Role of State S&T Councils in the Indian Innovation System: Policy Perspective

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ISTIP (Indian S&T and Innovation Policy): First Study of its kind focusing on various dimensions of innovation activity in India; aiming at providing valuable inputs for S&T and Innovation decision making.

Contents

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Introduction

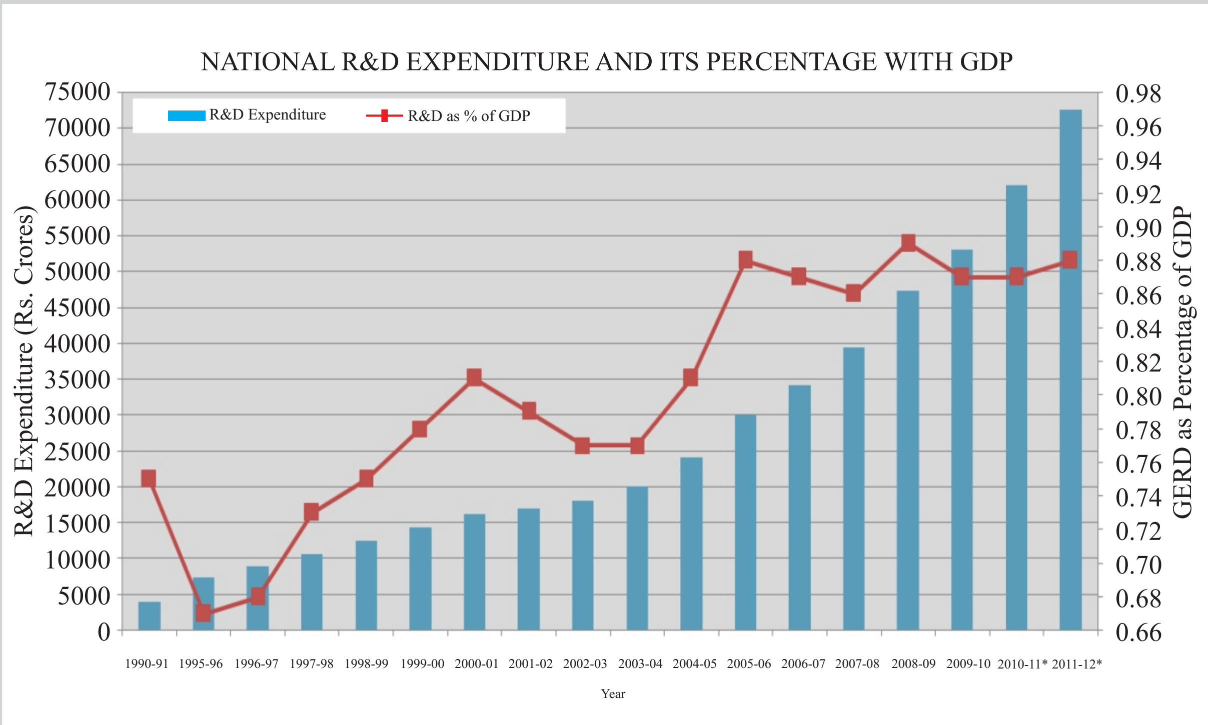
Science and Technology Policy Statements are the policy tools for the Government of India for stating science & technology policy objectives and approaches. Since Independence, four S & T policy statements have been issued, viz. (i) Scientific Policy Resolution (1958), (ii). Technology Policy Statement (1983), (iii) Science and Technology Policy (2003) and (iv) Science Technology & Innovation Policy (2013). Every policy statement has emphasized on a specific view point. This led to the creation of huge infrastructure for science and technology which encompasses organisations under central governments, state governments as well as public and private sectors working in the areas as diverse as agriculture and healthcare on the one hand and nuclear energy and space research on the other hand. How far these policy statements brought into translation/ implementation is very much dependent on a well structured S&T system. This policy bulletin pertains to the issues of S&T structure in India including State S&T Councils and its functioning. Having realized that the state S&T councils since their formation have now come of age, should initiate a phase where resources in terms of expertise and technology promoted and generated by the central and state S&T agencies to be pooled together to undertake joint S&T programmes which further proves that the state level machinery has to take the lead role while the centre could play a very catalytic and effective role in encouraging the initiatives of state Governments.

This bulletin briefly describes the results and some policy perspectives brought out by a study undertaken by CSIR-NISTADS for design and development of a comprehensive Science & Technology Policy for the state of Uttar Pradesh. A few success cases of State S&T Councils are also described while the concluding section enumerates some of the broad policy recommendations for better functioning of state councils across the country.

