

UNDERSTANDING INNOVATION THE INDIAN CONTEXT



A Bulletin Initiated by



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Understanding Innovation

The Indian Context

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Key observations

Total 1721 firms, chosen through sampling, have been studied in Bihar, Jharkhand, Himachal Pradesh, Tamil Nadu and Haryana.

State-wise proportions of innovative firms are Bihar 8.18, Jharkhand 45.78, Tamil Nadu 44.47, Himachal Pradesh 16.92, Haryana 25.99. These ratios have been used as innovation intensity of the respective states. The sectoral distribution of industrial units are highly skewed in Bihar and Himachal Pradesh. There is also a wide variation in sectoral intensity of innovation.

In terms of workforces most of the innovative firms are below 100 workers category. Ownership type is dominantly private. Most of the firms in Bihar and Himachal Pradesh were established after 2000, whereas for other states most of the firms are from 'before 1990' category.

Most of the innovations are 'new to firm' to remain competitive in the market. The firms in the pharmaceutical industry in Himachal Pradesh claim innovation for the Indian market. Product quality improvement and acquisition of new machines are the main forms of innovations.

Innovative firms have fairly clear understanding of the gains from innovations. Most of the innovative firms see themselves either at par or ahead of the other firms in their respective industries. Most of the gains appear to be in production process and quality of products. This is indicative of the main trends of innovation activities.

Accessing the institutional arrangements for various types of support to innovations is rare among the innovative firms. Resources

for technological information, training, and finance are managed internally. Development of capabilities of the human resources does not seem to be a priority concern for the innovative firms.

Examining the survey findings in the light of the National Innovation System (NIS), Regional Innovation System (RIS) and Sectoral Innovation system (SIS), it appears that innovative firms do not access the support system under NIS. There is correspondence between overall innovation intensity of a state and the state of RIS. It is SIS that largely influences the innovation intensity of a state. For the five states the survey observes:

- a. The National Innovation System (NIS), presently in place, is not popularly accessed by the production system (firms). A general awareness programme on the services rendered by the large number of institutions required to be taken up.
- b. Bihar requires special attention for rejuvenating industrial activities through strengthening RIS. One way could be to create a sector led push to the innovative intensity of Bihar.
- c. It appears that states having better RIS also could take the advantage of SIS, as it is evident from the cases of Tamil Nadu and Haryana. On the other hand only sectoral push or sector led innovation activities may not carry the state very far unless the RIS is strengthened, as it is evident from the cases of Jharkhand and Himachal Pradesh.

1 Introduction

In the first Bulletin we reported about the state-wise progress of the survey. Since then we have received the data for the sample firms for most of the states. At present we are at the stage of cleaning and processing of the data. In the present issue of the Bulletin we are presenting broad observations on five states, namely, Haryana, Tamil Nadu, Himachal Pradesh, Jharkhand, and Bihar. **States were chosen based on their HDI scores (IAMR report 2011); 2 states ranking below (Bihar 0.292 and Jharkhand 0.268), 3 from above (Tamil Nadu 0.480, Haryana 0.501 and Himachal Pradesh 0.581) the Indian average HDI score (0.467).** The main focus of this issue of the Bulletin is the status of innovation activities at the firm level (for sample firms) in these five states.

The structure of the Bulletin is as follows.

The second section is on the sample and innovative firms of the five states. Sampling of the firms for the survey was done for proportionate representation of the 2-digit NIC code, called sectors in the Bulletin. The survey, therefore, identifies sector-wise proportionate share of the innovative firms for each 5 states. The third section elaborates the identities of the innovative firms with reference to the size, ownership types and year of establishment. For size of the firm we have used number of workers in a firm. The fourth section throws light on types of innovations undertaken by the innovative firms. This section also reports on the activities pertaining to innovations undertaken by the innovative firms. What are the firms' perceptions of gains from innovations? This question has been briefly dealt in section five. Three different groups of inputs to innovations have been chosen for further exploration in section six. These

inputs are – technological and non-technological information pertaining to innovation, financial inputs, and inputs for human resource development. Since there is a substantial institutional arrangement to provide such inputs to the innovative firms, the survey throws light on the innovative firms' access to such arrangements. Section seven gives a broad view on the factors that come in the way of innovation related activities of the firms studied. The last section presents the understanding of innovation that can be built around the results drawn from the survey for the five states. The understanding has been woven around the concept of National Innovation System (NIS), Regional Innovation System (RIS), and Sectoral Innovation System (SIS) essentially to examine the relative influence of the systems.*

The observations reported in the Bulletin cannot be generalised for overall Indian scenario, which would be developed based on comprehensive analysis of all the states taken together.

* Innovation System - is the arrangement of interactions among the production system, knowledge generating system (R&D and educational institutions) and the executing agencies of the government (for policy led incentives) for strengthening the initiatives towards innovation. Innovation systems are identified at national level (NIS), Regional or state level (RIS) and sectoral level (SIS).

Innovativeness of a firm is the technological (product diversification, new product, quality, production process etc.) and non-technological (organisational, managerial, marketing strategies etc.) changes initiated by a firm.

Innovation intensity of a state- is the % of innovative firm in the total sample population of the state.

Sectoral innovation intensity - is the % of innovative firms in the total (5 states together) sample firms in a sector.

2 Sample and innovative Firms

Total 1721 firms were surveyed in the selected five states. State-wise distribution of sample is - Bihar 330, Jharkhand 332, Himachal Pradesh 325, Tamil Nadu 380, and Haryana 354. As per NIC code the industrial activities in the 5 chosen states are spread over 31 two digit industrial segments or sectors (refer to Figure 1). Five states have quite diverse industrial activities as shown by the skewness (presented in Figure 2). Industrial scenario in Bihar (skew – 5.06) is highly skewed followed by Jharkhand skew – 3.35). Manufacturing of non-metallic mineral products (NIC 23, mainly constituted of brick manufacturing units) has 54% and 31% shares of the total sample size in Bihar and Jharkhand respectively. This industry is not significant in other three states. Manufacturing of food products has

more or less similar shares (8-10%) in all the states except Himachal Pradesh, where pharmaceutical and electrical equipment industries have higher shares (20.31% and 16.31% respectively) compared to insignificant presence in other four states. Manufacturing of fabricated metal products (NIC 25) has higher presence in Tamil Nadu and Haryana (about 12%), who also have significant presence in the textile industry. Haryana on the other hand shows considerable presence of the wearing apparel industry. Both Haryana (skew – 1.35) and Tamil Nadu (skew – 1.70) have more diversified industrial structure, followed by Himachal Pradesh (skew – 2.40). India level data do not include Mizoram, Arunachal Pradesh and Lakshadweep.

Figure1: Share of Industrial Segments in total sample

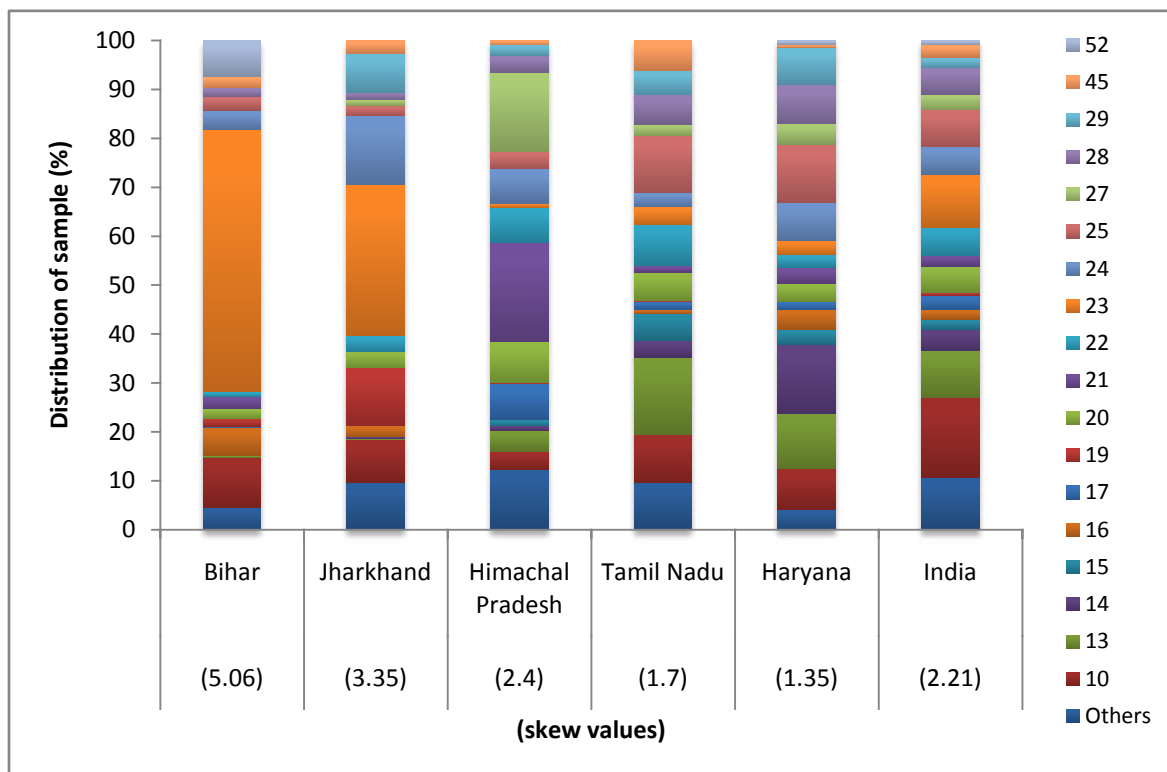
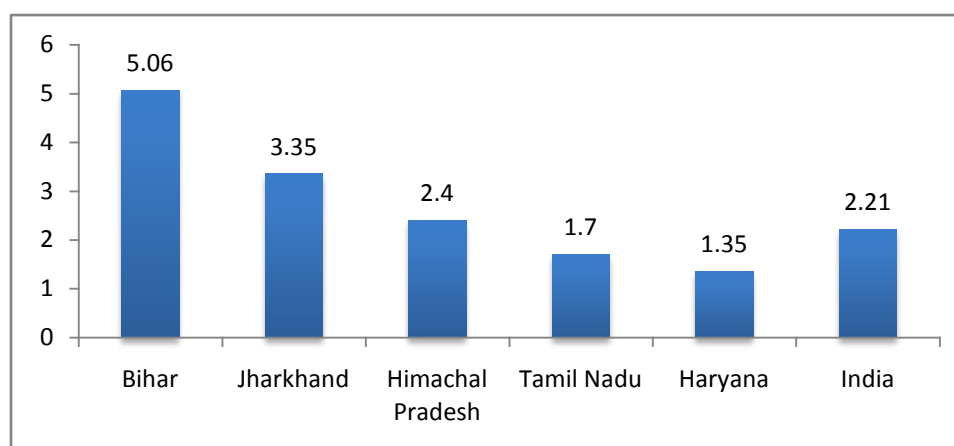


Figure 2: Skewed industrial activities over the sectors

Sectoral and cluster bias in industrialization is evident in all states. Thus Bihar and Jharkhand have sectoral bias towards brick industry, Jharkhand also has clusters of manufacturing of coke (NIC 19) and base metal (NIC 24). Both Tamil Nadu and Haryana have clusters of textile and wearing apparel (NIC 13 and 14), and sector/cluster of fabricated metal products (NIC 25), manufacturing of motor vehicles (NIC 29), equipment and machinery (NIC 28). Himachal Pradesh has, on the other hand clusters of Pharmaceutical industry (NIC 21) and electrical equipment (NIC 27) industry.

