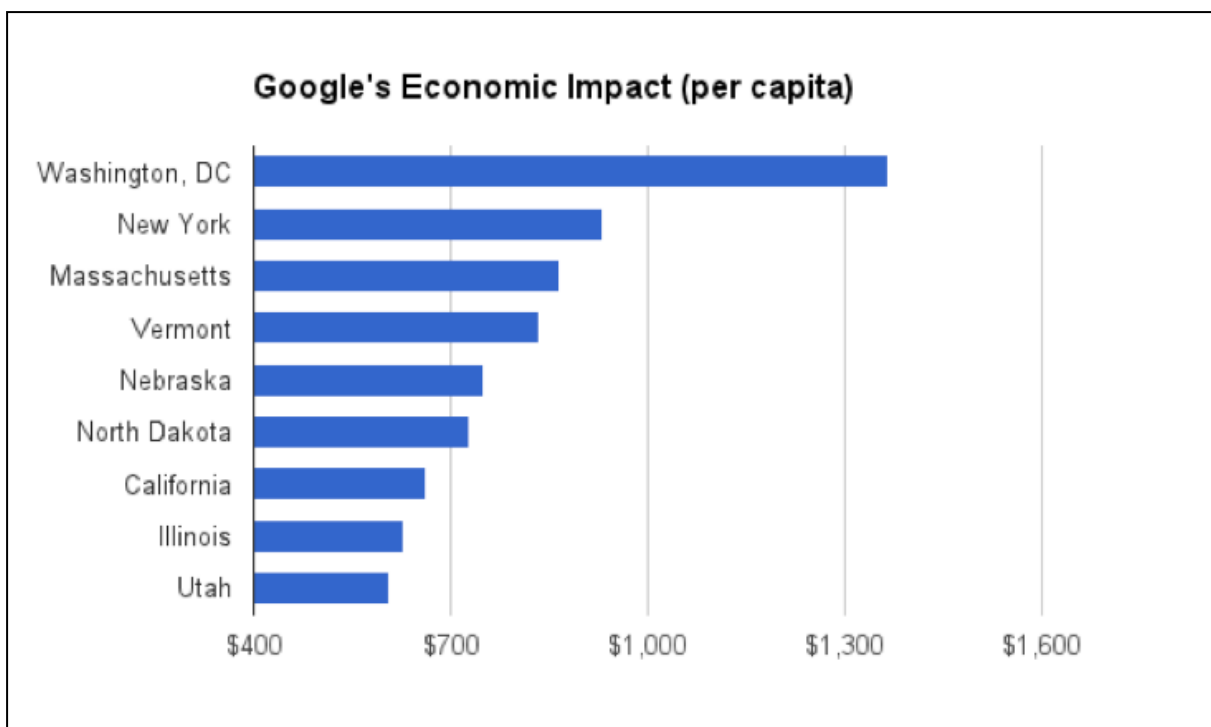
But Nokia that supplied 40% of the world’s mobile phones at its peak in the early 2000s crumbled following the launch of Apple iPhone and Android devices impacting the Finnish Economy significantly and contributed for less than 0.5%of the country’s output. With the seventh highest labour costs in the euro zone and labour productivity (GDP per hour worked) below the euro zone average, the aftermath of Nokia’s fall has undoubtedly increased the Finnish problems.

Figure 3.2: Falling GDP of Finland



Another good example is Google. The economic impact report by Google claims to generate \$111 billion in economic activity through more than 1.5 million businesses and non-profits nationwide. Another study showcases Google’s per capita impact in different states of US.

Figure 3.3: Google’s per capita impact



The Microsoft Economic Impact study by By Theo S. Eicher produces that excluding stock compensation and capital expenditures, Microsoft accounted for an estimated \$43.84 billion of Washington Gross State Product. The company generated a total of \$18.95 billion in personal income in Washington State, which was 6.8 percent of the state's personal income in 2008. The total economic impact of Microsoft amounted to 267,611 jobs or 8.4 percent of total Washington state employment in 2008. From 1990 to 2008, Washington employment grew at an average annual rate of 1.7% percent, while Microsoft employment expanded at a rate of 13.5 percent. Microsoft's employment multiplier was 6.81 in 2008, implying that every job at Microsoft supported 5.81 jobs elsewhere in the Washington state economy.

3.2.2 The impact of Economy on Innovation

Why has the growth performance of economies varied so much over time and across the world? What fuels the innovation in an economic space? Why do innovative performance of economies differ? Few questions in economics have generated so much research. This section reviews the ecosystem which generates or drives innovation.

The Innovative performance varies from country to country. Why are some countries more innovative than others? In a seminal study, David Landes (1969) argued that Germany was so successful in the second industrial revolution because of the characteristics of its education and research systems, which were lacking in Britain and elsewhere. This helped Germany to create new industries based on chemistry and physics.

How does the economic environment affect the direction of innovation? The economic policies, systems & capacities play important role. Research efforts evidence various factors such as follows:

- The dynamics of learning & Innovation: In a rapidly changing world the existing knowledge and information of individuals, firms and other organisations become quickly obsolete. The pace of knowledge creation and knowledge destruction has accelerated. This context of rapid transformations, accelerating innovations and intense competition has been defined as a “learning economy” (Lundvall and Johnson, 1994; Johnson and Lundvall, 2000; OECD, 2000; Lundvall, Johnson, Andersen and Dalum, 2002). Economic structure and institutional set-up have an important influence in determining the rate and direction of innovative activities.

- **The Demand conditions:** Studies suggest that demand conditions in an economy influence the innovations. Demand should influence product innovation more than process innovation (Lunn 1986). Heterogeneous demand directed toward series should enhance product innovations (Pavitt 1984). High price elasticity of demand should stimulate process innovations. Low price elasticity should stimulate product innovations (Spence 1975). Innovation elasticity of demand should stimulate product innovations, thus resulting in an increasing concentration level (Gomulka 1990). In an initial phase, product innovation should be the main type of innovation, followed by product/process innovation and then by process innovation (Utterback and Abernathy 1975). This is due to diminishing uncertainty.

- **Market structure:** The market structure of an economy also plays its role in determining the types of innovation. Concentration should be a characteristic of process innovation (Scherer 1983) but not for product innovation (Lunn 1986). If the high quality firm is a Cournot (quantity) competitor it opts for product innovation, but if it is a Bertrand (price) competitor it opts for process innovation. The low quality firm acts in the opposite manner (Bonanno and Haworth 1998, quoted in Le Bas and Cabagnols 1999).

Some of the other important factors include:

- Universities and their relations with the economy;
- The growth of technology policies & the innovative capabilities;
- The changing rationale of government laboratories;
- The growing role of regions in fostering innovation;
- The capability of the government to adapt to rapid changes in innovation systems;

What kind of ecosystem best supports the flourishing of innovation and the adoption of new technologies? The report “break through innovations and economic growth” by WIPO point to a number of well-known elements of success:

1. The role of the Government as the main source of funding for scientific Research. In many cases, governments have played a crucial role in initially moving promising technology

from the laboratory to the production stage – often motivated by national defence and industrial policy interests. The role of the Government also includes financing R& D and in some cases playing the role of the lead user.

2. Competitive market forces and efforts on the part of firms were equally crucial, especially in commercializing promising ideas and engaging in follow on innovation that facilitated scaled-up production, cost reductions and wide-scale adoption of new technologies.

3. Linkages between the various innovation actors mattered. Linkages range from informal knowledge exchanges, professional networks and worker movements to formal university–industry licensing frameworks and R&D collaborations. The sharing of knowledge among researchers and connections with the upstream and downstream activities that help transform promising ideas into commercial technologies. The development of aviation – from the Wright brothers’ breakthrough achievement of powered, controlled and unassisted flying for 56 seconds in 1903 to reliable long-distance air transportation in the 1970s – is the result of many incremental innovations and improvements from different technological fields. These innovations were the result of interactions between many elements of the airplane innovation ecosystem, which includes the role of the inventor, academic institutions and governments and the economic environment in which innovation occurred.

3. The absorptive capacity of the Economy that entails the ability to undertake incremental or radical technological and organizational innovation in order to adapt technology to local needs.

4. The strong IP protection regulatory framework that incentivises innovation.

5. The knowledge sharing arrangements: In the case of semiconductors, cross-licensing agreements have been found to be important for the commercialization of new technologies and follow-on innovation. Today, many firms engaging in 3D printing, nanotechnology and robotics research have embraced open innovation approaches. They recognize that they may be better innovators by collaborating with others even if that involves some sharing of proprietary knowledge.

CHAPTER 4 THE NATIONAL INNOVATION SYSTEM

4.1 NIS: An overview

Increasing importance has been given to the study of National Innovation System in recent years by the policy makers of the countries worldwide. The systems approach to innovation helps the policy makers have an insight into the nature and sources of innovative and economic performance. The process of innovation is a non linear multidisciplinary approach that involves multi actors' participation. Research & Development happens to be important for economic growth but the interactions between the institutions & organisations-both private and public are equally important. The underlying principle of the National Innovation System establishes the importance of such interactions as to how the universities, enterprises & the government organisations interact and the knowledge whether tacit or codified in an economic system. The policy relevance of understanding the innovation system and how the subsystems within the economic system interact can be of great help to augment the innovative performance and capacity of the knowledge based economies. For example the study of financial system as related to NIS could be of immense value for the policy makers to look into financial imperatives to promote the innovative activities in an economy.

An understanding of the NIS can help address the need gap in the current Innovation system, identify the system imperfections and direct the policy interventions to promote innovative performance of an economy. The relationship between different subsystems of the economy, e.g. R&D policies, Financial systems ,Taxation policies, Educational system and how they interact with each other can help the policy makers identify the gaps and recommend the institutional set up and relevant policies to enhance the innovative performance and competitiveness of the economy.

Technology-related analysis has traditionally focused on inputs (such as research expenditures) and outputs (such as patents). But the interactions among the actors involved in technology development are as important as investments in research and development.

The Definition

Traditionally the understandings of technology policy & performance have focused on the measurement of the *inputs* (such as expenditures on research and development and the number of research personnel) and *outputs* (such as patents). Recent theories of NIS have established the importance & significance of the interactions or linkages among the people and institutions. It is of utmost importance to understand how the different actors of the economic system namely the firms, universities and the government organisations relate to each other in knowledge production, flows and diffusion. The analysis of these linkages and the strengths of these linkages need to be identified to leverage on the conceptual and empirical understanding of the NIS. This is evident from the various definitions as follows:

“ .. the network of institutions in the public and private sectors, whose activities and interactions initiate, import, modify and diffuse new technologies.” (*Freeman, 1987*)

“ .. the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state.” (*Lundvall, 1992*)

“... a set of institutions whose interactions determine the innovative performance ... of national firms.” (*Nelson,*)

“.. that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies.” (*Metcalfe, 1995*)

“ .. the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country.” (*Patel and Pavitt, 1994*)

Common to all these definitions are the interactive behavior of the institutions and the knowledge flows (Table 4.1) between the various institutions-private and public.

Table 4.1: Core knowledge flows in National Innovation Systems

Type of knowledge flow	Main Indicator
<i>Industry Alliances</i>	
Inter-firm research co-operation	Firm Surveys Literature-based counting
<i>Industry/university interactions</i>	
Co-operative industry/University R&D Industry/University co-patents Industry/University co-publications Industry use of university patents Industry/University information-sharing	University annual reports Patent record analysis Publications analysis Citation analysis Firm surveys
<i>Industry/research institute interactions</i>	
Co-operative industry/Institute R&D Industry/Institute co-patents Industry/Institute co-publications Industry use of research institute patents Industry/Institute information-sharing	Government reports Patent record analysis Publications analysis Citation analysis Firm surveys
<i>Technology diffusion</i>	
Technology use by industry Embodied technology diffusion	Firm surveys Input-output analysis
<i>Personnel mobility</i>	
Movement of technical personnel among industry, universities and research institutes	Labor market statistics University/Institute reports

Source: OECD, 1997

4.3: The approaches to NIS

Recent trends in the research on national innovation systems focus on policy based approach and the Performance-oriented studies .Since the late 1990s, efforts have been made to evaluate and to compare innovation systems in terms of their performance. The growing number of policy-oriented studies of innovation systems signals that the creation of innovation-enhancing framework conditions has become a central target of policymakers around the globe, and particularly in highly industrialized countries.

Table 4.2: Descriptive model of National innovation Systems

Framework	Elements /activities (innovation processes)	Remarks
Liu & White (2001)	research, production, "end-use (customers of the product or process outputs)", "linkage" and "education"	
Chang and Shih (2003)	R&D expenditure, R&D performance, technology policy, human capital development, technology transfer and the climate for entrepreneurial behaviour	allow for an analysis of the structural specifics of a national system of innovation.
NIC model by Furman et al. (2002)	endogenous growth theory (Romer (1990)), the theory of international competitiveness as developed by Porter (1990), and the national systems of innovation approach	<p>it only takes account of one output measure of innovation, given that in an NIS various actors contribute in many different ways to the system's performance.</p> <p>Porter and Stern (2002) have recently applied the national innovative capacity model to a larger number of countries (75 countries in total) than Furman et al. (2002) have. Apart from the different sample size and differences in the employed data set, Porter and Stern (2002) make use of the empirical results in order to generate a ranking of the nations analyzed.</p>
Nasierowski and Arcelus (2003)	"R&D efficiency"-, and the second part examines "R&D productivity "which is defined as a country's efficiency in the translation of technological success into national productivity growth.	

4.4 NIS & Indian Economy

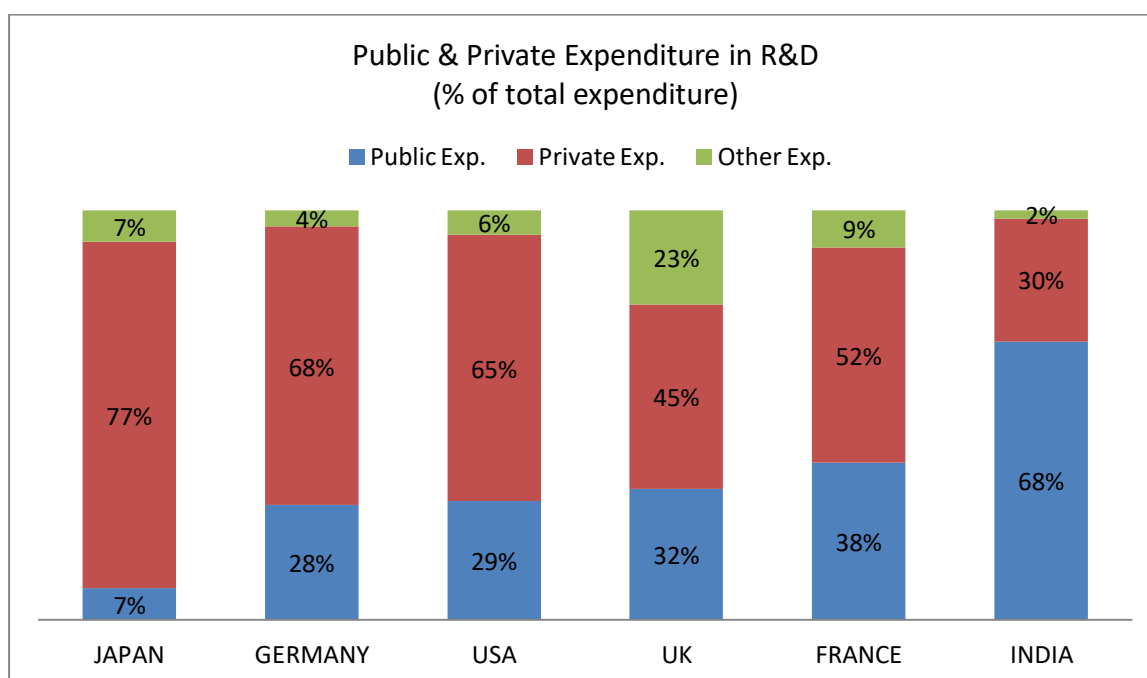
The word 'innovation' appears in a policy document for the first time in 2008, in the draft National Innovation Act. This development reflects a broad sentiment in both policy and business circles that the country is becoming more innovative – or at least certain industries.

In January 2003, the Prime Minister formally announced a new Science and Technology Policy, the main objective of which was to raise India's overall research intensity from 0.80% of GDP in 2003 to 2.0% of GDP by the end of the Tenth Five-Year Plan in 2007. Although this target has not been reached – the GDP/GERD ratio stood at 0.88% in 2007.

According to the Global Competitiveness Report 2014-15, India's capacity for innovation has been lower than that of many countries like the USA, UK, South Korea, and even other BRICS countries (Brazil, Russia, India, China, and South Africa) except Russia. Even in quality of scientific research institutions, India scores lower than China, Brazil, and South Africa. This is also exhibited through its poor score on university–industry collaboration on R&D as compared to some other BRICS nations like China and South Africa. In terms of patents granted per million population, India fares badly compared to other BRICS countries. In terms of company spending on R & D also India is far below China. Only in terms of availability of scientists and engineers, India scores better or is equal to other BRICS countries.

The R&D expenditure by the private enterprises has been also very low as is evident from the table in the following page:

Figure 4.1: Public & Private Expenditure in R&D



India faces an innovation challenge. Clusters can be powerful catalysts in this process and hence the research studies related to the innovative clusters merit due attention and appreciation. The Global Innovation Index reports conclude that India needs to improve the innovation performance to enhance its global economic competitiveness and bridge the innovation gap when compared to the innovating developed economies. The research efforts related to the *innovation ecology, the structure of innovative interactions, industrial interdependencies and the Government policies can help us plan and develop the cluster based policies to supplement the National Innovation Policy.*

Table: 4.3: Global Competitiveness Report

Country	Capacity for innovation		Quality of scientific research institutions		Company spending on R&D		University – Industry collaboration on R&D		Availability of scientists and engineers		PCT patents granted/ million population	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
USA	5.9	2	6.1	4	5.5	4	5.8	2	5.3	5	149.8	11
UK	5.3	10	6.3	2	4.8	14	5.7	4	4.8	22	89.1	18
South Korea	4.7	24	5.0	27	4.5	20	4.6	26	4.4	42	201.5	8
South Africa	4.3	35	4.7	34	3.4	48	4.5	31	3.5	102	6.5	45
China	4.2	40	4.3	39	4.3	23	4.4	32	4.4	43	11.7	34
Brazil	4.1	44	4.0	50	3.5	43	3.8	54	3.3	114	3.2	50
India	4.0	48	4.0	52	3.8	30	3.9	50	4.4	45	1.5	61
Russia	3.8	66	4.0	56	3.2	62	3.6	67	4.1	70	7.1	41

Source : Global Competitiveness Report 2014-15, World Economic Forum.

Note : PCT- Patent Cooperation Treaty.

The Science, Technology & Innovation policy in India has undergone significant changes keeping in mind the national interests and objectives.

Table 4.4: Innovation Policy in India

Innovation policy /Instruments			
Period	Horizontal Policies/Instruments	Vertical Policies/Instruments	Regulatory Framework
1947- 1980 (Science Oriented Approach)	SPR(1958), TPS(1993), Drug and Cosmetics Act (1940), Industrial policy(1948 and 1956)		IPA (1970)
1980-1995 (Technology Centric Approach)	HGT, Industrial Policy(1991) Education Policy (1986)	NBDB(1983), DBT(1986)	
1995-2000 (Technology Centric Approach)	DPRP (1994), NIMTLI (2000)	NBRI	WTO(1995), Patents Amendment(1999)
2000 beyond (Systemic Approach to S&T Innovation)	STP(2003), Tepp, NIF GLP NMCC(2005)	Biotechnology Vision(2001), DNBS(2005), SIBRI(2006)	Patents Amendment (2002 and 2005) , Ethical Guidelines

Source: Dr. Parveen Arora, Director (SC-F), NSTMIS, Department of Science & Technology,(DST) Government of INDIA

The Scientific Policy Resolution of 1958 envisioned the promotion of science and technology in India with the following objectives:

- To foster, promote, and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied, and educational;
- To ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognise their work as an important component of the strength of the nation;
- To encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfil the country's needs in science and education, agriculture and industry, and defence;
- To ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;
- To encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom;

- To secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

The first five year plan (1951-56) and the second one (1956-61) aimed at building the National Laboratories and research institutions primarily under the Council for Scientific and Industrial research. IITs were set up and infrastructural facilities were extended to institutions like IISc. The third plan (1961-66) focused on basic and applied research particularly in agriculture, atomic energy and engineering research. The fifth five year plan came out with the sectoral plan and efforts were made to enhance the interaction between research agencies and promote the technology transfer.

The Indian patent act of 1970 brought some significant changes related to the Intellectual property protection and regulation which helped the pharmaceutical industry grow and develop. A detailed technology policy statement was introduced in 1983 to align the science technological initiatives with national priorities. The sixth plan (1980-85) and the seventh plan (1985-90) encouraged capacity building through reverse engineering and import substitution. A proposal was made to provide for the fiscal incentives through public funding of Research and development. However tax breaks & exemptions till early 1990s were restricted primarily for public sector institutions and laboratories.

Post 1991 through the ninth, tenth and eleventh five year plan (1997-2012) greater emphasis has been laid out in the area of science and technology. DST and CSIR initiated the collaborations with the industry on public-private partnership. Various initiatives like the Drugs and Pharmaceuticals Research Programme (DPRP) was launched by DST in 1994 and The New Millennium Indian Technology Leadership Initiative (NMITLI) was promoted by the CSIR (under DSIR) in the year 2000

The Technology Development Board (TDB) established in 1996 after the adoption of Technology Development Board Act, 1995 assists firms that develop and commercialise indigenous technology or adapt imported technology for wider domestic applications. Assistance is implemented by way of soft loan or contribution towards equity capital. TDB has recently joined hands with two major private equity investors to invest in equities of start-up companies. There are some instances where the government and the private players have engaged in more target oriented projects by collaborating through consortiums. The Collaborative Automotive Research (CAR) by Technology Information, Forecasting, and

Assessment Council (TIFAC-DST) is an example. The very recent Science, Technology and Innovation (STI) Policy 2013 mulls over significant paradigmatic shifts to achieve innovations at all levels. The Eleventh Plan had also highlighted the urgency to put in place institutional mechanisms that may support an innovation ecosystem linking the public and the private and leverage innovation prospects in the SMEs.

4.4.1 Innovation support mechanism

A number of programmes were initiated by the different scientific departments of the Government of India to support the small enterprises:

1. The Small Business Innovation Research Initiative (SBIRI)- supports early stage, pre-proof-of-concept research in biotechnology by the industry, and late stage development and commercialisation of new indigenous technologies particularly those linked to societal needs in healthcare, food and nutrition, agriculture and other sectors

2. Technopreneur Promotion Programme – TePP (promoted by DSIR) supports individual innovators.

3. The TIFAC-SIDBI- Revolving Fund for Technology Innovation Programme (SRIJAN) was launched by TIFAC in 2010, as a joint TIFAC-SIDBI Technology Innovation initiative. Under the scheme, TIFAC set up a revolving corpus with Small Industries Development Bank of India (SIDBI) to fund industries particularly the Micro Small and Medium Enterprises (MSME) for scaling up and commercialisation of novel products and processes.

4. Under Technology Development and Demonstration Programme (TDDP) the DSIR provides partial financial support towards prototype development, cost of pilot plant, cost of equipment, test and evaluation of products, user trials, etc.

4.2.2 Cluster Based Approach for SMEs

The National Innovation Council (NInC) has aimed at facilitating and nurturing innovation ecosystems in industry clusters including those in the traditional sectors. The primary objective is to establish such mechanisms like Cluster Innovation Centres (CICs) which

would provide a platform for exchange of knowledge and learning among workers, entrepreneurs, exporters, public funded S&T institutions government agencies, etc. An established mechanism of this nature is expected to significantly augment prospects of technology adoption and ensure speedy diffusion.

The Ministry of Micro, Small and Medium Enterprises has also adopted cluster development approach as its key strategy for enhancing the productivity, competitiveness and capacity of Micro and Small Enterprises (MSEs). Clustering of units enables agencies including banks to provide services at lower physical and transaction costs. This in turn ensures improved availability of these services for enterprises in this sector. The flagship scheme of the Micro & Small Enterprises – Cluster Development Programme (MSE-CDP) was launched in October 2007 to support growth and sustainability of MSEs by addressing common issues technology improvement & skills and quality enhancement ,market access, access to capital, and to set up common facility centres.

CHAPTER 5 IDENTIFYING INNOVATIVE CLUSTERS IN INDIAN ECONOMY & ITS IMPLICATIONS FOR NATIONAL INNOVATION POLICY THE CLUSTERING OF INNOVATIVE ACTIVITIES

“Innovation is not usually a single-firm activity; it increasingly requires an active search process in order to tap new sources of knowledge and technology and apply these in products and production processes. Systems of innovation approaches give shape to the idea that companies in their quest for competitiveness are becoming more dependent upon complementary knowledge in firms and institutions other than their own. The cluster approach focuses on the linkages and interdependencies among networked actors in the production of goods and services and in innovation. In so doing, the cluster approach offers an alternative to the traditional sectoral approach.”(OECD, 1999)

5.1 Introduction

Polarisation of Innovation in some part of the economic space has been well attended earlier. Marshall’s industrial districts, Schumpeter’s innovation clusters, Eric Dahman’s development blocs, François Perrroux’s development & growth poles, the concept of high technology agglomerations all have accepted the polarisation of innovation in economic space.

This is the basic premise of my research effort. I aim to identify the innovative linkages by using innovation interaction matrices and the QIOA by performing Boolean transformation.

It draws mainly from the work by Christain De Bresson who in his various surveys along with a team of innovation researchers tried to answer as to “how Innovation emerges from normal economic activity?” His research endeavours tried to confront the following hypothesis by reconciling inter industrial analysis with the study of innovative activities:

D. Innovations cluster in part of the economic space (Schumpeter,1937)

E. Varied linkages in everyday economic life tend to favour innovative linkages and clusters(Aitken 1985)

F. Innovative clusters and linkages may contribute to increase the division of labour(smithian hypothesis)

Innovation here refers to the innovative activities and not the proven innovations per se as it would be known only after the adoption and diffusion whether the innovation is incremental

or radical. *Clustering of Innovative activities refers to the clusters that emerge out of various important interactions between the users and producers.*

The framework can be used to demonstrate & identify whether & how industrial linkages impact clustering of innovative activities. This will also help us locate the innovative clusters, map the structure of innovative interactions in Indian Economy and establish patterns in clustering and innovative activity. The findings can be very useful for policy decisions and prescriptions to have the structural insight and develop the required Institutional support to promote learning and innovation.

The thesis provides a pathway for the further research possibilities of examining whether innovative activity in India happens to be a function of or depends on the prior economic interdependence as manifested by input output analysis and to understand the impact of Indian economic environment on the innovative activities and vice versa.

5.2. The Cluster Analyses

The cluster concept as shown in the table below differs from the traditional sectoral approach. The sectoral approach emphasises the importance of horizontal relations and competitive interdependence (competitive partners operating in same industry), whereas the cluster approach also focuses on the importance of vertical relationships between dissimilar firms and symbiotic synergetic interdependence.

Table 5.1: Traditional sectoral approach vs. cluster –based approach

<ul style="list-style-type: none"> ▪ Groups with similar network positions 	<ul style="list-style-type: none"> ▪ Strategic groups with mostly complementary and dissimilar network positions
<ul style="list-style-type: none"> ▪ Focus on end-product industries 	<ul style="list-style-type: none"> ▪ Include customers, suppliers, service providers and specialised institutions
<ul style="list-style-type: none"> ▪ Focus on direct and indirect competitors 	<ul style="list-style-type: none"> ▪ Incorporates the array of interrelated industries sharing common technology, skills, information, inputs, customers and channels
<ul style="list-style-type: none"> ▪ Hesitancy to co-operate with rivals 	<ul style="list-style-type: none"> ▪ Most participants are not direct

	competitors but share common needs and constraints
<ul style="list-style-type: none"> ▪ Dialogue with government often gravitates towards subsidies, protection and limiting rivalry 	<ul style="list-style-type: none"> ▪ Wide scope for improvements in areas of common concern that will improve productivity ▪ and increase competition ▪ A forum for more constructive and efficient business-government dialogue
<ul style="list-style-type: none"> ▪ Search for diversity in existing trajectories 	<ul style="list-style-type: none"> ▪ Search for synergies & new combinations
Source : Adapted from Porter,1997	

The clusters have been analyzed at micro level, meso level and macro level. Micro level refers to clusters of firms whereas meso and macro level refer to clusters of sectors /industries. The “relation between the entities in a cluster may refer to innovative efforts or to production linkages.”(Alex Hoen)

Table 5.2: Production linkages (Source :Alex Hoen)

	Innovative efforts	Production linkages
Micro	Diffusion of technologies and knowledge between firms, research institutions ,etc.	Suppliers and buyers in a value added or production chain of firms
Meso	Diffusion of technology and Knowledge between sectors	Backward and forward linkages between sectors; partial analyses
Macro	A split up of the economic system in sectors that diffuse knowledge or technologies	A split up of the economic system in sectors that form value added or production chains.

Table 5.3: Cluster Analysis

Level of analysis	Cluster concept	Focus of analysis
National level (macro)	Industry group linkages in the economy as a whole	Specialisation patterns of a national/regional economy Need for innovation and upgrading of products and processes in mega-clusters
Branch or industry level (meso)	Inter- and intra-industry linkages in the different stages of the production chain of similar end product(s)	SWOT and benchmark analysis of industries Exploring innovation needs
Firm level (micro)	Specialised suppliers around one or more core enterprises (inter-firm linkages)	Strategic business development Chain analysis and chain management Development of collaborative innovation projects

Source: Boosting innovation: the cluster approach, OECD proceedings, 1999

There have been various techniques used for clusters analyses.

- *Input-output analysis*. Used for inter-industrial linkages (Hauknes, 1999; Roelandt et al, 1999; Bergman et al., 1999) and the interdependences among the innovative activities (DeBresson et al)
- *Graph analysis*. Useful to identify the shapes and patterns of the linkages between firms or industry groups (DeBresson and Hu, 1999)

- *Correspondence analysis* (such as factor analysis, principal component analysis, multidimensional Scaling and canonical correlation): Used for similarity-based cluster analysis (Vock, 1997; Arvantis and Hollenstein, 1997; Spielkamp and Vopel, 1999).
- The *qualitative case study* approach as exemplified by the Porter country studies (Rouvinen et al, 1999; Drejer et al, 1999; Stenberg et al, 1997, Roelandt et al, 1999)

5.3 Why would Innovations cluster in economic space?

Various theories exist exploring as to how the economic environment affects the direction of innovation & why do innovative activities cluster? One of the observations is that the sectors with relatively higher rate of growth of demand will witness more of innovative activities as the investors are likely to invest more into the sectors that appear more promising. (Schmookler, 1966)

Another reason for clustering is the relative differences in factor endowments and allocation that can also induce a bias towards techniques that avoid the use of scarce and expensive ones but use intensely the abundant & inexpensive ones.

DeBresson tried to answer this by building a stochastic model for locating Innovative activities. He began with his hypothesis that innovative activity is a function of prior economic linkages, or

$$I=f(L) +r$$

r being the residual.

To enable estimation, he writes

$$I=a+bL+r$$

Where a is the intercept and b the coefficient relating the linkage index L (the simple index of the combined first order forward and backward linkages) to the level of innovative activity I.

