

# Technology dissemination programmes and extramural R&D support in India

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**Abstract** This article offers a brief overview of the programmes in place for the provision of financial support to entrepreneurs and R&D organizations for technology commercialization and dissemination in India. Financial assistance is provided under these programmes to the industrial enterprises and R&D organizations by the Government of India for undertaking the development of new technology based products. Technology financing under these programmes is provided in the form of: grants, loan, and/or equity with the aim to strengthen the linkages of R&D laboratories with industry, as well as for the production of technology based products for the domestic and global market. Extramural funding agencies of the central government departments such as DSIR & DBT are involved in mainly the provision of financial support for R&D.

**Keywords** Technology dissemination · Innovation · Thematic · Social sciences · Extramural R&D

**JEL Classification** O32 · O38

## 1 Introduction

Direct financing of development of technological innovations and the support provided through extra-mural R&D and related programmes of incubation for the promotion of spin-offs and start ups has emerged over the period to be an important policy intervention for the governments in all the advanced countries. Policies under formulation are increasingly targeting the phases of incubation and commercialization of technological innovations for the dissemination of indigenous technology. Governments are encouraging the government R&D labs and the private sector enterprises to enter into active partnerships for which the

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financial support is provided in the forms of both grants-in-aid and concessional loans to the participating organizations.

Policy initiatives are still in infancy in this sphere In India. Investments for encouraging the R&D organizations and entrepreneurs to come together for the production of prototypes or the setting up of the demonstration plants, and the production of new technology based products at the pilot stage, semi-commercial and commercial levels, respectively are beginning to be strengthened slowly.

Direct financing of technology dissemination in India is at the moment the explicit aim of the following schemes operated by major scientific agencies:

1. The Department of Scientific & Industrial Research (DSIR), under its Tepp and Technology development and demonstration programme (TDDP) schemes, besides providing tax-incentives and granting of recognition to In-house R&D units, etc.
2. The Technology Development Board (TDB), for commercializing of technology-based products,
3. The Department of Science and Technology (DST) and Technology Information, Forecasting Assessment Council (TIFAC) as a R&D support fund for special projects on: development of instruments, drug and pharmaceutical products, technology missions for sugar, flyash, advanced composites and bamboo.
4. Indian Renewable Energy Development Agency (IREDA), under the Ministry of New and Renewable Energy, and
5. Department of Bio Technology (DBT), under SBIRI, for bio-tech related products, etc., for bio-tech related products.

## 2 Technology dissemination financing system

Below we note the ways and means being deployed for technology dissemination in these schemes. Financial assistance is provided under these programmes to the industrial enterprises and R&D organizations by the Government of India, public and private sector banks, venture capital companies for undertaking the production of new technology based products. Technology financing is provided in the form of: grants, loan, and/or equity is provided by various organizations in India such as DSIR, DBT, TUB, DST, TIFAC, IREDA etc. for strengthening the R&D labs and industry linkages, as well as for the production of technology based products for the domestic and global market. Policy initiatives of the Government of India focus on the technology development and commercialization of new technology based products by intervening in the activities of Proto type development, semi commercial and commercial level manufacture.

Details of the technology financing schemes and the promotional programmes of the Department of Scientific & industrial Research, Department of Science & Technology, TIFAC, Department of Biotechnology are provided here in brief:

### 2.1 Tepp: Technopreneur Promotion Programme

A novel scheme called *Technopreneur Promotion Programme (Tepp)* was launched by the Ministry of Science and Technology on 15 August 1998, to tap the vast innovative potential of the citizens of India. Indian citizens viz. farmers, students, housewives, scientists, engineers, doctors, technicians etc., having original idea/invention/patent/know-how can apply under this programme for the financial support. The provision of financial

assistance, as grant-in-aid under this programme would enable the individual innovators to convert their original ideas into working models, prototypes/processes. Altogether about 200 projects have been supported under the Tepp programme till March 2008. Tepp has been playing a catalytic role in promoting individual promoters, particularly the “Grass-root innovators” to become technology based entrepreneurs (technopreneurs). This programme has been jointly operated by the Department of scientific and Industrial Research (DSIR) and Technology Information Forecasting and Assessment Council (TIFAC), Department of Science and Technology, under the aegis of the Ministry of Science and Technology, Government of India New Delhi.