The survey had aimed at identifying innovative firms and their innovation related activities from the sample firms. Sector-wise distribution of innovation activities (% of firms) is highly skewed in case of Bihar. In general skew values for innovation follow more or less the same pattern as in the case of nature of industrialization (Figure 1) except the rank swapping between Himachal Pradesh and Jharkhand (Figure 3). Figure 4 - 8 show the state-wise percentage of innovative firms in different sectors. Samples were drawn proportionate to the size (number of firms) of a sector.

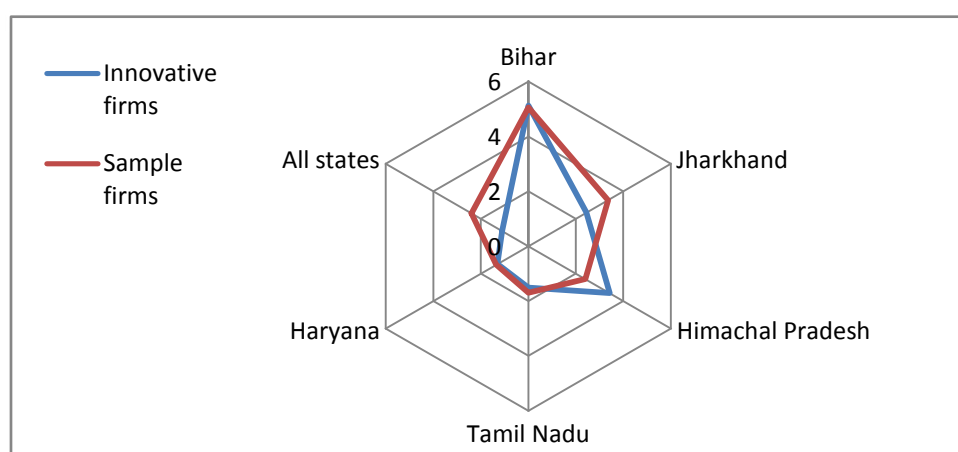
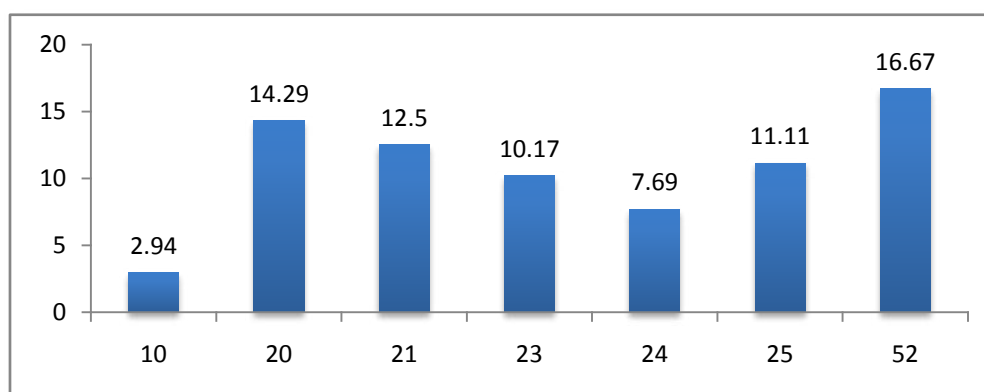
Figure 3: Skewness of distribution of innovative and sample firms over the sectors

Figure 4: Share of innovative firms in different industry segments (Bihar)

Out of 31 industrial segments, Bihar has reported innovative firms only in 7 segments; total 27 firms out of 330 (i.e. 8.18%) have reported some kind of innovative activities. The largest industrial segment (NIC 23 constituted of brick manufacturing firms) has reported about 10% firm having taken up any innovation related activities. Highest percentage of innovative firms, however, was returned by Warehousing and support activities for transportation (NIC 52), followed by manufacture of chemicals and chemical (NIC 20), manufacture of fabricated metal products, except machinery and equipment (NIC 21) and manufacture of pharmaceuticals, medicinal chemical and

botanical products (NIC 25). See Figure 4 - 8.

Jharkhand on the other hand reported much better results compared to Bihar. Innovation activities are spread over 21 (out of 31) industrial segments. Total 152 firms (out of 332) or 46% firms reported various types of innovations. Like Bihar, brick manufacturing has very large share (30.72%) of the overall industrial activities of the state. This sector has reported 35% firms being engaged in innovation related activities. High percentage of innovation activities is also reported from other sectors, although many of them have very small base (in some cases 1 unit in the sample making it 100% innovative firms).

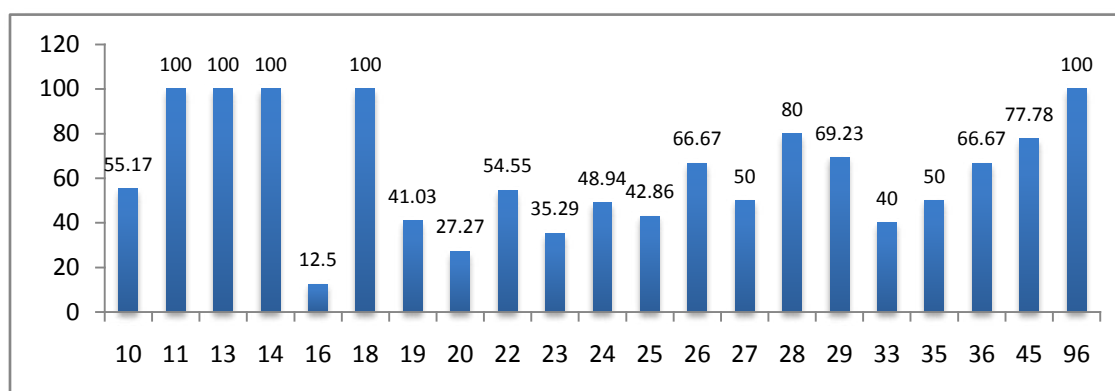
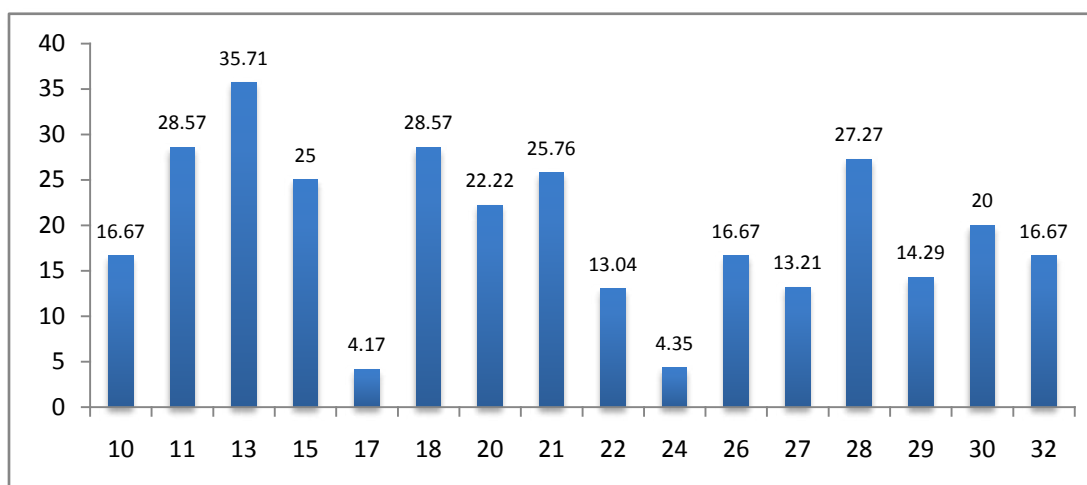
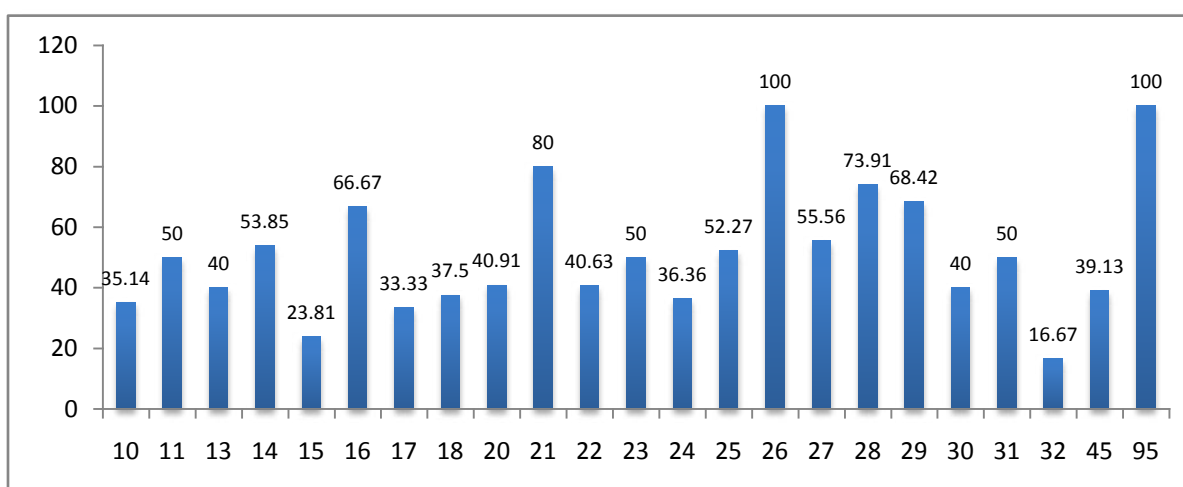
Figure 5: Share of innovative firms in different industry segments (Jharkhand)