A) National S&T Structure and Policy Framework

India has huge infrastructure for science and technology which encompasses organizations under central governments, state governments as well as public and private sectors working in different areas. The research and development statistics 2011-12 from the Department of Science and Technology reported the presence of 4,533 R&D institutions in the country in 2011. Global investments in science technology and innovation are estimated at $ 1.2 trillion. India's R&D investment is less than 2.5 percent of this and is currently under 1 % of the GDP (Figure1). Though the Gross expenditure on R&D (GERD) in the country has been consistently increasing over the years and has doubled from Rs. 24, 117.24 crores in 2004-05 to Rs. 53,041.30 crores in 2009-10 and further increasing in 2011 and 2012, still the increase in GERD to 2% of GDP is yet to be achieved which has been a national goal for quite some time[1].

Fig 1: National R&D Expenditure and its Percentage with GDP



Source: Research & Development Statistics at a Glance (2011-12), Department Of Science & Technology, September, 2013

[1]Science, Technology and Innovation Policy 2013, Ministry of Science and Technology, New Delhi

The R&D expenditure by major scientific agencies as given in Table 1, shows the growth pattern over a period of time, viz. from 1970-71 to 2009-10. The data provides an overall picture of the changing pattern of allocation and utilization of plan resources made available to the central Scientific and Socio economic Departments from central plan. This data on progress of plan expenditure on science and technology allocated to Central Scientific and Socio-economic Departments indicates that while the rate of growth of plan expenditure of Central Scientific Department has gone high over a period of time (1970-71 to 2009-10), a predominant proportion of additional resources have however, gone to strategic sectors namely Defence Research & Development Organization, Department of Atomic Energy and Department of Space. Amongst the major scientific agencies, DRDO accounted for the maximum share of 31.6% followed by DOS (15.5%), DAE (14.4%), ICAR (10.8%), CSIR (10.0%) and DST (8.3%) etc. (Figure 2)

Table 1: Expenditure on R&D by Major Scientific Agencies

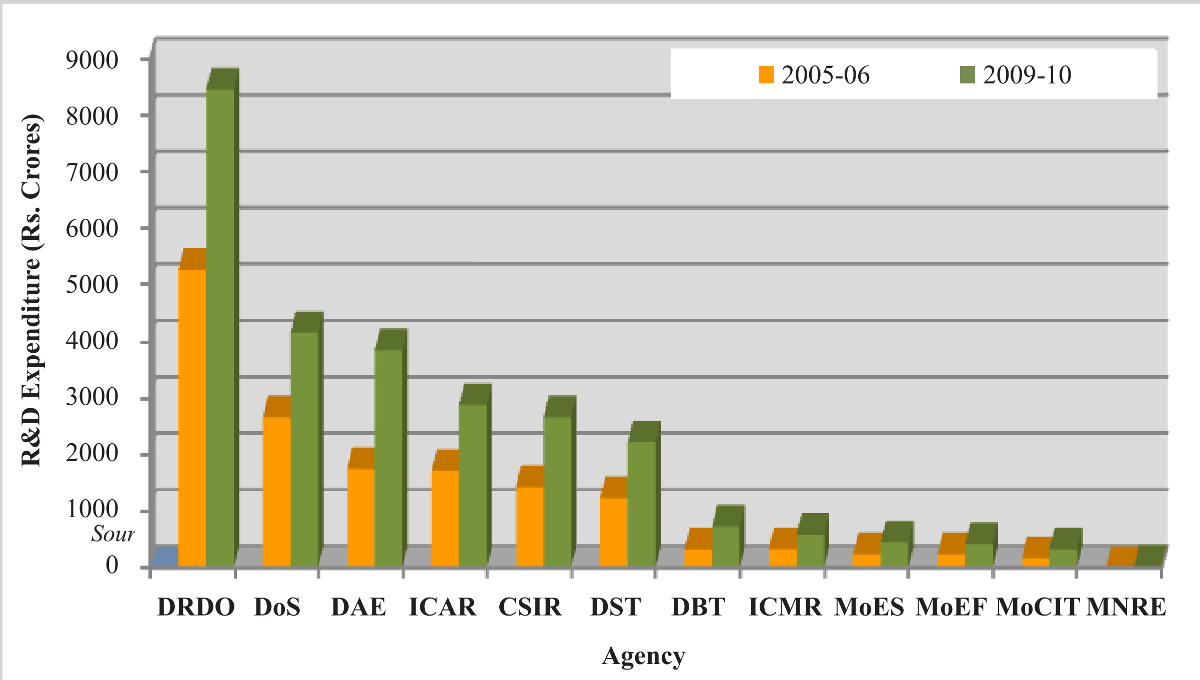
(Rs. in crores)