## 2.2 Supplementary Tepp Fund (STF)

Up to Rs. 5 lakhs to successful TePP innovators to those have developed products/process at concepts proving stage under TePP phase-I to refine technology transfer to entrepreneurs. The activities supported are testing/validation, patent filing, building improved prototype and aesthetic design, preparing technology transfer document.

## 2.3 Seamless scale-up support

For TePP projects limited to financial support of Rs. 30 lakhs. Proposal would be considered from successful TePP Innovators under TePP phase-I for innovations having significant market to facilitate them to turn into an entrepreneur.

## 2.4 New indicatives and modification in the programme

To increase the reach of TePP programme and to open multiple windows for receiving proposals under TePP, it has been decided to establish TePP outreach centers at different organization institution throughout the country following five TePP centres have been establish which are being coordinated by TIFAC:

- SIDBI innovation and incubation centre, IIT Kanpur
- Institute industry partnership cell, Institute of technology, Banaras Hindu University, Varanasi
- Central Glass and Ceramic Research Institute (CGRI), Kolkata
- Vellore Institute of Technology, Technology Business Incubation Centre, Vellore
- PSG-Science & Technology-Entrepreneurial Park, Coimbatore.

## 3 Technology development and demonstration programme

The efforts of the industry in technology development and demonstration of the indigenous technologies, as well as of the absorption of the imported technologies, are promoted by the Department of Scientific and Industrial Research (DSIR) under its plan scheme “Technology Promotion, Development and Utilization” (TPDU). The distinctive feature of the funding here is that it addresses innovations in SME’s. Environmental consideration is the prime criteria for supporting the projects.

Partial financial support, on a selective basis, is provided in the form of grants-in-aid to research, development, design and engineering projects undertaken or sponsored by the industry for the development and demonstration of the indigenous technology or the

absorption and upgradation of the imported technology. The projects are undertaken solely by the industry or could be with the national laboratories or in collaboration with academic/technical institutions. Project activities thus supported by the DSIR include prototype development and pilot plant operations, both in-house R&D by the industry or jointly with research labs, tests and evaluations of products emanating from such R&D, user trials etc. The financial support is catalytic in nature and the projects lead to the development of commercially visible new technology based products or processes. Bulk of the financial support to the projects is to be from Industry's resources. The financial support from DSIR is mainly to meet part of the development expenditure for—making proto types or building up of pilot plant and experimentation thereon for upscaling or optimization of processes product/process simulation/know-why studies.

About 110 projects have been supported under this scheme till March 2008. The scheme has been successful in synergizing the R&D efforts of the industry and has strengthened the linkages with more than 25 national research laboratories. 45 projects have been completed and over 35 technologies developed under the scheme have been commercialized or under commercialization, besides, and over 20 patents have been filed, under filing/being scaled up which would lead to their significant commercialization in the future.

#### **4 Technology funding by TDB**

The Government of India, in 1996, enabled the placing of the proceeds of the R&D cess Act 1985, i.e. 5% cess amount on the import of technology, into a fund called "The Fund for Technology Development and application", in a dynamic economic environment. The R&D cess collected was Rs. 1,279.16 crores during 1996–2007 out of which Government has made available Rs. 482.42 crores to the TDB. To administer the funds, the Government Constituted a statutory body, called Technology Development Board (TDB) over the period of 11 years, under the Department of Science and Technology. The board:

- Invests in equity capital i.e. upto 25% of the project cost, or
- Provides soft loans i.e. upto 50% of the project cost and charges 5% per annum as rate of interest payable in the next 5 years, to the industrial concerns and other agencies attempting development and commercial application of the indigenous technology or adapting imported technologies to wider domestic applications.
- Besides, the board provides financial assistance in the form of grants in-aid to the R&D labs/technical institutes/universities for the development and commercialization of the new technological products in collaboration with industry.