Model estimations at different spatial levels had the following conclusions:

- In most of the cases except Greece, the relationship of innovative activity and domestic linkages seem to hold. Domestic economic linkages and innovative activity were found to be related in case of Italy, France and China.
- Import linkages (including only imports of goods & equipment and NOT import of new technology) do not matter as much as foreign technological linkages do. It was observed that import linkages affect innovation propensity less than domestic linkages.
- Varied economic linkages are a necessary but not sufficient condition for innovative linkages. The variety of economic contacts and information may be a limiting factor, but not the only one. Beyond a certain threshold of linkages, other limiting factors may come into play.(DeBresson, 1996)

Various other studies suggest that the networks and industrial interdependences emerge due to the *trade linkages* (Hauknes, 1999; Roelandt *et al.*, 1999; Bergman and Feser, 1999), *innovation linkages* (DeBresson and Hu, 1999), *knowledge flow linkages* (Viori, 1995; Poti, 1997; Roelandt *et al.*, 1999; van den Hove and Roelandt, 1997) and *commonality of knowledge base or factor conditions* (Drejer *et al.*, 1999). Networks of innovation are the rule rather than the exception, and most innovative activity involves multiple actors (OECD, 1999).

“Innovation is not usually a single-firm activity; it increasingly requires an active search process in order to tap new sources of knowledge and technology and apply these in products and production processes. Systems of innovation approaches give shape to the idea that companies in their quest for competitiveness are becoming more dependent upon complementary knowledge in firms and institutions other than their own. The cluster approach focuses on the linkages and interdependencies among networked actors in the production of goods and services and in innovation. In so doing, the cluster approach offers an alternative to the traditional sectoral approach.”(OECD, 1999)

This interdependence has its manifestation in clustering of innovative activities in part of the economic space. Schumpeter also observed that the proven innovation will encourage more imitations leading to a bandwagon effect due to the reduction of uncertainty & the expectation of the entrepreneurial profits.

Some of the other reasons include the following:

- The conditional probability of adoption of complementary innovations is greater than that of adopting of substitutes. (Debresson)
- There exists lesser possibility that one will switch to a new technique (even if the technique is superior) (Cowan 1990)
- The transferability of the learning competencies (the firm can leverage on the existing knowledge base given the possibility of the transferability)

Understanding the dynamics of “knowledge-based economies” and “learning economies” merits understanding of innovation and technical change. The policy makers, economists and researchers have shown keen interest in understanding the first user’s role in innovation (Meyers & Marquis, 1969; Utterback, 1975; Rothwell et al., 1974; Teubal, 1987; Lundvall, 1988; Von Hippel, 1976, 1989). This importance of suppliers and customers’ interactions is all evident in many innovation surveys based on the OECD’s *Oslo Manual* of innovation indicators (OECD/EUROSTAT, 1997)

The point in focus is to examine the process of knowledge acquisition, usage and diffusion and the dynamics of social interaction and the cooperative networks. Lundvall states NIS as the “the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state”. (Lundvall, 1992) Nelson also mentioned NIS to be “... a set of institutions whose interactions determine the innovative performance ... of national firms.” Freeman defined NIS as “... the network of institutions in the public and private sectors, whose activities and interactions initiate, import, modify and diffuse new technologies.” (Freeman, 1987). Metcalfe also defined the NIS as “... that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies.” (Metcalfe, 1995)

Despite the conceptual variations approach of networking and interdependence, the literature on innovation systems underpins two essential dimensions of innovation:

- The interaction between different actors in the innovation process, particularly between Users and producers of intermediate goods and between business and the wider research Community is crucial to successful innovation (interdependency).
- Institutions matter, because innovation processes are institutionally embedded in the setting of systems of production (systemic character).

This chapter presents interdependence among innovative activities between different industries in Indian Economy. Table 5.4 presents the levels of analysis with variations on the cluster concept and the focus of analysis. My analysis uses the concept of Innovation interaction Matrices for identifying the linkages and aims to identify the clustering of innovative activities in Indian Economy.

Table 5.4: Level of Analysis and cluster concept

Country	Level of analysis			Cluster Technique					Cluster Concept
	micro	meso	macro	I/O	Graph	Correlation	Case	Other	
Australia		X	X	X		x	x		Networks of production, network of innovation
Austria		X	X					Patent data & trade performance	Marshallian industrial districts
Belgium	x				x			Sciento-metrics	Networks or chains of production, innovation & cooperation
Canada		X	X	X			x		Systems of innovation
Denmark	x	X		X	x		x		Resource areas
Finland	x	x					X		Clusters as unique combinations of firms tied together by knowledge
Germany	x	X		X		x			Similar firms & innovation styles

Italy		X		X					Inter-industry knowledge flow
Mexico		X	X				x		Systems of innovation
Nether-Lands		X	X	X			x		Value chains & networks of production
Spain		X		X			x		Systems of innovation
Sweden		X					x		Systems of interdependent firms in different industries
Switzer-land	x	X				x	x	Patent data	Networks of innovation
United Kingdom	x	X					X		Regional systems of innovation
USA		X		X			X		Chains & networks of production

Source: DeBresson, 1995

5.4: Identifying Innovative clusters in Indian Economy

Over the last decades, science policy produced a shift towards the policies designed to stimulate innovation (OECD, 1978). In its general review, *Technology and the Economy: the Key Relationships*, the OECD paid renewed attention to structural and systemic elements (OECD, 1992). There have been studies with focus on the NIS but (Lundvall, 1992; Nelson, 1993) but approaches focusing on reduced-scale systems, *i.e.* inter-industrial innovative clusters and networks have increased.

5.4.1 The Survey: Unit of analysis

Most of the surveys (France, Italy, China, and Greece) have considered the business units for analysis. The Canadian Survey included business units as well as the innovative outputs. I have used the hybrid approach as used for Canadian survey. For each innovative output, upstream and downstream interacting partners are identified.

Our assumption here is that both the manufacturing and service industries are the suppliers of innovative outputs. *The earlier surveys are representative of the manufacturing industries*

and represent only the manufacturing industries to be the suppliers of innovative outputs. However given the increasing economic importance of the service industries, I included them in my research.

The survey methods include interviews with the senior executives and R&D personnel of the business units. A questionnaire (**Appendix 1**) has been used for the survey. I interviewed 269 executives from different industries and visited 5 Innovation Labs. The secondary sources included the trade journals, reports of the trade and/or industry associations, Research and development laboratories and patents data among others. The industrial experts from different industries were also asked to identify the innovations in their sectors of competence. Based on their response, the further validations have been done with the supplying industries and the user industries of the innovative activities. For each innovative output, the upstream and downstream interactions are identified so that mapping of innovative interactions as much as possible becomes feasible.

5.4.2 QIOA (Qualitative Input Output Analysis)

Research studies in 1960s (Myers & Marquis,1969;Utterback,1975;Rothwell et al.,1974;teubel,1987;Von Hippel ,1976,1989;Lundvall,1988) evidenced the first users role in creation of innovative activities. Innovation happens to non-linear multidisciplinary process that involves at least two partners. Innovations do not happen in isolation. If this is true, then it is very easy to justify using input output analysis for studying innovative activities. After all Input output tables provide for the economic interdependencies .Innovative activities involve heuristic interdependence (DE Bresson, 1990). I have performed Boolean transformation to compile the Innovation interaction Matrices. (**Refer Appendix 2**)

Some important interactions between suppliers and users in the process of innovation have been shown in the following Figure.

Table 5.5: Supplier –user interactions

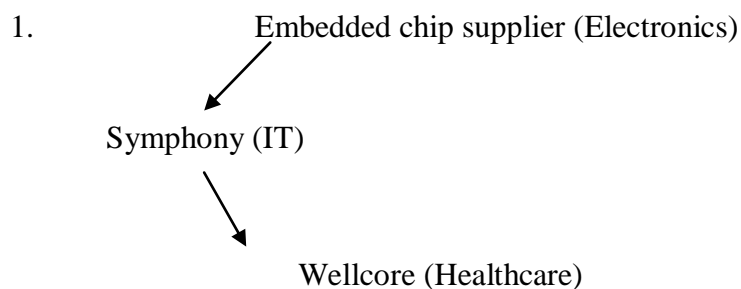
Supplier: the product or service	Client: Its use in a process
Search for a commercial application for supplier’s technical competence	Search for a technical solution for an identified problem and need specification of performance requirements
Conceptual design of solution	Assessment of design and further specifications of performance requirements
Value engineering Prototype model to demonstrate technical feasibility	Assessment of technical choices Testing and assessment of technical performance Specification of operating and fixed cost requirements
Value Analysis, new prototype	Testing, adjustment requirements and firm orders
Pre production engineering De-bugging, quality & production-cost control	Quality control, and operation cost control
Production & launch	Economic use

Source : Debresson

5.4.3: Mapping innovative activity in the Indian economy with innovative interaction matrices

The innovation interaction matrix has been compiled after identifying the innovations in Indian economy .The frequency in the cell manifests the various interactions between suppliers and the users for the innovative outputs. Some of the examples are shown below:

Figure 5.1: Innovative Linkages



2. TATA STEEL (Blast Furnace slag (a waste by product from steel))



ACC Chaibasa (Portland Slag Cement)

Innovation Interaction Matrices compiled from the survey responses tell us about the key locations in which innovation originates in Indian economy and then diffuses to the rest of the economy. As the creation, adoption and diffusion of innovation also reveal the knowledge creation, acquisition and diffusion of new technologies, the mapping innovative interactions also produces an understanding vis-a-vis learning dynamics in the economy, i.e. how the clustering of innovative activities emerge out of the increased social interactions and division of labour through cooperative networks. In other words it also explains the segments of the learning economy in which firms are more dynamic.

The matrices also allow for the comparison with the economic matrices and the patented inventions (Evenson 1997) by adopting Leontief I/O table as reference template. As stated in the section dealing with the methodology earlier, an innovative matrix is a square matrix, with the suppliers of the innovative output classified by industry in the rows, with the most frequent user industry of innovative outputs identified in the columns.

In an attempt to identify the economic locus of innovative activity in Indian economy, I began to survey the industries (sample size of 32 industries) with an objective to understand their innovation outputs & the first order forward and backward linkages. Such survey can be very crucial and useful in today's context due to the reasons as follows:

- 1) The augmenting importance of the innovation in economic growth and the importance of understanding the structure and pattern of the co-operative networks underlying them.
- 2) Comparing the degree of innovative activity concentration in different countries

The innovation interaction matrix has been compiled after identifying the innovations in Indian economy. The frequency in the cell manifests the various interactions between suppliers and the users for the innovative outputs.

5.4.4 The businesses size

The survey consists of business units of different sizes. The survey definition for the innovative activity is the introduction of a new product or a new process.

5.4.5 The structure of Innovative interactions in Indian Economy

In the survey, we found the main suppliers and users of the innovative activities as shown in the following Tables (5.6 & 5.7). In the table 5.6 , supplying industries of innovative outputs have been ranked; first by the importance of the first order forward linkages (i.e. number of user industries they supplied-column3) and second, by the total number of business units involved in innovating activities-column 1).

Table 5.6: The main suppliers of innovative output in India

Industries	Frequency	Percentage	Number of users
IT	116	17.28	80
RE	76	11.32	56
ELEC	89	13.26	54
BIO	62	9.23	41
CHEM	56	8.34	33
AG	48	7.15	15
STEEL	20	2.98	11
OIL & GAS	17	2.53	11
Sub-total	484	72.09	
Total	671	100.00	

In the table 5.7. User industries of innovative outputs have been ranked first by the importance of the first order backward linkages (i.e. number of supplier industries they had the supplies from-column3) and second, by the total number of business units involved in innovating activities-column 1).

Table 5.7: The main users of innovative output in India

Industries	Frequency	percentage	Number of suppliers
Healthcare	108	16.09	57
Agriculture	74	11.02	41
Power	24	3.57	23
Construction	25	3.72	22
Aerospace/Defence	31	4.61	18
Financial Services	25	3.72	17
Processed Food	20	2.98	17
Metal	29	4.32	13
Sub-total	336	50.03	
Total	671	100.00	

Figure 5.2: Inter industrial Innovative interactions

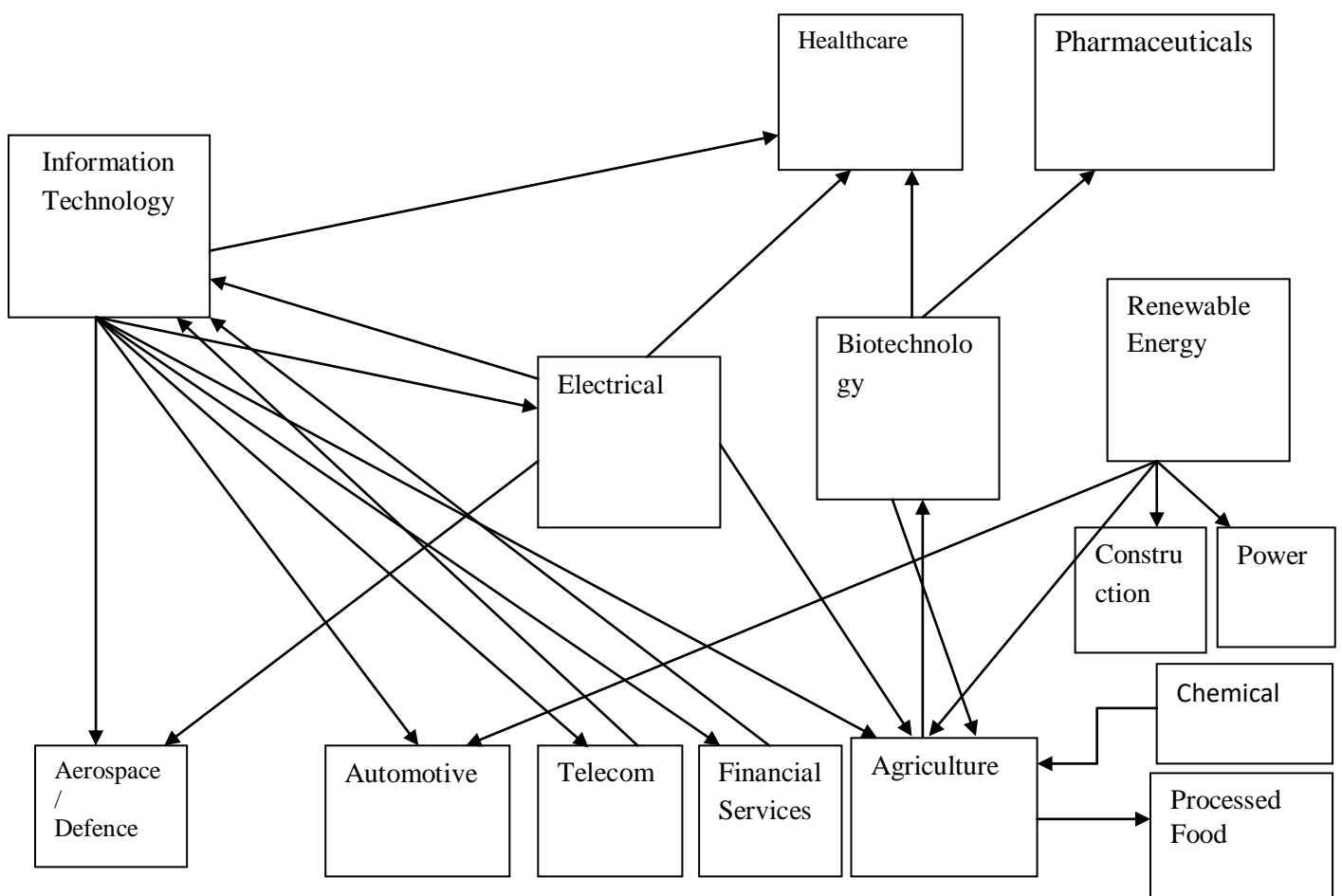
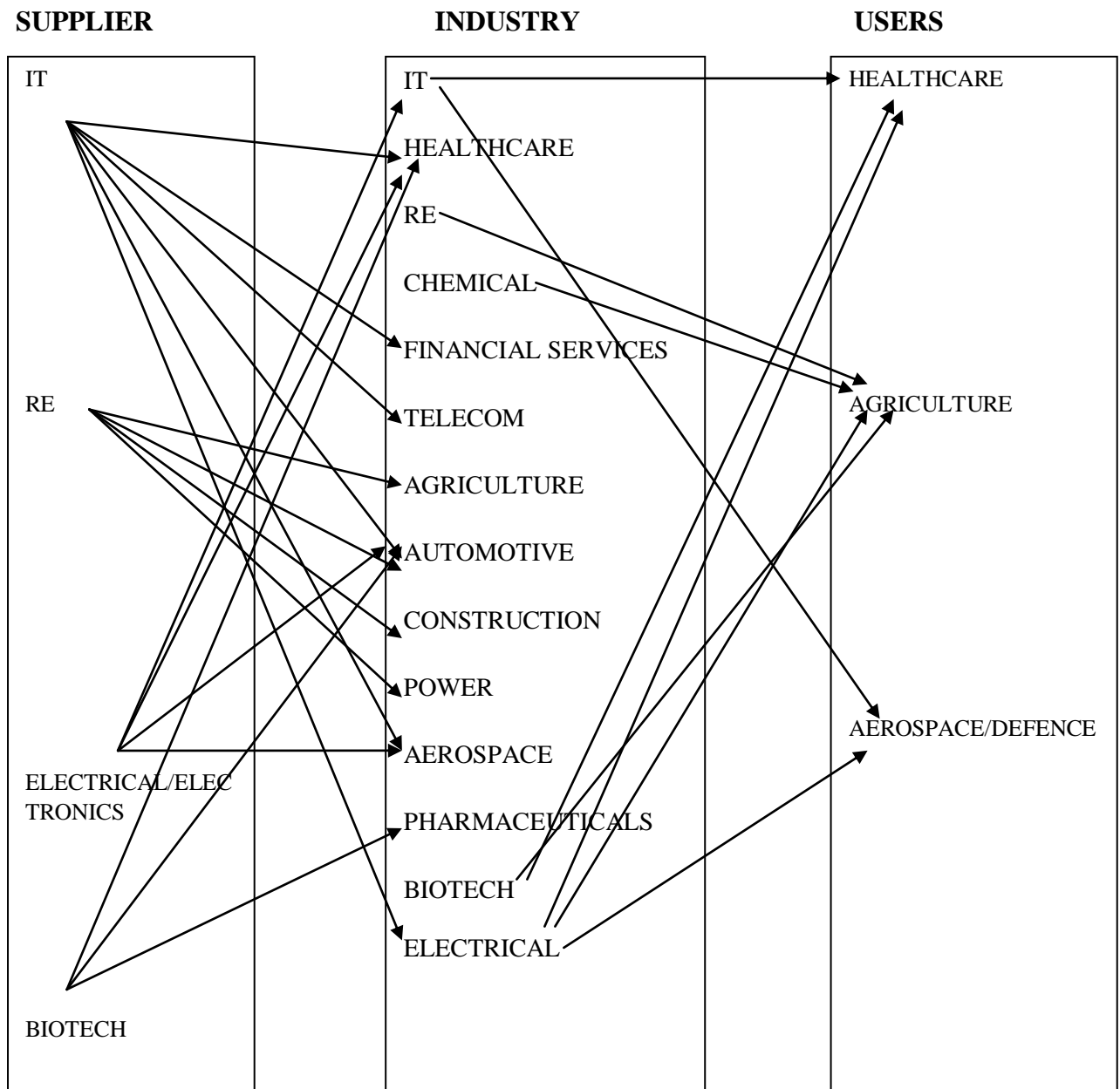


Figure 5.3: Supply-use innovation interactions in Indian Economy



5.4.6: The findings & recommendations:

The research findings are as follows:

- The innovative activities seem to have clustered around IT, Electrical & Electronics, Cleantech (Renewable Energy), Biotech, Chemical, Healthcare and Agriculture industry.
- The main suppliers for the Innovation outputs happen to be from IT, Electricals, Biotech & Chemical Industry (contributing to 51% of total supplies) whereas the key users happen to be the Healthcare & Agriculture industry (27% of the total use).
- Health care and Agriculture happen to be the main users of the Innovation outputs; however they do not supply the innovation outputs as much. Similarly IT, Electronics, Renewable Energy, Biotech & chemical industries –the key suppliers of the innovation output are not in the list of main users of innovation output.
- Unlike the developed countries, inter industry innovative linkages do not seem strong in cases of Aerospace & Defence, Steel, Metal Products & cement. The policy interventions and decisions have to support the innovation building strategies by promoting cluster dynamics and directing inter-industrial knowledge flows for the enhancement of establishing cooperative networks & production linkages in these industries and also the producer goods industries, particularly the fixed capital goods, as we see in industrially developed economies.
- The findings evidence the lack of interactions between different agents of innovative activities. The Science Technology and Innovation policy of India should map the non informal sources of learning (not captured in R&D, Patents or I/O data). The policy must include the cluster based policies to strengthen the inter industrial learning process and enhance the cluster dynamics and competitiveness.
- Increasing importance has been observed worldwide vis-a-vis the innovation surveys such as the **Community Innovation Survey, the PACE Survey and the surveys related to cluster interactions and the international knowledge flows**. India lacks such efforts. Efforts at the Government, Institutions and the Firms level should be made to undertake such surveys to make them internationally comparable to the benefit of the Growth and development Economists and the Policy makers. Reference Base can be **Frascati manual & Oslo Manual**.
- Listing grass root innovations as promoted by the National Innovation foundation is a very welcome move, however industry focused strategies need to be incorporated by

the growth strategists and policy makers such as ICAP (Industrial Capability Enhancement Programmes) in Singapore.

- More than 85 % of the respondents in the primary survey showed lack of confidence in government policies related to R&D, IP protection and the Government incentives. Care must be taken to address these issues.
- NIC has recommended setting up Innovation Universities, Meta Universities & Introduction of Innovations at Schools Programme, formation of State and Sectoral Innovation Council. The policy should also include industry-academia interaction with specialized profiles and focused strategy such as Brain 21 Programme in Korea. Lack of policy focus relating to enhancing the firms /universities specialized capabilities need attention.
- Maharashtra ,Karnataka,Tamilnadu,Andhra Pradesh ,Delhi including NCR seem to be contributing significantly in terms of innovating activities. Kerala & West Bengal are also catching up but other states really lag behind.

CHAPTER 6 THE MEASUREMENT ISSUES

This chapter illustrates the measurement issues related to the innovations. Increasing importance has been given in recent years to the theory and measurement of innovation. Though dealt by Schumpeter and many other economists, the contribution is specific to find measurements in terms of Leontief's production function of fixed input coefficients, capital coefficients of discrete and finite number of processes that may undergo technical change on account of innovations.

Subsequent to the emergence of the new endogenous growth models (Romer 1983, 1986; Grossman & Helpman 1992; Aghion and Howitt 1998), increasing importance has been given to the study of the theory and measurement of Innovation.

The growth report by the commission on growth & development that observed 13 economies growing at an annual rate of more than 7% for more than 25 years quoted "the growth of GDP may be measured up in the macroeconomic treetops, but all the action is in the microeconomic undergrowth, where new limbs sprout, and dead wood is cleared away."

Rightly so, in order to understand and build the new economic growth policies, an economy needs to understand the microeconomic issues related to the theory and measurement of innovation as the new economic policies need to acknowledge the augmenting importance of the technological progress that may have its impact on the factor and product prices and thereby changing the microeconomics of creation and destruction-the process that characterizes the contemporary economy.

6.1 Innovation – the concept and its measurement

Thanks to work by the OECD and others, we now have a definition of innovation done by firms that is fairly standard across a wide range of countries and surveys:

"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations."

6.2 A Taxonomy of Innovations

The taxonomy of innovations proposed by Freeman include

- Incremental Innovations-the innovations that follow each other continually and form the basis for the innovative process .However these innovations do not change the economic dynamics substantially.
- Radical Innovations-they are not uniformly distributed in time. They may arise frequently and shift to different technological groups. They consist both in capital goods, such as numerical control machines, and consumer goods, such as the television.
- New Technological Systems-the innovation that has pervasive influence on the economic system and brings about modifications in the conditions of not only in the principal sectors of production and utilisation but also in many other industrial and service sectors. Such innovations happen around the common technology basis and multiple innovations. Examples of new technological systems include the innovations in the fields of semiconductors, synthetic materials or electrical household appliances.
- Technological revolutions-innovation that changes the techno-economic paradigms and is associated with the major economic cycles. The case of steam engine, conveyor belt is known.

It is must that one of the definitions of innovation is taken as a unit of measure. As for new technological systems and technological revolutions, it is not possible to define them ex ante, since they can only be assessed on the basis of the economic effect taking place ex post.

It must be remembered that new technological systems and technological revolutions are made up of a number of interconnected innovations. It is, therefore, a question of identifying them according to the classification of incremental or radical innovation.

Another taxonomy recommended by Pavitt includes:

Supplier Dominated Firms-who do not produce majority of their innovations but source them from the suppliers. The industries in which such firms are typically found are traditional manufacture, building, and agriculture.

Scale-intensive Firms-who reap economies of scale to reduce the average cost of production. The typical sectors for firms of this kind are those of materials and, above all, those based on the conveyor belt.

Specialized Suppliers-include usually the small and medium enterprises. The typical sectors are those of machinery and scientific instruments.

Science-based Firms-are the firms with greater investment in Research & Development. They are characterized by the fact that they produce internally the majority of the innovations they use. Typical sectors are those of chemicals and electronics.

Both the taxonomy happen to be different. Freeman incorporates a sequence of breaks and subsequent re-composition whereas Pavitt, on the other hand, lays emphasis on the cumulative aspect of innovative activity, pointing out that what firms will do in the future is strongly conditioned by what they have done in the past. The nature of technological knowledge is therefore of a clearly

Though the definition by OECD is fairly standard across a wide range of countries and survey, the problem of measuring innovation still has limitations:

6.3 The measurement issues

1. Can we observe innovation in a timely enough way to act upon it? Debresson argues that innovations outcomes could be different. Some create new wealth and contribute in economic growth and development but not all innovations create wealth. Some just generate rents and redistribute existing rents (BAUMOL, 1993). Not all innovation may have been adopted at a scale large enough to have contributed economic growth (Rosenberg, 1969). David Sawers & Richard Stillerman (1958,1969) did not include computers in their writings “the sources of invention” in 1951 .The economic impact of computers would not have been same before the invention of semiconductors, integrated circuits and transistors Time bias in evaluating the importance and significance of an innovation is a pervasive and insurmountable problem.

The New York Times in 1939 did not see future in television.

“Television will never be a serious competitor for radio, because people must sit and keep their eyes glued on a screen; the average American family hasn’t time for it.” The forecast for the mobile subscriptions by 1999 was about one million by one of the leading consulting companies to AT&T. In fact the number of subscribers passed 70 million in that year.

The usage of LASER technology in chemistry, medical field, for the high quality reproduction of music CDs is another example. The behaviour of lasers had been predicted, on a purely theoretical basis, by Einstein, using no more than a blackboard and a piece of chalk, as long ago as 1916. But it took over 40 years before scientists could actually create a laser beam (Light Amplification by Stimulated Emission of Radiation). (Rosenberg)

2. A given innovative product or process for a given economic unit at a given time can be seen either as complement or a substitute. But at a macro level over time it may change radically. Semiconductor based computing was first used by IBM as a complement to punched cards. Then transistor electronics replaced punched cards in digital computers. Thus complement and substitute are not stable concepts.

3. The disruptive economic impact of an innovation is mostly due to an accumulation of improvements, complements and adaptations.

4. The proof of an innovation is in its adoption. That leads to another issue due to the analytical approaches that take into account innovation from the point of view of the innovation output or the business unit.

5. Innovation is new to the firm or new to the market? As innovation produces implementation of new or significantly improved product or process, it does not really say whether innovation is “new to the market” or “new to the firm” The difference in the extent & nature of novelty could have different impact on the economic growth and development and overall innovation ecosystem. This view of the “skewness” of innovation values is supported by a large amount of research on the valuation of patented inventions (Harhoff et al., 1999; Scherer and Harhoff, 2000; Hall et al., 2005).

6. Radical or incremental: Some innovations can be radical –the adoption of which can (E.G. aircraft, Peniciline, Semiconductors, Telephone) have profound impact on the economic growth and development. But some can be incremental. In one of the surveys by by Acs and Audretsch (1982), Over 85% of the innovations were modest improvements of existing products and none were radical enough to create entire new market.

7. The innovation surveys have typically measured innovation in two ways: first, by asking whether the firm introduced any innovation of a certain type (product, process,

organisational, marketing, etc.) during a preceding period (usually the past three years) and second, by asking the contribution of the innovation output to the sales revenue in the similar period. Some surveys have also included the degree of novelty, the share of exports revenue and the cost of innovative endeavours.

8. Many of the researchers study the share of sales of innovative products, which does give a good indication of how important the innovation(s) were overall for the firm in question. But this measure is useful only for goods and services and cannot be used to capture process or organisational innovation. (Bronwyn Hall)

9. Another problem exists vis-a-vis monitoring innovations whether it should be done on the level of individual productive unit (divisions) or at the industrial group level. The issue becomes more relevant in case of the multinational companies. The level of analysis chosen can impact the result especially with regard to the relationship between innovation and firm size.

10. In case of the finished products, it is practically not possible to determine a single sector of utilisation. The problem becomes more complex as many of the finished products are also used as the intermediary products.

As we deal with the measurement issues, it will be in the fitness of the things to mention about the following Institutions and their contributions:

SPRU –One of the biggest contributions in this field of the measurement and classification of innovation has been from Science Policy Research Unit of Sussex University. The innovations were classified on the basis of three criteria:

1. The “technological” group the innovation belongs to- such as “chemicals,” “electronics,” “Pharmaceuticals” etc. These are homogeneous innovations based on technical and engineering characteristics are grouped in technological categories
2. The prevalent economic activity of the body producing the innovation (or sector of production), and,
3. The sector of the utilization of the innovation, understood as the sector of the first application of the innovation.

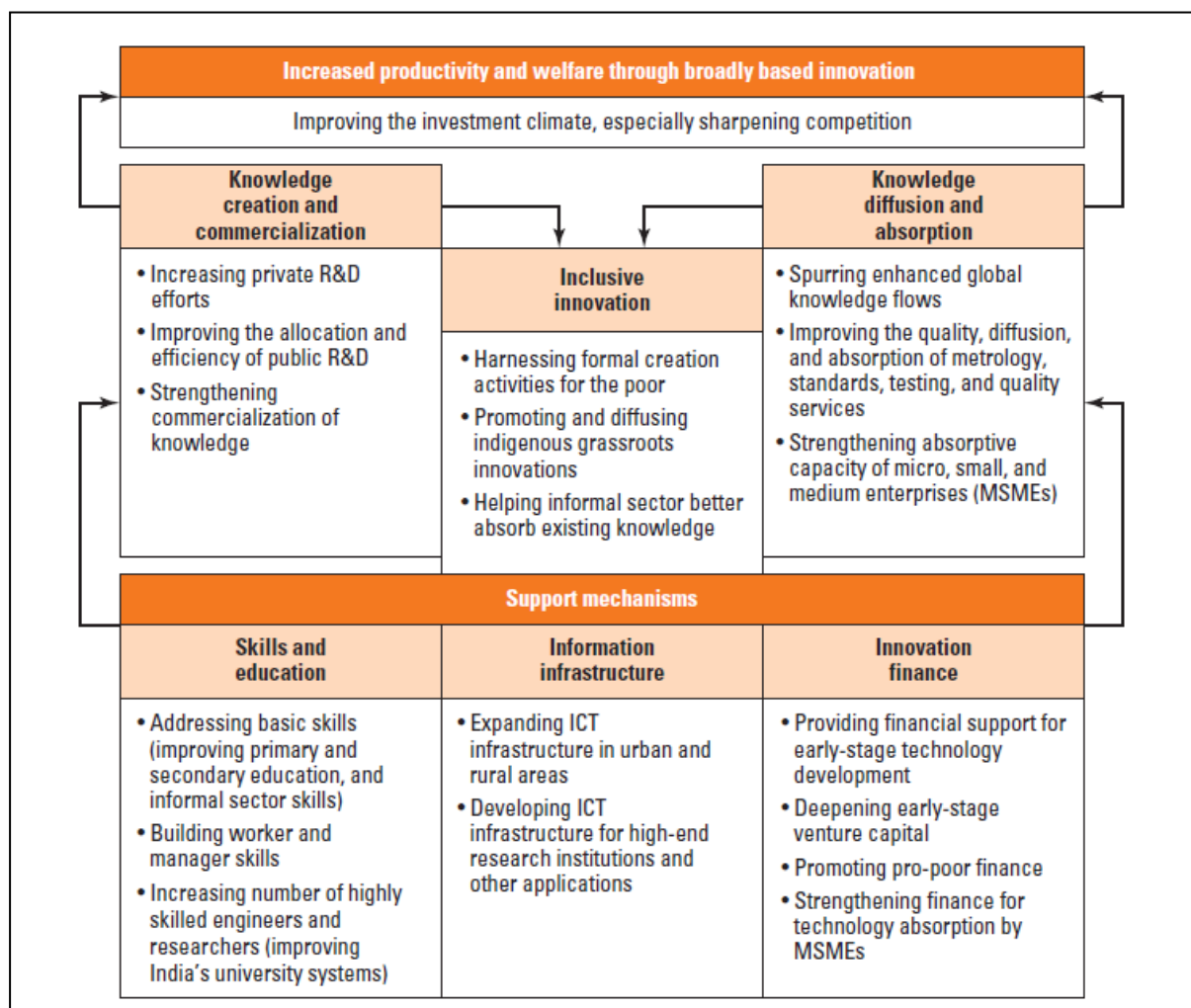
This classification however may coincide for some innovations such as a chemical process produced by a chemical firm and used by the same firm or others in the chemical industry. In other cases, they may be different, e.g., a coffee machine (under the first criterion, the technological group is that of “machinery”) produced by an automobile firm (under the second, the production sector is that of “means of transport”) and used in restaurants (under the third, the utilization sector is that of “catering”. (Daniele Archibugi’1988)

The *FRASCATI Manual* and *OSLO Manual* provide some guidelines for the measurement of innovation.