Agency/Year	1970-1971	1980-1981	1990-1991	1995-1996	2000-2001	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Council of Scientific & Industrial Research	21.56	69.00	249.19	411.70	864.12	1427.04	1457.46	1863.70	2355.20	2666.44
Defence Research & Development Org.	17.55	79.70	681.00	1395.40	3359.32	5283.35	5362.82	6104.55	7699.07	8475.38
Department of Atomic Energy	28.72	73.48	275.54	486.64	1005.52	1752.50	2060.09	2138.57	2982.50	3858.21
Department of Biotechnology	-	-	41.37	73.83	120.58	325.85	432.32	491.59	635.23	727.38
Ministry of Communication & Information Tech.(DIT)	-	5.41	33.03	36.38	51.07	167.85	199.18	236.22	243.04	327.96
Ministry of New and Renewable Energy	-	4.00	16.02	6.98	12.27	9.62	16.12	23.53	16.83	26.51
Ministry of Earth Sciences	-	-	27.80	45.64	84.23	235.48	256.55	292.98	271.76	448.24
Department of Science & Technology	0.84	40.64	119.82	223.67	311.46	1237.05	1359.46	1676.01	1991.16	2222.90
Department of Space	0.00	56.02	386.22	917.88	1905.40	2667.60	2988.67	3278.00	3493.57	4162.96
Indian Council of Agricultural Research	18.37	97.45	276.25	432.37	1161.74	1717.27	2014.16	1992.38	2583.80	2881.30
Indian Council of Medical Research	2.18	9.00	44.54	50.61	149.12	331.00	394.00	266.65	564.18	583.50
Ministry of Environment & Forests	-	3.74	162.09	244.60	272.86	235.31	275.71	311.21	376.13	415.57
Total	89.21	438.43	2312.88	4325.69	9297.68	15389.94	16816.54	18675.40	23212.46	26796.35

Source: Research and Development Statistics 2011-12, DST, September 2013

Department of Science and Technology (DST), Govt of India is primarily entrusted with the responsibility of formulation of S&T policies and their implementation, identification of thrust areas of research in different sectors of S&T; information technology, technology forecasting, international collaboration, promotion of science and society programs and coordination of S&T activities in the country.

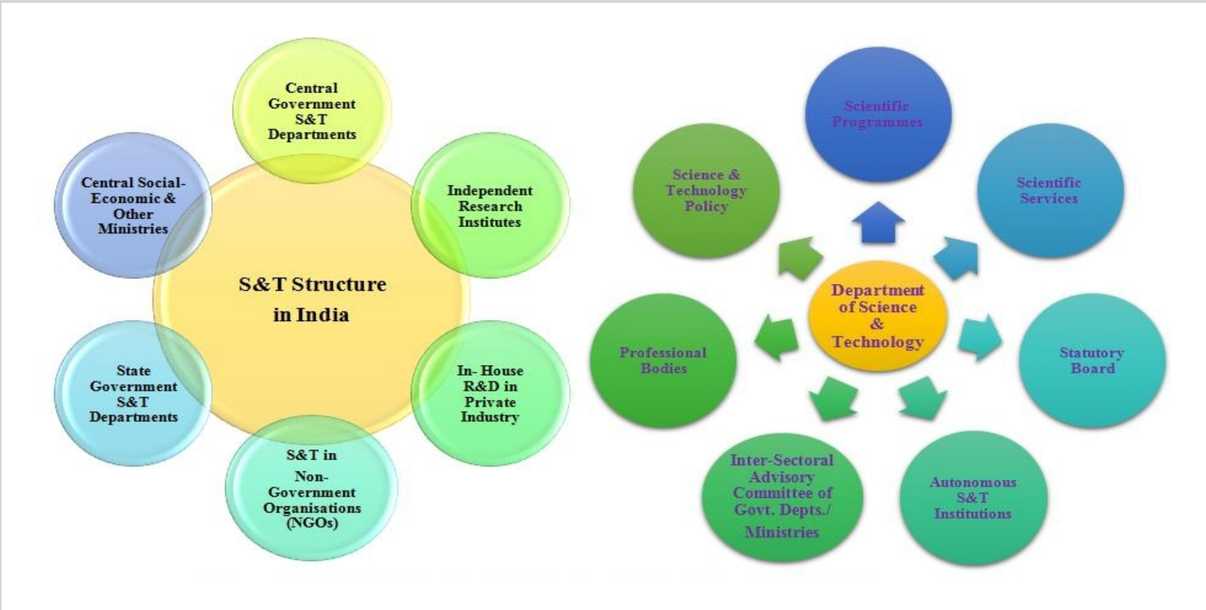
Fig 2: R&D Expenditure by Select Scientific Agencies (Plan + Non plan)



Source: Department of Science & Technology, Government of India

However, there are other S&T departments working under central government which include Department of Atomic Energy (DAE), Department of Space (DoS), Department of Biotechnology (DBT), Department of Ocean Development (DOD). Among the S&T organizations associated with other central government ministries, Defence Research and Development Organization (DRDO) under the Ministry of Defence, Indian Council of Agricultural Research and Indian Council of Medical Research (ICMR) under the ministry of Health and Family Welfare etc. have large R&D infrastructure. The Indian S&T structure includes all organizations and institutions playing a role in the system (public, private and semi-public) and their interaction. Figure 3 below shows Organisational Chart tracing evolution lines of the national S&T system in India.