The board has so far funded about 200 projects having a total cost of about Rs. 2,949.13 crores. It has provided a real opportunity to new entrepreneurs/technopreneurs at the start up and early stages 27 new enterprises were provided financial assistance by the board during 2007–2008.

#### **5 Sector-wise coverage**

TDB's financial assistance has covered almost all sectors of the economy. The following table gives sector-wise projects financially assisted by TDB for the year ended on 31st March, 2007, since inception in 1997–1998.

Sector-wise coverage 1997–2007 (rupees in crore)

No.	Sector	No. of agreements	Total cost	Sanctioned by TDB
1.	Health and medical	45	664.92	196.76
2.	Engineering	35	300.45	97.32
3.	Chemicals	17	127.65	41.08
4.	Agriculture	16	90.98	29.02
5.	Energy and waste utilization	6	98.34	43.98
6.	Tele-communication	9	65.94	24.41
7.	Defence and civil aviation	1	8.00	2.20
8.	Road transport	10	527.04	81.20
9.	Air transport	2	142.10	67.80
10.	Information technology	22	116.84	46.68
11.	Others including venture funds	10	528.83	150.50
	Total	173*	2,671.09	780.95

Financial participation by TDB depends largely on the market driven conditions and varies from one sector to another. Health and Medical along with engineering sector have a significant share in its financial assistance.

In the recent past, TDB has partnered with the UTIVF and APIDC venture capital funds to widen its scope with a view to leverage investment in innovative projects and also supported R&D initiatives by the incubators through seed support fund. These participations would enable TDB to enlarge its activities in potential areas with good scalability and to enhance its scope of commercialization of emerging technologies.

## 6 Special technological projects funded by DST

The Department of Science and Technology, DST, Government of India, New Delhi, with a view to promoting the development and demonstration of technology, provides financial support for

Instrument development programme and  
Drug and pharmaceutical research.

## 7 Instrumentation development programme (IDP)

With a view to indigenizing the development and production of instruments, continuous updating of the technology for the instruments developed earlier; designing and development of modern advanced and novel instruments, besides establishing a S&T base and the production techniques and extend support to the developmental projects focusing on creative ways of addressing the needs R&D labs and industrial sectors, the Department of Science and Technology (DST) initiated the Instrumentation development programme (IDP) in 1975. The IDP programme has identified the following priority areas:

Analytical instrumentation  
Medical Instrumentation & Health Care Systems

### Industrial instrumentation, and Sensors and Allied instrumentation.

The DST has recently constituted a National Instrumentation Development Board for strengthening the R&D activities for capacity building in the identified areas and to implement/formulate the policies in this regard i.e. developing of new and innovative instruments, modifying the existing ones etc.

Financial assistance is provided under this programme in the form of grants, to the R&D labs, academic institutions/universities etc. Collaboration with industry is encouraged. Industry is urged to contribute say at least 10% of the total project cost, in cash or kind, as a commitment fund for the production of the instrument developed under the joint efforts to the R&D labs/academic institution/universities.

So far, projects have been funded under the IDP programme and out of which have been designed, developed and commercialized by the industry.

## 8 Drugs & pharmaceuticals research programme

The Department of Science and Technology, DST, recognizing the profound influence of undertaking R&D on the future prospects and opportunities for the growth of the Indian drug industry, initiated a programme on drug development in 1994–1995 for promoting industry R&D labs collaborative programme in drugs and pharmaceutical sectors, with the following specific objectives to:

- Synergizing the strengths of publicly funded R&D institutions and Indian pharmaceutical industry, to generate the collaborative R&D projects (public–private partnership).
- Creating an enabling infrastructure, mechanisms and linkages to facilitate the new drug development.
- Stimulating skill development of human resource in R&D for drugs and pharmaceuticals, and
- Enhancing the nation's self-reliance in drugs and pharmaceuticals, especially in areas critical to national health requirements.