CHAPTER 7 BUILDING A CONCEPTUAL FRAMEWORK FOR NATIONAL INNOVATION POLICY

India faces an innovation challenge. Clusters can be powerful catalysts in this process and hence the research studies related to the innovative clusters merit due attention and appreciation. The Global Innovation Index reports conclude that India needs to improve the innovation performance to enhance its global economic competitiveness and bridge the innovation gap when compared to the innovating developed economies. The research efforts related to the *innovation ecology, the structure of innovative interactions, industrial interdependencies and the Government policies can help us plan and develop the cluster based policies to supplement the National Innovation Policy.*

Figure 7.1 Innovation ecosystem



Source: Mark A.Dutz

Efforts are afoot all over the world to plan, develop and implement a wide range of Cluster initiatives. European countries and regions have launched a wide range of cluster initiatives. Some of them have started clusters policies long ago (Catalonia and the Basque Country in Spain, Veneto in Italy ,Scotland in the UK, Sophia Antipolis in France, Denmark, the Netherlands) while others have started within the last few years (a number of Austrian regions, the Czech Republic ,the UK,Sweden)or have further developed them through national initiatives (France, Germany). Cross-border cluster initiatives operate in, for example, Republic of Ireland/Northern Ireland and the Oresund region. Activities specifically related to clusters are currently underway in several parts of the European Commission. The Competitiveness Innovation Programme, the Cohesion Policy, and the 7th Framework Programme include a wide range of activities open t o clusters, innovation and competitiveness.

Over the last few years, research efforts focused on *National Innovation Systems*, cluster analysis and cluster-based policy have gained global attention. Countries are increasingly using a “cluster approach” to analyzing *knowledge flows in national innovation systems* in recognition of the close interaction between certain types of firms and industries. These interactions may evolve around key technologies, shared knowledge or skills or producer supplier relationships. "Nations, whatever their overall level of innovative performance, do not usually succeed across the whole range of industries, but “in clusters of industries connected through vertical and horizontal relationships” (Porter, 1990). As the studies by DeBresson shows "the clusters display at an inter industrial level, underlying networks of interrelated cooperating businesses. The clusters are.... interdependent set of businesses structured through network relationships.

The use of innovation interaction matrices describing the flows of innovations from suppliers to users is promising, but is limited to the flows of major innovations of using and supplying industries. The main advantage of these tables is their focus on innovation interdependency and interaction between industry groups when innovating. Cluster based policy can play significant role in India’s economic growth and development .The cluster based policies can help

- Stimulating interactions and knowledge exchange between the various actors in systems of innovation;

- Identifying the policies that hinders the process of clustering and innovation;
- Planning for the cluster initiatives and the cluster improvement policy;
- strengthening the economic dynamism of existing clusters and to improving the opportunities for new clusters to emerge;
- helping Indian economy to build unique profiles of specialized capabilities to strengthen its relative competitiveness in the global economy;
- Policy formulation that allows competitive clusters to grow and structural change to occur;
- Encourage productive collaboration between companies, government agencies, research and educational institutions, and others that influence the overall ecology for innovative clusters;
- stronger cooperation between clusters with complementary strengths and between cluster initiatives learning from each other;
- Defining cluster-specific action agendas and strategies;
- strengthening the cooperation between cluster initiatives to create strategic business linkages and services platforms that leverage complementary assets and capabilities of different clusters;

Based on the research, the recommendations for India's Innovation policy should have the following considerations.

- The Research & Development expenses as the percentage of GDP should increase. In one of the articles 'What will it take for a resident Indian to win a Nobel Prize?' Dr R.A.Mashelkar said;

'Indians can always argue that we do not win Nobel prizes because our investment levels are low. The US spends \$ 2.50 billion (Rs 1,125,000 crore) on R&D as against India's \$ 0.5 billion (Rs 22,500 crore). Size of the funding is, of course, important. You build large critical mass in a given field, setting up a competition. You empower the scientists hugely with modern tools so that they can run faster and arrive at the results first.'

Table 7.1: R&D Forecast

Region	2010 GERD PPP (Billion U.S.)	2010 R&D as Percent of GDP	2011 GERD PPP (Billion U.S.)	2011 R&D as Percent of GDP	2012 GERD PPP (Billion U.S.)	2012 R&D as Percent of GDP
Americas	473.7	2.3	491.8	2.3	505.6	2.3
U.S.	415.1	2.8	427.2	2.8	436.0	2.8
Asia	429.9	1.8	473.5	1.9	514.4	1.9
Japan	148.3	3.4	152.1	3.4	157.6	3.4
China	149.3	1.5	174.9	1.6	198.9	1.6
India	32.5	0.8	38.0	0.8	41.3	0.8
Europe	310.5	1.9	326.7	1.9	338.1	2.0
Rest of World	37.8	1.0	41.4	1.1	44.5	1.1
Total	1,251.9	2.0	1,333.4	2.0	1402.6	2.0

SOURCE: Battelle and R&D Magazine, 2012 Global R&D Funding Forecast, December 2011.
NOTE: GERD: Gross Expenditures on R&D, PPP, Purchasing Power Parity. The Chinese government reports somewhat different estimates of 1.83% for 2011 and 1.76% for 2010. See “Statistical Bulletin on National Science and Technology Expenditures in 2010 and in 2011.

- Science, Technology and Innovation Policy must promote the culture of innovations and Innovation of culture. Indian Scientists in the past have contributed many “first to the world ideas”. The top 10 achievements of Indian STI in the 20th century as listed by Jayant Narlikar, one of the celebrated leading Scientists of India include the following:
 - a) *The contributions of Srinivasa Ramanujam;*
 - b) *Meghnad Saha’s ionization equation (1920) opening the door to stellar astrophysics;*
 - c) *S. N. Bose’s work on particle statistics (1922);*
 - d) *C. V. Raman’s discovery that molecules scatter light (1928), the Raman Effect;*
 - e) *N. Ramachandran’s pioneering work in structural molecular biology (mid-1960s), the Ramachandran Map& collagen triple helix;*
 - f) *The development of nuclear power and capability (1950s).*
 - g) *The Green Revolution in agriculture (the 1960s and 1970s).*

- h) *The Indian space programme and satellite fabrication with satellite vehicle launching capability (from late 1970s).*
- i) *The work in high temperature superconductivity (since the late 1980s).*
- j) *The transformation of the chain of 40 laboratories of CSIR towards an industry-oriented, performance- driven and accountable organization (in late 1990s).*

The PARAM Series of super computer was made by Dr Vijay Bhatkar, the most prominent IT scientist of India when USA had denied access to supercomputing. Thus the innovation potential of India cannot be questioned but we need to take measures to build the culture conducive to innovation.

- The policy efforts should further enhance the learning dynamics in the industries such as IT, Healthcare, Electricals & Electronics, Biotechnology and clean technology as the firms in these industries in India seem more active and dynamic. The focused strategy should be developed to enhance the cluster dynamics and cluster interactions.
- Institutional support mechanism to promote innovative linkages and interactions and the research & Development should be built by establishing well-funded public-private partnerships such as *Germany's Fraunhofer-Gesellschaft, Korea's Electronics and Telecommunications Research Institute, Taiwan's ITRI, and Finland's Tekes*. They have proven remarkably successful at helping domestic manufacturers translate new technologies into products and production processes. The support should also be extended in providing early stage finance.
- The university-industry interaction should be institutionalised to promote the applied research. WIPO report shows the rising share of University and PRO applicants in first patent filing in the emerging areas like aviation, 3D printing, Nanotechnology, Semiconductor, Robotics and antibiotics. Indian universities and the companies do not feature in the list.

Figure 7.2: Share of University & PRO applicants in first patent filings

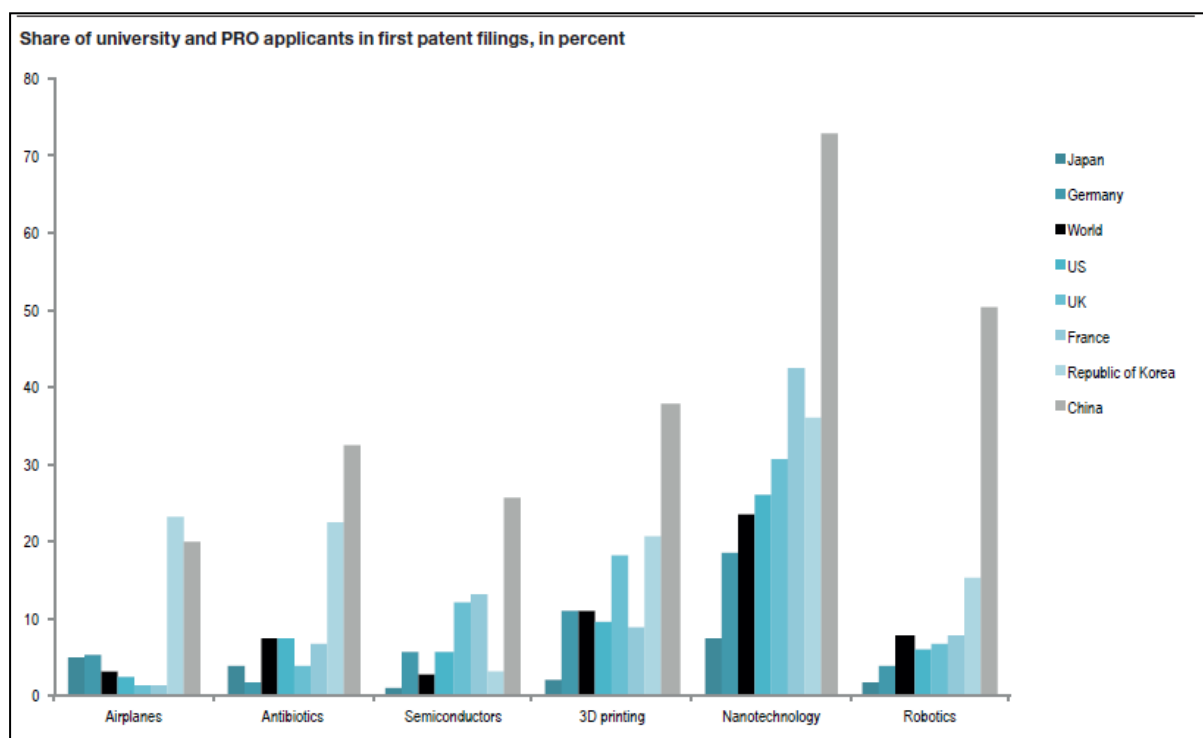


Table 7.2: Top10 patent applicants in 3D printing, Nanotechnology & Robotics since 1995

3D Printing			Nanotechnology			Robotics		
Applicant	Origin	First Filings	Applicant	Origin	First Filings	Applicant	Origin	First Filings
3D Systems	US	200	Samsung Electr	KR	2,578	Toyota	JP	4,189
Stratasys	US	164	Nippon Steel	JP	1,490	Samsung	KR	3,085
Siemens	DE	145	IBM	US	1,360	Honda	JP	2,231
General Electric	US	131	Toshiba	JP	1,298	Nissan	JP	1,910
Mitsubishi	JP	127	Canon	JP	1,162	Bosch	DE	1,710
Hitachi	JP	117	Hitachi	JP	1,100	Denso	JP	1,646
MTU Aero Engines	DE	104	Univ of California	US	1,055	Hitachi	JP	1,546
Toshiba	JP	103	Panasonic	JP	1,047	Panasonic	JP	1,315
EOS	DE	102	Hewlett Packard	US	880	Yaskawa	JP	1,124
United Technologies	US	101	TDK	JP	839	Sony	JP	1,057

Notes : JP-Japan, DE-Germany, KR-Korea, US-United States

The estimated market size of 3D printer seems very large, however no University has taken a lead in this direction of filing the patent .Thus our Innovation policy should encourage the research & development in these areas.

Table 7.3: Estimated potential size/growth rate of 3D printer

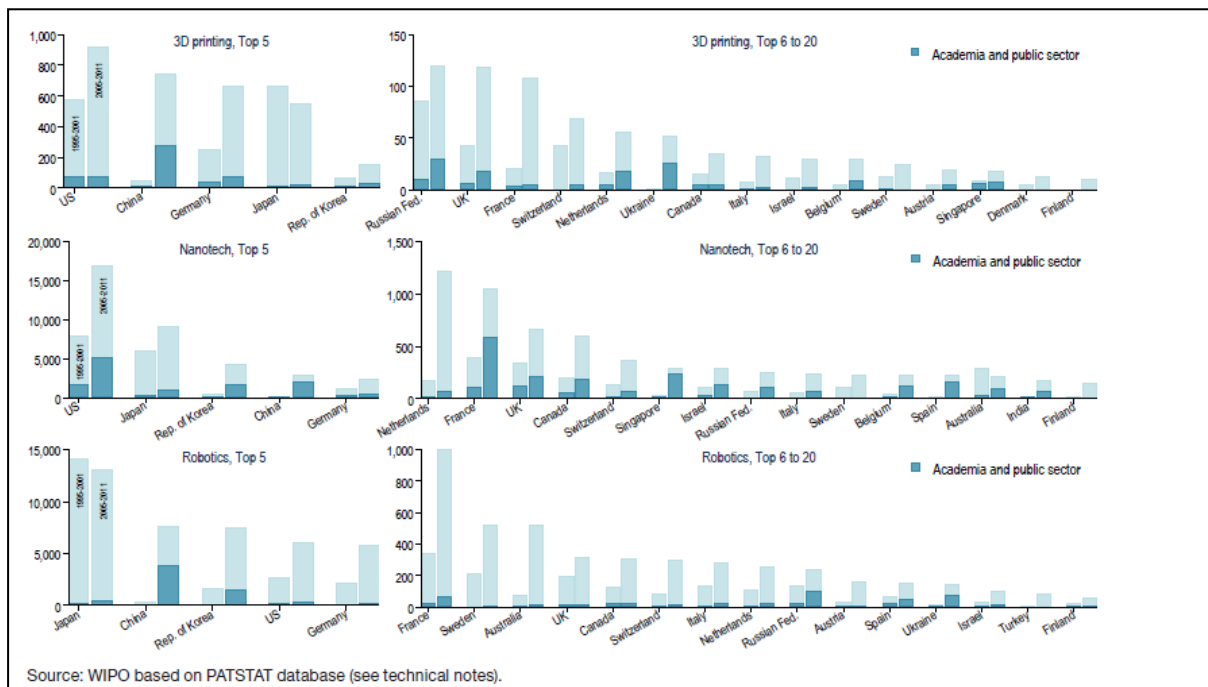
Market	Estimated Potential Size/Growth Rate	Source
Global 3D Printing industry (associated technologies, products & services)	USD 10.8 billion by 2021	Wohlers Associates,2013
Global 3D Printing industry (associated technologies, products & services)	USD 4 billion by 2025	Research & Markets,2013
3D printing materials market (including plastics ,metals, ceramics, others)	CARG 19.9% until 2018	RnR Market Research,2014
3D printing for medical application	USD 965.5 million by 2019,CARG 15.4%	Transparency Market Research
Source:Bechtold et al (2015)		

Table 7.4: University & number of first patent filings

University Name	Country	Number of first patent Filings
Fraunhofer Society	Germany	89
Chinese Academy of Sciences	China	79
Huazhong University of Science & Technology	China	46
MIT	US	37
Xi'an Jiaotong University	China	34
University of Southern California	US	31
South China University of Technology	China	27
Harbin Institute of Technology	China	24
TNO	Netherlands	24
Beijing University of Technology	China	17
Source: WIPO based on PATSTAT		

The absorption capacity building exercises should be encouraged through reverse engineering & knowledge sharing networks in India and overseas.

Figure 7.3: Countries driving patenting in 3Dprinting, Nanotechnology & Robotics



- Countries such as China and South Korea employ a powerful combination of state subsidies, national standards, preferential government procurement for national firms, and requirements for technology transfer to drive the growth of nationally based innovation. They also encourage state-owned or –supported enterprises to compete globally in strategic emerging industries with the help of low-cost loans—often with little concern for near-term return on investment or overcapacity.
- India should invest heavily in Broadband networks and other infrastructure required promoting learning, the knowledge flows and innovation. Once the innovative linkages are identified, cluster can be made more dynamic, productive and efficient.
- Efforts should be made to strengthen the link between manufacturing and innovation. Our finding show the lack of innovative clustering in manufacturing.
- Maharashtra, Karnataka, Tamilnadu, Andhra Pradesh, Delhi including NCR seem to be contributing significantly in terms of innovating activities. Kerala & West Bengal are also catching up but other states really lag behind

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APPENDIX – 1

THE SURVEY QUESTIONNAIRE

Gokhale Institute of
Politics & Economics,
Pune

Manoj K.Singh

[RESEARCH & INNOVATION-THE QUESTIONNAIRE]

The research aims to map the innovative activities in economic space and identify the innovative clusters and the structure of the innovative interactions in Indian Economy.

RESEARCH & INNOVATION-THE QUESTIONNAIRE

SECTION 1: RESPONDENT'S BACKGROUND

A. Respondent's details

1. Name:
2. Address:
3. Telephone:
4. Email:
5. Website:
6. Job designation:
7. Job Position:
 - a) Top Management
 - b) Middle management
 - c) Core Staff
 - d) Administrative Personnel
 - e) Other (please specify)
8. No of years with current organization:
 - a) 1-5
 - b) 5-10
 - c) >10

B. Company details

1. Name of the company:
2. Legal status:
 - a) Public
 - b) Private
 - c) Other (please specify)
3. Year of establishment:
4. Type of sector:
 - a) Manufacturing
 - b) Services
 - c) Research
 - d) Consulting
 - e) Other(please specify)
5. No. of staff:
 - a) 1 to 19
 - b) 20-199
 - c) 200-499
 - d) 500-999
 - e) >1000

RESEARCH & INNOVATION-THE QUESTIONNAIRE

SECTION 2: INNOVATION MANAGEMENT IN YOUR COMPANY

This simple self assessment tool focuses on some of the important areas of innovation management. For each statement simply put a score between **1 (=not true at all) to 7 (=very true)**

Serial no.	Statement	Score (1.....7)
STRATEGY		
1	People appreciate and understand the importance of innovation in order to compete	
2	Our innovation strategy is clearly communicated to support engaged and effective participation for better performance and innovative outcome	
3	People know the distinctive competence of the company	
4	Structured and predictive assessment of market/technology is conducted to be ready for future challenges and be aware of the SWOT factors.	
5	The top Management has the shared vision of innovation	
6	There is top management commitment and support	
7	We have processes in place to review new technological or market developments and what they mean for our firm strategy	
8	The innovation projects undertaken by the company align with the strategic goals of the business	
PROCESSES		
9	We have processes in place to help us manage new product development from idea to launch	
10	Our innovation projects are usually completed on time and within budget	
11	We have effective mechanisms to make sure everyone in the company understand customer needs	
12	The process strategies include effective mechanisms to accommodate process changes from implementation	
13	We systematically search for new product ideas	
14	We have mechanisms in place to ensure early involvement of all departments in developing new products/processes.	
15	We have a clear system for Choosing innovation projects	
16	There is sufficient flexibility in our system for product development to allow small fast track projects to happen	
ORGANISATION		
17	Our organisation structure supports innovation and not stifles it	

RESEARCH & INNOVATION-THE QUESTIONNAIRE

18	People work well together across departmental boundaries	
19	People are involved in suggesting ideas for improvements to products/processes	
20	Our structure supports effective and rapid decision making	
21	Communication is effective and works top-down, bottom-up and across the organisation	
22	Our reward and recognition system supports innovation	
23	We have a supportive climate for new ideas	
24	We work well in teams	
LINKAGES		
25	We value our relationships with our suppliers	
26	We regularly evaluate the needs of our customers /end users	
27	We work with universities & other research centres to help us develop our knowledge	
28	We work closely with our customers in exploring and developing new concepts	
39	We collaborate with other firms to develop new products/processes	
30	We try to develop external networks of people who can help us-for example with specialist knowledge	
31	We work closely with the local and national education system to communicate our needs for skills	
32	We work closely with lead users to develop innovative new products and services	
LEARNING		
33	There is strong commitment to training and development of people	
34	The projects are reviewed to improve our future performance	
35	We learn from our mistakes	
36	We systematically compare our products and processes with other firms	
37	We meet and share experiences with other firms to help us learn	
38	Learning outcomes are captured and shared to build and support the effective organisational learning capability	
40	We use measurement to help identify where and when we can improve our innovation management	

RESEARCH & INNOVATION-THE QUESTIONNAIRE

SECTION 3: THE DIFFUSION OF TECHNOLOGICAL INNOVATION

A product may be considered technologically innovative when it originates (creates) a new market or when it may be distinguished, from the point of view of the technology and of performance, from existing products.

1. Over the last five years the firm has	YES/NO
a) Improved considerably, from a technological point of view, the existing products	
b) Introduced into the market new or technologically innovative products	
c) Improved considerably ,from a technological point of view, the productive processes	
d) Introduced new productive processes	
e) Introduced considerable organisational innovations linked to technological innovations	
2. The innovative activity of the firm is linked to	YES/NO
a) R&D	
b) Doing and tooling up	
c) Patents held by the firm	
d) Acquisition of scientific and technological knowledge from outside	
e) Industrial property rights relative to patents, inventions, know-how etc	
f) Capital goods (plants, processes, machinery),intermediary goods, raw materials, acquired from other firms	
g) Public financing of industrial innovation	
h) Other	

Some factors which hamper or render inappropriate the introduction of new technologies into the firm are listed below. Please indicate in descending order of importance upto 5 reasons why the firm did not introduce technological innovations over the past five years.

3. Please indicate in descending order of importance	5...1
a) Problems linked to financing	
b) Excessive cost of innovation	
c) Excessive risk of innovation	
d) Insufficient knowledge of markets	
e) Shortage of qualified manpower	
f) Difficulties in introducing important changes into the organisation	
g) Shortage of scientific and technical knowledge within the firm	
h) Difficulty to collaborate with public/private research lab	
i) The firm introduced the innovations before the 3 years period considered	
j) The type of production of the firm does not require relevant technological innovations	
k) The industrial sector to which the firm belongs does not require relevant technological innovations.	
4. The firm plans to introduce, over the next five years, technological innovations relating to	Please tick.
a) New or improved product	
b) New or improved processes	
c) Organisational innovations	

RESEARCH & INNOVATION-THE QUESTIONNAIRE

SECTION 4: SOCIO CULTURAL DETERMINANTS OF INNOVATION

It will be a practice worthwhile to assess the socio-cultural determinants of innovation and how they relate to each other.

HUMAN CAPITAL		
S.No	Description	Score (1.....7)
	Human Resource in Science and Technology as % labor force	
	Relative competence in the industry	
	Availability of qualified personnel and domain experts	
	Job-to job mobility of employed human resource	
	Attitude towards learning	
	Willingness to take risks	
	Readiness to accept change	
	Openness to new information	
SOCIAL CAPITAL		
S.No	Description	Score (1.....7)
1	Cooperation with the competitors	
2	Cooperation with the Industry members not necessarily competitors	
3	Cooperation with the academic world	
4	Customer as a source of information	
5	Suppliers as a source of information	
6	Distributors response	
7	Trust	
8	Corruption	
CULTURAL CAPITAL		
S.No	Description	Score (1.....7)
1	Interest in science and technology	
2	Attitude towards science	
3	Attitude towards risk from new technology	
4	Attitude towards future	
5	Attitude towards environment	
6	Attitude towards other cultures	
7	Customer responsiveness	
8	Low on power/status ,hierarchy (Low power distance)	
ORGANISATIONAL CAPITAL		
S.No	Description	Score (1.....7)
1	The organization values the initiatives at work	
2	Readiness of management to delegate decisions to subordinates	
3	A lot of decisions are taken by domains and respective heads	
4	Relation between employers and employees is generally cooperative	
5	Risk taking ability and entrepreneurship is encouraged	
6	Introduction of an organizational innovation	
7	The importance of organizational rigidities as percentage of all innovative activities	
8	Long term orientation	

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SECTION 5: QUESTIONNAIRE ON INNOVATIVE OUTPUTS BY YOUR FIRM

An innovation is a commercialised invention or improvement. An innovation is a new or improved product which has withstood the trial for the market for approximately five years or a new or improved process used for commercial production for approximately five years in India. The period covered is 1947 to date.

1. Innovation

- a) Name:
- b) Description:

2.

- a) Name & Address of Innovating firm (Head Office):

- b) Innovating establishment (Factory/Lab/Mine or the Operating entity that first produced the innovation or used the process):

3 In what year was the innovative product first produced and marketed in India or the process used for commercial production in India?

4. Were you the first to market this product in India or use this process for commercial production in India?

- a) Yes
- b) No
- c) Do not know

5. Had this or a very similar product or process been marketed or used outside India before?

- a) Yes
- b) No
- c) Do not know

IF yes, Please name upto three countries:

Country

year

1.

2.

3.

6.

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a) Who was (were) the principal client(s) for the innovation during the first three years?

(Multiple answers are allowed)

1. Consumer and/or trading company
2. The establishment within your company that first produced the product or used the process
3. Another establishment of your company
4. Other non trade establishments and companies
5. Government/agencies
6. Other

b) Identify up to three establishments and/or companies

1. Name:

Address:

Town:

country:

Industry or economic activity:

2. Name:

Address:

Town:

country:

Industry or economic activity:

3. Name:

Address:

Town:

country:

Industry or economic activity:

7. Your product innovation probably competes for markets with firms that produce and market an identical or similar product(s) performing same function for the same clients;

RESEARCH & INNOVATION-THE QUESTIONNAIRE

or your process innovation has output that competes with that of similar or alternate production processes.

Name upto main 5 competitors in India /overseas

1. Name of the company:
Country:
Product/Process:
 2. Name of the company:
Country:
Product/Process:
 3. Name of the company:
Country:
Product/Process:
 4. Name of the company:
Country:
Product/Process:
 5. Name of the company:
Country:
Product/Process:
 8. Who developed the innovation? (Multiple answers are allowed)
 1. The establishment within your company
 2. Other establishments in the same company
 3. who supplied your firm with some of the key components contributing to this innovation?(scientific, technical, equipment, materials etc)
-
1. Name of the company:
Address:
Town: country:
Industry or economic activity:
 2. Name:
Address:
Town: country:
Industry or economic activity:

RESEARCH & INNOVATION-THE QUESTIONNAIRE

9. In which industries was your firm involved at the time the innovation was first produced, marketed or used?

	S.I.C Code
_____ main	-----
_____ second	_____
_____ third	_____
_____ fourth	_____
_____ fifth	_____

10. The number of employees your firm had at the time of innovation (produced, marketed or used)

- a) 1-19
- b) 20-199
- c) 200-499
- d) 500-999
- e) Over 1000

5. Confidentiality	YES/NO
a) I wish to make all data available	
b) I wish to exclude the names of the clients	
c) I wish to exclude Names of competitors	
d) I wish to exclude Names of component suppliers	
e) Other	

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SECTION 6: QUESTIONNAIRE TO INDUSTRIAL EXPERTS

(INNOVATION IN HEALTH CARE INDUSTRY IN INDIA)

Brief description of innovation	Year introduced	Innovating firm	address	User firm

You can name any innovation that has taken place in the health care industry in India since 1965.

Thank you for participating in the survey. I sincerely thank you all the time and efforts taken out. Please use the following sheet to write down anything that you feel could be of help to support the survey.