Figure 6: Share of innovative firms in different industry segments (Himachal Pradesh)

Himachal Pradesh has innovative firms in 16 industrial segments, and 17% firms reported innovation activities. The state presents interesting scenario. Pharmaceuticals and electrical equipment industries are most prominent industrial activities in the state. Other segments are small in size but have higher percentage of innovative firms. The industries in this

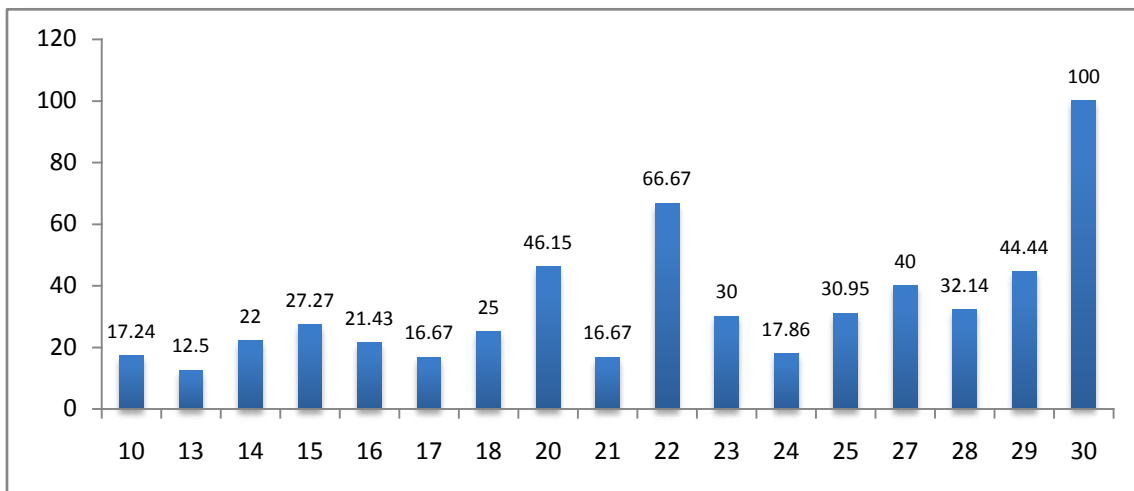
category are textile, leather, machinery and equipment, transport equipment etc. About 45% firms across 23 industrial segments have reported innovation activities in Tamil Nadu. Firms in the computer and electronic industry have reported innovations. Also firms associated with motor vehicle industry and machinery and equipment industry have reported innovations.

Figure 7: Share of innovative firms in different industry segments (Tamil Nadu)

In case of Haryana 26% firms across 17 industrial sectors have reported innovations. Most prominent industries are

transport equipment, plastic and rubber products and chemicals.

Figure 8: Share of innovative firms in different industry segments (Haryana)



Observation

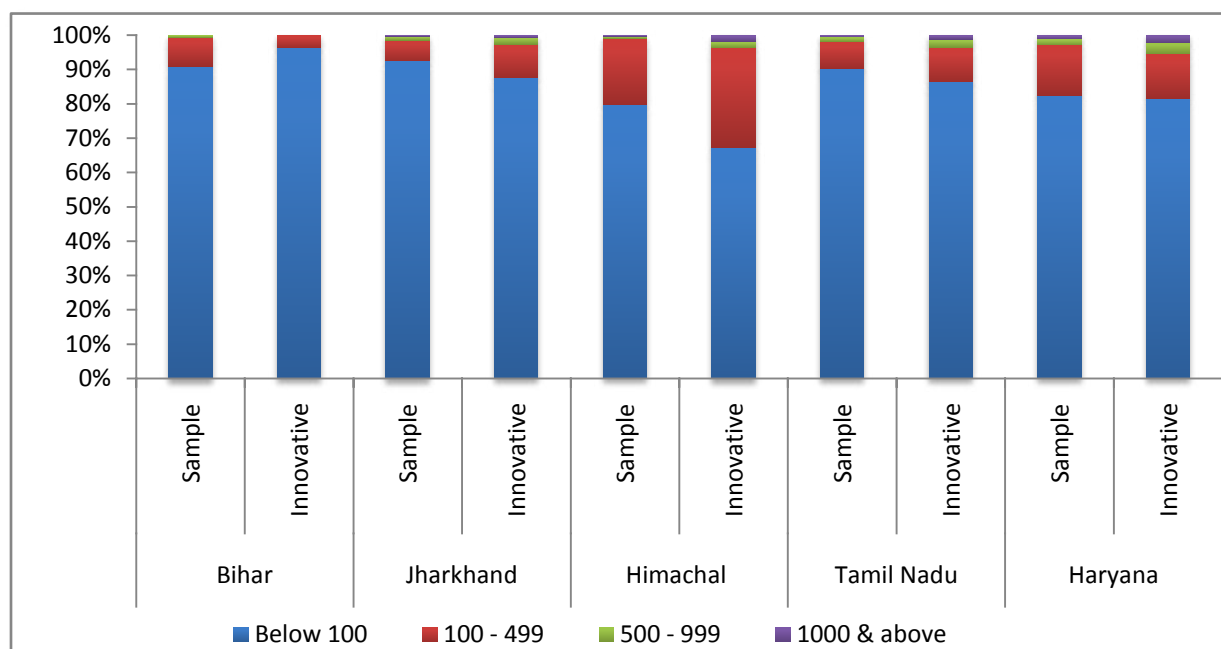
It is to be noted that different sectors have different proportion of innovative firms. It gives a broad indication that some states have strength in certain sectors. In other words it *indicates the presence of sectoral systems of innovation. Higher percentage of innovative firms in a sector in a state shows the sectoral innovation bias in the system of innovation in that state.* Compared with the overall innovative status of that sector, comparative strength and weakness of the sector can be assessed.

3 The Innovators

The innovative enterprises are identified by their size, types of ownership and year of establishment. In the absence of reliable data on the turnover of the firms we have used the information on employment for size of the enterprise. As shown in Figure 9, 80% to 90% (and above) of the sample firms in these five states have less than 100 workforce. In case of Bihar the percentage is 90.91. About 96% of the innovative firms in Bihar belong to this size of the firms (below 100 workforce). The share of this size is even higher (92.47) in case of

Jharkhand, where about 88% innovative firms fall in to this size category. The lowest firm size category (below 100 workforce) shares 80% of the total firms and 67% of the innovative firms in Himachal Pradesh. For the same size category Tamil Nadu has 90% of the firms and 86% of the innovative firms. Haryana has 82% firms in the lowest size category, and the same percentage share of the innovative firms. It is to be noted that the percentage share of the innovative firms increases, except in the case Bihar, with the increase in size of the firms.

Figure 9: Distribution of Sample and Innovative firms according to the Labour Size

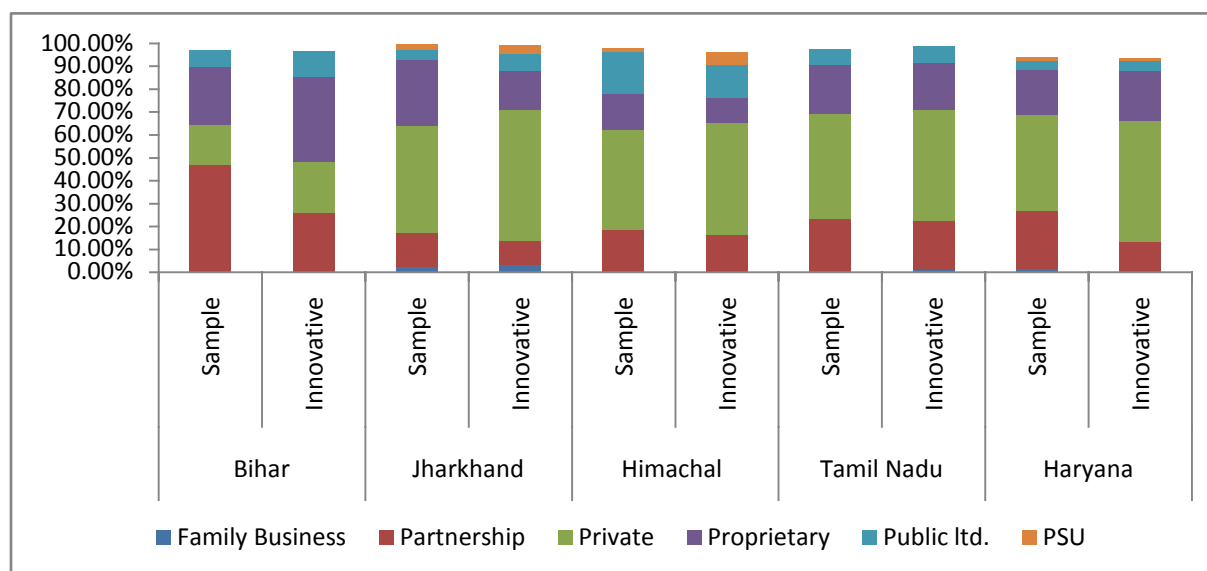


Ownership patterns of the sample and innovative firms are shown in the Figure 10. Major type of ownership of the firms studied is partnership (47%) and proprietary (26%) firms in Bihar. The latter, however, has a share of 37% of the innovative firms followed by 26% in the proprietary type of ownership. Jharkhand, on the other hand has 47% private ownership firms sharing 47% of innovative firms. Himachal Pradesh has 44% firms under private ownership category sharing 49% of the innovative firms. Tamil Nadu has 46% firms under private ownership sharing 50% of the innovative firms. Haryana has 42% firms under private category and 53% innovative firms fall in this category.