Enterprises engaged in drug development manufacturing with national R&D labs/academic institutions can be provided 50% cost of the project (other 50% should be borne by the industry). The Drugs & pharmaceuticals research programme (DPRP) programme supports both human and veterinary drug development for all types of medical systems—be it traditional Indian medicinal system or the modern one. The programme employs a two-pronged approach i.e.

1. Involving exploratory drug design and drug development
2. Candidate molecules already identified, on the one hand and
3. Providing a cutting edge to Indian industry through innovative
4. Process for known/generic drugs, as well as crucial intermediates, on the other.

## 9 TIFAC's mission-mode programmes

TIFAC (Technology Information, Forecasting and Assessment Council) New Delhi set up under the Union Department of Science and Technology provides financial support to the projects, coming under the preview of the:

- Sugar Technology Mission (STM)
- Advance Composites Mission and
- Fly Ash Mission

*The Sugar Technology Mission (STM)* is a joint project of TIFAC/DST and Department of Sugar and Edible oils (Ministry of Food) Government of India, for the technology upgradation of the sugar industry, through the implementation of the proven modern technologies, and the evaluation of selected bench level technologies and their adoption on the commercial scale, and the trial of new technologies which have not yet been proven on a commercial scale in the sugar industry through horizontal transfer of technology, technology adaptation and scale up of bench level/emerging technologies. With a focus on reducing sugar loses, energy conservation, superior product quality, minimization of pollution and value addition to by-products. This is being done by the identification of the technology gaps in the existing sugar factories as well as forging of strong linkages between the research institutes and the industry, etc. The Government of India, for this purpose has identified a special scheme of concessional finance through the *Sugar Development Fund* of the Ministry of Food, New Delhi. The scheme provides soft loans upto 60% of the project cost, at a simple rate of interest at 6% per annum, payable in the next 5 years with interest, from the date of the first disbursement of the loan amount.

*The Advanced composite Mission Mission (ACM)* attempts to bring together the R&D institutions and the industry towards the development and commercialization of novel composite product technologies, the key economic and industrial sectors, viz. railways, building and construction, Bio-medical tussles, chemical industry, automobiles, marine operation, sports goods etc. The ACM mission provides financial assistance in the form of soft loans, to the industry on repayable basis. The mission has successfully supported about 30 projects with substantial financial participation by the industry. More than 180 composite products for building and construction uses have been developed which the technology for FRP doors has been transferred to 12 industries by the RV-TIFAC Composite Design Centre of the Mission. Projects are underway for the development of newer composite material products.

*Fly Ash Mission* is a joint activity of the Department of Science and Technology, Ministry of Power and the Ministry of Environment and Forests, New Delhi it is being implemented by TIFAC, since 1994 with the close cooperation of thermal power plants, R&D agencies, industry, academia, government departments and ministries. It has so far financially supported 55 projects towards confidence building in fly ash disposal and utilization technology, spread over 21 geographical sites in the country.

*Small Business Innovative Research Initiative (SBIRI)* is a programme of the Department of Biotechnology (DBT) Government of India, undertaken with a view to realizing the full potential of bio-technology has launched this scheme (SBIRI) for promoting the commercialization of new technologies and high-tech products in various bio-tech industries. The distinctive features of the scheme are to boost public-private partnership efforts and support high risk, pre-proof of concept of research and late stage development of small and medium scale companies led by innovators, in lead areas of Biotechnology and/or commercialization of biotech products. The financial assistance can be extended upto a soft loan of Rs. 10 crores for projects which have established the proof of concept and have ability to get venture capital funding. The Department of Biotechnology has so far supported projects on tissue culture, aquaculture, hybrid seeds, vaccine development, bio-fertilizers and bio-pesticides DBT has also set up a Biotech consortium India Ltd—a

SBIRI management agency, for promoting, transfer and commercialization of Biotechnologies in India.