CONFIDENTIAL

RESEARCH & INNOVATION-THE QUESTIONNAIRE

Your comments (if any)

CONFIDENTIAL

APPENDIX – 2

INNOVATION INTERACTION MATRICES

APPENDIX – 3

SURVEY OF THE THESIS

S.No	Title	Innovator	Address	Website	Primary application
1	E-20	Mahindra Reva (Electric Automotive)	Mahindra Electric 122 E , Bommasandra Industrial Area, Off Hosur Road, Bangalore, Karnataka-99	www.mahindrareva.com	Automobile
2	Professional Emergency Management service	GVK-EMRI (Energy management & Research Institute)	Devar Yamzal, Medchal Road, Secunderabad – 500 078. Telangana, India.	www.emri.in	Healthcare
3	Touchscreen devices	Micromax (Telecom)	Micromax House 90B, Sector- 18, Gurgaon - 122015	www.micromaxinfo.com	Telecom
4	Step-less boarding ramps ; maintaining the highest on-time performance levels	Indigo (Airline)	IndiGo Central Wing, Ground Floor, Thapar House, 124, Janpath, New Delhi – 110001 India.	https://www.goindigo.in	Air transport
5	RFID-equipped ATMs dispense purified water	Sarvajal (social enterprise)	Piramal Water Pvt Ltd Chandan Bungalow, Usmanpura, Ahmedabad, Gujarat	http://www.sarvajal.com	Chemical
6	Electronic asset management	Attero Recycling (E-waste Management company)	H-59 Sector 63, Noida, UP 201301,	http://www.attero.in/	Electronics Metal
7	Numeric weather prediction models & crop insurance solutions	Skymet Weather monitoring & risk solutions company	Plot no. 10 & 11, GYS Heights, Sector 125, Noida - 201303	www.skymetweather.com	Agriculture

8	Digital movie distribution industry	UFO (Digital Movie Distribution)	Valuable Techno Park Plot No.53/1, Road No.7 Opp. Akruiti Trade Centre MIDC, Marol, Andheri - East Mumbai - 400 093	http://ufomoviez.com/	Entertainment IT Telecom
9	\$2200 car	Nano (Automotive)	Tata Motors Limited 20th floor, Tower 2 One Indiabulls Centre, 841, Senapati Bapat Marg Mumbai-13	http://nano.tatamotors.com	Automotive
10.	Standardization principles from McDonalds	Aravind Eye Hospitals (Healthcare)	1, Anna Nagar, Madurai - 625 020, Tamilnadu, India	www.aravind.org	Healthcare
11	Open heart surgery	Narayana Hrudayalaya, (Healthcare)	Banagalore	http://www.narayanahealth.org	Healthcare
12	SyRe Reagent	Agappe (Diagnostics)	Agappe Hills, Pattimattom (PO), Dist. Ernakulam, Kerala - 62	http://agappe.com	Healthcare
13	Online energy management system	Bharat Forge (Forging)	Bharat Forge Limited Pune Cantonment, Mundhwa Pune -36	http://bharatforge.com	Power
14	Accelerating Drug Development Cycles and Speed-to-Market	Bilcare Limited (Pharmaceutical)	601, ICC Trade Tower, Pune - 411 016, India	http://www.bilcare.com/insight/success_stories.htm	Pharmaceuticals
15	nonClonableID Technologies	Bilcare Limited	601, ICC Trade Tower, Pune - 411 016, India	http://www.bilcare.com/businesses/bilcare_technologies2.htm	Pharmaceuticals
16	Pharmaceutical Packaging	Bilcare Limited	601, ICC Trade Tower, Pune - 411 016, India	http://www.bilcare.com/pdf/PPR_leaflet_%20jan%2013.pdf	Pharmaceuticals
17	Ricela-Rice	A.P.Organics Ltd	Village Manwala, Saron	http://www.ricela.com/what_is_rbo_and_its_pr	Processed

	Bran Oil	(agriculture)	Road, Dhuri - 148024 Distt. Sangrur, Punjab	ccess.html	food
18	Lullaby LED Phototherapy System	Wipro-GE Healthcare	6th Floor, Windsor Building, Windsor Lane, Kalina, Near University, Santacruz East, Mumbai - 98	http://www3.gehealthcare.in/	Healthcare
19	Indigenous floating solar photovoltaic (PV) plant design	Tata Consulting Engineers Ltd	Pashan-Sus Rd, Pashan, Pune, Maharashtra 411021	www.tce.co.in	Power
20	India's largest blast furnace for steel plant in Rourkela	Tata Consulting Engineers Ltd	Pashan-Sus Rd, Pashan, Pune, Maharashtra 411021	http://www.tce.co.in/case-studies.php#.V30UePI971X	Steel Metal
21	World's first neural automation system for enterprises	Tata Consultancy Services Limited (IT)	Tata Consultancy Services Air-India Building, 11th Floor Nariman Point, Mumbai 400 021	http://www.digitate.com/	IT
22	BaNCs	Tata Consultancy Services Limited	Tata Consultancy Services Air-India Building, 11th Floor Nariman Point, Mumbai 400 021	http://www.tcs.com/offers/bancs/Pages/default.aspx	Financial services
23	Hybrid Idler	JYOTI CERO RUBBER (Material handling)	NS- 1 & 2 (P), Phase - III Adityapur Industrial Area, Jamshedpur	http://www.jyoticro.com/rubber-products.html	Steel Cement Power
24	Coolants and Chemical Products	Fleetguard Filters Pvt Ltd (a Cummins Inc Joint Venture) (Chemical)	Campus Tower A Survey No. 21 Balewadi Pune -45 Maharashtra India	http://www.cumminsindia.com/MAIN/fleetguard.html#	Commercial engines

25	Launchers with Integrated sensors for All Types of Missiles and Rockets	(TataPowerSE D) (Power)	The Tata Power Company Limited Strategic Engineering Division 42 Off Saki - Vihar Road Andheri (East) Mumbai 400 072 India	http://www.tatapowersed.in/	Aerospace/Defense
26	eFACiLiTY® - Enterprise Facility Management System.	SIERRA ODC Private Limited (IT)	188/1 Varadharaja Layout-1, PN Palayam Road, KR Puram, Ganapathy, Coimbatore – 641 006, INDIA.	http://www.sierratec.com/index.php/sierra-adjudged-one-top-26-innovative-companies-india	Construction
27	Tata Swach-a low cost water purifier	Tata Chemicals Limited (Chemical)	Bombay House 24 Homi Mody Street Fort, Mumbai 400 001	http://www.tatachemicals.com/innovation/innovation_centre.htm#.V30dQf197IV	Chemical
28	Paras Farmoola customised fertilisers	Tata Chemicals Limited (Chemical)	Bombay House 24 Homi Mody Street Fort, Mumbai 400 001	http://www.tatachemicals.com/innovation/innovation_centre.htm#.V30dQf197IV	Agriculture
29	Agricultural water pumps	Southern Agro Engine Private Ltd (Agri Equipments)	24A, III Phase, Industrial Estate, Guindy, Chennai - 600 032, India.	http://www.southernagro.com/	Agriculture
30	Building automation products	L&T Electrical & Automation (Electrical)	L&T House, Ballard Estate P. O. Box: 278, Mumbai 400 001, India	http://www.larsentoubro.com/electrical-automation/products-services/products/automation-products-systems/building-automation-products/	Electrical construction
31	Ravelfire	RAVEL ELECTRONICS PVT. LTD (Electronics)	150A, Electronics Industrial Estate, Perungudi, Chennai 600 096.	http://www.ravelfire.com/	Electronics
32	Jeevan Amrit	Sesa Sterlite Limited	75, Nehru Road Vile Parle (East),	http://www.vedantalimi	Chemical

		(Energy)	Mumbai, Maharashtra 400099, India	ted.com/media/77292/jevan_amrit_project_fnl.pdf	
33	Redox engineering for 3-Hydroxypropionic acid	Mr. Sathyavrathan Pathanjali, (Biotech)	SVBIOTECH		textiles, chemical plastics health care
34	Solar Bottle Bulb	MIT	originally designed developed by students from Massachusetts Institute of Technology (MIT).		Renewable Energy
35	Companion diagnostics for diabetes management The innovation offers a simple test to detect anti-Insulin antibodies and there by allow doctors to make informed decision to change the dose or switch the patients to other insulin analogues	Affigenix Biosolutions Pvt Ltd. (Biotech)	Affigenix Biosolutions Pvt Ltd.	www.affigenix.com	Healthcare Biotech
36	Assisted respiration-mechanical ventilation	OneBreath India Pvt. Ltd. (Healthcare)	Flat No.302 Wellington Park Apartments 8/16 Wellington Street, Richmond Town Bangalore, Karnataka, India 560025	www.onebreathventilators.com	Healthcare
37	Pest-repellent food	Leela Holdings (Transportatio	Unit 10, Block 64,Bollineni	www.rominguard.com	Transport

	protecting sheets	n)	Hillside, Nookampalaya m Road, Sithalapakkam Chennai, India- 600126		Food
38	Bio-adhesive a protein based adhesive material replace stitches, staples and screws used in repairing the damaged tissues.	Dr. (Ms.) A. Gnanamani CSIR-Central Leather Research Institute	CSIR-Central Leather Research Institute CLRI, Adyar, Chennai 600 020.	www.clri.org	Biotech
39	Geothermal cooling technology	Mr. Arun Shenoy, GIBSS(Renewable Energy)	GIBSS	www.gibss.in	Construction
40	Swajal: Smart water station	VS Saurya EnerTech Private Limited 230 Udyog ,Vihar Phase 1 Gurgaon, NCR - 122016	Saurya EnerTech	https://sauryaenertech.com	Chemical
41	Medical diagnostic test kit	Thrombochek Labs Private Limited (Healthcare)	Thrombochek Labs Private Limited		Healthcare
42	Solar boiler using linear fresnel technology for process heat	Promethean Energy Pvt. Ltd. (Renewable Energy)	Promethean Energy Pvt. Ltd. 202-A, Shyam Smruthi, Sec-19, Nerul, Navi Mumbai - 400706	www.prometheanenergy.in	Renewable energy Power
43	Visually challenged ergonomic footwear	Mr. Krishna Sailnkoolu	Gitam University	www.gitam.edu	Healthcare
44	Zerodor Waterless Urinals	Ekam Eco Solutions Pvt. Ltd. (Sustainable Sanitation/healthcare)	A-425, Sarita Vihar, New Delhi – 110076, India	www.ekamecosolutions.com	Chemical

45	Low cost solar parabolic dish concentrator	Solwedish Solar Pvt. Ltd., Secunderabad (renewable energy)	Solwedish Solar Pvt. Ltd., Secunderabad	solwedish.com	Renewable energy
46	Hurdle technology for processing of shelf stable meat products	Dr. R. Thomas	Indian Council of Agricultural Research	www.icar.org.in	Agriculture Processed food
47	Solar conduction dryer- to carry food dehydration to prevent losses in agriculture		Science for Society	www.scienceforsociety.co.in	Agriculture
48	Halditech – turmeric processing Unit		Science for Society	www.scienceforsociety.co.in	Agriculture
49	CareMother - an end to end mHealth solution with <i>solar powered</i> medical devices kit for at door tests, open source <i>mobile application</i> and <i>web portal</i> for any time anywhere access and reporting to doctors		Science for Society	www.scienceforsociety.co.in	Healthcare
50	UltraHealth-waterfun station	Energy & Cleantech	Science for Society	www.scienceforsociety.co.in	Healthcare
51	Alternate Analytical Technology-soil nutrient	K.Perumal, Deepak Khemani, J Arun Kumar Chennai		www.amm-mcrc.org/pdf/AAT_mnua_l_english.pdf	Agriculture

	analysis				
52	Solar Powered Crop Harvester- reduce the labour needed in harvesting while cutting down the usage of fossil fuels in conventional harvesters	T J David, Hyderabad (Renewable Energy)	TJD Energy Solutions	www.tjdenergysolutions.com	Agriculture
53	Automated Solar Irrigation System	Atul Kulkarni,Bangalore	Spark-the rise (Mahindra & Mahindra)	www.sparktherise.com/projectdetails.php?pld=5844	Agriculture
54	Remote Controlled Power Tiller	Prajwal Kumar,Mangalore	Suvarna Building, Padukodi, Near Kuloor Bridge, Behind Kuloor Bus Stop, Kuloor, Mangalore - 575 013, Karnataka, INDIA.	www.robautonics.com	Agriculture
55	Remotely piloted aircraft for investigation of biological samples from farms	Bhushan Gosavi,Thane		www.youtube.com/watch?v=TaAMynliYEO	Agriculture
56	Sugarcane budd chipper	Roshanlal Vishwakarma	Narsimhapur, Madhya Pradesh	http://nif.org.in/innovations/sugarcane_bud_chipper/55	Agriculture
57	ENOVISION: Electronic Nose and vision system- tea process quality	Dr Nabarun Bhattacharya			Agriculture

	monitoring				
58	Intelligent water management system	Redi technologies Pvt Ltd			Agriculture
59	Bhungroo-waterlogging & irrigation solution	Naireeta services Pvt Ltd (social enterprise)	B7 Aditya Flats, Opp Rusabh Society, Fatehpura, Paldi, Ahmedabad 380007	http://www.naireetaservices.com/innovations/	Agriculture
60	Automatic sugarcane planter	Abhishek mengi		https://www.youtube.com/watch?v=RJAcOo5TjG0	Agriculture
61	Advanced PCM heat exchanger for cold storage	Thermal Energy Solutions Pvt. Ltd. (Thermal Energy solutions)	R-389, MIDC, Rabale, Navi Mumbai - 400701 India	http://www.tessol.in/	Agriculture Processed food
62	PLUGnCHILL Freezebox for grocery e-commerce	Thermal Energy Solutions Pvt. Ltd. (Thermal Energy solutions)	Thermal Energy Service Solutions Pvt Ltd Thermal Energy Solutions Pvt. Ltd. R-389, MIDC, Rabale, Navi Mumbai - 400701 India	http://www.tessol.in/tessol-launches-plugchill-freezebox-for-grocery-e-commerce/#.V3uO9fI97IU	Processed food Pharma Products
63	Seed vigour enhancement through magneto priming		Academy of embedded technology	https://www.youtube.com/watch?v=aAwNKcWx4uM	Agriculture
64	Vesag watch-personal emergency response system	Vyzin Electronics Private Limited (IT)	# 101, 8-2-268/2/C, Aurora Colony , Road No. 3, Banjara Hills, Hyderabad-500034, AP, India.	www.vesag.in	healthcare

65	SuCheck- intelligent Sugar Management	Biosense Technologies Pvt. Ltd (Medical Engineering)	Plot No. A, 233, Road No. 21-Y, Wagale Estate, Near Ashar IT Park, Thane West - 400604	http://www.biosense.in/suumlchek-new.html	Healthcare
66.	TouchHB- is a hand-held needle-free battery operated device that enables screening for anemia and simplifies monitoring of treatment on regular basis	Biosense Technologies Pvt. Ltd.	Plot No. A, 233, Road No. 21-Y, Wagale Estate, Near Ashar IT Park, Thane West - 400604	www,biosense.in	Healthcare
67	Ucheck- uses the smartphone camera to read test strips,to analyse results of urine or pin prick blood tests	Biosense Technologies Pvt. Ltd.	Plot No. A, 233, Road No. 21-Y, Wagale Estate, Near Ashar IT Park, Thane West - 400604	www,biosense.in	Healthcare
68.	Breathing Sensor Apparatus- This device is a User Interface that converts breath intensity into commands. With training ,it can allow a completely blind,deaf & dumb person to control various machines like wheelchairs &	Sussant Patnaik odhisa		www.sushantpattnaik.com	healthcare

	do a lot of work through them as a normal human being				
69.	3Nethra-an Intelligent Pre-screening Ophthalmology Device for automated identification of eye problems such As cataract,diabetic retinopathy,Glaucoma and cornea problems & refractive errors	Forus Health Pvt. Ltd. (Medical engineering)	#2234, 23rd Cross, Banashankari 2nd Stage Bangalore – 560 070, India	www.forushealth.com	Healthcare
70	Orthosis for Treatment of Infant Club Foot which is a complex congenital foot deformity where the infant's feet are twisted		Techpedia		Healthcare
71.	BxOne - Biopsy -The BioScoop™ and BXSeal™ technologies, integrated into novel biopsy platform are designed to provide safe, simple & affordable access to liver & other soft	Siraj Bagwan, Jonathan Pillai, Jagdish Chaturvedi, Sidharth Joshi	Indiolabs Omya Healthcare Campus, 116, Shailendra TechnoPark, 3rd Floor EPIP, Whitefield, Bangalore - 560 066	www.indiolabs.com/technologies.html	healthcare

	organs biopsy				
72	OcuDA-Ocular Digital Adaptor is a simple & compact external attachment, made to affix to any affordable common cameras (hotshot, smart phones & web camera & get a picture of the front portion of the eye & image processing software to evaluate for abnormal conditions.	Dr Ramesh Ve, Manipal		www.sparktherise.com/projectdetails.php?pld=168	Healthcare
73	NanoSniff-The solution is a low-cost, diagnostic aid for detecting biochemical markers that occur in cardiac dysfunctions	Nanosnifftechnologies. (Diagnostic)	Mumbai SINE , 3rd Floor, CSRE Building, IIT Bombay, Powai, Mumbai – 76	www.nanosniff.com	Healthcare
74	Laptop / PC based in 12 Led ECG Plug in-It features a real time display of the ECG signals on the screen and the ability to print on a standard A4 printer and an archival	Dr Ravi Mehrotra	NPL, CSIR	https://www.youtube.com/watch?v=j3nQlo8ugb8	healthcare

	database for later retrieval				
75	Sanjeevani: Disaster Kit-emergency & accident conditions as diverse as drowning,snake bite,fractures, toxicity & more	Rajendra Ladkat Pune		www.rajendraladkat.com	Healthcare
76.	AxioStat: Bleeding Arrestor- AXIOSTAT is a sterile, single use, non-absorbable wound dressing to stop traumatic external bleeding	Axio Biosolutions Private Limited (Medical)	99, Shangrila, 100 ft. Hebatpur Road, Thaltej, Ahmedabad - 380054, Gujarat, India	www.axiobio.com/product.html	Healthcare
77.	Digital Braille	Rakshith, Likhtih S		http://i4c.co.in/idea/getIdeaProfile/idea_id/746	Healthcare
78.	ViSparsh:Waist Belt-ViSparsh uses Microsoft Kinect as a depth sensor and processes its data to identify direction,distance & movement of potential obstacles coming into the users way	Jatin Sharma,Tushar Chugh,Rolly Seth		Visparsh.blogspot.in	Healthcare
79	Kavach-a T-shirt that measures	Rolly Seth, Jatin Sharma, Harsh, Manasvi Sihag		http://www.tusharchugh.com/works/kavach/	Healthcare Textile

	bodily functions such as body temperature, pulse rate, acceleration & GPS Location.				
80	Smart Pill Box-dosage schedule	Manasvi Sihag Faridabad		www.dellchallenge.org/projects/swasthya-sanjivani	Healthcare
81	Smart Cane- The smart cane has a detector which gauges distance to obstacles & operates a vibrator for warning the user of nearby obstacles	M Balakrishnan & students		www.cse.iitd.ernet.in/-assistechnology/	Healthcare
82	Sanket: Pocket ECG Recorder	Agatsa (Medical)	C-20/1, JSSATE, STEP, Sector 62, Noida - 201309. UP	www.agatsa.com	Healthcare
83	Smartphone for Visually impaired	Sumit Dagar Delhi		www.kriyate.com	Healthcare
84	Smart Skull - An Accident and Trauma Alerting Helmet	Mohit Bahl, Faridabad		News.yahoo.com/a-helmet-that-saves-lives-103903313.html	Healthcare
85	Multifunction Laparoscopy instruments	Chinmay Deodhar,Pune		Biodesign.stanford.edu/bdn/people/chinmaydeodhar.jsp	Healthcare
86	Fall Detection for Geriatric monitoring	Vinay Chaddha,Noida		www.sparktherise.com/projectdetails.php?pld=4701	Healthcare
87	Nila non-invasive healthcare	Bhairav Shankar,Hyderabad		www.avantari.co.in	Healthcare

	information monitoring system				
88	Cardea ECG: Mobile ECG- an external device which links up with a phone via Bluetooth	Cardea Biomedical Technologies Pvt. Ltd. (bio-medical)	Cardea Labs Office No. 305, 3rd Floor, Laxman Plaza Building Munirka New Delhi - 110067	www.cardea-labs.com	Healthcare
89	Sanitary Napkins-The technology is raw material for making Biodegradable Sanitary Napkins from indigenous pulps (Bagasse (Sugarcane waste), Bamboo stem, Knit-wear waste, banana stem, Water Hyacinth etc.) as an absorbent material and bio-degradable & compostable plastic	Aakar Innovations Pvt. Ltd. (social enterprise)	B-303, Great Eastern Summit Sector 15, CBD Belapur Navi Mumbai - 400614		Healthcare
90	Root Canal- Broad spectrum root canal filling composition for endodontic usage	Dr Rajdeep Pavaskar	Goa Dental College and Hospital,goa		healthcare
91	CardioTrack - Remote ECG Diagnostics	uber Diagnostics (Healthcare)	1670, 1st Floor, 18th Cross Rd, MRCR Layout, Stage 2, Vijayanagar,	http://www.uberdiagnostics.com/about-us/cardiotrack/	Healthcare

			Bengaluru, Karnataka 560040		
92	Non-invasive oral cancer detection device- a portable and non-invasive device for oral cancer detection, using optical fiber probe.	Mr. K.R. Suresh Nair Innobreeze Communication Technologies, Pvt. Ltd. (electronics)	Innobreeze Communication Technologies, Pvt. Ltd. Kerala		Healthcare
93	MOBMON:12.0-ECG-using an Android Smartphone	Kallows Engineering India Private Ltd (Software services company)	S . 7, Second Floor, Pai House, Sadar, Ponda, Goa India 403401	http://www.kallows.com/products.html	Healthcare
94	Muscle Strength Enhancement- Isokinetic Isometric Muscle Strength Enhancement of the paralysed muscle		Vel Tech Multi Tech Engg. College		Healthcare
95	Kinetic assay kit for eruloplasmin estimation		AFMC/DRDO		healthcare
96	Technology platform for producing proteins and viral therapies -The technology platform offers, (a) an Oncolytic virus that can kill cancer cells without	Mr. Vishwas Dattatraya Joshi,	Seagull Biosolutions Pvt. Ltd.		Healthcare

	affecting normal cells & (b) Dengue Virosome that will produce Dengue Virus like Particles inside human body and induce anti-Dengue immunity.				
97	Auto Kit to Improve Efficiency-This kit for 4 stroke engines, can be easily fitted in the inlet manifold line & increases the mileage without compromising on power.	Harinarayan Prajapati,Jaipur		www.nif.org.in/bd/product-detail/petrol-performance-enhancer	Automotive Power
98	Mobile Controlled Starter for Motors-A device to remotely control and monitor motors / pumps & similar equipment using a GSM mobile phone	Vijay Mehta, pune		www.khyatee.in (electronics)	Agriculture
99	Mitticool: Electricity-less Refrigerator	Mansukhbhai Prajapati,Rajkot	Mitticool	www.mittikool.in	Engineering
100	RVCR Renewable energy product			http://gyatk.com/rvcrEngines.html	Renewable energy Wind & water

	t				power generators
101	RVCR:Hybrid Fuel Engine Technology (automotive)	Ajee kamat,Pune		www.gyatk.com/index.com	Power
102	AutoCAST-X(SOFTWARE): Fast & Accurate Method for Solidification Simulation of Metal casting.	Dr B.Ravi		Efoundary.iitb.ac.in	Metal
103	FlakerBot / RefilBot- Recycling Waste Plastic as a Raw Material for 3D Printing;Flaker Bot which effectively shreds either PET or HDPE bottles & cups and RefilBot which melts the flakes and extrudes filament for use in 3D printers	Sidhant pai,Jayant Pai ,Suchismita Pai,Pune	Protoprint	www.protoprint.in	Engineering IT
104	Ride 2.0: Foldable Bicycle	Pankaj Kamatkar,Indore	Vgyan	http://www.pankajkkamatkar.blogspot.in/2012/11/about-my-invention-of-low-cost-folding.html	Engineering
105	Scooter Based Mill	Sheikh Jahangir Sheikh,Jalgaon		www.nif.org.in	Processed food Engineering

106	Solar Mosquito Trap and Destroyer	Matthew K Matthew, Kerala		www.nif.org.in/bd/product-detail/solar--mosquito-destroyer	engineering
107	MPP - Multi Purpose Processing (processed food)	Dharamveer singh	Haryana	7award.nif.org.in/award/profile/details.php?profile_id=6&page=6&st_id=1	Processed food
108	Enable Talk Gloves-a device that recognizes the user's hand gestures and outputs an electronically generated voice.	Vinoth Gurusamy	Chennai	www.knowtheworld.in/talking-gloves/	Electronics Healthcare
109	Comprehensive Protection from Electrocutation- It is based on the principle of detecting the increased electromagnetic field that occurs through a sensor.can be instilled on the helmets.	Ramdas M U,Ashfaq Muhammed T,Shahin T A,Sonu Unnikrishnan, Sreelakshmi,T hrissur	Techpedia	http://techpedia.com_profile/comprehensive-protection-from-electrocum.2013.pdf	Electronics
110	Reveteq© (Refrigerated Vehicle Tracking Equipment)		takshati		automotive Transport Processed food
111	Mobile Shoe Charger	Mandar Tulankar			Energy-power (engineering-added)

112	CanSat: Upper Air Monitoring Device	Udit Kumar, Abhish ek, Amay, Divye, Kalyan, Pankhuri, Rakshit Chennai			Engineering
113	Melt-It: World's Smallest Desktop - a 'coffee-maker' sized machine that can safely melt diverse metals like Aluminium, Silver, Zinc, etc.	Prof. Dipankar, Mumbai	Treelabs	www.treelabs.org	Metal Engineering (added)
114	SaUsR-Smart Autonomous underwater service robot		Gridbots		Engineering
115	Sar Fuel Saver- It offers vehicle users a dual advantage of fuel saving and causing less environmental damage.	Ramesh Rathi, Pune		Sarfuelsaver.blogspot.in	Automotive
116	Duct Bot Robot	Fahad Azad, Mumbai		www.robosoftsystems.co.in	Construction
117	Fin-a wearable technology	Rohil Dev, Arvind Sanjeev, Charles, Kerala		www.wearfin.com https://www.pinterest.com/pin/172122016983079040/	Electronics
118	Parinat Humanoid robot	Asahy Tejawani, Mumbai		http://technovation.stab.org/parinat/	Electronics

119	Payjal	Kirti Ranjan, Bangalore	payjalsolutions	http://www.i4c.co.in/idea/getIdeaProfile?idea_id=747	Chemical
120	Multiutility heat pumps (renewable energy)	M V Rane, Mumbai		www.iitb.ac.in	Agriculture Dairy
121	Recycling Plastic Packaging- Which are used in food packaging	Hetal Vaishnav Rajkot		http://nif.org.in/innovation/recycled_composite_material_made_from_multi_layer_film_plastic_packaging_waste/439	Plastic Processed food
122	E-Waste Recycling : used to recycle all kinds of e-Waste to create materials that can replace natural resources like wood, stone etc. and also fossil fuel created plastics. It is used to create useful articles that can be applied in construction, packing and manufacturing		rescuwearth	http://rescuwearth.com/	Construction Packing,
123	Prakhar: Rechargeable Solar Lamp	Ashish Gawade & Aniruddha Atre, Pune	Bopeei	www.bopeei.in/products	Renewable Energy
124	Vortex Power Generation- a hydroelectricity generator that directly harnesses the	Aravind Venukumar kerala		www.point5.in/arvo.html	Power

	kinetic energy of rivers to generate electricity. (RE)				
125	Clean energy generation using plasma process	Rajeev Prasad gupta Patna		www.eai.in/360/videos/lists/60	Renewable Energy
126	SolarEx-Highly Efficient Solar to Power Generation	Gaurav Dahake,kharg pur		www.cleaninventions.in/index.html	Power
127	i-Solarlite-solar lamp with mobile charging USB Socket	Rahul Pushp,Mumbai		www.i-solarite.com/products.htm	Renewable Energy
128	B-dream-This innovation is about using chewing gum and paper, including waste and scrap paper, to manufacture construction material such as bricks.	Binish Desai,Valsad		http://bdrmz.in	Construction
129	El-Rhino: Wood-free Paper from Rhino and Elephant Dung				Paper
130	Recycling of Rexine- converting discarded / torn rexine and reusing it for other useful	Ankur Vaishnav Rajkot		www.intel.com/cd/oo/oo/47/92/479240_479240.pdf	Construction

	products in construction , manufacturing (LEATHER).				
131	Pine Needle Gasifier:This innovation is a pine needle based generator which can produce 9 kW, out of which 7.5 kW can be used for domestic purposes.	Rajnish Jain Pithoragarh		www.avani-kumaon.org	Power
132	Road Energy Generation system	Srinivas & Sasiprabha,Hyderabad			Automotive
133	Novel Fuel Cell:An effective renewable resource that can conserve much needed fossil fuel required for running DG sets etc.	Ashish Lele, Pune		www.ncl.res.in	POWER(EARLIER FUEL) Renewable energy
134	EAPS:Exhaust Air Purification System (EAPS)		School of Electrical Engineering, KIIT University & Flat No-010, Neelamber Vihar Comple, Block-C, 40 Dum Dum Road, Kolkata-700074, West Bengal		Electrical

135	Floating wetland ecosystem (CHEMICAL)		Alaknanda Technologies Pvt. Ltd.	http://www.alaknanda.co.in/	Construction
136	Plug-in Parallel Hybrid Solution:Revolution improves fuel efficiency by 35%, reduces greenhouse gas emissions by 30%, and reduces travel costs by 25%.		KPIT pune		Automotive
137	Sodium Pumps for Prototype Fast Breeder Reactor		Kirloskar Brothers Ltd, (Power) Pune	http://www.process-worldwide.com/kbl-technology-to-cool-500-mw-fast-breeder-reactor-a-422797/	Power(nuclear)
138	Solar Biomass Hybrid Power generation at Shive Village		THERMAX Pune	http://www.thermaxglobal.com/solar-solutions/news-and-events/	Power
139	Rural Solar-Biomass Hybrid Cold Storage Project at Solar Energy Center, Gurgaon		THERMAX pune	http://www.thermaxglobal.com/solar-solutions/news-and-events/	Agriculture Processed food
140	MoboMoney & FightBack		Tech Mahindra	http://mobo-money.android.informer.com/	Financial services
141	PACE:Praj Advance Cellulosic Ethanol-(2nd generation)		Praj Industries pune	http://praj.net/pace.html	Brewery Biotech

	technology to process ligno-cellulosic raw materials (like sugarcane and corn residue) to bio-ethanol.				
142	Personal Emergency Response System:Automatic Fall Detection System		Symphony Teleca pune	http://www.symphonyteleca.com/	Healthcare
143	Services delivery platform		Symphony Teleca pune	http://www.harmandsp.com/#sdp	Automotive
144	IPMPlus – Intelligent Power Management of IT infrastructure (IT)		VigyanlabsInnovations Private Limited	http://vigyanlabs.com/	IT Telecom
145	Zero mail		ATOS	http://atos.net/en-us/home/we-are/zero-email.html	IT Financial services
146	Big Data : Viewer Engagement Analytics Solution for Leading Indian TV show Satyamev Jayate		Persistent Systems pune	http://www.nasscom.in/sites/default/files/uploads/Awards2013/InnovationAwards2013/docs/Persistent%20Systems%20TI_Shortlist.pdf	Consumer goods Pharmaceuticals
147	Olabs		CDAC Pune		IT

148	Cloud Computing : Platform for Indian language Application		Grass Root Software		IT
149	Companion diagnostics for diabetes-		Affigenix Biosolutions Pvt Ltd		Healthcare
150	maternal healthcare-ICT intervention to empower maternal healthcare		IIT Guwahati		Healthcare
151	Low cost automated web security solution		Ironwasp Information Security		IT
152	energy efficient pre-calcination technology		ACC		Construction
153	Manufacture of Hydrophobic (waterproof) cement		ACC		Cement
154	laminated polypropylene bags.(India's first commercial RMC)		ACC		Construction
155	Portland Pozzolana Cement using naturally available materials		ACC		Cement

156	BIOGAS DIRECTLY USED TO FRY THE FRYER BURNER		PEPSICO pune		Beverage
157	RENEWABLY SOURCED PET BOTTLE (BIO-BASED RAW MATERIALS,E. G.SWITCH GRASS,PINE BARK AND COM HUSKS(FUTURE POTATO PEELS,ORANGE PEELS OAT HULLS & OTHER AGRI BYPRODUCTS)		PEPSICO pune		BEVERAGE
158	HOTEL LOAD TRACTION ALTERNATOR WITH COMPANION ALTERNATOR		BHEL		Electronics
159	BHELSCAN:an advanced micro controller based flame scanning system		BHEL		ELECTRONICS
160	COPPER FREE COATING ON ELECTRODE WIRES FOR THE CO2 GAS METAL (METAL)			http://www.allindianpatents.com/patents/272023-method-for-producing-electrode-wire-for-gas-metal-arc-welding	Metal
161	Wet HNx		TATA STEEL	http://www.tata.com/article/inside/1tjxlyeO8fs=	AUTOMOTIVE

	system		Jamshedpur	/TLYVr3YPkMU=	
162	UTILISATION OF SOLID WASTE		TATA STEEL Jamshedpur	http://www.tata.com/article/inside/1tjxlyeO8fs=/TLYVr3YPkMU=	Cement
163	Dyes from Tea Waste		TATA TEA	http://www.tata.com/article/inside/1tjxlyeO8fs=/TLYVr3YPkMU=	Chemical
164	Managing the waste from the soda ash plant.		TATA CHEMICALS	http://www.tata.com/article/inside/1tjxlyeO8fs=/TLYVr3YPkMU=	Cement
165	Technology for utilization of used Iron Fines utilized as a partial replacement of cement in concrete road		ESSAR		CEMENT
166	Technology to make tiles or building blocks from the non-magnetic part of slag has been developed		ESSAR	http://www.essar.com/	Construction
167	Introduction of Stamp Charging and Partial Briquetting of Coal Charge (PBCC) for production of metallurgical coke:		ESSAR	http://www.essar.com/	COAL
168	energy recovery coke ovens to meet power requirements		ESSAR	http://www.essar.com/	POWER