Fig. 3: Organisational Chart of the National S&T System in India.



Source: Adopted from (http://www.dst.gov.in/stsysindia/st_sys_india.htm)

Policy making and evaluation practice

(i) Scientific Policy Resolution (1958)

The main aim of Scientific Policy Resolution (1958) was to have scientific approach and method and the use of scientific knowledge so that reasonable material and cultural amenities and services can be provided for every citizen of the country as it was out of recognition of this possibility that the idea of a welfare state has grown. Hence, the Government of India accordingly decided the aims of their scientific policy as, i.e. (i) to foster, promote, and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied, and educational; (ii) to ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognize their work as an important component of the strength of the nation; (iii) 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; (iv) to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity; (v) to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom; (vi) and, in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

(ii) Technology Policy Statement (1983)

After twenty five years of Scientific Policy Resolution (1958) a new white paper called Technology Policy Statement (TPS) was announced by then Prime Minister in January 1983. It emphasized the need to plan collaboration agreements in ways that would ensure effective transfer of basic knowledge, know-why important inputs to the importing firms for subsequent absorption, adaptation and up-gradation of the initially acquired knowledge.

The TPS placed emphasis on reducing technological dependence in key areas, technology acquisition from abroad to not be at the expense of national interest, due recognition and support to the indigenous initiatives. It contemplates that lists of technologies that have been adequately developed locally be prepared and updated periodically and normally no imports of these will be permitted. A National Register on Foreign Collaboration (NRFC) was to provide analytical inputs of various stages of technological acquisition.

The initiative taken as follow up of TPS included a Technology Absorption and Adaptation Scheme (TAAS) that aims to provide catalytic support for accelerated absorption and adaptation of imported technology by the industrial units. It was made mandatory to highlight efforts taken towards absorption of technology imports in a separate chapter of the annual reports of all importing firms. The economic policy of India has been liberalized in 1991. Policy changes announced by the government abolished industrial licensing except for short list of industries related to security and strategic concerns, hazardous chemicals. The restrictions imposed by Monopolistic and Restrictive Trade Practices (MRTP) Act on large firms expansion, merger, amalgamation and take over etc… have been abolished. Now Multinational Corporations (MNCs) are free to use their brand names. Now MNCs can increase the permissible extent for foreign equity from 40-51 per cent.

The above policy has been evaluated and reviewed number of times since then by a committee appointed by the Ministry of Finance and which has further liberalized the Indian economy, for example in Drugs and Pharmaceutical sector 100% foreign investment automatically permitted, abolition of industrial licensing for all bulk drugs intermediates and formulations.

(iii) Science and Technology Policy (2003)

As a result of evaluation of Technology Policy Statement (1983), Government of India came out with a new, Science and Technology Policy 2003, which lays a lot of emphasis on international collaboration in science and technology. It states as one of the objectives to promote international science and technology cooperation towards achieving the goals of national development and security and make it key element of international relations. The policy has thought of a strategy and a kind of plan of action for meeting the objectives of the policy and it states Scientific Research and Technology Development can benefit greatly by international cooperation and collaboration. International collaboration programs especially those contributing directly to scientific development and security objectives got encouraged between institutions and national laboratories in India and other counterparts in all parts of the world including participation in mega science projects as equal partners. Special emphasis was also placed on collaboration with other developing countries.

(iv) Science Technology & Innovation Policy (2013)

With the pronouncement of 2010-20 as the 'Decade of Innovation', the government of India stressed the need to enunciate a policy to synergize science, technology and innovation, the Prime Minister in January 2013 announced a new policy entitled, 'Science, Technology and Innovation Policy 2013'. Main features of the STI policy include a) expressed levels of aspiration, b) balancing between excellence and relevance, c) creating an enabling policy ambiance for attracting larger investments of private sector into Research and Development, d) promoting a science-led innovation ecosystem and e) establishing linkages between discovery processes of science and developmental priorities of the country in agriculture, manufacturing, services and infrastructure sector. To make this policy effective there is a need to create the necessary framework for enabling the integration in identified priority areas by exploiting endogenous resources, strengths and capacities. The investment in science and investment in science-led technology and innovation in select areas of socio-economic importance will bridge the gaps between the STI system and the socio-economic sectors.

The state S&T Councils can play a significant role to bring the new policy into action with the help of mission oriented approach and adoption of new delivery models with provision of accountability. This will require a relook into the dynamics of S&T policy making and its implementation at the state level. The state governments constitute important stakeholders, guiding state specific S&T vision and plans by aligning the new STI Policy objectives. Needless to say that the State S&T Councils need to develop effective linkages with S&T institutions, State Government line departments and central S&T agencies/departments to ensure better effectiveness in their schemes and programmes and to be aligned with the new STI policy objectives and outcomes.