Are the new firms more innovative than the older ones? We have made three broad

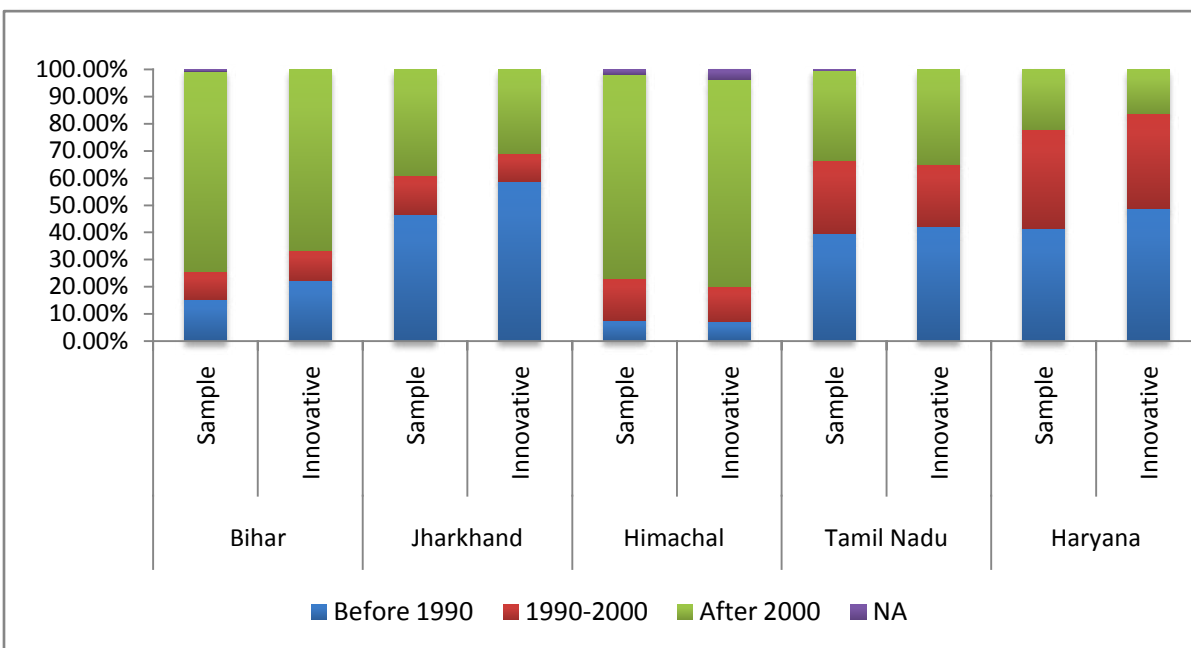
categories – before 1990, between 1990 and 2000, and after 2000. In case of Bihar about 73% of the sample firms were established after 2000. The same group has 67% of the total innovative firms. Jharkhand has 47% firms established before 1990 and the same group of firms has 59% of the innovative firms. Himachal is a newly industrializing state and has more than 75% firms established after 2000 sharing 76% of the innovative firms. Tamil Nadu has almost equal share of the firms established before 1990 and after 2000, sharing 42% and 35% of innovative firms respectively. Haryana has 42% firms established before 1990 and 36% between 1990 and 2000. The shares of innovative firms are 49% and 35% respectively.

Figure 10: Distribution of Sample and Innovative firms according to the Ownership Type



Note: there is a small percentage of firms in the ownership types like subsidiaries, associates, branches and also those who have not answered (NA). The bars, therefore, do not touch 100%.

Figure 11: Distribution of Sample and Innovative firms according to their year of establishment.



Observation



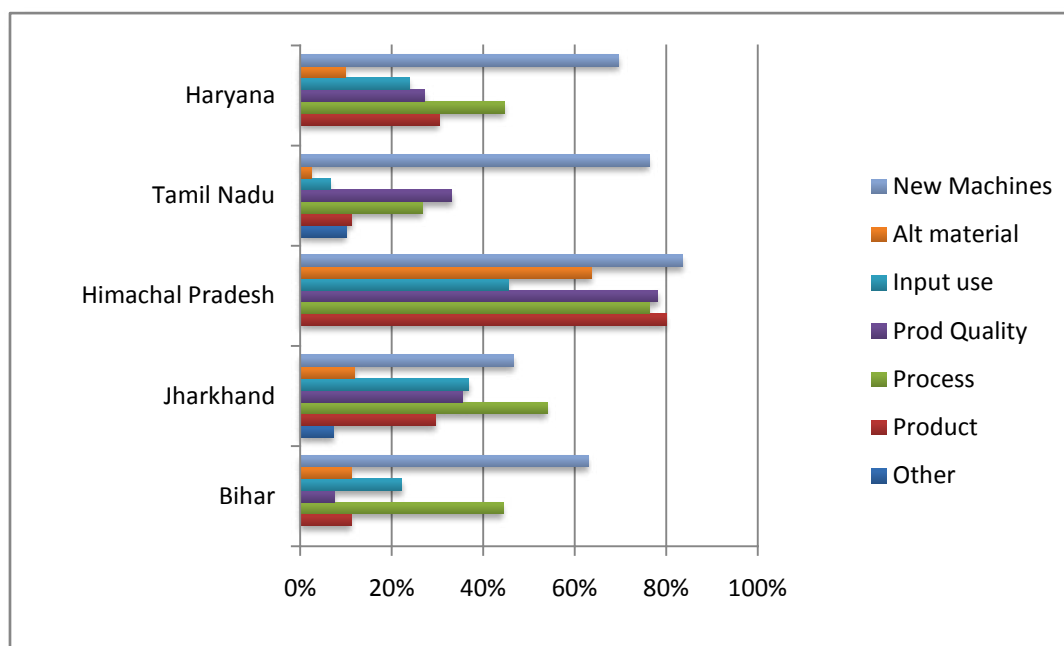
Most of the firms in the sample belong to the size category below 100 workforces. So do innovative firms. *Firms are mostly under private ownership or proprietary firms* and also share most of the innovative firms. In Bihar and Himachal Pradesh most of the firms (sample and innovative) were established after 2000, whereas in other three states higher percentage of firms are established before 1990 sharing higher percentage of innovative firms.

4 Innovations and Actions for Innovation

Innovative firms were identified based on the responses on changes initiated by these firms in different categories like introducing new product, quality/standard improvement of the existing product, process innovation if any, changes in the input use, use of new/alternative material, introduction of new machine etc. Although not necessarily, it was expected that many of the above mentioned innovations would result to expansion of production capacity or/and installed capacity. Many innovative firms reported such changes further corroborating the act of innovations.

Figure 11 shows the types of innovations carried out by the innovative firms in the sample firms. Figures refer to the percentage of total innovative firms engaged in particular types of innovation. Many innovative firms have reported more than one type of innovations, but process innovation and innovations through introduction of new machines are most common types of innovation. To recapitulate, percentages of innovative firms in the five states are - Bihar 8.18%, Jharkhand (45.78), Himachal Pradesh (16.92), Tamil Nadu (44.47), Haryana (25.99).

Figure12: Types of Innovations



Observation



Many innovative firms have reported more than one type of innovations, but *process innovation and innovations through introduction of new machines are most common types of innovation.*

Activities related to innovation are grouped in 6 broad categories (refer table 1).

Table 1 shows the engagement or involvement of the innovative firms in these activities. Firms in Himachal Pradesh have leads in all categories, followed by Haryana. It is interesting to note that innovative firms of Tamil Nadu (having higher percentage of innovative firms (44.47%) have not reported much of the activities pertaining to innovations. On the other hand state like Himachal Pradesh – at the bottom in terms of percentage share of innovative firms, shows high percentage of firms engaged in in-house R&D activities, acquisition of new machines and training of the personnel. The reasons appear to be the presence of pharmaceutical and electrical goods industries in Himachal Pradesh. Also the presence of PSUs and large firms in Jharkhand, Himachal Pradesh and Haryana

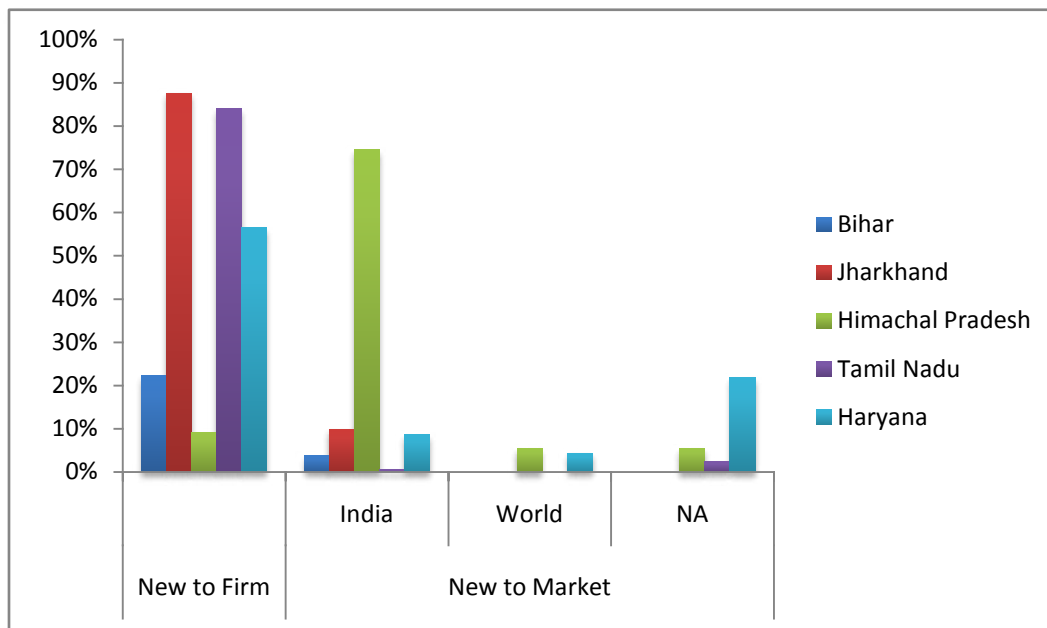
makes in-house R&D activities more visible in these states.