169	Use of non-coking coal in iron making Use of Direct Reduced Iron (DRI)/Sponge iron in steel making		ESSAR	http://www.essar.com/	Steel
170	Use of hot metal in electric arc furnaces		ESSAR	http://www.essar.com/	Steel
171	E-waste recycling and metal separation plant (RE)		Respose Waste Management & Research Pvt Ltd Hira Krishna, Rajaji Road Cross Road no 1, Ramnagar, Dombivli East, Dist Thane Maharashtra - 421201.	http://www.resposeindia.com/	Metal
172	Hybrid Air Conditioner		Toro cooling systems	http://www.toro.net.in/	Consumer goods
173	Climaprint :Eco friendly Print services- printing from vegetable sources (CHEMICAL)		ENNATURA ENNATURA TECHNOLOGY VENTURES (P) LTD. Module - 8, Technology Business Incubation Unit Block - I, Indian Institute of Technology, Hauz Khas, New Delhi - 110016 India		Paper Packaging
174	SOLAR INVERTERS		SOLARURJA	http://www.solar-urja.com/	Power Agriculture

					Construction
175	MOTOR DESIGN AND ANALYSIS SOFTWARE		GLOBAL MOTORTECH (IT)	http://globalmotortech.com/products.htm	Automotive
176	OPTIBLEND SYSTEM:ALTERNATIVE FUELING OPTION		EDEN ENERGY INDIA PVT LTD	http://www.edenenergy.co.in/	Automotive
177	Hythane-the transitional Fuel: premium blend of Hydrogen and Natural Gas		EDEN ENERGY INDIA PVT LTD	http://www.edenenergy.co.in/dual-fuel-system.html	Automotive
178	Carbon Nanotubes & Nanofibres		EDEN ENERGY INDIA PVT LTD	http://www.edenenergy.co.in/bi-fuel-system.html	Chemical Plastic Cement
179	Wood burning stove		FIRST ENERGY	http://firstenergy.in/	Food
180	PCR Kits with internal control for shrimp viruses WSSV, YHV, TSV and IHHNV		Aristogene Biosciences Pvt. Ltd., Rajaji Nagar Industrial Town, Rajaji Nagar, Bengaluru, Karnataka 560023	http://www.aristogene.com/	Agriculture Processed food
181	an indigenous India specific 15 valent pneumococcal conjugate vaccine		Tergene Biotech Pvt. Ltd, Secunderabad	http://www.tergene.com/	Healthcare

182	Biomedical Devices, Implants and Diagnostics		Vinvish Technologies Pvt. Ltd., Trivandrum BIOTECH	www.vinvish.com	Healthcare
183	the development of Anaerobic Membrane Bioreactor (AnMBR) for waste to energy solutions		THERMAX Pune	http://induswater.ncl.res.in/Resources/Presentations/Kalyanraman-Thermax.pdf	BIOGAS Chemical
184	The development of pet animal food, fish leather and other marine biotechnology products from fish waste		Millenium Exports, Chennai (PROCESSED FOOD) MILLENNIUM EXPORTS 10/14, Anaikar Complex, 1st Floor, M.V. Badran Street, Periamet, Chennai - 600003, Tamil Nadu, India	http://millennium.tradeindia.com/	BIOTECH Leather Processed food(for fish)
185	Additive manufacturing Machine/3D Part Printer	Mr. Jeldi Bala Anand	JB Design Technologies Hyderabad, AP	www.jbdesigntech.com	IT
186	Automatic Chlorine Dispenser	Mr. Suprio Das	ZIMBA P2, Block B, Lake Town, Kolkata, West Bengal	www.zimbawater.com	Chemicals

187	Bionic Arm	Mr. Nitesh Kumar Jangir	Electro Systems Associates Pvt Ltd 4215, J.K.Complex, First Main Road, Subramanyanagar, Bangalore - 560 021 , Karnataka		Healthcare;
188	BounzD - Online public-business cloud telephony system	Mr. Bushairusalam	Waybeo Technology Solutions Thejaswini building, Technopark Trivandrum State: Kerala	www.waybeo.com (http://bounzd.com)	IT
189	Branchless Banking Technology Solution Combined with Extensive Distribution Channel	Ms. Seema Prem	FIA Global 550 Kailash Towers 3, East of Kailash City: Delhi	www.fiaglobal.com	IT Financial services
190.	Cloud Content Delivery Platform	Mr. chandra Kotaru	GAIAN, 7-8-22,RK Mission Rd, Waltair ward, NearRK beach Visakhapatnam Andhra Pradesh	www.gaiansolutions.com	IT
191.	A Novel Strategy of Botanical Biocides to Control Eriophyid Mite in Coconuts to Improve Productivity BIOTECH		IIMT Bhubaneswar Address: AMT Department, IIMT Bhubaneswar	www.immt.res.in	Agriculture and Forestry
192.	Defluoridation of Water and Removal of Arsenic from Groundwater	Dr. Pawan Labhassetwar, Mr. Subhash Andey	Water Technology and Management Division – NEERI Address: National	www.neeri.res.in	Chemical

			Environmental & Engineering Research Institute, Nehru Nagar, Nagpur, Maharashtra		
193.	Design and Development of a Proton Exchange Membrane Fuel Cell Stack (RE)	Dr. Dharmalingam Sangeetha	Sardar Patel Road, City: Chennai State: Tamil Nadu	www.annauniv.edu	Energy (fuel)
194.	Development of Bioplastics from Agricultural Waste	Mr. M S Shankara Prasad	SPC Biotech P Limited C 409 Pasha Court Somajiguda City: Hyderabad	www.greenplastics.org	plastic Biotech
195.	Drug Discovery/Drug-Target Identification Technology	Dr. Chaitanya Saxena	Shantani Proteome Analytics Pvt. Ltd. 100 NCL Innovation Park, Dr. Homi Bhabha Road, Pune 411008 City: Pune State: Maharashtra	www.shantani.com	Pharmaceutical
196.	Ear, Nose and Throat Multiscope and Recorder	Ms. Sapna Behar	Icarus Design Pvt Ltd, No 7 Rogers Road, Richards town City: Bangalore State: Karnataka	www.icarus.co.in (IT)	Healthcare
197	Eco Pots (BIOTECH)	Dr. Vijayan	19, 1st.Parthasarathy Nagar City: Chennai State: Tamil Nadu	http://www.neuecotechs.com/	Biotech
198	Energy-Efficient Compressor	Mr. Vijay Jain	Address: 603, Block-1/Magic Ray, Suncity Apartments Opp Sarjapur Crossing City:		power

			Bangalore,Karnataka		
199	First Ever File Format for Security (PawaaFILE)	Mr. Prakash Baskaran	Pawaa Software Address: 1133 AnandEmbassy, 100 Ft Road, Indira Nagar Bangalore,Karnataka	www.pawaa.com	IT
200	Geothermal Energy based temperature control device	Col. Raj Vijay Rohlania	Rohlania Innovators Address: C-2616, Shushant Lok-1 City: Gurgaon,Haryana	www.rohlania.com	Construction
201	HRIDAY` : A Mobile Based Heart Disease and Stroke Detection System	Mr. Prodyut Dhar	NIT DURGAPUR Address: Room No 381, Nit Durgapur City: Durgapur State: West Bengal	www.nitdgp.ac.in	Healthcare
202	HyCator Cavitation Reactor Company/Institution (cleantech)	Mr. Anjan Mukherjee	HyCa Technologies Pvt. Ltd. Address: 176, Udyog Bhavan, Sonawala Road,Goregaon (E) Mumbai Maharashtra	www.hycator.com (cleantech)	Renewable energy
203	Hydrogen-fueled Engine	Prof. Lalit Mohan Das	Engines and Unconventional Fuels lab, Centre for Energy Studies, Indian Institute of Technology New Delhi, Delhi	www.iitd.ac.in	Automotive
204	Incense Stick Making Machine	Mr. Paresh Panchal	Satellite Complex, Premchand Nagar City: Ahmedabad State: Gujarat	www.nifindia.org	Mechanical engineering
205	A System and Method for Price	Mr. V S K Murthy Balijepalli	Research Scholar, Department of		IT

	Forecasting (ELECTRICAL)		Electrical Engineering, 2nd floor- GG Building, IIT Campus, Powai City: Mumbai State: Maharashtra		
206	A Process of Making Lifestyle Wellness Garments	Mr. Rajiv Rai Sachdev	Advantage Organic Naturals Technologies Pvt. Ltd. Address: B-5, 2nd Floor, East of Kailash, New Delhi	www.advantagenature.com	Textile
207	Low-Cost Photo Bioreactor System for Cultivation of Micro Algae	Mr. Srinivas Gogineni	Green Cell Biotech Private Limited Address: D.No 40-9/11-7, Jhansi Building 2nd floor, M.E.colony,Vija yawada ,AP	www.gcbglobal.com	BIOTECH
208	Low Power Bio Medical Transmitter	Dr. Jayanta Mukherjee	Electrical Engg.,IIT Bombay, Powai,Mumbai, Maharashtra	www.iitb.ac.in	Healthcare
209	Fast and Accurate Method for Solidification Simulation of Metal Casting (AutoCAST-X)	Prof B Ravi	I.I.T. Bombay, Powai Address: Mechanical Engg. Dept., I.I.T. Bombay, Powai,City: Mumbai, Maharashtra www.iitb.ac.in	www.iitb.ac.in	Metals
210	Milking Machine	Mr. Raghav Gowda	Satellite Complex, Premchand Nagar,City: Ahmedabad,Sta te: Gujarat	www.nif.org.in	DAIRY
211	Motorcycle Operated Multipurpose Farm Implement (AGRI)	Mr. Mansukbhai Jagani	Satellite Complex, Premchand Nagar,City: Ahmedabad, State: Gujarat	www.nif.org.in	Agriculture and Forestry

212	PC Plug-In 12 Lead ECG	Dr. Ravi Mehrotra	National Physical Laboratory, CSIR, Dr. K. S. Krishnan Rd., City: New Delhi	www.nplindia.org	Healthcare
213	PENPAL - Electronic Pen Aiding Visually Impaired in Reading and Understanding Textual Contents	Mr. Joshi Kumar A V	Sai Leo Nagar, West Tambaram, Chennai, Tamil Nadu	www.sairam.edu.in	Healthcare
214	Plastic BioChip-based Disposable Electrochemical Immunosensor	Ms. Priyanka Sharma	Institute of Microbial Technologies Address: Biosensor Lab, Institute of Microbial Technology, Sector 39-A, City: Chandigarh	www.imtech.res.in	BIOTECH
215	A Man Portable Unmanned Ground Vehicle Robot for Defense Surveillance/ reconnaissance & Bomb Disposal	Mr. Aakash Sinha	Omnipresent Robot Technologies Pvt. Ltd. Address: 20 Supreme Enclave, Mayur Vihar-I, New Delhi 110091	www.omnipresenttech.com	Defense
216	Production of germanium nano wires encapsulated by MWCNT METAL	Dr. A. Pandurangan	Anna University Address: Institute of Catalysis and Petroleum Technology, Anna university, City: Chennai, State: Tamil Nadu	www.annauniv.edu	Metal

217	Pyka / Automatic wakeup call for train passengers	Mr. Bala Sundara Raman	Ideophone Technosol Private Limited Address: 106, Devi Residency, 1st Cross, Church Road, Murugeshpalya ,Bangalore Karnataka	www.ideophone.in	transport
218	Rainrunner PLASTIC)	Mr. Karan Randhawa	B 392, Second Floor, Chittranjan Park, City: New Delhi	www.rooffortwo.com	Transport and Logistics
219	From Waste to Wealth Through Recycled Tungsten Carbide Alloy Powders and Products	Mr Jaykanan	Aeyyes Tungsten Address: 11,36, Cholapuram Extension, Nochi Vayal Pudur, Tiruverumbur,Tr ichy, State: Tamil Nadu	www.aeyyescarbides.com	Chemical METAL-ADDED CHEMICAL IS WRONG
220	Remote Controlled System for Power Tiller	Mr. Prajwal V Kumar	Mangalore Robautonics Pvt ltd Shiva Prasad Building, Main road, Near Post office, Surathkal,City: Mangalore,State: Karnataka		Electronics IT
221	Safety Medical Device (MecSafe Safety I.V. Cannula)	Mr. Manoj Kumar Maan	Mecmann,City: Bangalore, Karnataka		Healthcare

222	Solar Mosquito Destroyer	Mr. Mathews K	National Innovation Foundation Address: Satellite Complex, Premchand Nagar, City: Ahmedabad	www.innovationcouncil.gov	Consumer goods
223	Solar Photo Voltaic Water Pumping	Mr. Praveen Jambholkar	Cybermotion Technologies Pvt. Ltd. Address: Plot #235, Road #14, Banjara Hills, City: Hyderabad, State: Andhra Pradesh		Agriculture
224	Solar Powered Constant Move Pivot Irrigator	Mr. Padmakar Waman Kelkar	Bright Stars Electronics Address: 43/2, Erandawana, Erandawana Industrial Estate, City: Pune, State: Maharashtra	www.brightstarindia.com	Agriculture and Forestry
225	Soleckshaw, a pedal operated, motor assisted, zero carbon emission, urban transport vehicle	Mr Amit Jyoti Banerjee	CSIR-Central Mechanical Engineering Research Institute Address: Manufacturing Technology Group, CSIR-CMERI, M.G. Avenue, City: Durgapur, State: West Bengal	www.cmeri.res.in	Transport
226	User-Wearable Portable Communication Device (Vesag Watch)	Mr. Rajendra P Sadhu	Vyzin Electronics Private Limited Address: #405 V.V.Vintage Boulevard, Raj Bhavan Road, Somajiguda, City: Hyderabad, State: Andhra Pradesh	www.vyzin.com	Electronics

227	ViTranSP – Virtual Transaction Service Provider	Mr. Ramesh Baswa	BASIX Sub-K IT iTransactions Limited Address: 58 & 59, Saranya, 1st Floor, Nagarjuna Hills, Road No.2, Banjara Hills,City: Hyderabad State: Andhra Pradesh	www.subk.co.in	Financial services
228	Zed Magic Water-Solar Powered Air to Water Generator	Mr. Chandrasekhar Hariharan	Biodiversity Conservation India Pvt .Ltd #397, 13th Cross Road, Sadashiv Nagar,Bangalore, State: Karnataka	www.zed.in	Agriculture and Forestry Renewable energy
229	Zed Sun-zyme Foliar Spray (RE)	Mr. Chandrasekhar Hariharan	Biodiversity Conservation India Pvt .Ltd #397, 13th Cross Road, Sadashiv Nagar,Bangalore, State: Karnataka	www.zed.in	Agriculture and Forestry IS WRONG CONSTRUCTION (RIGHT)
230	2 in1` Self-Secured Orthodontic Spring Separator for Dental Patients	Dr. Sudhanshu Kansal	Address: E-9/23, Vasant Vihar,City: New Delhi,State: Delhi		Healthcare
231	3nethra - An intelligent pre-screening ophthalmology device	Dr. Shyam Vasudeva Rao	Forus Health Pvt. Ltd. 4085-A, II Floor, K.R.Road, Banashankari II Stage Bengaluru	www.forushealth.com	Healthcare

			Karnataka		
232.	A biological method for rapid treatment of municipal waste water	Dr. Rita Kumar	Institute of Genomics and Integrative Biology - CSIR Address: Mall Road, Near North Delhi University Campus, City: New Delhi - 110007, State: Delhi	www.igib.res.in	chemical
233.	A photonic smart card (ELECTRONICS)	Dr. P.T. Ajith Kumar	Light Logics Holography and Optics Address: Crescent Hill, ,City: Trivandrum - 695 027, State: Kerala	www.lightlogics.in	IT
234.	Adsorbent for used frying oil	Dr. Padma S. Vankar	Facility for Ecological and Analytical Testing, IIT Kanpur Address: 204 - A Southern Block, FEAT Lab, IIT Kanpur, City: Kanpur, State: Uttar Pradesh		Consumer Packaged Goods
235.	Agent oriented dynamic information system	Mr. Antony Alappatt	MasterKube Software Products and Services Private Limited Address: Second Floor S1, 13 Kamaraj Avenue 1st street,	www.masterkube.com	IT

			Adyar,City: Chennai,State: Tamil Nadu		
236.	An apparatus for automating pathological procedures (ELECTRONICS)	Innovator's Name: Mr. Sushant Gupta	MicroMed Address: C-114, Azad Hall, IIT Kharagpur, City: Kharagpur, State: West Bengal		Healthcare
237.	Artificial intelligence based power management system	Mr. Nelvin Joseph	Artin Dynamics Address: Artin Dynamics, 4th Floor, Nila Building, Technopark Campus, City: Trivandrum,State: Kerala	www.artindynamics.com	POWER
238.	Automatic dental X-ray processor (ELECTRONICS)	Vaibhav Tidke, Swapnil Kokate, Sheetal Somani, Aditya Kulkarni	Science for Society Techno Services Pvt. Ltd. Address: Room No. 72, Old Hostel, UDCT, Matunga, City: Mumbai, State: Maharashtra		Healthcare
239.	BCMS - Business continuity management system	Mr. Sundar Raman	Perpetuiti Technologies Address: 501 Shah and Nahar Worli Industrial Estate,City: Mumbai - 400018,State: Maharashtra	www.perpetuiti.com	Financial services
240.	Content verification	Mr. Ashish Anand	LinkSmart Technologies Private Limited Address: Level 2 Prestige omega, No. 104 EPIP Zone, Whitefield, Bengaluru - 560066, Karnataka	www.securespin.in	IT
241.	Diabetes complication diagnosis and	Mr. Nitin Jobanputra	Advance Dia- Bese Care Pvt. Ltd.	www.diabese.net	Healthcare

	guidance		Address: 93 - B Park Plaza, New Yari Road, Versoa, Andheri (W),City: Mumbai,State: Maharashtra		
242.	DSP based adaptive control algorithm for aerospace & defense	Mr. Praveen S. Jambholkar	Cybermotion Technologies Pvt. Ltd Address: Plot No. 234, Road No.14, Banjara Hills City: Hyderabad State: Andhra Pradesh		Defense
243.	EasySecured password less online authentication	Mr. Gurudatt Shenoy	EasySecured Software & Services Ltd. Address:City: 5/31 A, Shrinath Building, 103/105 Old Hanuman Lane, Kalbadevi, Mumbai - 400 002,State: Maharashtra	www.easysecured.com	Financial services
244.	Education tool for fiber optic communication	Mr. Hitesh Mehta	Fiber Optika Technologies Pvt. Ltd. Address: No. 6 & 7, 2nd Floor, W.O.C Road, Industrial Town, Rajajinagar, City: Bengaluru - 560044 State: Karnataka	www.fiberoptika.com	IT
245.	Electrohydraulic assisted cycle rickshaw	Dr. Sunil Jha	IIT Delhi, Room No. 351 Block III, Department of Mechanical Engineering,	www.iitd.ac.in	Transport
246..	Enhancement of oral bioavailability of ester prodrug	Dr. Shamrez Ali M.	KLE University Address: New Bank colony,Gulbarga ,Karnataka	www.kleuniversity.edu.in	Pharmaceuticals

247.	Enterprise energy management using wireless sensor networking technologies	Mr. Jay Krishnan	Wifinity Technology Pvt. Ltd. Address: 30, NSRCEL, IIM Bangalore, Banerghata Road, Bengaluru, Karnataka	www.wifinitytech.com	IT electronics
248.	Grid based micro air-conditioners	Mr. Sanjay Deshpande	Uniken Inc. Address: Shrileela Plaza, 1st floor, Survey No.115, Baner Road, Pune, Maharashtra	www.uniken.com	engineering
249.	Hairminator	Ms. Mrinmayee Bhushan	Mindfarm Novatech Pvt. Ltd. Address: `Vishwa-Pushpa`, 992/93/14, Rajendra Nagar, Pune 411030, Maharashtra	www.mindfarm.org (healthcare)	Healthcare
250.	Holistic bio treatment of pulp and paper waste water	Dr. Rita Kumar	Institute of Genomics and Integrative Biology-CSIR Address: Mall Road, Near North Delhi University Campus, Delhi - 110007	www.igib.res.in	Paper and Packaging
251.	Innovative & cost effective knee-ankle-foot-orthosis	Mr. Mayank Pareek	Rehabilitation Research, Design & Development Laboratory, Indian Institute of Technology Madras, India Address: 10-H-7 Mahaveer Nagar III, Paarijaat Scheme Kota - 324005	www.iitm.ac.in (healthcare)	Healthcare
252.	Intuitive programmable device for	Mr. Sandeep Senan	Evobi TechnoCentre LLP	www.evobi.in	electronics

	control/automation applications		Address: No. 510, 5th floor, PESSE Campus, Hosur Road, Bengaluru		
253.	IPintention - Web-based IC design platform	Mr. Arijit Dutta	DSipher Design Solutions Pvt. Ltd. Golden Square Business Centre, 53/A, 16th C Main, 4th Block, Koramangala, Bengaluru-560034, Karnataka	www.dsipherdesign.com (IT)	electronics
254	Large scale production of biofungicide spores using citrus peel waste	Mr. Pushpendra Awadhiya	Jagsonpal Pharmaceuticals Address: Flat No 205, Omgurukripa Apartment, 4 Visnupuri Main, Indore, Madhya Pradesh	www.jagsonpal.com	Agriculture and Forestry WRONG pharmaceuticals biotech
255	Low consumption "air conditioning/refrigeration system" in AutoLPG vehicles (power)	Mr. Annida Sircar	IIT Kanpur Address: 91/26, Jadunath Sanyal Road: Parallel to Hewett Road, Lucknow, Uttar Pradesh ??	www.iitk.ac.in	Automotive
256	Making natural sugar diabetic friendly (processed food)	Mr. C.K. Nandagopalan	Ingredients Revolution Address: Old No:29 , New No:65, 3rd Main Road, Gandhi Nagar, Adyar Chennai – 600020, Tamil Nadu		Healthcare
257.	MEMS sensor	Dr. Jamil Akhtar	Name: CEERI, Pilani (CSIR), SNTG, CEERI, Pilani, Rajasthan	www.ceeri.ernet.in	ELECTRONICS
258.	Mobile banking	Mr. Abhishek Sinha	Eko India Financial	www.eko.co.in	Financial Services

			Services Pvt. Ltd. Address: 547, Mandakini Enclave, Alaknanda, New Delhi, Delhi		
259	Multiple zone well completion for enhanced oil recovery	Mr. Chanchal Dass	Dass Oilfield Technologies Pvt. Ltd. Address: F 201 Parth venue, Chandkheda Ahmedabad Gujarat		FUEL
260	Nano Ganesh	Mr. Santosh Ostwal	Ossian Agro Automation Private Limited Address: 305, Munisuvrat Avenue, 3rd floor, 1089 Shukrawar Peth, Shivaji Road, Swargate Corner Pune – 411002 Maharashtra	www.nanoganesh.com	Agricultural and Forestry
261	Non-humid air cooler	Mr. Altaf A. Tinwala	Energia Drying & Cooling Equipment Pvt. Ltd. Address: GIDC Vatva Ahmedabad		Consumer goods
262	Novel herbal formulation for arthritis and related condition	Dr. Manu Chaudhary	Venus Remedies Limited Address: 51-52, Industrial Area, Phase I Panchkula Haryana	www.venusremedies.com	Pharmaceuticals Healthcare
263.	Novel topical micro emulsion formulations for the treatment of rheumatic disorders and related infection	Dr. Manu Chaudhary	Venus Remedies Limited Address: 51-52, Industrial Area, Phase I Panchkula Haryana	www.venusremedies.com	Healthcare

264.	Organic silica SiO2	Mr. Vasudev Nair	Rudra Herbal Remedies Address: A/1, Rathod Pride, 154, Yeshwant Nagar, Talegaon Dabhade City: Pune State: Maharashtra		Agriculture and Forestry Is wrong Pharmaceuticals
265.	Patented copy protection & monetization technology for video	Mr. Aniruddha R. Gupte	keeninc.com incorporated Address: A2/502 Windosor Avenue, Wanawadi City: Pune Maharashtra	www.keeninc.net	IT Entertainment-added
266.	Photoactive scratch resistant TiO coating 2	Dr. K.K. Saini	National Physical Laboratory Address: Dr. K. K. Saini, Scientist, National Physical Laboratory, Dr. K. S. Krishnan Road City: New Delhi - 110012 State: Delhi	www.nplindia.org	Construction Healthcare
267.	Quaternized peptide for cosmetic industries	Mr. Jibananda Mukherjee	Dr. Subhas Mukherjee Memorial Laboratory Address: 31 Jogendra Nath Ghoshal Road, Ariadaha City Kolkata - 700057 : State: West Bengal		Consumer goods
268.	Sanjeevani disaster management package	Mr. Rajendra Vithal Ladkat	Sanjeevani Disaster Research and Development Center Address: Shop 1 & 2 Akash, 396 Kasba Peth City: Pune - 411 011	www.rajendraladkat.com	Chemical

			State: Maharashtra		
269	Simple software program on web to help manage Indian SME business	Mr. Sharath Chander	Naramax Consultants Pvt. Ltd. Address: 5303, Block 5, Nandi Deepa Apartments, 124, Kammanahalli Main Road City: Bengaluru – 560076 State: Karnataka		Financial services
270.	Solar tracker and concentrator World's first fixed receiver/furnace with dual axis solar dish	Dr. Rajarshi Banerjee	Sollecator Systems Address: 4441 Lanes End Ct. City: San Jose State, Country: California, USA	www.sollecsys.com	Power
271.	Steel drums	Mr. Balbir Onkar Singh	Javs Engineering (India) Ltd. Address: 221, Swastik Chambers, C.S.T. Road, Chembur City: Mumbai State: Maharashtra		Metals
272.	System, method and computer program for providing mobile access to financial data	Mr. Rohit Bhargava	BOM Tech Inc Address: 6A Marble Arch, 52 Pdder Road City: Mumbai Maharashtra	www.bankingonmobile.com	Financial Services
273.	Thermal plasma process for production of TiO2 rich slag	Dr. P.S. Mukherjee	Institute of Minerals and Materials Technology (CSIR) Address:), Acharya Vihar City: Bhubaneswar	www.immt.res.in	Chemicals

			State: Orissa		
274.	TMail		Synersoft Technologies Private Limited 409, Nalanda Enclave, Near Sudama Resorts, Pritamnagar, Ellisbridge Ahmedabad Gujarat	www.synersoft.in	IT
275.	Urine Albuikit	Mr. Sarabjeet Singh Johar	Kanpur Test House Address: 118/23, Nazirabad, Gumti No. 5 City: Kanpur State: Uttar Pradesh		Pharmaceuticals Healthcare
276.	Vertical wind power generator	Ms. J. Jayasudha	Biswakarma Bricks & Blocks Address: 1191/1927, Nayapalli City: Bhubaneswar State: Orissa		Renewable Energy power
277.	Vidyut - context sensitive, over the cloud, energy efficiency solutions for SmartGrid, Smart Meters	Mr. S. Uma Mahesh	Indrion Technologies India Private Limited Address: 145. 4th Cross, 7th Main, JP Nagar, 3rd Phase City: Bengaluru-560 078 State: Karnataka,	www.indrion.co.in	IT Electrical
278.	Washing cum exercising machine/washing machine without electricity	Ms. Remya Jose	National Innovation Foundation Address: -City: Malappuram State: Kerala	www.nif.org.in	Consumer goods
279.	XAPP cross platform executable application	Mr. Anand Raj	InXero Technologies Pvt. Ltd Address: JSSATE Science & Technology	www.inxero.com	IT

			Park, C-20/1, Sector 62 City: Noida , Delhi		
280.	Asthma cure, a herbal product for curing asthma and bronchitis/allergy	Mr. Harendra Prasad Singh	Regain Herbal Remedies Address: DT/2032, HEC Township Ranchi Jharkhand		Pharmaceuticals
281.	A new method for detecting diabetic neuropathy and predicting foot ulcer development	Dr. C. Jairaj Kumar	Kyatha Abhijith Pharma & Healthcare Systems Pvt. Ltd. Address: Nithyananda Nagar Mangalore Karnataka	www.nitte.ac.in	Healthcare (Medical Devices)
282.	Active current conditioner	Mr. Shwetank Jain	P2 Power Solutions Pvt. Ltd. Address: 18 New Mohan Puri Meerut Uttar Pradesh	www.p2power.com	Renewable Energy Power
283.	Advanced oxidation process using photochemical oxidation	Mr. T. Chandran	Wytewater Technologies Pvt. Ltd 401-404, Pawan Apartments, Pashan-Sus Road, Pashan,Pune,India	www.wytewater.com	Chemical
284.	Automatic video description	Mr. PulkitGaur	Gridbots Technologies,Office 12 -First Floor -CIIE Building, IIM Ahmedabad,new campus-Vastrapur,Ahmedabad,Gujarat	www.gridbots.com	IT
285.	Biological neutralization of alkaline waste water	Dr. Rita Kumar	Institute of Genomics and Integrative Biology- CSIR Mall Road, Near North Delhi	www.igib.res.in	Biotech Textile

			University Campus,New Delhi - 110007		
286.	BOD biosensor	Dr. (Mrs.) Rita Kumar	Institute of Genomics and Integrative Biology (IGIB, CSIR) Mall Road, Near North Delhi University Campus New Delhi Delhi	www.igib.res.in	BIOTECH
287.	BODBEADS - Instant reference seeding material for BOD analysis Key Facts	Dr. (Mrs.) Rita Kumar	Institute of Genomics and Integrative Biology (IGIB, CSIR) Mall Road, Near North Delhi University Campus,New Delhi,Delhi	www.igib.res.in	BIOTECH
288.	Cellulose based porous membrane for bioseparation, bioconversion	Dr. H. V. Adikane	National Chemical Laboratory Address:Chemic al Engineering Division, National Chemical Laboratory, Dr. Bhaba Homi Road,Pune,Mah arashtra	www.ncl-india.org	Chemicals
289.	CleverTexting	Mr. Abhijit Bhattacharjee	Luna Ergonomics Address: No.3, JSSATE STEP, C- 20/1, Sector 62, Noida,City: New Delhi, State: Delhi	www.paninikeypad.com	IT

290.	Holographic solar concentrator modules for higher efficiency solar energy conversion	Dr. P. T. Ajith Kumar	Light Logics Holography and Optics Address: CresecentHill, Thinavila, Thiruvallom, City : Trivandrum, State: Kerala	www.lightlogics.in	Renewable Energy
291.	Development of nano-materials for efficient removal of bacteria and viruses from water	Prof. P. Pramanik	Indian Institute of Technology, Kharagpur Address: Dept. of Chemistry, IIT Kharagpur, City: Kharagpur, State : West Bengal	www.iitkgp.ac.in (metal)	chemical
292.	Energy cakes	Dr. Anil Kumar Singh	Energy House, Plot no. -294, Sector – 39, City: Gurgaon, State: Haryana		Renewable energy
293.	Extraction of ethanol from de-oiled rice bran - BRANETOH	Mr. Sanjay Singh	Bran Engineering Private Limited Address: 401-402, Fortune, Baner Road, Aundh, City: Pune, State: Maharashtra	www.bran.co.in (agri)	Agriculture and Forestry Fuel
294.	Handheld digital retinal imaging system (world's first angiography retinal imaging system)	Dr. Anand Sivaraman	Remidio Innovative Solutions Pvt Ltd. Address: No. 2206, Nandi Park, Gottigere, Bannerghatta Road, City: Bengaluru, State : Karnataka	www.remidio.com (IT /Medical)	Healthcare (Medical Devices)
295.	High purity & fine grained alpha-alumina at low temperature	Dr. P. K. Panda	National Aerospace Laboratories Address: Materials Science Division, National Aerospace Laboratories, Kodihalli, City: Bengaluru State: Karnataka	www.nal.res.in	Chemicals