Since there cannot be a uniform S&T policy across the states as each state has different characteristics, potentials, resources and priorities, therefore each state has to plan its priority areas for development and accordingly a comprehensive S&T policy. Thus it is the state S&T Councils who play the lead role to bring into the development mechanism by stating mission oriented goals/targets of the state and to achieve them with the help of S&T interventions**. State priority has also been emphasized by the Hon'ble Prime Minister Shri N.Modi indicating his office to consider issues, especially those raised by the States on priority and with sensitivity. The statement said ".....this is important because India's progress lies in the progress of states and this would strengthen our federal structure."(Times of India 29th May, 2014, Page 1)**

B) State S&T Development/Councils

Role of DST in evolving State S&T Councils

Having realised that key to the success of India in the ensuing global knowledge economy rests in the active enrolment of various state machineries into science-led innovation processes, one of the key mechanisms connecting science based developmental activities is the State Science and Technology Council. It is in this context that the initiative to establish state councils for S&T was first taken up in 1971 by the National Council for Science and Technology under the Department of Science & Technology, (DST), Govt of India. It was stressed that irrespective of large investments of the Central Government in S&T in various sectors and institutional infrastructure, the central S&T agencies must take the states along if the development goals are to be attained. State S&T councils have been hence established for wider reach of S&T programmes. Thus Karnataka, Kerala, Uttar Pradesh and West Bengal were the first to establish their state S&T councils by the end of the Fifth Five-Year Plan. Since then, each state and union territories have their own councils. These councils play a catalytic role for the promotion of S&T in the respective states and supplement/ complement the developmental programmes of the state in different sectors.

Serving as a bridge between the central S&T sector and the states, these state S&T councils however, have remained weak links in promoting the applications of technologies as is categorically stated in the working group report of XII Five-Year Plan[2]. One of the said causal factors is the budget constraint. Apparently, the functioning of these councils depends upon the financial support from DST in the form of core support and grant (shown in table 2) and from their respective state governments. Though the main objective of the core support and grant from DST is to set up the technical secretariat and to facilitate state S&T councils in planning, monitoring and implementing S&T activities in the state, still functioning of these councils more or less depends upon the budget support by the state.

Considering the need for disseminating knowledge on patents and spreading its awareness in the country, the Department also facilitated in establishing patent information centre in different state S&T Councils. In order to give focussed attention to identification and demonstration of S&T projects including field trails, a special mechanism operates in the form of core group to facilitate identification of technologies developed in the S&T institutions and for field trails and demonstration at a sizeable scale so that benefit of intervention could be visible in various states. This group, in its two meetings considered 33 new projects in diverse areas of socio-economic importance and have also monitored 33 ongoing projects[3]. Beside this core support provided by DST to State S&T Councils, states like Punjab, Kerala, Karnataka, Madhya Pradesh, Tamil Nadu, Gujarat and few other state S&T councils have extensive schemes and programmes funded from State S&T plan as well. This could be seen from the data provided on various state R&D expenditure across the Indian states depicted in Table 3.

[2]Working group report of XII Five- Year Plan (2012-2017)
dst.gov.in/about_us/12th-plan/11-wg_dst-2905-report.pdf

[3]Department of Science and Technology, Annual Report, 2012-13.

Table 2: Core Grant to State Science & Technology Councils

(Rs. in Lakhs)