Figure 13 further explores the market extent of innovations undertaken by the firms. The market extent of innovation has been captured by the novelty or newness of the innovations done by a firm. Responses were poor in the case of Bihar. General picture is that the innovation is venturing into something already there in the market but new to the firm. Himachal Pradesh is widely different in this respect. Most of the firms claim that they are getting into things that are new to the Indian market. From the Figure 1 we see that Himachal Pradesh has large number of pharmaceutical firms and also electrical equipment firms. These are the industries that have wide scope of introducing new product variations both in the domestic market as well as in the Global market.

Table 1: Involvement of firms in the activities pertaining to innovation

Activities ↓	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
In-house R&D	22.22	30.92	52.73	8.28	30.43
Extramural R&D	3.70	1.97	21.82	0.00	7.61
Acquisition of machine	0.00	0.66	78.18	3.55	45.65
Acquisition of knowledge	0.00	0.00	47.27	0.59	4.35
Training of employees	18.52	3.95	61.82	2.96	17.39
Market introduction of innovation	11.11	0.00	49.09	1.18	7.61

Figure 13: Extent of Innovation



Observation



Innovations are mostly adoption of the market trend in terms of product quality, machine etc. *Himachal Pradesh scores better in every aspect of innovation mainly due to the presence of pharmaceutical and electric goods industry and also due to the presence of PSUs.*

5 Gains from Innovation

Did the firm gain from innovations? What are the natures of gains? Has the innovating firm gained in competitive position in the market? These are the issues that explore the justification of innovation and verify the claims of innovation.

Figure 14 shows the percentage of innovative firms expressing the various types of gains from innovations undertaken. While for the pharmaceutical and electrical good industry of Himachal Pradesh claims are for all round gains in terms of product

and process for wider market, product quality and process improvements of various types appear to be the major gains from innovations.

While achieving what they achieved through innovations how do the innovative firms perceive themselves vis-à-vis their competitors? Table 2 presents the perceptions of the innovative firms in this regard. Bihar being the exceptions, most of the innovative firms in other states consider themselves ahead of or at par with the competition.

Figure14: Gains from Innovation

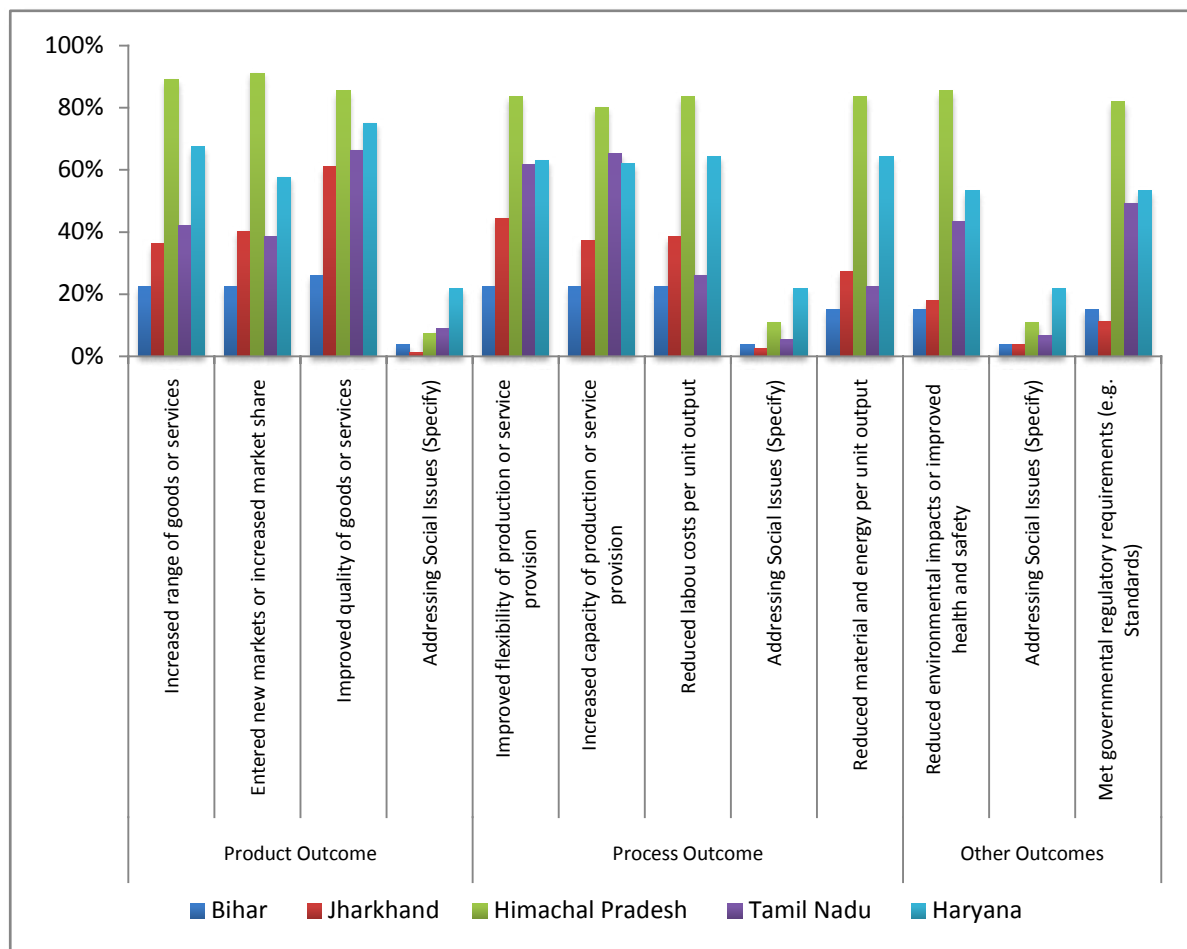


Table 2: Competitive status of the innovative firms

Status ↓	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
R&D Activities	14.81	88.82	96.36	31.36	89.13
Quality of Manpower Employed	29.63	98.68	100.00	86.98	96.74
Technology in-licensing	18.52	82.89	100.00	49.70	86.96
New Collaborations	3.70	23.68	96.36	5.33	48.91
FDI	3.70	3.95	96.36	3.55	41.30
Sourcing of raw material and other inputs	25.93	94.74	100.00	83.43	83.70
Efficient cost management	29.63	98.03	100.00	83.43	91.30
Quality of machine and equipment	29.63	95.39	98.18	88.76	94.57
Efficient organizational practice	29.63	99.34	94.55	82.84	95.65
Efficient marketing arrangement	29.63	97.37	100.00	68.64	92.39
Better information management	25.93	98.68	100.00	75.74	96.74
Successful brand development	25.93	95.39	92.73	49.70	96.74

Observation

Innovative firms have fairly clear understanding of the gains from innovations. Most of the innovative firms see themselves either at par or ahead of the other firms in their respective industries. Most of the gains appear to be in production process and quality of products. This is indicative of the main trends of innovation activities.

6 Inputs to Innovation

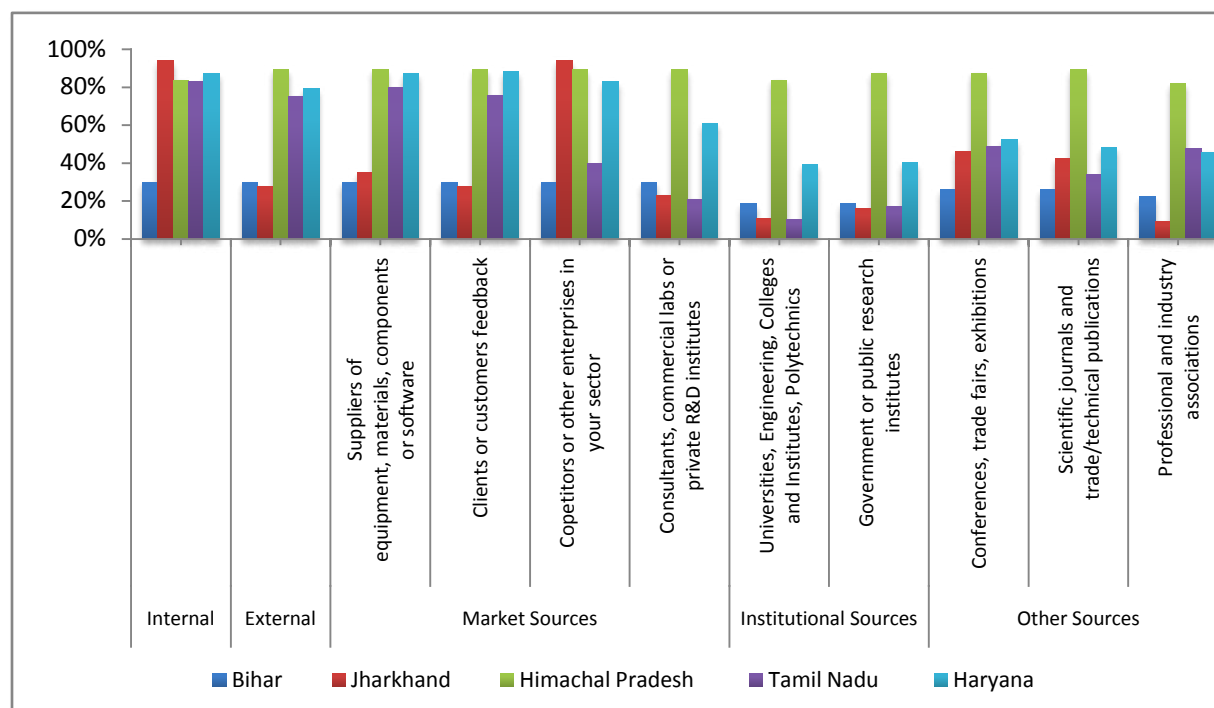
How much a firm accesses resources from sources external to the firm? Or in other words, how well networked a firm is for accessing resources? By resources we mean inputs that contribute to strengthening of innovative activities. Such inputs are technological, managerial, financial etc. and generally would be in the form of soft inputs (information and knowledge) and hard inputs (machines and equipment).

Table 3 captures the extent of external sourcing accessed by the identified

innovative firms. Firms in Jharkhand appear to be dependent more on their own sources; whereas extent of networking is expected to be higher in other states. Firms in Himachal Pradesh appear to be most dynamic in accessing all available sources for information, where as customer feedback is important source of innovation for firms in Tamil Nadu and Haryana. It is to be noted that Himachal Pradesh has large number of Pharmaceutical and electrical equipment industries, whereas Tamil Nadu has computer and electronic industries and motor vehicle industries. Haryana on the other hand has plastic, rubber and motor vehicle equipment industries.