## 10 Funding structure

The SBIRI scheme will operate in two phases, viz. for establishment of pre-proof of concepts of innovations and for product and process development. In both the phases, projects will be implemented at the industry site. However, in any case the actual project cost would not involve cost of land and building but only capital investment and recurring costs.

SBIRI phase-I: The following structure of funding will be available to industry depending on the project cost and own resources brought in by the promoter to the project.

- a. If the actual project cost is upto Rs. 25 lakhs, 80% of the project cost will be available as a government grant.
- b. If the actual project cost is between Rs. 25 lakhs and Rs. 100 lakhs, 50% of the project cost will be available as government grant subject to a minimum of Rs. 20 lakhs and maximum of Rs. 50 lakhs.
- c. If the project cost is beyond Rs. 100 lakhs, in addition to the Government grant of Rs. 50 lakhs, the unit will be eligible for interest free loan upto 50% of the amount (subject to a limit of Rs. 50 lakhs as loan) by which the total project cost exceeds Rs. 100 lakhs.
- d. SBIRI Phase-II: It is proposed to provide soft loan upto Rs. 10 crores for a project as per its requirement. Soft loan upto Rs. 100 lakhs will carry a simple interest of 1% while the interest rate will be 2% (simple interest) on the amount of loan beyond Rs. 100 lakhs. The role of public R&D institution at this stage too is critical, as many of the projects would continue to require technical support from the public funded R&D institutions. The partner in the public institution at this stage will get the R&D support as grant.

## 11 National innovation fund

The Government of India has supported the establishment of a National Innovation Foundation, with an initial corpus of Rs. 200 million. This foundation, inter alia, is expected to document the grass root innovations and establishes a national register for them, set up incubators to nurture the innovations for up scaling their commercialization and marketing, and have promotional programmes in the areas of grass-root innovations.

## 12 Pattern of innovation oriented extra-mural R&D funding support

In the case of extramural research and development funding, the share of central Government S&T agencies is quite small. During the year 2001–2002 to 2005–2006 the number of projects awarded to industry and not-for-profit organizations were only 60 and 138, respectively. In terms of percentage share for innovation oriented extra mural R&D support funding support provided for social and technological innovation aims were merely 0.43 and 0.98%, respectively. See Table 1 for the details.



**Table 1** Extramural R&D Projects approved for technological innovation support to industry and not-for profit organizations during 2001–2002 to 2005–2006 (figures in bold represent percentage share)

Schemes	2001–2002		2002–2003		2003–2004		2004–2005		2005–2006		2001–2002 to 2005–2006	
	No. of projects	Total approved cost (Rs. crores)	No. of projects	Total approved cost (Rs. crores)	No. of projects	Total approved cost (Rs. crores)	No. of projects	Total approved cost (Rs. crores)	No. of projects	Total approved cost (Rs. crores)	No. of projects	Total approved cost (Rs. crores)
Thematic social	18	1.56	10	0.87	16	2.55	10	1.48	6	0.87	60	7.33
%	<b>0.78</b>	<b>0.35</b>	<b>0.37</b>	<b>0.19</b>	<b>0.58</b>	<b>0.57</b>	<b>0.36</b>	<b>0.26</b>	<b>0.17</b>	<b>0.07</b>	<b>0.43</b>	<b>0.24</b>
Innovation	24	7.88	27	8.35	29	12.74	18	5.54	40	29.97	138	64.48
%	<b>1.04</b>	<b>1.77</b>	<b>0.99</b>	<b>1.86</b>	<b>1.06</b>	<b>2.85</b>	<b>0.65</b>	<b>0.97</b>	<b>1.12</b>	<b>2.58</b>	<b>0.98</b>	<b>2.10</b>