Sate/UT	No. of Employees supported in SSTP*			Core Grant Sanctioned By DST (years - wise)						
	SE*	AE*	Total	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	Total
Andhra Pradesh	5	1	6	29.00	32.00	35.00	51.00	58.00	62.74	267.74
Arunachal Pradesh	6	9	15	27.00	29.20	43.50	53.00	73.00	90.75	316.95
Assam	14	-	14	38.08	38.12	41.00	53.00	59.00	97.00	326.20
Bihar	11	3	14	29.50	31.50	19.46	18.68	36.26	31.07	166.47
Chhattisgarh	10	-	10	19.00	23.00	31.00	55.45	62.03	74.32	264.80
Goa	8	7	15	27.50	32.14	43.00	61.50	52.31	68.70	285.15
Gujarat	8	11	19	30.00	32.40	49.00	53.00	66.09	56.00	286.49
Haryana	5	1	6	17.60	23.35	19.64	19.04	23.00	27.74	130.37
Himachal Pradesh	9	8	17	44.00	46.00	50.00	65.00	73.00	84.65	262.65
J&K	-	-	-	-	-	-	-	-	-	-
Jharkhand	-	-	-	-	-	-	-	-	-	-
Karnataka	9	5	14	41.00	45.70	48.42	72.50	79.50	87.00	374.12
Kerala	11	3	14	31.00	34.00	39.00	61.00	69.00	76.00	310.00
Madhya Pradesh	9	13	22	46.43	48.50	64.50	81.00	93.00	105.38	438.81
Maharashtra	4	4	8	14.00	14.00	14.00	14.00	14.00	14.00	84.00
Manipur	8	12	20	36.69	38.50	51.05	59.30	74.00	83.57	343.11
Meghalaya	5	4	9	9.14	8.84	10.54	11.25	14.50	18.08	72.35
Mizoram	8	2	10	23.00	24.00	26.00	34.00	41.00	52.00	200.00
Nagaland	3	2	5	-	-	-	30.40	44.00	46.00	120.00
Orissa	-	-	-	-	-	-	-	-	-	-
Punjab	9	6	15	61.50	68.00	85.50	95.50	110.00	125.50	546.00
Rajasthan	14	9	23	41.36	47.69	63.04	77.90	84.50	85.20	399.69
Sikkim	8	7	15	37.00	40.00	48.16	92.63	68.00	87.00	372.79
Tamil Nadu	7	5	12	36.30	37.00	50.15	65.87	66.52	51.34	307.18
Tripura	8	5	13	18.20	19.50	20.00	27.00	33.00	42.00	159.70
Uttarakhand	8	-	-	21.70	22.00	37.50	55.00	61.50	77.97	275.67
Uttar Pradesh	14	5	19	54.50	58.50	70.50	86.50	96.50	110.50	477.00
West Bengal	3	1	4	13.38	10.65	16.15	14.77	18.83	28.99	102.77
Andaman & Nicobar	3	1	4	3.29	5.16	6.34	9.35	9.10	-	33.24
Chandigarh	2	4	6	3.61	2.31	2.90	-	-	-	8.82
Dadra Nagar	-	-	-	-	-	-	-	-	-	-
Daman Diu	-	-	-	-	-	-	-	-	-	-
Delhi	-	-	-	-	-	-	-	-	-	-
Lakshadweep	-	-	-	-	-	-	-	-	-	-
Pondicherry	3	2	5	-	-	-	-	-	-	-
Total	212	130	342	753.78	812.06	985.35	1317.64	1480.14	1522.30	7032.47

**SE: Scientific Employees; *AE: Administrative Employees; * State Science and Technology Programme,*

Source: Evaluation Report of Core Grant Support State S & T Councils, DST, 2014

The basic objectives of the State Councils for Science and Technology are to identify areas in which science and technology can be utilized for achieving the socio-economic objectives of the State, and in particular the problems of backwardness, unemployment and poverty in the rural areas and among the under privileged section of the society. The specific functions of the Council are: (i) To advice the government on policy measures necessary to promote utilization of science and technology for the achievements of the socio-economic objectives; (ii) To interact with other State Councils and other national science and technology bodies on behalf of the government on common issues;(iii)To promote the popularization of science and the spread of scientific temper and attitude amongst the people of the State and to disseminate scientific knowledge by means of pamphlet, journals films etc. The Council functions through various authorities such as General Body; Executive Committee and Special Committee. The Executive Committee functions as the Executive Body of the Council for the management of its daily affairs like formulation and implementation of administrative, financial and personnel policies designed to promote scientific and technological activities.

Table 3: Expenditure on Research and Development (R&D) by State Governments

Sl. No.	State		R & D Expenditure			(Rs. Crores)
		2005-06	2006-07	2007-08	2008-09	2009-10
1	Andhra Pradesh	146.30	154.30	162.82	263.18	272.32
2	Assam	77.37	108.35	113.16	151.63	144.63
3	Bihar	39.69	41.67	43.76	45.95	48.24
4	Chhattisgarh	28.70	39.58	29.18	29.00	30.19
5	Gujarat	208.11	260.42	273.39	389.59	472.40
6	Haryana	117.93	126.52	134.87	141.18	148.24
7	Himachal Pradesh	90.11	103.65	96.53	111.92	131.46
8	Jammu & Kashmir	98.89	125.49	100.16	87.77	100.57
9	Jharkhand	61.99	68.18	64.62	62.00	60.07
10	Karnataka	200.44	243.23	375.92	428.39	334.09
11	Kerala	115.83	127.30	105.21	145.30	153.25
12	Madhya Pradesh	98.39	111.47	103.54	119.96	125.95
13	Maharashtra	271.43	324.45	317.28	374.01	413.87
14	Manipur	27.39	40.70	34.43	44.94	83.08
15	Meghalaya	2.42	2.90	3.45	3.63	5.33
16	Orissa	26.21	63.17	61.56	75.18	96.15
17	Punjab	162.90	186.91	187.43	226.86	268.42
18	Rajasthan	95.16	108.54	107.96	142.18	161.36
19	Tamil Nadu	144.26	150.52	191.30	229.57	281.60
20	Uttar Pradesh	130.23	147.60	178.69	205.14	234.28
21	Uttarakhand	116.18	126.92	158.67	165.05	161.08
22	West Bengal	74.66	95.91	107.87	120.13	138.66
	Total	2334.60	2757.79	2951.80	3562.54	3865.24