Table 3: Information Source & Innovation Activities

Source	Important+ Most Important	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
Internal		29.63	94.08	83.64	82.84	86.96
External		29.63	27.63	89.09	75.15	79.35
Market Source	Suppliers of equipment, materials, components or software	29.63	34.87	89.09	79.88	86.96
	Clients or customers feedback	29.63	27.63	89.09	75.74	88.04
	Competitors or other enterprises in your sector	29.63	94.08	89.09	39.64	82.61
	Consultants, commercial labs or private R&D institutes	29.63	23.03	89.09	20.71	60.87
Institutional Source	Universities, Engineering, Colleges and Institutes, Polytechnics	18.52	10.53	83.64	10.06	39.13
	Government or public research institutes	18.52	15.79	87.27	17.16	40.22
Other Sources	Conferences, trade fairs, exhibitions	25.93	46.05	87.27	48.52	52.17
	Scientific journals and trade/technical publications	25.93	42.11	89.09	33.73	47.83
	Professional and industry associations	22.22	9.21	81.82	47.34	45.65

Figure 15: Information source and innovation activity

Availability of fund for innovation is an important aspect of innovation ecosystem.

Table 4 reveals that most of the firms depend on their own internal sources.

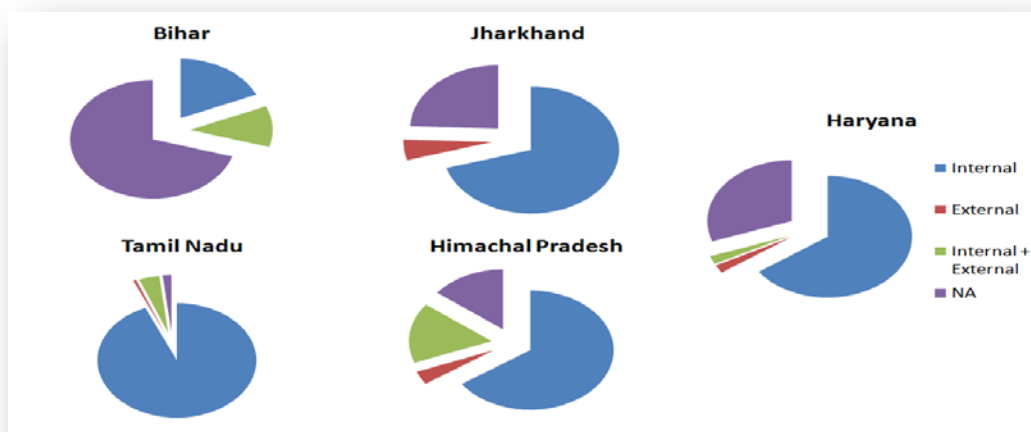
Table 4: Source of finance for innovation

Sources	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
Internal	18.52	70.39	65.45	93.49	65.22
External (Govt. + Foreign)	0.00	5.26	3.64	0.59	2.17
Internal + External	11.11	0.00	16.36	4.14	2.17
NA	70.37	24.34	14.55	1.78	30.43

Observation



Innovative enterprises in *Himachal Pradesh* claim close interaction with institutions like universities and R&D institutions for sourcing information for innovative activities. The same is very poor for states like Bihar, Tamil Nadu, Haryana and Jharkhand.

Figure16: Source of Funding Innovation

Like information and finance, human resource is the most indispensable component of innovation related activities. Figure 17 shows number of firms as percentage of total firms having different size class (%) of scientists and engineers as total employment. Most of the firms across the states and industries have less than 10 technical personnel. This is indicative of the fact that innovative activities constitute minor part of the firms' activities. This is reinforced by the fact, as shown in Figure 18 most of the firms do not have any major

human resource development programme. Again accessing the skill development programmes outside the firm is a rare initiative from the innovative firms (as shown in Figure 19). Most of the training is imparted in-house. Jharkhand and Himachal Pradesh, however, show some firms accessing outside the firm programmes. So far funding of training and skill development initiatives are concerned, again firms access mainly the internal sources, as shown in Figure 20.

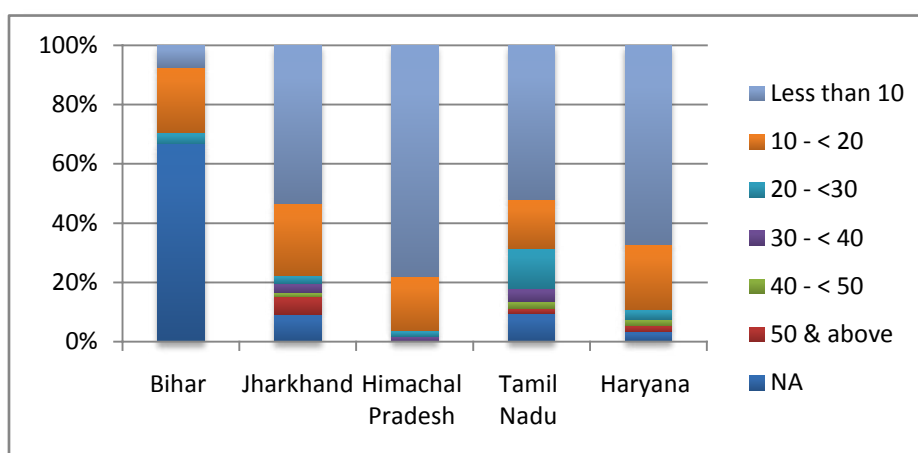
Figure 17: Scientist and Engineers (as % of Total Employment)

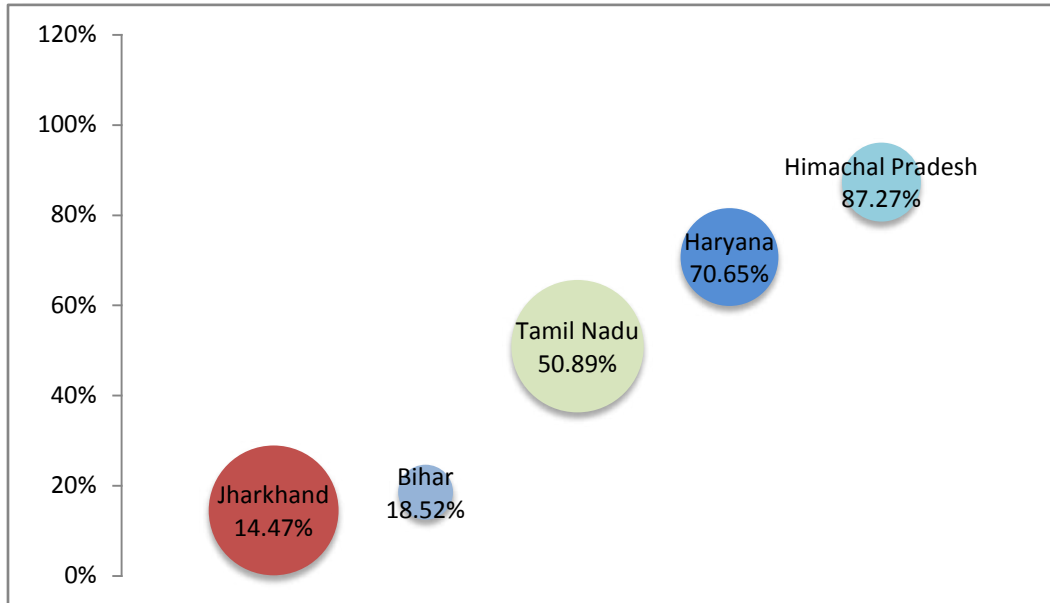
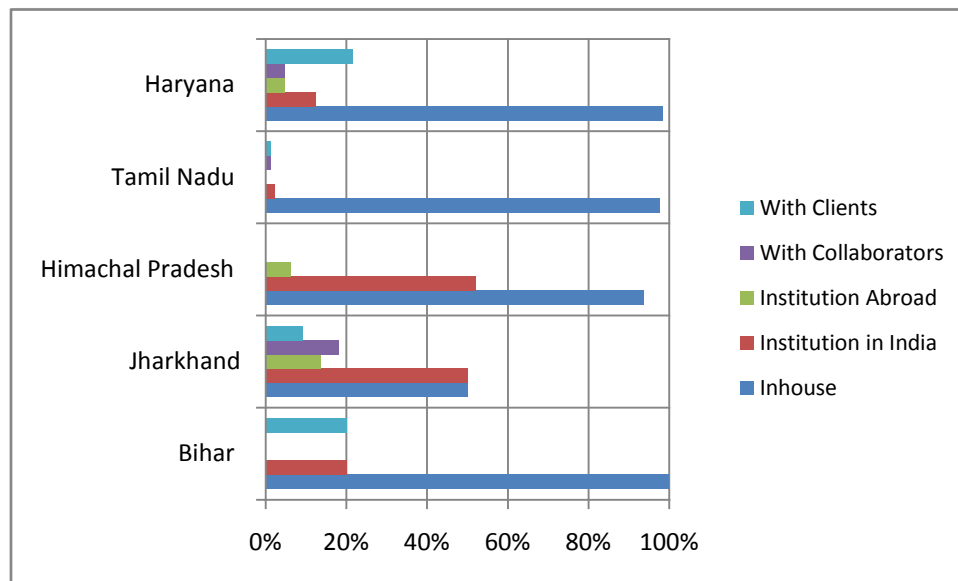
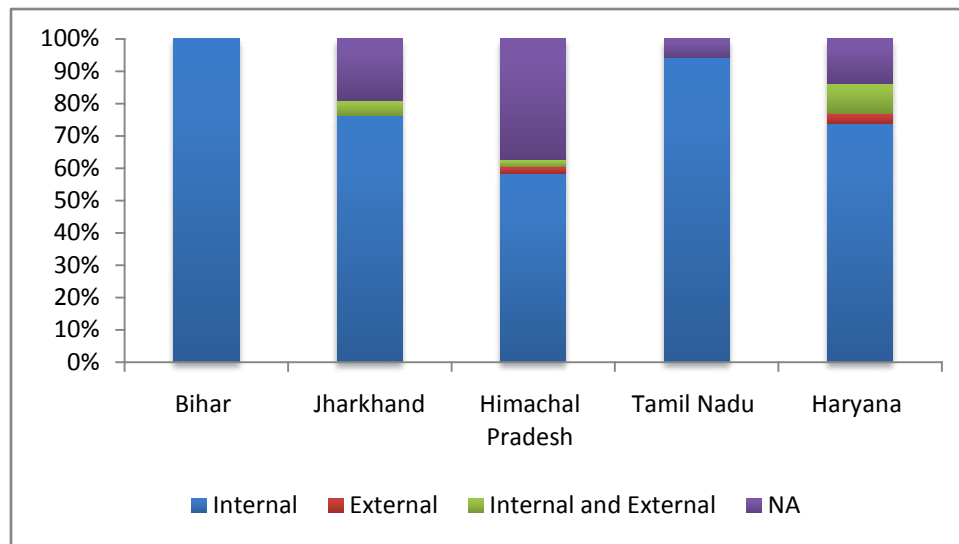
Figure 18: Percentage of Innovative firms providing training**Figure 19: Human Resource Development by Innovative firms**

Figure 20: Source of fund for human resource development (training)**Observation**

Human resource development does not seem to be an important activity among innovative firms in Bihar and Jharkhand. It is to be noted that Jharkhand, the most innovation intensive state, figures at the bottom in this regard. For finance and training of human resources for skill development innovative firms mainly use internal sources.