**Table 2** Innovation oriented Extramural R&D funding for different subject areas during 2001–2002 to 2005–2006 (Rs. in lakhs)

Subject	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006
Biological science	–	–	–	15.76	53.40
				<b>0.03</b>	<b>0.05</b>
Chemical science	339.26	252.32	296.74	103.44	374.25
	<b>0.76</b>	<b>0.56</b>	<b>0.66</b>	<b>0.18</b>	<b>0.32</b>
Earth science	–	–	<b>13.93</b>	–	
			<b>0.03</b>		
Engineering and technology	31.32	271.78	544.00	358.79	2,307.79
	<b>0.07</b>	<b>0.61</b>	<b>1.22</b>	<b>0.63</b>	<b>1.98</b>
Medical science	–	–	11.86	11.48	195.00
			<b>0.03</b>	<b>0.02</b>	<b>0.17</b>
Physical science	5.64	–	41.68	46.24	67.16
	<b>0.01</b>		<b>0.09</b>	<b>0.08</b>	<b>0.06</b>

Bold figures represent percentage share of total EMR funding

**Table 3** Extent of innovation oriented extramural R&D from the main S&T funding agencies to industry & not-for-profit sector organizations during 2001–2002 to 2005–2006 (Rs. in lakhs)

Agency	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006
DSIR	308.45	252.32	744.00	224.90	839.00
	<b>0.69</b>	<b>0.56</b>	<b>1.66</b>	<b>0.39</b>	<b>0.72</b>
DST	67.77	271.78	164.21	310.81	2,158.60
	<b>0.15</b>	<b>0.61</b>	<b>0.37</b>	<b>0.54</b>	<b>1.85</b>

Figures in bold represent percentage share

**Table 4** Subject wise extramural funding support of social sector agencies during the year 2001–2002 to 2005–2006 (Rs. in lakhs)

Subject	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006
Agricultural science	–	10.34	–	–	–
		<b>0.02</b>			
Engineering and technology	155.92	77.07	58.09	–	72.37
	<b>0.35</b>	<b>0.17</b>	<b>0.13</b>		<b>0.06</b>
Medical science	–	–	197.15	12.67	15.00
			<b>0.44</b>	<b>0.02</b>	<b>0.01</b>

Bold figures represent percentage share of total EMR funding

Table 2 depicts subject wise support from all R&D agencies during the year 2001–2002 to 2005–2006 for innovation. Funding in the areas of Chemical Science and Engineering & Technology are higher than the rest of areas. Support provided by the two main S&T departments (DSIR and DST) for innovation oriented extra-mural R&D is shown in Table 3. In the case of social sector innovations main funding agencies are MOSJE and AYUSH. Tables 4 and 5 shows MOSJE & AYUSH working in this field.

**Table 5** Funding agency wise extramural support of social sector agencies during the year 2001–2002 to 2005–2006 (Rs. in lakhs)

Agency	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006
MOSJE	155.92	87.41	112.66	12.67	72.37
	<b>0.35</b>	<b>0.19</b>	<b>0.25</b>	<b>0.02</b>	<b>0.06</b>
AYUSH	–	–	142.58	–	15.00
			<b>0.32</b>		<b>0.01</b>

Figures in bold represent percentage share

### 13 Conclusion

Direct aid being provided for technology commercialization and dissemination to industry and not-for-profit sector users is rather small compared to the overall R&D and related S&T services support provided of the government departments to R&D organizations. Needless to state, this component of public support is miniscule compared to advanced countries. The situation of funding for extramural R&D support for undertaking bridging R&D work is not very different. Analysis undertaken of extramural R&D funding in different disciplines as provided by the S&T and social sector agencies too indicates that the aid being received by the users in industry and not-for-profit sector is quite meager and limited to only a few subject areas.

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