Source: Data collected and compiled by DST

Currently DST in collaboration with state councils, has organized the all India thematic meetings/workshops whose recommendations helped to identify activity-areas for promotion by the state S&T councils; periodic review meetings to discuss the status of various S&T programmes and to plan the strategy for future; regional meetings to review state S&T structures and identification of areas of mutual cooperation between states[4]. This review indicates desire for a phase change geared towards programmatic support and strengthening linkages between state S&T Councils and central S&T agencies by suitably dovetailing various programmes of State S&T Councils with those of central S&T agencies.

Expanding Role of State S&T Councils

Since India has declared 2010-2020, as the decade of Innovation and the states were expected to open State Innovation Councils to prepare roadmaps for their respective states, the Govt. has stressed the need to enunciate a policy to synergize Science, Technology and Innovation and has also established the National Innovation Council (NInC). The STI Policy 2013 is in furtherance of these pronouncements. It aims to bring fresh perspectives to bear on innovation in the Indian context. The capturing aspirations and the key elements of the STI Policy are: creating an environment for enhanced private sector participation in R&D; enabling conversion of R&D output into societal and commercial application by replicating successful models as well as establishing of new PPP structures; seeding S&T based high risk innovations through new mechanisms; triggering changes in the mindset and value system to recognize, respect and reward performances which create wealth from S&T derived knowledge; creating a robust national innovation system. To fulfil these aspirations, some of the states considered to expand the role of their State Councils for Science & Technology (SCS&T) to perform this role too while a few thought it appropriate to create State Innovation Councils (SIC) separately. In this context a number of state S&T Councils are in a process to prepare innovation roadmap for 2010-2020 and few of them have already drafted innovation roadmap with a focus on sectoral development. For example Punjab State Innovation Council has already drafted its Innovation Roadmap: 2010-2020, identifying six key sector viz. Agriculture; Energy; Health; Higher Education; Manufacturing; and Construction Sector. To make this roadmap functional the council has also worked out sectoral sub-committees as well the nodal agencies.

Success Cases of a few Indian State S&T Councils.

DST has facilitated all the state governments in establishing and developing the state S&T councils by providing support for their technical secretariat and core support in planning, monitoring and implementing S&T activities in the state. This support is intended to develop and nurture S&T capabilities required for development of the state through S&T intervention and has to be specifically oriented to the identified needs of the state[5]. In addition to this, states like Punjab, Kerala, Karnataka, Tamil Nadu, Gujarat and few more state S&T Councils have extensive schemes and programmes funded from state S&T plan and have performed in a big way to transform their respective states with S&T and Innovation support. Details on some of these state S&T Councils are given below.

[4]Development of Evaluation Mechanism for Annual Core Grant Support to State Science and Technology Councils, DST, 2014.

[5]State Science and Technology Programme (SSTP), DST, March, 2010

Karnataka State Council for Science and Technology (KSCST)

Established in the year 1975, Karnataka State Council for Science and Technology (KSCST) is one of the first State S&T Councils set up in the country. Over the last 39 years, KSCST has completed several projects in various sectors like energy, environment, building technology, agriculture, information technology, health, rural industry and water. Successful projects/technologies developed by KSCST include energy planning of Karnataka; energy food; house numbering system for Bangalore city; hand pumps for drinking water wells; and community jiggery making units; solar water heating system; natural resources data management system (NRDMS); rainwater harvesting; Karnataka state spatial data infrastructure (KSSDI); etc. Council is funded by both government of India and the state government.

With the goal of supporting joint industrial R&D projects between Israeli and Karnataka-based companies, recently an Memorandum of Understanding was signed in March 2013, between MATIMOP –the Israeli Industry Center for R&D, on behalf of the Office of the Chief Scientist (OCS) in Israel; and the Karnataka Science and Technology Promotion Society (KSTePS) and the Karnataka State Council for Science and Technology (KSCST), to create mechanisms through which small/medium scale industries located in Karnataka, may seek funding support for joint bilateral research and development projects.

Punjab State Council for Science & Technology (PSCST)

Established in 1983, the Punjab State Council for Science & Technology (PSCST), endeavours to harness the potential of science & technology as an instrument of socio-economic change. The Council strives to ensure that efforts in science & technology are not restricted to scientific laboratories and academic institutions but percolate to the users so that science, technology & innovation increasingly become part of the everyday life as well as transform rural Punjab. Over the past two decades of existence, the Council's impact in society is significant.