296.	Man portable autonomous unmanned aerial vehicles	Mr. Ashish Bhat	ideaForge Technology Pvt. Ltd. Address: Office No. 4, 4th Floor KRESIT Business Incubator IIT Bombay, Powai City: Mumbai State: Maharashtra	www.ideaforge.co.in (IT)	Aerospace and Defense
297.	Micro-blast wave assisted applications in bio-technology	Prof. Jagadeesh	Indian Institute of Science Address: Dept. of Aerospace Engineering, IISc, Gulmohar, Marg, Mathikere, City: Bengaluru State: Karnataka	www.iisc.ernet.in	biotech
298.	"MozziQuit" multi-purpose mosquito trap	Mr. Ignatius Orwin Noronha	Leowin Solutions Pvt. Ltd. Address: 406, Mannagudda Towers, Mannagudda City: Mangalore Karnataka		Consumer goods
299.	MPPT solar power converters	Mr. Vikram Mehta	Solar Power India Address: Coratin a Way City: Rancho Cordova State: California, United States		Renewable energy
300.	Natural formulation for chronic wound healing	Dr. Manu Chaudhary	Venus Remedies Ltd. Address: Venus Industrial Complex, Hill Top Industrial Estate, Near Jharmajri, E.P.I.P., Phase-I, (Extention) Village BhatoliKalan City: Baddi State: Himachal Pradesh	www.vmrcindia.com	Healthcare

301.	Next generation holographic weapon sight	Dr. P. T. Ajith Kumar	Light Logics Holography and Optics Address: Cresecent Hill, Thinavila, Thiruvallom City: Trivandrum State: Kerala	www.lightlogics.in	Aerospace and Defense
302.	Oral sustained release nano-drug for treatment of tuberculosis – Phase I	Dr. Jitendra N. Verma	Lifecare Innovations Pvt. Ltd. Address: B-589, Sushant Lok-I, Gurgaon, Haryana	www.lifecareinnovations.com	Healthcare
303.	Process for manufacture of sweetening catalyst Thoxcat ES	Dr. M. O. Garg	Indian Institute of Petroleum Mohkampur, Dehradun, Uttarakhand	www.iip.res.in	(Petroleum Refining)
304	Shock wave treatment for bamboo	Prof. Jagadeesh	Indian Institute of Science Address: Dept. of Aerospace Engineering, IISc, Gulmohar Marg, Mathikere, City: Bengaluru State: Karnataka	www.iisc.ernet.in	Agriculture and Forestry (Bamboo Wood)
305	Smart coating hypersonic technology	Prof. Jagadeesh	Indian Institute of Science Address: Dept. of Aerospace Engineering, IISc, Gulmohar Marg, Mathikere, City: Bengaluru State: Karnataka	www.iisc.ernet.in	Aerospace and Defense
306	Social business works - social computing network for businesses	Mr. Anand Raj	InXero Technologies Pvt. Ltd. Address: B-505 Royal Tower C 54 A, Sector 61, City: Noida, State:	www.inxero.com	IT

			Delhi		
307	Spray continuous pan (SCP)	Mr. Vipin Gupta	Spray Engineering Devices Limited Address: SPRAY HOUSE, C-82, Industrial Area, Phase 7, S.A.S. Nagar, City: Mohali State: Punjab	www.sedl.in	Agriculture and Forestry
308	Titanium based wonder gels for separation and degradation of organic dyes from aqueous solution	Dr. Mohan K. Dongare	National Chemical Laboratory Address: Dr. Homi Bhabha Road, Pashan, City: Pune, State: Maharashtra	www.ncl-india.org	Chemical textile
309	Video communications for masses	Mr. Hardik Sanghvi	VMukti Solutions Pvt. Ltd. Address: 7 CIE IIMA New Campus, Vastrapur, City: Ahmedabad, State: Gujarat	www.vmukti.com	IT
310	Wastewater treatment reactor that generates electricity in the process	Mr. Manoj Kumar Mandelia	Locus Systems Address: IIT Kharagpur, C-326, LLR Hall, City: Kharagpur, State: West Bengal		ELECTRICAL
311	Automation of HR Process	Mr. Amit Gajwani	Cybage Ltd., Pune, Maharashtra	www.cybage.com	IT
312	2-D nano-positioner	Mr. Reetesh Singh	Simplifix Automation & Solutions Pvt. Ltd. (IIT Kanpur) Address: S-1, SIIC, IIT Kanpur, City: Kanpur, State: Uttar Pradesh	www.iitk.ac.in	IT
313	3D visualization solution	Mr. Neehar Karnik	Maitree Consultants Address: P/2/6,		IT

			Sundar Nagar, Malad west City: Mumbai- 400064 State: Maharashtra		
314	Balanced split type profile forming cutters	Mr. Vinayakpandi N.	Biramha Machine Tools Address: No. 1, By Pass Road, Bethaniapuram, City: Madurai,State: Tamil Nadu		Machine Tool
315	Beans TradeEngine	Mr. Anshuman Verma	Beans & Intellect Financial Technology Pvt. Ltd. Address: 363, Powai Plaza, Hiranandani Gardens, Hiranandani, Powai-76,City: Mumbai,State: Maharashtra	www.beansindia.com	Financial Services
316	Bio-diesel production by catalysis from algae	Mr. T. Raghavendra Rao	Sustainable Technologies & Environmental Projects Pvt. Ltd. Address: 602-B, Sweet Home, S V Patel Nagar, Andheri west,City: Mumbai- 400053,State: Maharashtra	www.stepsenergy.net	Renewable energy Biotech
317	clean air through universal mobile platform using nano coating technologies	Mr. T. Raghavendra Rao	SustainableTech nologies & Environmental Projects Pvt. Ltd. Address: 602-B, Sweet Home, S V Patel Nagar, Andheri west,City: Mumbai- 400053 State: Maharashtra	www.stepsenergy.net	Chemical

318	Complete recycling of beverage cartons	Mr. Tushar Shah	Daman-Ganga Group,Address: 256 GIDC,City: Vapi State: Gujarat	www.damanganga.com	beverage
319	Cost effective technology for the mass production of bacillus thuringiensis (Bt) biopesticide	Dr. M. Mohan	Directorate of Rice Research (ICAR) Address: Entomology section, Directorate of Rice Research, Rajendranagar, City: Hyderabad,State: Andhra Pradesh	www.drricar.org	Agriculture and Forestry
320	Development of new high strength low alloy (HSLA) steel sheets - BEML E500 & BEML E550	Mr. Rajeev Srivastava	BEML Limited Address: BEML Soudha, 23/1, 4th Main, SR Nagar.,city: Bengaluru,State : Karnataka	www.bemlindia.com	Metals and Mining Steel
321	ECM analog technology	Dr. Aroop Kumar Dutta	ExCel Matrix Biological Devices Pvt. Ltd. Address: 12-5-149/16-2, Vijaya puri, Opp NIN,City: Hyderabad,State: Andhra Pradesh	www.excellmatrix.com	Healthcare
322	E-waste to the best	Mr. B. K. Soni	Eco Recycling Ltd. Address: 205 Center Point, 2nd Floor, Andheri Kurla Road, Andheri (East), City: Mumbai-400059 State: Maharashtra	www.ecoreco.com	Metal
323	Eyefunda from Omeon	Mr. S. Basker	Omeon Solutions MR Building, 1st	www.omeonsolutions.com	IT

			Floor, Old No.78, New No.34, C P Ramasamy Road,Alwarpet, Chennai-600 018, Tamil Nadu		
324	Fibre reinforced concrete	Mr. N. Pannirselvam	VIT University Address: Vellore,City: Vellore-632 014,State: Tamil Nadu	www.vit.ac.in	Construction
325	Heart sound analyzer	Dr. Goutam Saha	Indian Institute of Technology Address: Department of Electronics & ECE, IIT Kharagpur,City: Kharagpur,State : West Bengal- 721302	www.iitkgp.ac.in	Healthcare
326	Injection stretch blow molding machine with linear indexing	Mr. Swanand Sohoni	Omicron Technologies Pvt. Ltd. Address: A-2, UdyogSadan No.1, MIDC, Andheri,City:Sta te: Maharashtra		Machine Tool
327	Insulitte light weight insulation concrete (construction)	Mr. Sandeep Vidwans	Enercon Address: A/408, Neelkanth Palace, 100 ft Road, Satellite,City: Ahmedabad- 380015,State: Gujarat	www.gbcindia.org	Construction
328	Interferential non-invasive pacer	Mr. Narayanan Lakshmanan	SiliconLabs Pvt. Limited Address: 21, Kamber Street East Tambaram,City: Chennai,State: Tamil Nadu	www.siliconlabs.org	Healthcare
329	LAMP based diagnostics	Dr. Shesheer Kumar	RAS Lifesciences Pvt. Ltd.	www.raslifesciences.com	Healthcare

			Address:2-2-7/5/B, 2nd Floor, Shiva sai complex Shivam Road City: Hyderabad-500 007 State: Andhra Pradesh		
330	Latent metonymical analysis and indexing (LMai) (IT)	Mr. Syed Yasin	No. 33 SRS House, Hanes Road, Central Street, Frazer Town,City: Bengaluru,State : Karnataka		IT
331	Micro-wind turbine with remote online monitoring -	Mr. Vinayak D. Manmadkar	Suvarna Urja Windpower Pvt. Ltd. Address:CTS N-371,3rd Floor, Morya,Commerical Complex, Chafekar Chowk ChinchwadCity: Pune State: Maharashtra	www.suvarnaurja.com	Renewable Energy
332	Nano polymer coatings on coronary stent systems (CHEMICAL)	Prof. Sundar Manoharan	Indian Institute of Technology, Kanpur-208016,State: Uttar Pradesh	www.iitk.ac.in	Healthcare
333	Natural product based formulations for aseptik	Mr. Y.S.R. Venkata Rao	Asian Herbex Limited Address: No. 5, Prembagh, 3-4-490/A, Barkatpura,City: Hyderabad,State: Andhra Pradesh	www.asianherbex.biz	Healthcare
334	Noddler-personalized voice based information and transaction system	Mr. Umesh Sachdev	Uniphore Software Systems Pvt. Ltd. Address:Unit 5, 1st Floor, IIT Madras Research Park, Kanagam,Road, Taramani,City: Chennai- 600 113,State: Tamil	www.uniphore.com	IT Financial Services

			Nadu		
335	Safety device for preventing night-road-accidents,	Mr. Vijay Sharatchandra Tase	Peer Technical Services Private Limited J-3, Nav-Prabhat Society, Hanuman Rd, Near, Pitale Wadi, Vile – Parle (E), Mumbai – 400057, Maharashtra	www.peertechnical.net	IT
336	Sensor array based wide frame digital diagnostic X-ray imager	Mr. Karthikeyan Jawahar	Adhithiya Medical Systems Address: 11, Vidhya Nagar, Civil Aerodrome Post,City: Coimbatore,State: Tamil Nadu	www.xrayequipments.com	Healthcare
337	V-One Mobile, peer-to-peer communication session initiation in mobile devices .	Mr. Gopi Kumar Bulusu	Sankhya Technologies Private Limited No.10-1-27,IV Floor, Sampath Vinayaka Temple Road,City: Visakhapatnam, Andhra Pradesh	www.sankhya.com	IT TELECOM
338.	WiLT	Dr. Sondur Lakshmipathi	MYMO wireless Technologies Pvt. Ltd Address: 1st Floor, Entrepreneurship Building, SID, Indian Institute of Science,City: Bengaluru Karnataka	www.mymowireless.com (TELECOM)	TELECOM DEFENSE
339.	Water pollution free starch/sago plant Ingredients	Mr. Natarajan Rayar	M/s. Nasel Starch Industries Address: North Irumbulikurichy – Po,Sendurai – TK,City: Perambalur District- 621 804,Tamil Nadu		Chemical

	.		IIGP 2008: End-User Industrial Classification of Selected Technologies		
340.	A method for carrying out a surface plasmon resonance measurement	Prof. L. Kameswara Rao	Indian Institute of Science, Bangalore Address: Society for Innovation and Development(SID), IP cell, IISc,City: Bengaluru - 560012 State: Karnataka	www.iisc.ernet.in	Metals and Mining
341.	A novel process for the fabrication of Mg-30% SiC particle reinforced composites by casting route	Prof. M.K. Surappa	Indian Institute of Science, Bangalore Address: Society for Innovation and Development(SID), IP cell, IISc,City: Bengaluru - 560012,State: Karnataka	www.iisc.ernet.in	METAL
342.	A novel therapy for colon cancer	Prof. V.B. Gupta	B. R. Nahata College of Pharmacy Address: P. B. No. 6, Mhow-Neemuch Road,City: Mandsaur - 458001,State: Madhya Pradesh	www.brncop.org	Healthcare
343.	Agmonts general-purpose adaptive autonomic system	Mr. Arhat Basak	CL104 Sector-2, Salt Lake City,City: Kolkata,State: West Bengal		Aerospace and Defense
344	An electrochemical	Dr. N. Munichandraiah	Indian Institute of Science Address: Society	www.iisc.ernet.in	METAL

	supercapacitor (ELECTRICAL)		for Innovation and Development(SID), IP cell, IISc,City: Bengaluru - 560012 State: Karnataka		
345.	An improved method and a system for ventricular defibrillation (ELECTRICAL)	Prof. Rahul Pandit	Indian Institute of Science Address: Society for Innovation and Development (SID), IP cell, IISc,City: Bengaluru - 560012,State: Karnataka	www.iisc.ernet.in	ELECTRICAL
346.	ClimaGear WEARABLE ELECTRONICS	Mr. Kranthi Kiran Vistakula	Dhama Apparel Innovations Pvt Ltd Address: 503 Legend Appts, StreetNo.7, Himayatnagar, Hyderabad,Andhra Pradesh	www.dhamainnovations.com (TO BE RESEARCHED MORE)	Textiles
347.	Coir Atlas	Mr. Himanshu A. Sheth	Coir Atlas Address: C-34, B.S.Estate, D-Road, Anil Sur Path, Kadma,City: Jamshedpur,State: Jharkhand	www.coiratlas.com (PACKAGING PRODUCTS)	STEEL
348.	Development of 2-MNA/PES based films for optoelectronic application	Dr. Yuvraj Singh Negi	Indian Institute of Technology, Roorkee Address: C-10, DPT, Saharanpur Campus, Paper Mill Road,City: Saharanpur,State: Uttar Pradesh	www.iitr.ac.in (CHEMICAL)	GLASS
349.	Dynamic software tools generation for new processors	Mr. Gopi Kumar Bulusu	Sankhya Technologies Private Limited Address: No. 10-1-27, IV Floor, Sampath	www.sankhya.com	IT

			Vinayaka Temple Road,City: Visakhapatnam, Andhra Pradesh		
350`.	Fruit coatings	Prof. H.M. Chawla	Indian Institute of Technology, Delhi Address:Chemistry Department, Indian Institute of Technology,Hauz Khas,City: New Delhi,State: Delhi	www.iitd.ac.in	Processed food
351.	Integrated biotechnological farm with self sufficient energy generation	Mr. Ashok Shukla	SPA Associates Address:3282, Plot F 3, FDDI Sahkari Awas Samiti,Alok Vihar-I, Sector-50,City: Noida,State: Delhi		Biotech Renewable Energy
352.	Knowledge based engineering	Mr. Amit Dutta Gupta	Adroitec Information System Ltd,Address: D-194, Okhla Industrial Area, Phase I,City: New Delhi,State: Delhi	www.adroitecinfo.com	AUTOMOTIVE CONSTRUCTION
353.	Waste plastic to Fuel	Mr. T. Raghavendra Rao	Sustainable Technologies & Environmental Projects Pvt. Ltd. Address: 602-B, Sweet Home, SV Patel Nagar, Andheri west,City: Mumbai,State: Maharashtra	www.stepsenergy.net	fuel
354.	Method of making Al rich and AlN rich matrix composites by	Prof. Vikram Jayaram	Indian Institute of Science Address: Intellectual Property Cell,	www.iisc.ernet.in	Metals and Mining

	pressureless infiltration of molten aluminum alloys using an external getter		SID, Indian Institute of Science, Bengaluru, Karnataka		
355.	mPire - portlet maker	Mr. Ahmed Hasan	Trans IT mPower Labs (P) Ltd. Address: No. 42, Nandidurg Road, Bengaluru, Karnataka	http://transitmpowerlab.tradeget.com	IT
356.	Nanotechnology-based fingerprint dusting composition	Dr. G.S. Sodhi	SGTB Khalsa College, Delhi University Address: 38, Jagriti Enclave, Vikas Marg Extension, City: New Delhi, State: Delhi	www.sgtbkhalsadu.ac.in	IT Electronics
357.	Optical cryocooler	Prof. Subhash Jacob	Indian Institute of Science City: Bengaluru State: Karnataka	www.iisc.ernet.in	Electronic
358.	Pedal crank assembly	Mr. Manoj Kumar Mondal	Indian Institute of Technology, Kharagpur, 240/1 South Side, PO-Kharagpur, PIN-721301, Kharagpur, West Bengal	www.iitkgp.ac.in	automotive
359.	Power over ethernet technology (POE)	Mr. Devesh R. Agarwal	Infomart (India) Pvt. Ltd. 99, 5th block, 5th cross, Koramangala, Bengaluru, Karnataka	www.infomartgroup.com	IT Electrical
360	Process for the manufacture of nitrobenzene using solid	Dr. Mohan K. Dongare	National Chemical Laboratory Address: National Chemical		Chemicals

	acid catalyst		Laboratory,Catalysis Division, National Chemical Laboratory,Pune Maharashtra		
361	Recombinant protein with serological and cancer diagnostic application	Dr. B.M. Swamy	Karnatak University Address: Dept. of Biochemistry, Karnatak University,Dharwad - 580003,Karnataka	www.kud.ac.in	Pharmaceuticals biotech
362.	Simple, cheap and eco-friendly process to polymerize silicone	Mr. Bimal Pillai	Nouveaw Exports Pvt. Ltd. Address: A3/4-1, Alak CHS, Sector 19A, Nerul-E, Navimumbai, 400706,Mumbai ,Maharashtra	www.nouveaw.com	Chemicals
363.	Slow-release micronutrient fertilizers (chemical)	Dr. Chandrika Varadachari	Raman Centre for Applied and Interdisciplinary Sciences 16A , Jheel Road,Kolkata,W est Bengal	www.rcais.res.in/index.htm	Agriculture and Forestry
364.	Smoke, fumes & gases arrestor (oil & gas)	Mr. Ashok Rai	Ashok K. Rai Associates,701, Ashadeep, 9-Hailey Road,New Delhi,Delhi		Power chemical fertiliser steel
365.	Solar thermal engine (RE)	Mr. Gurmit Singh	PranatEngineers Pvt. Ltd. Address: 28, Rishabh Vihar,New Delhi,Delhi		Electrical
366.	Switch reluctance motor	Dr. Samsul Ekram	Crompton Greaves Ltd Address: CG	www.cgglobal.com	electronics

			Global R&D Center, AMDTC, Crompton Greaves Ltd., Kanjurmarg (East), Mumbai Maharashtra		
367.	Unique thermal management in outdoor type dry transformers	Mr. Arun Dattatraya Yargole	Crompton Greaves Ltd Address: CG Global R&D, Kanjur, Mumbai, Maharashtra	www.cgglobal.com	electrical
368.	Video tracking algorithm (IT)	Mr. Himesh Madhuranath	Deccan Signals, No. 499, 13th Main, 21st Cross, BSK 2nd Stage, Bengaluru 560070, Karnataka	https://sites.google.com/a/deccansignals.com/www/home	Defense
369.	3D imaging for characterization of semiconductor wafers	Mr. Pullaiah Dussa	No.S-2, HIG Flats, Kottur Gardens, Kottur Puram, City: Chennai, State: Tamil Nadu		IT Electronics
370.	Apoptotic proteins	Mr. Janak Sheth	Century Pharmaceuticals Ltd 406, World Trade Centre, Sayajigunj City: Vadodara State: Gujarat	www.centurypharma.com	BIOTECH
371.	Biodiesel process	Mr. Sanjeev Sharma	Gomti Biotech Ltd. Address: Tikonia Road City: Haldwani State: Uttaranchal	www.gomtibiotech.in	Biotech Renewable energy
372.	Biomass gasification for electricity generation & thermal applications	Mr. Ankur Jain	Ankur Scientific Energy Technologies Pvt. Ltd. Near Old Sama Jakat Naka 390 008 Vadodara Gujarat	www.ankurscientific.com (RE)	Biotech Renewable Energy

373.	CAD tool for rapid automated 2D to 3D conversion	Mr. Amarnath Bhat	Oriental Software Pvt. Ltd. Address: 43/1, Richmond Road 560 025, City: Bengaluru, State : Karnataka	www.oriental-software.com	Construction
374.	CastDESIGN	Mr. Amarnath Bhat	Oriental Software Pvt. Ltd. Address: 43/1, Richmond Road 560 025, City: Bengaluru, State : Karnataka	www.oriental-software.com	IT
375.	Catalytic Conversion of Waste Plastic to Petroleum Fuels	Mr. T. Raghavendra Rao	Sustainable Technologies & Environmental Projects Pvt. Ltd. 602-B, Sweet Home, SV Patel Nagar, Andheri west City: Mumbai Maharashtra	www.stepsenergy.net	FUEL
376.	Embedded technology, smart card operated prepaid energy meter with automatic load controller	Mr. Joydeb Roy Chowdhury	Embedded Systems Laboratory, Central Mechanical Engineering Research Institute Address: M.G. Avenue 713 209, City: Durgapur, State: West Bengal	www.cmeri.res.in	Electronics IT
377	Energy conservation	Mr. Bipin Gadhiya	Genius Technologies Address: Mahuva Road, City: Savarkundla, State: Gujarat		Renewable energy
378.	Energy saving LED lighting solutions for rural & urban lighting	Mr. K. Vijaya Kumar Gupta	Kwality Photonics Pvt. Ltd. Address: 29, Electronic	www.kwalityindia.com/main.html	Renewable energy

			Complex, Kushaiguda,Hyd erabad, Andhra Pradesh		
379.	Generation of electrical energy from sea waves	Mr. W. Amarnath	Kenwrich Technologies Address: No.5, First Avenue, Indra Nagar, Adayar, Chennai, Tamil Nadu		Renewable energy
380.	Gold tracking	Mr. Sanjay Vijayakumar	Torque Address: Torque, Technology Business Incubator, Park Center, Technopark,Triv andrum,Kerala		Metal
381.	Green energy & environment conservation (GEECON)	Mr. D.M. Charles			Renewable energy
382.	Hasta-Vaani	Ms. Ruzan Khambatta	8th Floor, White House, Panchwati 380006,Ahmeda bad,Gujarat		IT
383.	Herbal insect repellant Company/Insti tution	Ms. Meera Goel	B-6/2, Site IV, UPSIDC Industrial Area, Dist. Ghaziabad,Sahi babad,Uttar Pradesh		Chemicals
384.	iMFAST	Mr. Mahendra Pratap	Integra Micro Systems Pvt. Ltd. Address: No.4, Bellary Road, 12th KM, Jakkur,Bengaluru, Karnataka	www.integramicro.com	Financial services
385.	Industrial applications of applied mathematics	Mr. Vishal Goyal	Sigma Numerics Pvt. Ltd. Address: KM-78, Kavi	www.sigmanumerics.net /index.html	IT

			Nagar, Ghaziabad, Uttar Pradesh		
386.	Mobile internet browser	Mr. Arun Tanksali	No. 4, 12th KM, Bellary Road, Jakkur, City: Bengaluru, State: Karnataka	IP Patent Protection Status: None Technology Development Status: Party developed / commercialized	IT
387.	Nanotech	Surjit S Maann	Maann Innovations Address: G-81, G - K - 11, City: New Delhi, State: Delhi		Textiles
388.	Natural fibre - glass fibre hybrid bio-composites materials and products	Dr. R. Gopalan	Composites Technology Park Address: No. 205, BandeMutt, Kengeri Satellite Township - 560060, Bengaluru, Karnataka	www.compositestechologypark.com	GLASS & CERAMICS
389.	Nitrifying bioreactor technology	Mr. Mohan Kandaswamy Innovator's Name: Dr. I. S Bright Singh	Oriental Aquamarine Biotech India Private Limited Address: U7, Kovaipudur, City: Coimbatore, State: Tamil Nadu Cochin University of Science and Technology (CUSAT) Address: Cochin-22, City: Cochin, State: Kerala	www.nitrifying-bioreactor.com www.cusat.ac.in	Agriculture and Forestry biotech
390.	Numerical simulations	Mr. Basant Kumar Gupta	Zeus Numerix Pvt. Ltd. Address: M 03, SINE, CSRE Building, IIT Bombay Campus, Powai 400076, Mumbai, Maharashtra	www.zeusnumerix.com (IT)	Aerospace and Defense

391.	Passenger connectivity	Mr. Ashwin Bhambri	Dotcommer Address: 424, AFNO Enclave, Sector-&, Plot-11, Dwarka-110075, City: New Delhi, State: Delhi		Aerospace and Defense
392.	Physician assistant artificial intelligence system (PAIRS)	Dr. A.M. Mohan Rao	Logic Medical Systems, 80, Salarjung Colony, Kakatiya Nagar, Hyderabad State: Andhra Pradesh	www.cyberdoc.freewebspace.com	Healthcare
393.	Pollution free cotton seed delinting technology	Mr. Vinod Kalbande	Maharashtra State Seeds Corporation Limited Mahabeej Bhavan, Krishi Nagar 444 104, City: Akola, State: Maharashtra	www.mahabeej.com	Agriculture and Forestry
394.	RAGe	Mr. Pani Kumar Sharma	Avishkaar Techno Solutions Private Limited Address: nd No. 640, 10th A cross, West of Chord Road 2 stage - 560 086, Bengaluru, Karnataka	www.avishkaar.co.in	IT
395.	Real time dual kernel Linux operating software	Mr. GK Sastry	321, Jalvayu Vihar, Kukutpally, City: Hyderabad, State: Andhra Pradesh		Aerospace and Defense; IT
396.	SMSReachOut	Mr. Natesh Babu	Techweb Technologies P. Ltd. 86, 3rd Floor, Gandhi Bazaar, Basavan a Gudi-560 004 Bengaluru	www.techwebindia.com	IT

			Karnataka		
397.	Unmanned aerial airship	Mr. Raejus T. Job	Thaejus Aerodyne Research Labs. Address: 21/2, M.G. Road City: Bengaluru State: Karnataka	www.thaejus.com	Aerospace and Defense
398	Unmanned aerial vehicles	Mr. Nimish Sharma	Aurora Integrated Systems Pvt Ltd 60/4, Srirampura Cross Opp. JNC ASR, Bengaluru 560064,;Karnataka	www.aurora-is.com	Aerospace and Defense
399	Dev. of Ferrite phase shifter technology (A) Nonreciprocal toroidal phase shifter and (B) Reciprocal dual mode phase shifter.	Dr. (Ms.) Bharathi Bhat, Dr. S	Indian Institute of Hauz Khas, New Delhi		Defense
400	Carbon Composite Heat Shield for Re-entry structure of Rockets METAL	Prof. K.V.A. Pandalal	Indian Institute of Technology		Aerospace & Defense
401	Digital Autospan & Autosampler- An Opto-Electronic instrument for evaluating cotton length parameter	Sh. Shobha Nath Misra	Bombay Textile Res. AsMumbai, Maharashtra	www.btraindia.com	Textile
402	Wide Field Unit Magnification Telescope (Guidescope)	Dr. Jagpal Singh, Sh. N	Haryana State Electronics Dev. Corp. Ltd., Chandigarh Instruments Design & D Harya	www.hartron.org.in	Electronics
403	Micro Processor Based Mobile Metallizing Equipment	Dr. Mohammad Ghouse	Bharat Heavy Electricals Hyderabad	http://web.bhelhyd.co.in	Metal

404	A Device for Reducing carbon monoxide (CO) emission from the exhaust of automobile engine.	Dr. V.Panduranga, Sh.	The Enfield India Ltd.,	http://royalensfield.com/	Automobile
405	Electromagnetic Stirrer (Motoless)	Prof. D.V.S.Jain, Sh. Jo	Punjab University, Chandigarh		Electronics
406	Microprocessor based automatic pH control system for juice clarification process in sugar industry.	Sh. Laxmi Narayan, Sh CEERI, Pilani		http://www.ceeri.res.in/	Agriculture ELECTRONICS
407	Pyrophoric metal powder of zirconium and nuclear grade magnesium granules.	Sh. Shree Kant Chaudh Nuclear Fuel Complex, Hyderabad		www.nfc.gov.in/	metal
408	Micro Mini Printer	Sh. Lakshman Prasad M/s. Numerators India Ltd., Aligarh			Consumer goods
409	Process for the manufacture of low moisture refractory composition	Dr. Anukul Chandra Da Central Glass & Ceramic Research Institute Kolkata, West Bengal		www.cgcri.res.in	Glass & ceramic
410	A process for the manufacture of Mass Culture of Spirulina Algae	Dr. C.V. Seshadri, Sh. B. V. Umesh Shri. A.M.M. Murugappa, Chettiar Research Centre, Tharamani Chennai		www.amm-mcrc.org/	Biotech
411	W-Band monopoles antenna system for	Dr. K.K.Srivastava, Sh. B.K. Mukhopadhyaya			Defense

	missile sector application.	y, Sh. J.V. Prasad, Sh. M. Damodar, Sh. N. Addishesu Secker Herad LAB. RCI, DRDL, Hyderabad IIT, Kharagpur			
412	Glass Reinforced Gypsum Composite- A Partial Substitute of Timber	Sh. K. K. Phani, Sh. S. K. Som, Sh. M. Roy Choudhury, Sh. S. Ram, Sh. P. L. Chanda Central Glass & Ceramic Research Institute, Kolkata West Bengal		www.cgcri.res.in	Construction
413	Flexible Graphite for Tapes and Sheets	Dr. O. P. Bahl, Dr. R.B.Mathur, Sh. S.S. Haanspal National Physical Laboratory, New Delhi	WRITTEN TWICE??	www.nplindia.org/	Electronics
414	Submerged arc welding flux for narrow gap applications	Sh. G.Buvashekan, Sh. P.Dhandapani, Ms. Kamla Narayanaswamy Bharat Heavy Electricals Ltd., Welding Research Institute Tiruchirapalli		www.wriindia.com	Electrical
415	A new method for application of manganese dioxide ore to Battery Grade	Sh. K. L. Luthra, Sh. B.B.Choudhary Manganese Ore India Ltd., Nagpur		moil.nic.in/	Metal POWER
416	New improved process of continuous wet ball milling.	Sh. R.Basharapandian The Metal Powder Co. Ltd.,		www.mepco.co.in/	Metal