7 Factors influencing Innovation

What are the factors that are perceived as critical for promotion of innovation? Responses of the firms show (table 5) that

innovative and non-innovative firms alike, cost, infrastructure and access to new knowledge of innovation considered as most important factors that required to be strengthened.

Table 5: Factors important for influencing innovation

Factors	Firms	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
Cost Factors	All firms	69.49	30.52	97.95	71.23	94.92
	Innovative	33.33	29.61	98.18	77.51	92.75
Knowledge Factors	All firms	60.61	48.69	97.95	73.68	93.41
	Innovative	33.33	51.10	96.97	83.43	92.03
Infrastructure Factors	All firms	48.33	62.20	90.00	20.92	77.82
	Innovative	31.48	64.80	90.00	28.11	69.57
Market Factors	All firms	34.70	13.35	98.51	44.78	86.35
	Innovative	29.63	12.28	96.67	48.82	79.71
Others	All firms	37.73	32.23	98.77	18.55	90.40
	Innovative	29.63	29.28	97.27	17.46	88.04

Reflections from interviews

Common hindrance encountered by the firms in their business activities

- Labour shortage and increasing labour cost
- Uncertain Power supply
- Government policy (tax structure, land acquisition etc.)
- Government support system (R&D facilities, funding etc.)
- Official procedure

8 Understanding Innovation

The survey shows that Jharkhand (46%) has highest percentage of innovative firms closely followed by Tamil Nadu (45%). Haryana and Himachal Pradesh are distant 3rd (26%) and 4th (17%) respectively, whereas Bihar (8%) comes at the bottom. The nature of innovation differs from one state to the other in terms of sectoral pattern, types and nature of innovations. These factors together create the overall innovativeness of the state. Let's call the percentage of innovative firms in a state, as mentioned above, as the innovation intensity of a state. They differ substantially from each other.

Overall status of innovative activities in the production system of a region is the result of the dynamics of the production system itself in one side and the technological and non-technological support available to the enterprises on the other. Together they create innovation eco-system. The system is constituted of demand and supply side. An innovative production dynamics creates demands on the state for appropriate technological and non-technological support to facilitate and augment its own initiatives towards innovation. Such types and nature of demands depend on the overall economic status of the region/state, industrial policy, historical pattern of growth of different sectors (path dependence of technological development), entrepreneurship development etc. Institutional arrangements for addressing such demands are done at the national level as well as at the regional/state levels.

These arrangements have three interconnected facets. Some of the arrangements are activated through

national government at the national level and create National Innovation System (NIS). Another set is created at the regional/state level by the state authority according to the states own planning for economic development and industrialization. Let us call it Regional System of Innovation (RIS). There are also sectoral specificities of innovation. Different sectors have different innovation dynamics. Under a particular economic and industrial and policy environment certain sectors might show more dynamism towards innovation compared to other sectors. Such sectors develop their own systems of Innovation and innovation dynamics. In many cases such sectors grow in clusters that create a new innovation dynamics. Let us call it Sectoral Innovation System (SIS). It is, therefore, possible to witness higher innovation intensity in a region even in the absence of strong RIS and NIS but in the presence of strong SIS and clusters.

An effective innovation system would require large number of institutions extending various types of technological and non-technological inputs for promotion of innovation. In India, there are several initiatives through national level organisations/institutions engaged in technology generation, technology diffusion and marketing, technological consultancy, tools equipment and prototype development, common facilities and testing centres, raw material, machine and equipment supply, finance and refinance, infrastructure development, training and skill development, entrepreneurship development etc. Many of these organisations function through the corresponding departments under state government for extending services at the

state and district levels. Such arrangement can be called network of Indian National System of Innovation (NIS).

While at the state level state government is the main agent of activating the NIS, on its part state government also creates its own institutions for providing technological and financial services to enterprises. The most important role played by the state government is to guide and build the industrial structure of the state, create physical infrastructure (roads and transport, power etc.) and create education and health infrastructure for human resource development. This arrangement is a part of RIS.

Clusters come into existence in various ways. It could be locational advantage for certain industrial sectors, or it also could be led by industrial policy of the state. It may also because of a set of historical reasons. Both NIS and RIS do contribute to the growth of clusters and development of a

particular sector in a particular region. But important distinctive factor is its own dynamics of growth and innovation, which might get complemented by RIS and NIS.

The survey indicates broad understanding of the reach of NIS, RIS and SIS as presented in table 6.

Accessing finance is a rare action by the innovative firms. Even in case of Himachal Pradesh where sectors like pharmaceutical and electrical industries have shown higher level of innovative activities, institutional sources of finance does not appear to be a popular mode of funding innovation. Accessing institutional facilities for technological and non-technological support to innovation is quite limited in general except in Himachal Pradesh where pharmaceutical and electrical industries are very active in accessing NIS.

For RIS at the state level a comparative status of the five states are shown in table 7.

Table 6: Access of NIS by the innovative firms (%)

NIS components	Bihar	Jharkhand	Himachal Pradesh	Tamil Nadu	Haryana
Source of knowledge(Educational institution)	19	11	84	10	39
Source of knowledge (R&D institution)	19	16	82	17	40
Institutional Source of finance	1	5	20	5	5
Training in institutions	20	50	52	2	12
Novelty of innovation	93% new to the firm	88% new to the firm	75% new to the Indian market	84% new to the firm	78% new to the firm

Table 7: Indicative factors of Regional System of Innovation

States	NSDP per-capita (Rs.)	Industry Share (%)	Highway (per 100 sq km)	Power generation (MU per million population)	Health centre (per 100 village)	Higher edu. Inst. (per million population)	RIS rank	Rank with respect to innovation intensity	HDI
Bihar	11558	4.63	0.08	145.4	25.78	193	5	5	4
Jharkhand	22780	35.82	0.10	210.5	13.72	277	4	1	5
Himachal	40690	11.77	0.05	2378	12.88	770	3	4	1
Tamil Nadu	46823	17.43	0.11	876.3	61.85	296	1	2	3
Haryana	55214	18.21	0.09	869.7	43.59	356	2	3	2
National	33731	21.40		744.8	27.44				

Source: Handbook of Statistics on Indian Economy 2010-11; Ministry of Road Transport & Highways; Indiatat database; Ministry of Human Resource Development; Ministry of Health and Family Welfare.

Note: Although in most of the cases absolute number and values are quite low, sparse population makes the ratio very high for Himachal Pradesh.

States were ranked separately under each column and assigned the rank value 5 for the lowest and 1 for the highest scores. Rank values were added (unweighted) laterally to derive overall rank values. Himachal Pradesh and Jharkhand scored the same rank value, but Himachal Pradesh was ranked higher taking into consideration the higher per capita NSDP. A comparison of the ranking with the HDI ranking shows interesting rank swapping, of which most interesting is between Himachal Pradesh and Tamil Nadu.

Again it is to be noted that innovation intensity of a state does not have correspondence with the state's rank in HDI, but the same is not wayward in terms of the overall RIS ranking except the case of Jharkhand. The case of Jharkhand is special because unlike other states it has very high contribution of industry in the GDP. Most of the industries are based on rich natural resources of the state. In addition strong presence of steel industry has helped

development of competitive ancillary units and metal processing industry. It, therefore, appears that more than the RIS it is the sectoral impetus that has defined the innovation intensity of the state. Figure 21 shows comparative ranking of the states for RIS, innovation intensity and HDI. The correspondence among the three, although intuitively tenable, does not appear to be very strong among the five states. It is, however, expected that larger number of state would give a clearer picture of the correspondence.

How influential is the Sectoral Innovation System (SIS)? We have calculated two indicators. The sectoral variation in innovation intensity is quite skewed. This indicates that there are a few sectors that are much more innovative than other sectors which have very few innovative activities. We define the sectoral intensity of innovation as the ratio between innovative firms in a sector and total number of firms in that sector.

a) If we have overall sectoral intensity of innovation (% of innovative firms in the total firms in a sector taking 5 states together), we can examine the industrial activities of the state (distribution of sample firms over different sectors in a state) and assess the alignment of the same with the overall innovativeness of different sectors. This is done by calculating the rank correlation between the industrial activities at sectoral level (number of firms in different sectors) and sectoral innovation intensity. Rank correlation coefficients for the 5 states along with the skewness of the sectoral activities are presented in the Figure 21. Bihar and Himachal Pradesh show negative correlations (see Figure 22). This implies that the states' economic activities are mostly different from the sectors that are generally more innovative. Jharkhand returns highest positive correlation (0.31). This means that although it ranks low in national and regional systems of innovations it has stronger sectoral system of innovations that makes it most innovative states among the five. Jharkhand is followed by Tamil Nadu and Haryana with small but positive correlation coefficients implying that the innovation systems in these states are mostly driven by regional systems of innovations.

b) The other measure for sectoral innovation system is the ratio between total innovative firms in a sector and total innovative firms in the state (in other words the sectoral distribution of innovative firms in a state). We examine how skewed is the distribution of innovative firms in a state. The skew value (refer to Figure 22) for all states together is 1.11. Higher (lower) the skew value from the overall value less (more) would be the innovativeness of the state. Bihar with a value 5.12 is far above

the overall skew value. Bihar is followed by Himachal Pradesh and Jharkhand. Haryana has least skewed distribution of the innovative firms over the sectors followed by Tamil Nadu.