417	Deolier: A Cationic Polyelectrolyte	Dr. Duleshwar Mahanta, Sh. Azizur Rahman, Sh. B.P.Chaliha Regional Research Laboratory Jorhat		www.neist.res.in/	Chemical
418	A Process for the Manufacture of building bricks / blocks from fly ash	Dr. S.N. Mukherjee, Sh. S.K. Majumdar, Sh. S.K.Das Gupta, Sh. A.K. Moitra, Ms. A. Lahiri Central Fuel Research Institute Dhanbad Bihar		www.cimfr.nic.in	Construction steel
419	Digital micro meter for technology gap measurement	Sh. Nirmalendu Das Bhilai Steel Plant Bhilai	TWICE??	https://www.sail-bhilaisteel.com/	steel
420	Two stage pulping of whole bagasse	Sh. B.K. Moorthy, Dr. R.S.Tripathi, Sh. K.C. Rajasekhar Mandya National Paper Mills Ltd. Belagula			Agriculture Renewable energy
421	An improved type of hand operated crichsen tester to determine the deep drawing property of metal sheets	Sh. Kumar Balram Bhatia Blue Steel Engineers Pvt. Ltd.,		www.bluesteeltester.com	metal
422	Multipurpose self retaining new brain retractore	Dr. S.P.Agarwal Dr. Ram Manohar Lohia Hospital, New Delhi			healthcare
423	Indigenous fabrication of modified	Sh. Daya Kishab Wali, Sh. P.Dharma		www.ecil.co.in	engineering

	version of cold reducing tube mill	Rao ECIL Hyderabad			
424	Development of a combined harvester with simultaneous straw burising provision by new type of threshing and separation system.	Sh. Shamsher Singh Faridkot, Punjab			agriculture
425	Parallel Processor building block	Sh. S.G.Gopalan, Sh. A P Vinayagam BMS College of Engg. Bangalore, Karnataka		www.bmsce.ac.in	engineering
426	Armour Steel Coded Ass Jackal	Sh. S.R. Sahay Defence Metell. Res. Lab, Kanchanbagh, Hyderabad			steel
427	Colour Photowrite	National Remote Sensing Agency Hyderabad		http://www.nrsc.gov.in/	engineering
428	Dynamic Hardness Tester	Sh. S.D. Kulkarni Fasje Test Equipment Pvt. Ltd., Sangli			Machine tool
429	Multidirectional Carbon fibre preform process technology	Sh. Veluturi Murli Mohan Defence Res. & Dev. Laboratory Hyderabad			textile
430	Thick Film Potentiometric Sensor for Flight Control Actuation System	Sh.S.S.Misra, Sh.S.Rajendra Kumar, Dr.T.R.Reddy Sh.K.Barua, Sh.M.D.Das Research Centre Imarat Hyderabad DERL, Hyderabad			Aerospace defense

431	Laser based alignment system for electrical power & other industries	Dr.Chandra Shanker, Dr.U.M.Chaudhari Indian Institute of Technology, New Delhi BHEL, Hyderabad			electrical
432	Personal Braille Embosser	Dr. M.P.Srinivasan, Sh. J.E. Diwaakar Indian Instt. Of Science, Bangalore,Kar anataka		www.iisc.ernet.in	engineering
433	Innovation of Handloom effectively suitable for the visually handicapped	Dr B P Sarkar, Dr S N Mahendra, Sh Mahadev Prasad Indian Instt of Handlooms technology, Varanasi		www.handlooms.nic.in	textile
434	Street Light fitting of superior designs	Sh Kurian George Kerala State Electricity Board, Kerala		www.kseb.in	electrical
435	Large optics polishing machine	Sh. Raj Bahadur M/s Prabhat works, Delhi			Machine tool
436	New process for the manufacture of multi layer printed circuit board	Sh Vedu Mitter	M/s. Micropack Ltd., Bangalore		electrical
437	Chitra Heart Valve Prosthesis	Sh.G.S.Bhuvaneshwar, Sh.D.S.Neelkantan Nair, Sh.C.V.Murlidharan Shree Chitra Tirunal Instt. For Medical Sc. & Tech, Trivandrum			healthcare
438	Development of high strength low density	Dr. A. A. Gokhale, Sh. R. K. Singh Defence		Dmrl.drdo.in	aerospace

	aluminium - lithium aerospace alloy	Metallurgical Research Laboratory, Kanchanbagh Hyderabad			
439	Automatic Self adjusting spanner/wrench	Sh.C.V.Solanki, Sh.Harindra V.Siolanki M/s. Solsons Ahmedabad		www.solsons.com	Machine tool
440	Improved software package for planer near field measurement-class	Dr. S. Christopher, Sh. Suma S. Rao, Sh. Shaji P. Alex, Sh.R.C.Sedho u Electronic & Radar Dev. Establishment, Bangalore Karnataka		http://www.drdo.gov.in/drdo/labs/LRDE/English/index.jsp?pg=homebody.jsp	defense
441	X-Band high Bit Rate QPSK Modulator	Dr. S. Pal, Sh. V. Sambasiva Rao, Sh. D. V. Ramana, Ms. L. Suvarna, Sh. K. Krishna Murthy, Sh. A. Bhaskarnarayana ISRO Setallite Centre, Bangalore, Karnataka		http://www.isro.gov.in/about-isro/isro-satellite-centre-isac	aerospace
442	Passive radiant cooler for very high resolution of payload of high resolution of payload of INSAT-2 Satellite	Sh. Prakash P. Gupta, Sh. S.C. Rastogi, Dr. Indira Rajgopal, Dr. Ajay Kumar Saxena ISRO Setallite Centre, NAL, Bangalore, IIA, Bangalore, Karnataka			aerospace
443	Mini crane for builders	Sh. J.P.Kaushish, Sh. Bhagwan Das, Sh. S.K. Saini, Sh. D.K. Gautam, Sh. Mahendra Pal Central Building		cbri.res.in	construction

		Research Institute Roorkee			
444	Mechanisedl process for Converting Pineapple leaf fibres into yarn	Sh. T. V. Ratnam, Ms. Indra Doraiswamy, Sh. P. Chellamani, Sh. R. Gunasekaran The South India Textile Research Association Coimbatore Tamilnadu		http://www.sitra.org.in/	Textile AGRICULTURE
445	Electronic Wheel Chair	Prof. A. G. Patil S. B. M. Polytechnic, Mumbai		sbmp.ac.in	Healthcare electronics
446	Manufacture of surface coating from oligomeric polymer waste	Dr. N. D. Sharma, Sh. Atul P. Jain, Sh. A. K. Panday, Dr. B. V. Rao Sir Padmpat Research Centre Kota, Rajastha n			chemical
447	Development of aeronautical grade cast acrylic sheet	Dr. T. J. M. Sinha Gujarat State Fertilizers Co Ltd., Vadodara Gujarat		www.gsfclimited.com	chemical
448	Air Plasma cutting cum TIG cum MMA welding equipment	Plasma Cutting Equipment Pvt. Ltd., E-10/19, 83, M I D C, Bhosari, Pune 411026 Sh. H u g h e n T h o m a s			metal
449	Dev. of Berryllium Components for strategic application	Sh.N.Sivasubr amanian, Sh.Beant P.Sharma, Sh.Ved Prakash Sharma Bhabha		www.barc.gov.in/	chemical

		Atomic Research Centre, Mumbai			
450	Building block technique for solid propellant grains	Sh.L.Ramachandran, Sh.S.K.Athithan, Sh.P.M.Varkey , Sh.V.N.Krishnamurthy Vikram Sarabhai Space Centre Thiruvananthapuram		www.vssc.gov.in	aerospace
451	Boron Technology	Dr.C.K.Gupta, Sh.D.K.Bose	Bhabha Atomic Research Centre, Mumbai, Maharashtra	www.barc.gov.in/	Pharmaceuticals
452	Spark Gap for protection of series capacitors in 220 Kv transmission system	Dr. S. C.Gupta, Sh. R. Rajaraman, Sh.K.R.Sulaiman Sheriff Bharat Heavy Electricals Ltd., Corp. R&D Division, Vikasnagar Hyderabad		http://www.bhel.com/about_rd.php	electronics
453	Intelligent Braille Interpreter	Sh.Ajit Madhav Patankar, Sh.Ashok K.Bayala Bhabha Atomic Research Centre, Mumbai, Maharashtra		www.barc.gov.in/	engineering
454	Mechanized Depillaring of thick coal seam with cable bolts	Dr. Tribhuwan Nath Singh, Sh. Bimla Kant Dubey Central Mining & Research Institute, Dhanbad, Bihar	TWICE NOTED	http://www.cimfr.nic.in/	coal
455	Development of (a) Novel cross linked macroporous	Dr R A Mashelkar, Dr S Penrathnam, Dr C R Rajan,	National Chemical Laboratory Pune	www.ncl-india.org	Chemical pharmaceutical

	Polymer matrix useful for immobilization of industrial enzyme(s) (b) process for production of immobilized Pencillin G Acylase using the Polymer Matrix and production of 6-Amino Penicillanic Acid using the Immobilized Enzyme.	Dr S R Naik, Dr. J. G. Shewale, Dr. G. R. Ambekar, Dr. K K Krishnadas			
456	Space worthy coilable lattice boom	Sh. S. K. Balan, Sh. V. Sridharamurthy, Sh. T. P. Murli, Sh. Raju Aller, Sh. B.S. Nataraju, Sh. G. Murugavel, Sh. D. Kamesh ISRO Satellite Centre, Bangalore, Karnataka VSSC, Trivandrum			aerospace
457	Continuous production of invert sugar (Syrup) through biotechnology route	Dr. Sailen Ghosh Bhabha Atomic Reseach Centre, Food Technology Division, Trombay Mumbai, Maharashtra		www.barc.gov.in/	biotech
458	Multi band Antenna system at L/S/UHF band for satellite/cellular hand held phone	Dr. S. Pal, Sh. V. K. Lakshmeesha, Sh. V. Mahadevan, Sh. K. Sadanandan, Sh. M. L. Subramanya, Sh. C.D.V. Subramanyan.		www.isro.gov.in/about-isro/isro-satellite-centre-isac	aerospace

		Sh. L. Nicholas, Sh. M. Kumar, Sh. S. Ashwathanarayana, Sh. V. Subramanya, Sh. T. Mallikarjunaih ISRO Satellite Centre, Bangalore, Karnataka			
459	High set remote Prop	Sh.Sibnath Maity		Central Mining Research Institute, Dhanbad, Bihar	coal
460	Permeability Meter or hysteresis loop tracer	Sh.Narhar Gopal Nandikar M/s Ferrites India, Mumbai, Maharashtra			electronics
461	Mechanized Depillaring of thick coal seam with cable bolts	Dr. Tribhuwan Nath Singh, Sh. Bimla Kant Dubey Central Mining & Research Institute, Dhanbad, Bihar			coal
462	Advent of Titanium complex grease: a break through in the history of lubricating greases	Dr. A .K. Bhatnagar, Dr. M.M. Rai, Dr. K. P. Naithani, Sh. A. S. Verma, Dr. E. Sayanna, Dr. Anoop Kumar Indian Oil Corporation Ltd., Research & Development Centre, Faridabad, Haryana		https://www.iocl.com	oil
463	Dynamic Carrier control for high power Radio	N. Srinivasan, R. Narasimha Swamy, S. Ramachandran, P. P. Murlidharan		allindiaradio.gov.in	power

		All India Radio & Doordarshan, New Delhi			
464	Chemglage-A process for improving fatigue crack growth resistance by laser beam	Sh.Arvind Bharti, Dr. Vikas Kumar Saxena Defence Metallurgical Research Laboratory, Kanchanbagh, Hyderabad		www.drdo.gov.in/drdo/labs/DMRL/English/index.jsp?pg=contact.jsp	aerospace
465	Dev. of Neutron radiography transfer imaging technique using linear accelerator for qualification of space components	Sh. K. Vishwanathan, Sh. C.Subbiah, Sh. K. VenkataRao, Sh. V. N. Misale, Sh.P.V.Sai Suryanarayana, Sh. S.K. Athithan, Sh. M.C. Uttam ISRO Setallite Centre, Sriharkota		www.isro.gov.in	aerospace
466	Universal Commutator Turning fixture(At Situ)	Sh. D. P. Vishwakarma, Sh. K. C. Naik Bhilai Steel Plant, Bhilai		https://www.sail-bhilaisteel.com	Steel
467	"CEPIN" & "PHEB"- New and improved tools for site metallography / remaining life assessment of boilers	Dr. G. Venkataraman Bharat Heavy Electricals Limited, Welding Research Institute Tiruchirapalli			Electrical METAL
468	A novel process for reduction roasting of Manganese ore and device therefore	Sh. Sudhakar V. Kothari, Sh. N. Subramanian A. Paramount Sinters Pvt Ltd Nagpur		http://infoline.com/paramount-sinters-	metal
469	Wide L&C Band Antenna for remote controlled aircraft	Dr. Surendra Pal, Sh. V. K. Lakshmeesha, Sh. S. Kumar Barnwal ISRO Satellite Centre		www.isro.gov.in/about-isro/isro-satellite-centre-isac	aerospace

		Bangalore			
470	Dual Polarised Vsat Antenna Feed	Dr. S. Christopher, Dr. A. K. Singh, Dr. (Ms.) Anjana Kaul LRDE Bangalore		www.drdo.gov.in/drdo/labs/LRDE/English/index.jsp?pg=homebody.jsp	aerospace
471	Acephate Technical	Dr. N. K. Roy Indian Agricultural Research Institute New Delhi		www.iari.res.in	Agriculture chemical
472	Dev. of process & Machinery for spinning jute/cotton blended yarn in short staple spinning system	Ms. Indra Doraiswamy, Sh. P. Chellamani, Sh. A.Kanthimathi nathan, Sh. M. Kathirvel, Sh. M. Murthy SITRA Coimbatore			textile
473	Regulation of speed of steam turbine through an innovative auto suction control of coke oven gas with built-in safety interlock	Sh. Shankar Prasad, Sh. Ganpat Ram Sahu, Sh. Niranjan M Muley, Sh. N. C. Bansiyar Bhilai Steel Plant		https://www.sail-bhilaisteel.com/	steel
474	Design, Development, installation and commissioning of 100 TPD capacity high pressure sintering unit	Sh. Nirmal K.Kakkar, Sh. Samir K .Roy, Sh. Arun K .Pd Singh, Sh. Subhasis Chaudhuri, Sh. Kirti Prasad Verma SAIL Ranchi		https://www.sail.co.in/other-unit/rd-centre-iron-and-steel	steel
475	Development of process technology for manufacture of detergent grade Zeolite-A	Sh. M. M. Seth, Dr. C. R. Misra, Dr. R. S. Somani, Dr. P. M .Oza, Sh. M. R. Gandhi, Sh. V. M. Sheth CSMCRI, Bhubaneshwar, National			chemical

		Aluminium Co. Ltd., Bhubaneswar Orissa			
476	Process for the preparation of alumina hydrate of superior purity and fitness & process for preparation of low soda high alpha pure alumina	Dr.Bijoy Kumar Satapathy, Sh.Sirish Chandra Patnaik, Sh.Saroj Kumar Patnaik National Aluminium Company Ltd. Bhubaneswar Orissa		www.nalcoindia.com	metal
477	Fluidized abrasive polishing machine	Prof.(Dr.)V.Radhakrishnan, Dr.R.Jaganathan IIT Chennai		https://www.iitm.ac.in	Machine tool
478	Upgradation of Electro Optical Tracking System	Dr.B.K.Das	Electro Optical Tracking Division Interim test Range		electronics
479	Hydroxyapatite coated titanium implant for tooth	Dr. Sabrata Pal, Sh. T. K. Pal, Dr. Anjana Pal Jadavpur University Kolkata West Bengal		www.jaduniv.edu.in	Healthcare
480	X & S band Monopulse Tracking Feed for remote sensing satellite earth station	Dr.S.Pal, Sh.V.K.Lakshmeesha, Sh.V.V.Srinivasan, Sh.M.Kumar, Sh.V.Senthil Kumar ISRO Satellite Centre Communication Systems Group Bangalore, Karnataka		www.isro.gov.in/about-isro/isro-satellite-centre-isac	aerospace
481	Conversion of slab caster into combination three strand	Sh.Jai Ram Gupta, Sh.V.Balasubramani Bhilai Steel Plant		https://www.sail-bhilaisteel.com/	steel

	bloom cum slab caster	Bhilai			
482	Design & Development of an automatic irrigation system	Sh.Surinder Kumar Luthra, Sh.M.J.Kaledhonkar, Dr. Om Pal Singh, Dr.Narender Kumar Tyagi Central Soil Salinity Research Institute (CSSRI) Karnal, Haryana		www.cssri.org	agriculture
483	A Clock controlled sun tracking system for photo voltaic and solar thermal collectors	Prof. Yash pal Singh, Prof. V. G. Rao			Renewable energy
484	Palmyrah Fibre Separator	Sh. I. Srinivas, Sh. R. Sudhakar, Dr. K. Nagarajan Central Tobacco Research Institute Rajamundry (AP)		www.ctri.org.in	agriculture
485	Bio-inoculant in liquid form with plurality of strains used as soil application or biofoliar sprays for Augmentation of crop yield	Sh. R.U. Kanitkar, Ms. Snadeepa Inamdar Kumar Krishimitra Bio-Products (I) Pvt. Ltd. Pune Maharashtra			agriculture
486	Combustible Cartridge cases for Tank Gun Ammunition	Sh. R.K. Syal, Sh. S.B. Talegaonkar, Sh. S. K. Saudi, Sh. K. D. Borole, Sh. J. R. Peshave High Energy Materials Research Pune		www.drdo.gov.in/drdo/labs/HEMRL/English/index.jsp?pg=homebody.jsp	defense

487	Development of cheap & suitable fire protective coating materials for preventing spontaneous heating in open cast mines	Dr. R.V.K. Singh, Dr. Salil Kumar Ghosh, Dr. Bharat Bhushan Dhar Central Mining Research Institute Dhanbad			Coal
488	New Ejection Mechanism of spent cases of Gas Operated Rifle	Sh. Prasanta K. Das Rifle Factory Shapore P.O. Ishapore, West Bengal		rfi.nic.in	engineering
489	Vijetha- A Silkworm body & rearing agent set disinfectant	Dr. R.K. Datta, Dr. M. Baig, Sh. T. Selvakumar, Dr. M.B.V. Subbiah, Dr. B. Nataraj, Dr. M. M. Ahsan Central Sericultural Research & Training Instt. Srirampura, Mysore		http://www.csrtimys.res.in/	Agriculture
490	Reducing the period of retting of coconut husks & upgrading the quality of unretted green husks Coir Fibre	Dr. Uma Sankar Sarma & Dr(Ms.) Anita Ravindranath Das	Central Coir Research Institute Alleppey Kerala	www.ccriindia.or	Agriculture
491	An Intramedullary interlocking nail- New design for joining fractures of Tibia	Dr. K.P. Daga Daga Hospital, Solapur - Maharashtra			Healthcare
492	Curvex Batch Coder	Sh. Lakshman Prasad M/s Numerators India Aligarh - UP			chemical
493	Pedal operated Rice	TH. Surendranath			Processed food

	Mill	Singh Manipur Science & Technology Council Imphal - (Manipur)			
494	Coconut Husking Tool	Sh. Jippu Jacob & Sh. Joby Bastian	Keral Agricultural Univ. Kellappaji College of Agricultural Engg. and Technology Tavanur		agriculture
495	Altitude Encoder Unit	Sh. S.M. Sharma & Sh. Uma Kant Hindustan Aeronautics Limited Lucknow - UP		www.hal-india.com/	aerospace
496	Composite indentation hardness tester with built-in base for rubber and the like substances such as plastics.	Sh. Kumar Balram Bhatia M/s Blue Steel Engineers Pvt. Ltd. Mumbai - Maharashtra		www.bluesteeltester.com	steel
497	Electronic Wood Moisture Indicator	Sh. K. Shyama Sunder Indian Plywood Industries Research Bangalore Karnataka		ipirti.gov.in	Agriculture
498	Development of ISROFLEX Heater	Sh. H. Bhojraj, Sh.M.H.R.Sreenivasa, Sh. Y.G.N. Appa Rao, Dr. Surya Kumar Sharma, Sh. R. Rathna Kumar Indian Space Research Organisation Thermal Fab. Division Satellite Centre Department of Space,		www.isro.gov.in/about-isro/isro-satellite-centre-isac	aerospace

		Airport Road, Vimanpura Ba ngalore Karnataka			
499	Twin Screw Food Extruder	Dr. Subodh K. Mukherjee M/s Basic Technology Pvt. Ltd. 2/28, Nundy Street Kolkata West Bengal			Food
500	Development of Technology and systems for Slipring unit of precision coherent Monopulse C- Band Radar	Sh. K.R. Kaimal, Sh. V.V. Karunakaran, Sh. Gangadhar De, Sh. K. Raveendar Sh. V.C. Vijaykumar, Sh.S.Chandras ekharan Nair Thumba Equatorial Rocket Launching Station, Vikram Sarabhai Space Centre Thiruvanantha puram (Kerala		www.vssc.gov.in/VSSC_V4/index.php/about-isro/genesis	aerospace
501	Novel Spray Formulations based on Xanthen Dyes for Detecting Latent Finger Prints	Dr.G. S. Sodhi, Dr. Jasjeet Kaur SGTB Khalsa College & College of Applied Science for Women, Delhi University Delhi		http://sgtbkhalsadu.ac.in/	Engineering chemical
502	Three Channel Monopulse Receiver at Ka-Band (Millimeter Waves)	Dr. K.D. Nayak, Sh. Virpal Singh, Sh. Ashok Mittal, Sh. Ajay Malik Defence Electronics Applications Laboratory Dehradun		www.drdo.gov.in/drdo/labs/DEAL/English/index.jsp?pg=homebody.jsp	defense
503	SITRA Enerspin"	Ms. Indra Doraiswamy,		http://www.sitra.org.in/	textile

	Drive System for Ring Spinning and Doubling Machines	Sh. P. Muthukumara swamy, Sh. N. Vasantha Kumar, Sh. G. Ilango The South India Textile Research Association, Coimbatore Tamilnadu			
504	Direct Gas Fired and Steam Blended Loop Ager System	Sh. Girish R. Luthra M/s Luthra Dyeing and Printing Mills, Surat Gujarat		www.luthraindia.com	chemical
505	Low Squint Non-Resonant Wave Guide Slotted Array Antenna for Surveillance radar	Dr. S. Christopher, Mr. V.A. Abid Hussain Electronics Radar Development and Establishment (LRDE) Bangalore		www.drdo.gov.in/drdo/labs/LRDE/English/index.jsp?pg=homebody.jsp	defense
506	Technology on Pollution Control in Brick Kilns	Prof. R.N. Iyengar, Dr. Ashok Kumar Gupta, Dr.Chaman Lal Verma, Sh. Ram Gopal Gupta, Sh. Ephraim Samuel Hiral, Sh. Surendra Kumar, Dr Ashwani Kumar manocha and Sh. Shivappa Himesh. Central Building Research Institute Roorkee		cbri.res.in	construction
507	Chemical Detectors for Toxic Gases-Detector	Dr. R.C. Naik, Dr. K.S. Ajayakumar	M/s United Phosphorus Ltd.	www.uplonline.com	Chemical gas

	Strips, Short term Detector tubes & Dosimeter Tubes				
508	Areca nut Dehusking Tool	Sh. Sudarshana Puttur (D.K.) Karnataka			Agriculture Processed food
509	Shape Memory Alloy (SMA) Actuated Stepper Drive Mechanism	Sh. N.Viswanatha, Sh. T.P.Murali, Sh. M.K.Ravindran, Sh. T.S.Simil & Sh. N. Prasad ISRO Satellite Centre Bangalore Karnataka		www.isro.gov.in/about-isro/isro-satellite-centre-isac	AEROSPACE/DEFENSE
510	Cocolawn-A Ready Made Lawn	Sh. Christy Fernandez, Dr. Uma Sankar Sarma & Sh. K.P.Somanthan Nair Coir Board Kochi Kerala		coirboard.gov.in/?page_id=276	Agro
511	An Apparatus for Plant Tissue Culture	Dr. Satyahari Dey, Dr. P.S.Bhattacharya & Prof. B.C.Bhattacharya Indian Institute of Technology Kharagpur West Bengal		www.iitkgp.ac.in	Biotechnology
512	Automatic Insect Removal Bins for Safe Storage of Grains and Seeds.	Prof. S. Mohan	Tamilnadu Agricultural University Coimbatore Tamil Nadu	http://www.tnau.ac.in/	Agro
513	Rock Bee Clip	(Late) Sh. Amritrao Indurao Ghadge Dattapur Wardha			Agro
514	A Device for Production of Soft Coke and Process	Dr. Sushanta Kumar Hazra & Sh. Partha Sengupta		www.cimfr.nic.in	Metal

	Thereof	Central Fuel Research Institute Dhanbad			
515	Micro Microscope	Sh.Ramendra Lal Mukherjee Micro Instruments Howrah West Bengal			Electrical/ Electronics
516	A Device for recovery of finest cleans from accumulated slurry in coal beneficiation plant and process thereof	Dr. Kalyan Sen & Dr. Dilip Kumar Chakraborty Central /fuel Research Institute, Dhanbad		www.cimfr.nic.in	coal Metallurgy
517	Development of M type Dispenser cathodes for microwave tubes	Dr. K S Bhat, S/Shri Meduri Ravi & C. Suresh Microwave Tube R & D Centre (MTRDC)		http://www.drdo.gov.in/drdo/labs/MTRDC/English/index.jsp?pg=homebody.jsp	Electrical/ Electronics
518	Opto-electronic apparatus for static & dynamic measurements	S/Shri Rajkumar Sameul, M.V. Rao, Dr. P.S.Nair, Shri Akkaram Ananthan, Prof. r.S. Sirohi & Prof. M.P. Kotyal ISRO Satellite Centre Bangalore Karnataka and IIT, Delhi and IIT, Chennai			AEROSPACE/DEFENSE
519	Multi Purpose food processor	Shri K X Benedict Ochanthuruth, Kochi Kerala			Food
520	Maleic anhydride grafted	S/Shri Devendra Jain & Anil Mehta		www.pluss.co.in	Chemical

	polymers	Pluss polymers (P) Ltd., New Delhi			
521	Tractor mounted multipurpose deep trencher	Shri C P Sadashivaiah Shiva Industries, Tumkur, Karnataka			agriculture
522	Fresh Flavour Ginger Oil from green ginger	Dr. C. Arumughan, Shri M M Sree Kumar, Ms. B. Sankarikutty, Dr. (Ms.) M A Sumathykutty & Dr. (Ms) K P Padmakumari Regional Research Laboratory, Thiruvananthapuram		www.niist.res.in	Processed Food
523	Manufacturing furniture from Old used Automotive tyres	Mrs. Rama Anand R A Innovations New Delhi		https://www.behance.net/gallery/37000909/RA-Innovation-Eco-Friendly-Furniture	Mechanical engineering
524	A Whole-Blood Agglutination Assay for On-site Detection of Human Immunodeficiency Virus Infection (HIV)	Prof. V.K. Chaudhary and Dr. (Mrs.) Deptt. of Biochemistry, University of Delhi, South Campus, New Delhi		www.du.ac.in/du/index.php?page=biochemistry	HEALTHCARE
525	Process for the Extraction of Ecdysteroid (Sampoorna) from Caryophyllaceae family of Plants	Dr. (Ms.) Kanika Trivedy, Dr. K. Sashindran Nair, Dr. S. Nirmal Kumar, Dr. Rajat Kumar Datta (Rtd.), Dr. Shankar B. Dandin Central Sericultural Research and Training Institute,		www.csrtimys.res.in	Agro

		Mysore			
526	On-Line Property Prediction System For Hot Rolled Coil	Dr. Ananya Mukhopadhyay, Dr.Sudipta Sikdar, Sh.Saurabh Kundu & Sh.Ashwin Pandit R&D and Scientific Services Division, Tata Steel, Bistupur, Jamshedpur (Jharkhand)		tatasteelindia.com/products-and-processes/processes/rnd/default.asp	STEEL
527	Cotton Stripper Machine	Sh. Mansukhbhai Baldevbhai Patel	Ghatiodia, Ahmedabad		Agro Power automobile
528	Normal Cure Composite Tape Seal (NCCS) for Cable Joint	Dr. Kandasamy Natarajan Advanced Polymer Materials Laboratory, R.V. College of Engineering, Bangalore		rvce.edu.in/chem-kn	Chemical
529	Development of Corrosion Inhibitors/Metal Passivator additive for Lubricant, Grease and fuel Application from Waste Refinery Streams	Dr. Akhilesh Kumar Bhatnagar, Dr. Deepak Kumar Tuli, Dr. Rakesh Sarin, Dr. Ajay Kumar Arora and Sh. Pankaj Kumar Mondal Indian Oil Corporation Ltd., R&D Centre, Faridabad		https://www.iocl.com/aboutus/research_development.aspx	Chemical fuel
530	Novel Method for In-situ Balancing of Rotors	Sh.Prakash Mangesh Rao Katak Engineering Training Div., Air India, Mumbai			aeronautics
531	On Line Fault Sensor for	Dr.Vagish Shrinet,		www.erda.org	Electrical/ Electronics

	Transformer	Sh.Nilesh R.Pandya & Dr.M.Ramamoorthy Electrical Research & Development Association, Vadodara			
532	An Improved Mild Steel Handloom for Weaving Matting	Dr. Uma Sankar Sarma, Sh. T.A. Rajendrababu, Sh. C.R. Komala Kumar and Sh. A. Radhakrishnan Central Coir Research Institute, Aleppey, Kerala		www.ccriindia.org	textile
533	An area specific mineral mixture to increase productivity of Bovines of Uttaranchal and Uttar Pradesh	Dr. M.C. Sharma, Dr. M.P. Yadav, Dr. Chinmay Joshi and Dr. N.N. Pathak Indian Veterinary Research Institute (IVRI), Izatnagar, Bareilly			AGRICULTURE
534	Oilzapper eliminates crude oil spills, manage oily sludge	Dr. Banwari Lal The Energy & Resources Institute (TERI), New Delhi		http://terragreen.teriin.org/popup.php?section_id=523&category_id=16	biotech
535	Blood Glucose Digital Analyzer	Dr. Bansi Dhar Malhotra, Dr. Rajender Kumar Sharma, Shri Rajesh Kumar, Dr. Shyam Sudhir Pandey, Dr. Kumaran Ramanathan,	National Physical Laboratory, New Delhi Institute of Genomics and Integrative Biology, Delhi	http://www.nplindia.org/sites/default/files/bgdig.jpg	healthcare

		Shri Ved Prakash Arya & Shri Sanjay Kumar Rajput Dr. N.B. Tulsani, Ex-Scientist			
536	Process for the Production of Porous Ocular Implant from synthetic Calcium Hydroxyapatite	Dr. Debabrata Basu and Dr. Mithlesh Kumar Sinha Central Glass & Ceramic Research Institute, Kolkata			healthcare
537	Development of Process Know-how for the Manufacture of Abrasive Silica which is used in GEL Toothpaste Formulations	Shri Vinod Mansukhlal Sheth, Shri Niraj Natvarlal Gohil, Shri Nilesh Trivedi and Shri Sanjay Jayantilal Makwana Madhu Silica Pvt. Ltd., Bhavnagar www.madhusilica.com			Consumer Goods
538	Treatment of Industrial Alkaline Waste Water (Sodic Condensate) for removal of Aluminium ions from Condensate containing Trace Amount of Sodium aluminate By Ion exchange method for Boiler use	Dr. Balakrushna Padhi, Shri Benjamin Toppo and Shri P. Vidyasagar National Aluminium Company Ltd., Damanjodi, Orissa			chemical
539	Enhancement of Short circuit Level of Low Tension Air Circuit Breaker by Optimising	Dr. Mukesh Kantilal Shah and Shri Muraleedharan Nair MB Electrical Research &			electrical