Rank correlations and skew values when examined together bring out another interesting dimension. Bihar has highly skewed but negative correlation implying that firms reporting innovative activities are away from the sectors with high innovation intensity. On the other hand in the case of Jharkhand, distribution of innovative firms is skewed towards innovative sectors. Himachal Pradesh also has high skew value but positive correlation implying skewed towards a few sectors of high innovation intensity (in this case the pharmaceutical and electrical industries).

The broad understanding that comes out of the survey, therefore, is as follows:

- It appears that the National Innovation System (NIS), presently in place, is not popularly accessed by the production system (firms). A general awareness programme on the services rendered by the large number of institutions required to be taken up.
- Bihar requires special attention for rejuvenating industrial activities through strengthening RIS. One way could be to create a sector led push to the innovative intensity of Bihar.
- It appears that states having better RIS also could take the advantage of SIS, as it is evident from the cases of Tamil Nadu and Haryana. On the other hand only sectoral push or sector led

innovation activities may not carry the state very far unless the RIS is strengthened, as it is

evident from the cases of Jharkhand and Himachal Pradesh.

Figure 21: Rank correspondence of different indicators

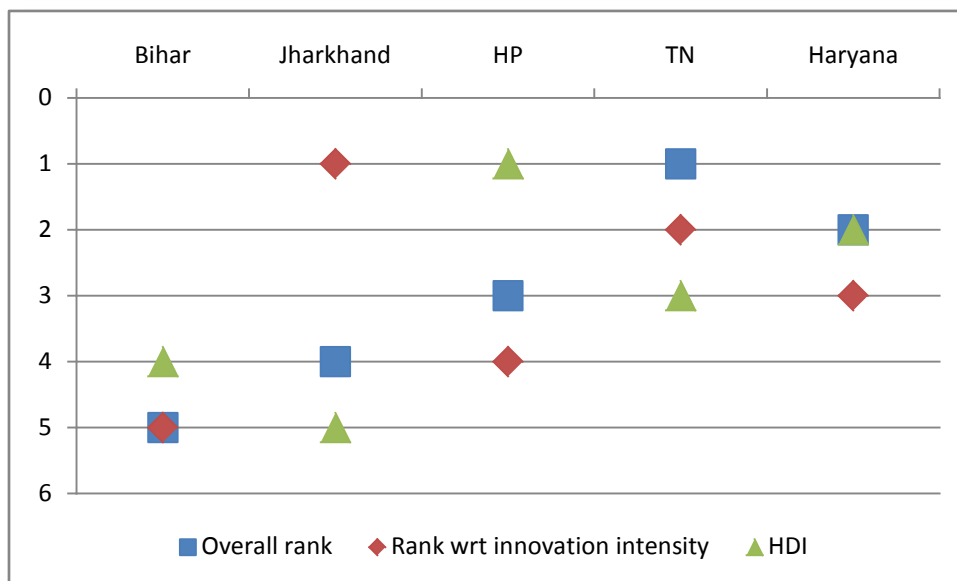
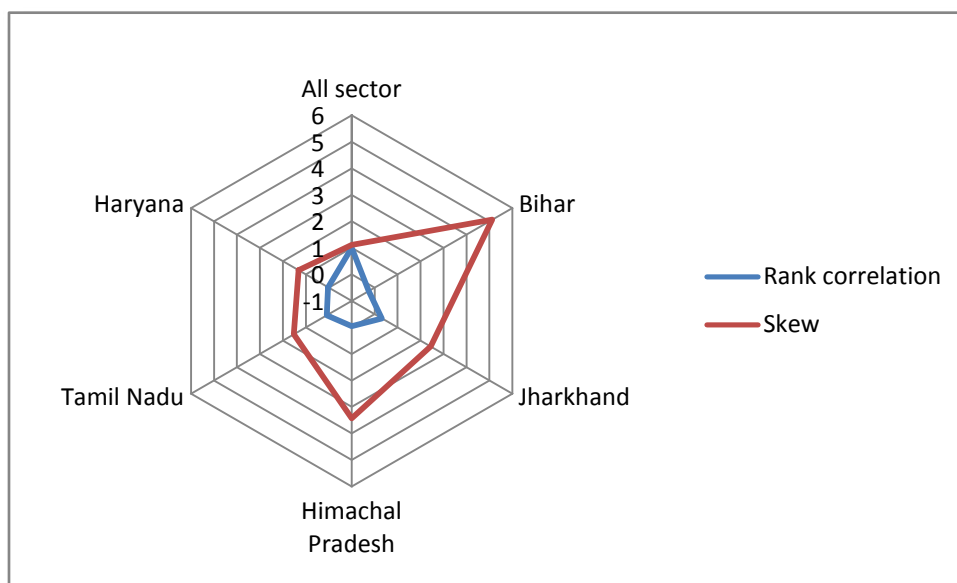


Figure 22: Influence of Sectoral System of Innovation



Industrial Classification as per the NIC code 2008	NIC08
Crop and animal production, hunting and related service activities	01
Manufacture of food products	10
Manufacture of beverages	11
Manufacture of tobacco products	12
Manufacture of textiles	13
Manufacture of wearing apparel	14
Manufacture of leather and related products	15
Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16
Manufacture of paper and paper products	17
Printing and reproduction of recorded media	18
Manufacture of coke and refined petroleum products	19
Manufacture of chemicals and chemical products	20
Manufacture of pharmaceuticals, medicinal chemical and botanical products	21
Manufacture of rubber and plastics products	22
Manufacture of other non-metallic mineral products	23
Manufacture of basic metals	24
Manufacture of fabricated metal products, except machinery and equipment	25
Manufacture of computer, electronic and optical products	26
Manufacture of electrical equipment	27
Manufacture of machinery and equipment n.e.c.	28
Manufacture of motor vehicles, trailers and semi-trailers	29
Manufacture of other transport equipment	30
Manufacture of furniture	31
Other manufacturing	32
Repair and installation of machinery and equipment	33
Electricity, gas, steam and air conditioning supply	35
Water collection, treatment and supply	36
Wholesale and retail trade and repair of motor vehicles and motorcycles	45
Warehousing and support activities for transportation	52
Repair of computers and personal and household goods	95
Other personal service activities	96

National Innovation Act, 2008

Preamble

- To facilitate public, private or public- private partnership initiatives for building an Innovation support system to encourage Innovation,
- To evolve a National Integrated Science and Technology Plan,
- To codify and consolidate the law of confidentiality in the aid of protecting Confidential Information, trade secrets and Innovation.

How it defines Innovation

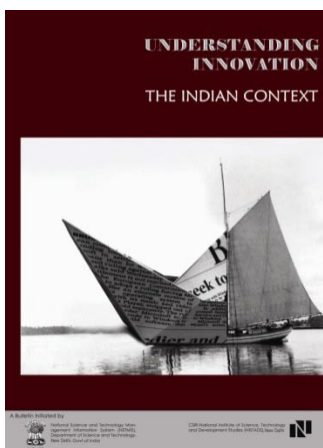
It defines innovation to be *a process for incremental or significant technical advance or change, which provides enhancement of measurable economic value like increase in market share, competitive advantage, improvement in the quality of products or services, reduction of costs etc, and it shall include,*

- Introducing new or improved goods or services;
- Implementing new or improved operational processes;
- Implementing new or improved organizational / managerial processes.

Proposals of the Act

- The Act proposes that the definition of Innovation to include only processes directed towards achieving technical advance are intentional and further innovations are stressed to be distinctive from new and innovative technology or advances achieved as a consequence of the Innovation. Also it state that new products or new processes arising out of innovative technology, which are protectable under the prevailing IPRs would not fall under the ambit of the present statute;
- Provide incentives in order to encourage any person or entity which provides risk capital to start up ventures that facilitate and encourage Innovation;
- Put the resources of the investors to encourage innovation such that entity like *Angel investors* would not involve themselves in the management, but would add value providing access to commercialization of products and services through its social, professional or business networks and expertise;
- Identify Special Innovation Zones and Innovation Parks to enable clustering of enterprises engaged in specific areas, and in turn stimulate innovation;
- Implement low cost technologies by appropriate government for the creation of a market place to trade innovation.

Source: Excerpts taken from the **Draft version** of The National Innovation Act, 2008.
For details please check: <http://www.dst.gov.in/draftinnovationlaw.pdf>



First Issue is downloadable from

http://www.nistads.res.in/images/recentupd/BULLETIN_Nov2011.pdf

http://nationalinnovationsurvey.in/download/BULLETIN_Nov._2011.pdf

The third issue of the Bulletin will cover states of Karnataka, Odisha, Chattishgarh, West Bengal, Kerala and Gujarat.

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CSIR 800: Empowering the Indian masses

A Council of Scientific and Industrial Research (CSIR) initiative for Income Augmentation and Improvement in the quality of life of 800 million people

The project aims at providing a better life to 800 million people in the country and hence bringing solutions in the area of health, agriculture, and energy.

Salient features of CSIR 800

- Proposes product based and service oriented/solution based employment/entrepreneurship generation through S & T intervention.
- Transferring technology to entrepreneurs for large scale and/small scale production of goods and services for the 800 million.
- CSIR will target 1% of the target group at proof of concept level and NGOs will scale – up to 10%.
- Aims to encourage technology diffusion in partnership mode with universities/Institutes located in small towns and rural areas.
- Seeks to transfer technology, procurement by respective programmes/missions and / or ministerial departments for propagation and implementation.
- Envisages implementation of 10-100 projects: each with a minimum customer base of one million people.
- Involves financing mechanism that use funding schemes of respective ministries, bank loans and philanthropic/CSR funds.
- Extensive involvement of State Governments and State S & t councils.
- Established of CSIR-State DST Centre for Dissemination of technology.

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