	Contact Dynamics	Development Association, Vadodra			
540	Low Sidelobe Microstrip Antenna Array for Man-portable Radars	Dr. U.K. Revankar and Smt. K.S. Beenamole LRDE, Bangalore			electrical
541	Design and Development of Tractor Operated Paddy Straw – Chopper-cum-Spreader	Dr. Ishwar Kumar Garg Shri Sarbjeet Singh Panesar Punjab Agricultural University, Ludhiana Dashmesh Mechanical Works, Sangrur (Punjab)			agriculture
542	A need based user friendly low cost device Banana Fibre Extractor	Shri Rupakula Sudhakar, Dr. Kapil Deo Singh (Shri Indravarapu Central Tobacco Research Institute, Rajahmundry) (Central Research Institute for Dry Land Agriculture, Hyderabad)(Krishna Milk Union Project, Vijayawada)			agriculture
543	New Varieties of Ornamental Crossandra	Sh. Venkatapathy T. Lakshmi Narayan's Crossandra Centre, Koodapakkam, Pondicherry			floriculture
544	Development & commercialisa	Dr. R P Verma, Dr U Manna, Shri S Kumar,			Oil&Gas

	tion of novel process technology for removal of H2S and mercaptans from LPG through continuous film contactor (CFC).	Shri G V Butley and Dr S Banik Indian Oil Corporation, R & D Centre, Faridabad Engineers India Ltd.R & D, Gurgaon			
545	Full Garlic peeling machine	Shri M Nagaranjan V rgo Engineering Works, Usilampatti, Madurai			agriculture
546	Vivek Thresher for Mandua (Finger Millet) / Madira (Barnyard Millet)	Shri Krishna Pratap Singh, Dr Samaresh Kundu and Dr. Hari Shankar Gupta Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora			agriculture
547	Membrane Oxygenator, a medical device for cardiac surgery	Dr G S Bhuvaneshwar, Shri D S Nagesh, Shri C V Muraleedharan, Dr R Sankarkumar and Shri H Vijaykumar Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram			healthcare
548	Design and Development of Pollution Free Cotton Seed Delinting	Sh. Vinod H. Kalbande, Sh. Prakash G. Shinde, Sh. Dilip P. Dhote			agriculture

	Plant	Maharashtra State Seeds Corporation Ltd., Akola			
549	A High Performance Polymeric Syntan For Ecobenign Chrome Tanning	Dr. (Ms.) Mookandi Kanthimathi, Dr. Jonnalagadda Raghava Rao, Dr. Palanisamy Thanikaivelan, Dr. Balachandran Unni Nair, Dr. Thirumalachari Ramasami Central Leather Research Institute, Adyar, Chennai			Leather PROCESSED FOOD
550	Anti-scratch coatings on plastic ophthalmic lenses and Sheets using Inorganic – Organic Hybrid Nano-composites	Dr. Goutam De, Mr. Samar Kumar Medda Central Glass & Ceramic Research Institute, Kolkata West Bengal			chemical
551	Fault current limiter for LT switchgear and appliances	Dr. Vagish Shrinet, Dr. Mukesh K. Shah Electrical Research and Development Association, Makarpura, Baroda			electrical
552	Jhoola Pump	Sh. Mehi Lal Yadav Gaya, Bihar			agriculture
553	Silicon Locket for WEB enabled Cardiac Diagnostic	Sh. Sudip Nag Indian Institute of Technology, Powai, Mumbai			healthcare
554	The Charismatic Chair - A boon for Children	Sh. Rahul Katyal, Sh. Mandeep Singh			healthcare

	with cerebral palsy	Sethi M.M. Institute of Physiotherapy & Rehabilitation, Ambala			
555	A Portable device for in-situ sub-sampling of Aqueous Sediments	Dr. Anil Bhimrao Valsangkar, National Institute of Oceanography Dona-Paula, Goa		http://www.nio.org/index?option=com_newsdisplay/task/view/tid/4/sid/23	Mechanical engineering
555	Clean Bioprocessing of white pepper from fresh and dried black pepper (Pepper Nigrum L)	Dr. V.B.Manilal Sh. Ajit Haridas Dr. K.M.Gopinath an National Institute for Interdisciplinary Science & Technology, Thiruvananthapuram Mahatma Gandhi Government Arts College, Pudducherry			agriculture
556	Pomegranate De-Seeder	Sh. Uddhab Kr Bharali North Lakhimpur, Assam			Agriculture
557	Novel Universal Technique to establish the identity of enormous number of animal species for Forensic Applications.	Dr. Lalji Singh, Dr. Sunil Kumar Verma Centre for Cellular and Molecular Biology, Hyderabad			BIOTECH
558	Design and Development of low cost sanitary Napkins using alternate material	Dr. Bhawana Chanana Lady Irwin College, University of Delhi, New Delhi			healthcare
559	Evaporative cooling	Dr. V. K. Saxena, Dr. T.			healthcare

	apparatus resistant to Vector Breeding	G. Thomas, Dr. Shiv Lal Centre for Medical Entomology and Vector Management (NICD), Delhi			
560	Online Security System Serving as a Unique and Exclusive Password Generator for Every Internet Transaction	Sh. K Balaraju Hyderabad			IT
561	A deep soil volume loosener-cum-fertiliser				agriculture
562	A novel composition for trichoderma virens A formulation of a well-known fungal organism Trichoderma virens, which finds application as a bio-control agent for controlling a number of plant pathogenic fungi. Currently, the organism is used in powder form by formulating the mass of the spores as powder employing a suitable carrier/ diluents or other				agriculture

	formulants as required.				
563	<p>Nitrification Inhibitors</p> <p>The present invention reports the development and use of potential nitrification inhibitors and their compositions for improving Nitrogen Use Efficiency and a process of obtaining such products.</p>				agriculture
564	<p>Process for Extraction of Bio-pesticide from Cassava Bio-wastes</p> <p>Insecticidal principles isolated from cassava can effectively be utilized as a source of bio pesticide to manage a wide spectrum of borer pests in agricultural crops of national importance. Best solution for the management of papaya mealy bugs and aphids in vegetable crops.</p>				Biotech Agriculture
565	<p>Polymeric Seed Coats</p> <p>This</p>				agriculture

	<p>technology relates to the development of polymeric seed coats with the azadirachtin-A for improving the shelf life and germination of seeds and enhancing the overall seed quality, plant viability and vigour. Prevents the fungal / nematode/insect infestation that is a pest for the agronomic plant and against which a meliacin compound has bio activity.</p>				
566	<p>Seaweed Extract Fertilizer</p> <p>A simple and novel process of production of Seaweed extract Fertilizer in liquid and powder form useful as an organic nutrition source for almost all type of plants. Fertilizers derived</p>				agriculture

	<p>from seaweeds are found to be superior to chemical fertilizers due to high level of organic matter, micro and macro elements, vitamins and fatty acids. They can be used with or without chemical fertilizers.</p>				
567	<p>Subsolar-cum-differential rate fertiliser applicator</p>				agriculture
568	<p>A Device and Method for Determining the Elemental Identity and Analysis on Moving Target from a Variable Stand-Off Distance. The invention relate to laser induced breakdown spectroscopy (LIBS) technique for detecting a contaminant or a pollutant layer on moving targets such as wind turbine</p>				RE

	blades.				
569	<p>Advanced Cigarette Filters</p> <p>Tobacco smoke contains more than 4000 compounds. The newly developed filter effectively reduces the level of harmful components, which are highly reactive and are responsible for oxidative damage of protein & DNA and also reduces the level of nitric acid and tar without significantly affecting the flavour and taste of the smoke</p>				chemical
570	<p>Anti-Corrosive Treatment for Steel Reinforcement Rods in RCC- Anti-corrosive treatment for steel reinforcement rods is used in (i) RCC buildings,(ii) RCC bridges</p>				Construction steel

	(Road and Railways), (iii) Repair works of deteriorated structures.				
571	Pickling Acid Recovery				chemical
572	A Mobile Coir Fibre Extraction Machine				Machine tool
573	A process for dyeing of coir with natural colours- Dyes from vegetable materials used for dying of coir yarn, coir mats and mattings. It can replace the synthetic dyes and avoid pollution to the effluents of dyeing. The dyes extracted from Cinnamon, Red Sandal, Nalpamara, Pomegranate, Gall nut, Turmeric, Bixa orellanda (Annato), Tea, Coffee, Henna, Hibiscus, Onion, Teak, Pappaya, Marigold, Nutmeg,				chemical

	Grape, etc.				
574	<p>A process for treatment of coconut fibres with oil-in-water emulsion-The process comprises of preparation of an emulsion of castor oil and urea is added as a moisturizer that is sprayed with a sprayer on the fibres and left under piling conditions for 24 hours.</p> <p>During this period, the fibres become soft and suitable for spinning. It has been found that this new process increases the production by 10%.</p>				agriculture
575	Biochem treatment for softening of coir fibre				chemical
576	Pith Plus for the bio-conversion of coir dust in to a very useful organic manure which				agriculture

	<p>has application in agriculture and horticulture industry. The product obtained after bio-conversion has excellent properties of being used as growing medium especially in soilless containers for growing high value horticulture crops. Coir pith manure offers to be an ideal soil re-conditioner, soil structure improver and soil substrate with excellent water holding capacity.</p>				
577	<p>Design and Development of Holographic Pulse Portrait Camera System</p>				eletronics
578	<p>Development of i. g. b. t. based 3-phase 415vac, 25kva inverter for railways ac coaches railways ac coaches Lead acid storage</p>				automotive

	<p>battery inverter for railways ac coaches.</p> <p>This is the design and development of IGBT based Booster_inverter Technology.It works on the principle of “Chopper and Inverter” technique</p>				
579	<p>Digital Controlled Valve</p> <p>Using only one single Digital Controlled Valve and specially developed controller one can dispense a wide range of target quantities without any need for separate calibration</p>				automotive
580	<p>Electronic-Purse</p> <p>Electronic-purse is nothing, but a modified-calculator. It is 'total-e-money-solution', means this instrument</p>				Electronics IT

	will take place of currency, in near future.				
581	<p>Lead acid storage battery</p> <p>Lead acid batteries find wide application in motor cars, trucks, aircrafts, ships, submarines, railways etc. The major user of the product is in automobiles for providing energy for, ignition of the engine and lighting. In addition it is also used for uninterrupted power supply for computers, emergency lights for houses, telephone systems, power tools, communication devices, as power source for mining and material handling equipments, etc.</p>	CECRI, Karaikudi			Automotive aerospace
582	Magnesium silver chloride	CECRI, Karaikudi			POWER

	sea water activated battery				
583	Maintenance Free Lead-Acid Battery (6V-6Ah) For Use In Emergency Light	CECRI, Karaikudi			Electrical
584	Programmable Sign Systems				Electronics IT
585	Thermosyphon system for power transformers- an on line transformer oil filtration system having some absorbents and mounted in the flow line of transformer oil out side the main tank of transformer.	Electrical Research & Development Association, Makarpura Road, Vadodara-390010(A Dept. of Science & Technology Sponsored Project)			ELECTRICAL
586	Gravitational Settling Chamber for Pollution Control in Brick Kilns Developed for Pollution control in Brick Kilns (& other low stack) as per the Government norms of the				Engineering construction

	<p>maximum permissible SPM concentration in the effluent gases , 750mg/Nm³ and provision of a Gravitational Settling Chamber (GSC). It is a simple and rugged design of GSC. The technology has been implemented in over 5000 brick kilns in the state of Haryana, Punjab, UP, UA and Rajasthan</p>				
587	Low Cost Power from Biomass				Power
588	Mini Climbing Crane				construction
589	<p>Plant for Shaping of Building Bricks from Inferior Soils-Industrial Waste by Extrusion Process</p> <p>Extrusion m/c is of double deck design having independent clutches.</p>				construction

590	<p>Polytiles</p> <p>Suitable for floors and walls of residential, commercial and industrial buildings</p>				construction
591	<p>Roof Cooling Device- a self-contained device for cooling roofs of the houses from where 60 to 80 % heat enters the house. The device maintains a moist covering on the roof by an electronically controlled water spray mechanism, which operates intermittently as and when needed. The cool ceiling stops radiating heat on the occupants indoors air gradually cools, ceiling fans deliver cooler air and the thermal comfort improves considerably at a very small</p>				construction

	investment.				
592	Solar Water Heater Water heating for use in residential and institutional buildings such as hospitals, hotels, canteens etc				Construction
593	Stationary Concrete Block Maker It can cast solid and hollow concrete blocks. The machine is suitable for handling lean concrete mixes of low mobility for making economical concrete blocks using large aggregates of around 50 mm and ensures uniformity in dimensions and density.				automotive
594	Trolley with Jack-Improved mechanical technology of Trolley with Jack				automotive
595	Two Speed System for				automotive

	Manually Pulled Rickshaw				
596	Two wheeler Parking				automotive
597	Ceramic coating for photocatalysis & self-cleaning glass- A ceramic coating solution which when applied to glass decomposes organic pollutants in sunlight, thus removing dirt on glass surface.				Glasss & ceramics
598	Photoactive scratch resistant Titanium Oxide coating on glass-A photoactive scratch resistant Titanium oxide coating with thickness of 60-140 nm when applied to glass surface decomposes organic pollutants in sunlight, thus removing dirt. Used for buildings, homes etc.				glass

599	Smart epoxy conducting polymer coating composite for corrosion protection-A conducting polymer composite coating blended with epoxy powder is used for protection of steel in industrial/marine environment.				Steel
600	Production of Various Gluconate Salts by Fermentation Technology				Pharmaceutical agriculture
601	Novel Topical Natamycin Formulation for Ocular Antifungal Therapy				biotech
602	Novel Bifunctional Chimeric Keratinase Enzyme from Bacillus sps				biotech
603	Nano-transmucosal patch for insulin delivery				healthcare
604	Live-attenuated Salmonella				pharmaceuticals

	Typhimurium vaccine				
605	Silver Nano Particle as Antidandruff Agents				healthcare
606	Liposomal Amphotericin-B				healthcare
607	Leptospirosis Latex Test Kit				healthcare
608	Johne's disease Detection Kit				healthcare
609	Innovative Modification on Screw Conveyor for continuous Press (Multi Crop Portable Circular Oil Expeller)				agriculture
610	In-Vivo Dielectric Measuring Instrument using Picosecond Pulse for Detection of Oral Cancer				healthcare
611	Equine Herpes Virus-1 vaccine				Biotech pharmaceutical
612	Dengue Detection Kit				healthcare
613	Cultured Epithelial Autograft Cultivated from Adult				biotech

	Epidermal Stem cells				
614	Cost Effective Media for the Mass Production of Bacillus thuringiensis (Biotech)				agriculture
615	Coimmobilization of Detergent Enzymes onto a Plastic Bucket and Brush for Their Application in Cloth Washing				chemical
616	Brucellosis Detection Kit				healthcare
617	Brain Targetted Nanocurcumin for Cerebral Ischemia (healthcare)				healthcare
618	Azolla Based Animal Feed Pellets				agriculture
619	A pregnancy diagnostic kit for equine, based on detection of ECG by ELISA				healthcare
620	A Biocompatible , Self-Digestive and Antimycotic Intra Ocular				healthcare

	Natamatrix				
621	Synthetic Milk Detection Kit				Dairy
622	Virosome Based Targeted Gene Delivery System				biotech
623	Water based Spermicidal Vaginal Contraceptive				healthcare
624	Artificial Heart Valve	Sree Chitra Tirunal Institute of Medical Sciences & technology, Thiruvananthapuram			healthcare
625	yush 64	The Central Council of Ayurveda & Siddha			pharmaceuticals
626	Beta Naphthol is used in the manufacture of dyes and dyes intermediates and in pharmaceutical industries. Thus, with the assistance of the Corporation the firm has achieved a great commercial success.	Central Fuel Research Institute, Dhanbad has developed the process and the Corporation licensed the process to one firm in Bihar and further funded to the firm for further development/improvement of the process			Chemical pharmaceuticals
627	Chromium Metal Chromium metal flakes are used in production of	The technology for manufacture of chromium metal flakes and powder was			metal

	high alloy steels, super alloys for high temperatures and heating elements, fluxes, coins and the use of chromium metal powder largely confined to the manufacture of welding electrode manufacturing industries.	developed by Central Electro Chemical Research Institute, Karaikudi and the Corporation has licensed the process to a few firms. The process achieved commercial success and most of the electro manufacturing companies have been obtaining their raw material (chromium metal powder) from these technologies.			
628	Cinema Arc Carbon used in motion picture projections, photolithography and searchlights.	National Physical Laboratory, New Delhi The corporation licensed the technology to several companies who has commercialised successfully and supplied the product to the cinema industries..			Electronics entertainment
629	Disposable Blood Bag System Blood Bags	Sree Chitra Tirunal Institute of Medical Sciences &			healthcare

	are disposable bio-medical devices used for the collection, storage, transportation and transfusion of blood and blood components.	Technology developed the technology for the manufacture of these bags conforming to international quality requirements. The Corporation identified M/s. Peninsula Polymers Ltd. for setting up a plant based on indigenous technology and provided equity assistance of upto 25% of the total equity. The production of the blood bags started for the first time in the country in 1987 by this company. Subsequently the Corporation has licensed to a number of companies in India			
630	Fly ash Bricks Fly ash, an industrial waste arising from coal fired Thermal Power Stations currently poses a serious operational constraint and	The know-how has been licensed to Pulver Ash Projects Ltd., Kolkata and number of other parties in India			construction

	environmental hazard.				
631	Glucose Bio-Sensor	<p>The process was developed at NPL, New Delhi under DST sponsorship. The Corporation licensed the process to two firms one in Bangalore and the other in Faridabad. Since these firms encountered some problems in commencing their commercial production, the Corporation sponsored Rs. 6.00 lakhs (Rs.1.50 lakhs already released) to NPL for further improvement of the process. The two firms are now manufacturing the product based on the improved process and have achieved commercial success.</p>			biotech
632	<p>Glycol Based Antifreeze Coolant</p> <p>Glycol based Antifreeze Coolant have brought a</p>	<p>developed by The Defence Material & Stores Research & Development Establishment, Kanpur</p>			Automotive

	<p>breakthrough in the technology of engine cooling system in vehicles operating in low temperature conditions upto – 40 degree Centigrade. These coolants are especially useful for defence vehicles operating in high altitudes. The Corporation has licensed the technology to several companies who are successfully manufacturing the product and catering to the defence need.</p>				
633	<p>High Draught Continuous Kiln</p> <p>High Draught Continuous Kiln is used to manufacture clay bricks with advantages of less energy consumption and</p>	<p>CBRI Roorkee</p> <p>The Corporation has licensed the process to a large number of companies (117 parties) throughout India who are now supplying the product to</p>			construction

	continuous operations.	the individuals as well as construction industry to meet the ever increasing the demand of the building materials.			
634	Indelible ink	<p>manufactured under license from NRDC to M/s Mysore Paints</p> <p>The process was developed by National Physical Laboratory, New Delhi.</p>			chemical
635	Infant Food	<p>Central Food Technological Research Institute (CFTRI) The Kaira District Milk Producers Union, to whom NRDC licensed the process, producing 20,000 tonnes/annum infant food under the "Amul Spray" brand name which became very popular and has been in use in almost all the houses in the country</p>			dairy

636	Invert Sugar Invert Sugar, an equimolecular mixture of glucose and fructose, is a valuable sweetener in food and pharmaceutical industries. . (biotech)	The technology for production of Invert sugar from cane sugar was developed by Bhabha Atomic Research Centre, Mumbai and the technology has been licensed by NRDC to several companies. A large number of industries from confectioneries, fruit processing, pharmaceutical, soft drink industries are using the product.			Processed Food Pharmaceuticals Beverage
637	Liposomal Amphotericin-B	FUNGISOMET M, India's first Liposomal Amphotericin B developed by employing DBT technology was transferred to M/s. Lifecare Innovations Pvt. Ltd. by NRDC.			Chemical Pharmaceuticals
638	Liquid BioFertiliser The liquid Bio	M/s Kumar Krishi Mitra Bio Products			Agriculture biotech

	fertilizers are suspensions having agriculturally useful microorganisms, which fix atmospheric nitrogen and solubilise insoluble phosphates and make it available for the Plants.	Ltd., Pune			
639	Metal Anodes for Cathodic Protection	The Central Electro Chemicals Research Institute, Karaikudi. The Corporation has licensed the technology for manufacture of these anodes to number of companies			metal
640	Monocrotophos The process for manufacture of Monocrotophos, a widely used pesticide,	developed at IICT, Hyderabad. The Corporation licensed the process to M/s Vantech Pesticides Ltd. The corporation since then licensed to 7 more firms			AGRICULTURE
641	Phosphamidon	The technology for manufacture			Chemical

	Dichlorophos (DDVP) is an organo phosphorous pesticide. It is highly toxic to insects and is also a fumigant for beef and dairy cattle	of Dichlorophos was developed by Regional Research Laboratory, Hyderabad (Presently known as Indian Institute of Chemical Technology) .The Corporation licensed the process to many companies			dairy
642	Silver Impregnated Graphite (SIG) Contacts	The technology for manufacture of SIG Contacts was developed at NPL, New Delhi and the Corporation has licensed the process to a large number of companies who are catering the services to meet the requirements of the Railways			Metal automotive
643	Soft Ferrite- had been widely used in radio receivers, TV receivers, electronic	The technology was developed at NPL, New Delhi and the Corporation			Electronics

	instrumentations, telecommunications, etc	has licensed the technology to number of industries.			
644	Spice Oleo Resins The use of spice oil and oleoresins from agricultural products like ginger, pepper, cardamom, turmeric and chillies have now become common both in hotels and domestic kitchens	The technology for extraction of oleoresins and oils from spices has been developed by. Central Food Technological Research Institute, Mysore			Processed food
645	Spirulina Algae – the only single, natural source of providing the highest amount of protein even known to man. The Spirulina contain 71% protein, which is three times that of soyabean, and five times that of meat. The protein quality is among the best with a good degree	The Corporation in collaboration with M/s. AMM Murugappa Chettiar Research Centre, Chennai set up a pilot plant for the development of process for the manufacture of Spirulina Algae. The first licensee namely, New Ambadi Estates Ltd. is			Biotech

	of aminogram. It contains very high amounts of Beta-carotene, a precursor of Vitamin A. It is the only vegetable source of vitamin B 12, containing two-and-a-half times that of liver.	producing 100 T/annum at Severiyapuram			
646	Swaraj Tractor	Central Mechanical Engineering Research Institute, Durgapur in early 70's The Corporation licensed the know-how to Punjab Tractors Limited to manufacture Swaraj Tractors, based completely on Indian know-how.			Automotive Agriculture transport
647	Titanium Substrate Insoluble Anodes The process was subsequently licensed to M/s WIMCO	Titanium Substrate Insoluble Anodes (TSIA) developed at CECRI Karaikudi were being extensively used by chlor-			chemical

	and M/s BHPV. These companies has supplied a large number of chlor-alkali industry resulting a very power saving in their manufacturing .	alkali and chlorate industry for reducing power consumption. The Corporation licensed the process to M/s Titanium Equipment and Anode Manufacturing Company (TEAM) with equity participation of the Corporation.			
648	Vijetha (Silkworm bed disinfectant) Vijetha is a bed disinfectant applied on silkworm rearing bed to avoid pathogenic causing infectious diseases to silkworm.	The Central Silk Board has developed the technology for the manufacture of Vijetha and the Corporation has licensed the technology to M/s Tetragon Chemi Ltd., Bangalore			Agriculture
649	Water Filter Candles Raw water contains suspended impurities and bacteria, which have to be removed to make the water safe for	by CGCRI, Calcutta and RRL, Jorhat licensed by corporation			healthcare

	<p>drinking. One of the well known method is to filter water through beds of sand, gravel and charcoal to remove suspended impurities followed by boiling to kill the bacteria. This process, though efficient, is costly and time consuming.</p>				
650	<p>'777 oil' - a herbal preparation developed by siddha system of medicine for the safe and affective treatment for control and management of all types of psoriasis. the drug is also found to be very effective in the treatment of dandruff.</p>	Licensed by NRDC			healthcare
651	<p>Biopesticidal NemaGel-This nematode species is heat tolerant and can kill a broad range of soil and foliar insect</p>				agriculture

	<p>pests such as diamond back moth, gram pod borer, rice borer, white fly, cabbage butterfly, cotton boll worm, tobacco caterpillar, cut worms, root grubs, desert locust, mole cricket, field cricket, rice grasshopper, red cotton bug, mustard aphid, termites etc. infecting various crops such as cereals, pulses, oilseeds, vegetables, fruit trees, etc</p> <p>Its efficacy in field is visible within 24-48 hours of its application and it overcomes contamination by not allowing growth of microorganisms.</p>				
652	ASR 901: Advanced services mobile wireless router for	Cisco Systems India Private Limited			telecom

	<p>2G/3G/</p> <p>ASR 901 is Cisco's next generation mobile wireless router that addresses the needs of Access, Carrier Ethernet, TDM backhaul and Cell Site Gateway. It is also the first Cisco product to be completely developed from the India site – from conception, architecture, hardware/software implementation, testing and qualification to marketing.</p> <p>Benefits to the customer: The ASR 901 helps the cellular service providers build 3G/4G networks with reduced total cost of ownership.</p>				
653	<p>"Operational Excellence through accelerated 'Intuition' building" in a BPO – Harnessing discoveries in pattern</p>	<p>HCL Technologies, Business Services (BSERV – BPO) Division</p>			telecom

	recognition, mass communication and psychology for back office operations” Building a mental vocabulary of patterns with actions, feelings and a catchy name.				
654	Network Shark (A Network Level Troubleshooting tool)	Ericsson India Global Services Pvt. Ltd			Telecom
655	CDAC-Revival 2000 Disaster Recovery Solution	Centre for Development of Advanced Computing			IT telecom
656	Healthcare Anywhere	Logica Pvt. Ltd.			healthcare
657	War Rooms: Global Business Services (GBS), Hewlett Packard.	Company Name: HP, Global Business Services (GBS) GBS is the internal shared services organization for HP		www8.hp.com/h20195/v2/GetPDF.aspx%2F4AA4	Financial services
658	IPMPlus – Intelligent Power Management of IT infras	Vigyanlabs Innovations Private Limited		vigyanlabs.com	IT POWER
659	mPower RPS on Cloud	Phoenix IT Solutions		http://www.fluentgrid.com/	power

660	<p>txtWebBrief Overview: txtWeb is a global, cloud-based platform through which anyone with any type of mobile phone can discover and consume content from the Internet as well as txtWeb-only content just by texting keywords (very much like entering domain names into internet browsers) to ONE national number, and receive content (up to 900 characters per SMS). A user can think of txtWeb as an SMS-based browser, but much more accessible than web browsers on computers since anyone with a simple feature phone can use it.</p>	Intuit Inc		http://www.intuit.in/	IT
661	The Unified Threat Management security products	Elitecore Technologies Pvt. Ltd.			IT Telecom

662	the TJI 1600C. The offering is a POTP (Packet Optical Transport Platform)	Tejas Networks Ltd		http://www.tejasnetworks.com/	TELECOM IT
663	Chillr	MobME Wireless Solutions (P) Ltd		http://www.mobme.in/ https://chillr.com/	Financial services
664	develop reference design for Solar LED Lanterns and charging stations..	The Energy and Resources Institute (TERI)in partnership with Texas Instruments		http://labl.teriin.org/	Renewable Energy
665	Genpact launched an improved version of existing BPM suites, by developing a Smart Enterprise Process Management Solution (SEP)	GENPACT		http://www.genpact.com/	Financial services
666	speed up the simulation time in the automobile design validation process, from 16 hours to 10 minutes!.	Mahindra Engineering Services Ltd.			Automotive
667	SNAzzy, a product for Telecom Service Providers (TSPs)-Social	IBM corporation		http://www.isical.ac.in/~scc/SNAW_Lecture_Material/Amit_Nanavati/SNAzzy-talk-June-2012.pdf	Telecom

	Network Analysis of TELECOM Call records				
668	Revolvo, an intelligent, plug-in hybrid solution for vehicles	KPIT Cummins Infosystems		www.kpit.com/Revolvo	Automotive (passenger car)
669	"Eka", an integrated product suite for commodity trading and risk management	Eka Software Solutions		https://www.ekaplus.com/Financial	Financial services
670	Innovation: Mobiquity mMoney Mobile based wallet solution	Comviva		http://www.mahindracomviva.com/products/mobile_financial_solutions/mobiquity-money.htm	Financial services
671	Cigma (Center for Integrated Global Management of Applications) integration of BPO,IT & device management	Wipro Technologies		http://www.wipro.com/newsroom/press-releases/Wipros-Cigma-wins-NASSCOM-Award-for-Process-Innovation/	IT Financial services
672	Innovation - the innovation of sourcing talent, recruitment and training methodologies through in-house universities to tap talent in high school graduates.	Zoho Corporation -		https://www.zohocorp.com/	IT
673	Voice of the Customer Analytics (VOCA)	IBM Daksh Business Process Services Pvt			Telecom finance

		Ltd			
674	Carrier Ethernet functionality on native packet transport products (TJ2000 family) and in existing SONET/SDH platforms	Tejas Networks		http://www.tejasnetworks.com	Telecom RE
675	SpectraGuard Online:a wireless security solution that is delivered online, on-demand SaaS model	AirTight Networks -		http://www.mojonetworks.com	FS IT
676	Rural Shoring is an innovative extension to the offshore business process outsourcing model to the rural populace.	MindHelix Technosol Pvt Ltd			telecom
677	Flash Telephony - Unified Communication platform with browser based voice call facility	TringMe			Telecom
678	Setup of the IT infrastructure at Greenfield facility,Chakan	Mahindra Vehicle Manufacturing		http://www.nasscom.in/sites/default/files/Mahindra%20Vehicle%20Manufacturers%20Limited.pdf	automotive
679	Yes money “Domestic Remittance”	Yes Bank		https://www.yesbank.in/how-to-bank-with-us/yes-money	Financial services
680	“Union Bank Money”, a tool enabling	Union Bank of India		Union Bank of India http://www.nasscom.in/sites/default/files/Union	Financial services

	a non-banking customer to avail a gamut of banking services;			%20Bank%20of%20India.pdf	
681	Union eCash-Transfer Emergency fund using MOBILE NUMBER through ATM and UMobile	Union Bank		http://www.unionbankofindia.co.in/personal_alternatechannels_Remittance.aspx	Financial services
682	"Business Performance Management & Intelligence (BPMAI)" System	BPCL – Mumbai Refinery		https://bharatpetroleum.com	OIL & GAS
683	IRDA Agency Licensing Portal , Integrated Grievances Management System, Stolen Vehicles Recovery Information System	Insurance Regulatory & Development Authority		https://www.irdai.gov.in	Finance
684	Electronic Health Record Management, Barcode Medicine Administration	HEAMax Healthcare Institute Ltd			healthcare
685	Barcode Medicine Administration,	HEAMax Healthcare Institute Ltd			healthcare
686	Tele-Medicine, m-Health supporting virtual in-patient and Integration with Core System	HEAMax Healthcare Institute Ltd			healthcare
687	MANUFACTURING (PROCESS) Implementation of Mobile Asset	Hindustan Zinc Ltd		http://www.hzindia.com/	metal

	Management application that assists the field service maintenance technicians operating in 3 shifts across over 100 critical equipments to perform daily activities at maintenance & process sites and within plants;The data capture and transfer is synchronized onto handheld devices using RFID and integrates with the preventive maintenance functionality of the ERP system				
688	Host of IT initiatives which has helped them to strengthen their operational processes and improve supply chain visibility;	Surat District Coop Milk Producers' Union Ltd		sumul.com	Dairy
689	Astra - an integrated business information system enabling insightful role based business analytics, standardization and digitization of processes.	TC Ltd			IT

690	Comprehensive Cloud Strategy; Involving Public and Private cloud implementing SaaS, PaaS and IaaS; Virtualization of Servers and Desktop; Migrating their Critical Applications to Cloud; Bringing significant cost and energy savings	ESSAR Group		Essar.com	IT
691	PeopleHub”;	Mindtree		https://peoplehub.mindtree.com	IT Automotive
692	Installation of Solar powered ATMs; Reducing GHG emission by nearly 122 tons	IndusInd Bank-First ATM installation was in Mumbai		http://www.indusind.com/content/csr-home/environmental-stewardship/banking-on-solar.html	Banking & Finance
693	Low cost automated web security solution	Mr. Lavakumar Kuppan Ironwasp Information Security Solutions Pvt Ltd		http://ironwasp.net/	IT
694.	Algae to biodiesel		Sustainable Technologies & Environmental Projects Pvt. Ltd. Address: 602-B, Sweet Home, SV Patel Nagar, Andheri west, City: Mumbai, State: Maharashtra	www.stepsenergy.net	Gas