The Council's activities are towards: Popularization of science; Conservation of environment; Consultancy to industries for enduring development; Biotechnological interventions; Intellectual Property Rights, nanotechnology, pollution control and socio-economic development. Some of the major outcomes of PSCST under socio-economic development activities are following: Mohali Biotechnology Park, Project titled 'Field Demonstrtation of Cultivation & Processing of selected Aromatic Crops in Dhar Block of District Gurdaspur, Production and Promotion of Neem based Biopesticide as Environment Friendly Biodegradable Alternative to Chemical Pesticides, Promotion and Pilot Production of Low Cost Sanitary Napkins using Cotton Knitwear Waste, Promotion of Cultivation & Value Addition through Post Harvest Processing of Bio-resources in Shivalik belt.

Beside other significant technologies demonstrated by the council, a cost effective scrubbing technology for air pollution control was evolved and approved by Punjab Pollution Control Board. The demonstration units of the above were setup in the States of J&K, Haryana, Jharkhand, Karnataka and Bihar with funding from SIDBI and DST to share the benefits of this technology & for wider dissemination.

Gujarat Council on Science and Technology

Established in 1986, Gujarat Council on Science and Technology (GUJCOST), identified different emerging areas of S&T from time to time and presently these include: nanotechnology; Nanoscience & Nanomaterials, Supramolecules Fullerene, Nanotubes, Rotaxanes, Calixarenes. The council undertakes programmes of awareness, education, research, development, design and engineering in nanotechnology, and transfer the technology to industrial sector in order to increase Gujarat's competitiveness, and improve the quality of life and the environment. As the Govt of Gujarat, is committed to make use of the Nano science and Nanotechnology for the welfare of the society, the GUJCOST has taken an initiative to promote this interdisciplinary field of Nano Science and Nanotechnology which has capable of opening limitless possibilities to create novel things.

GUJCOST has taken the responsibility to identify the appropriate need and area and to define the scope and opportunities in this sector and also preparing the road map of Gujarat Nano Mission and to networking with India Nano Mission as well as other International collaborations. The Gujarat Nano Mission will facilitate necessary support and environment to Nanoscience education, research, development, design and engineering in nanotechnology, and transfer the technology to industrial sector in order to increase Gujarat's competitiveness. Since Gujarat is now hub of manufacturing transport vehicles, work could be undertaken to develop and manufacture materials catering to these industries. These are again structure materials (nanostructured composites) catalyst for increasing fuel efficiency as well as to minimize pollution. The council is taking all possible initiatives to support the Nano Mission of the state.

Andhra Pradesh State Council for Science and Technology

Established in 1986, the Andhra Pradesh State Council of Science & Technology (APCOST), was identified by Government of India as the Nodal Agency for implementing Integrated Rural Energy Programme (IREP) in Andhra Pradesh as centrally sponsored scheme. The major programmes undertaken by the APCOST are APCOST Organic Waste Management Initiative - Food Waste Portable Biogas Plan. Besides, there have been various Projects/Programmes which are running under APCOST including: Village Information System; Plasma Pyrolysis Plant; Water Purification System based on Reverse Osmosis Technique; EduSat – Satellite Interactive Terminal Programmes; Regional Science Centre – Vijayawada; and Regional Science Centre, Warangal etc.

In line with the National Mission on Strategic Knowledge for Climate Change, Andhra Pradesh State Council of Science & Technology (APCOST) is encouraging innovative adaptation of technologies by concerned agencies to conserve energy and for propagation of non-conventional energy technologies in Andhra Pradesh. APCOST is promoting innovative biogas technology at household, community and institutional level to promote organic waste management in Andhra Pradesh.

Uttarakhand State Council for Science and Technology

Established in 2002, Uttarakhand State Council for Science and Technology (UCOST) has mainly focussed on Bio-Prospecting and Agro-Bio-Diversity. The council has come up with a new S&T draft policy in 2006 known as “Science & Technology Promotion and Development Policy”, identifying the following priority areas for S&T intervention: Innovation Promotion; IPR Protection; Networking of Institutions; Inter-Ministerial Co-ordination; Industry- Academia Partnership; Popularization of Science, Himalayan System Science; Human Resource Development and Water Resource Management etc.

The Council is also networking through district coordinators by taking initiative of nominating the District Coordinators in all the 13 districts of the state for creating effective network of its nodal officers and to increase outreach upto the remotest village of the state. The core activities of the District Coordinators include: Identification of persons/teachers having science background at block level; State level S&T youth festival and exhibition/Mela's; Science workshop/conference/symposium; Popular science lectures; District level science competitions and training programmes; and entrepreneurship development programme.

Kerala State Council for Science, Technology and Environment (KSCSTE)

Established in 2002, the Kerala State Council for Science, Technology and Environment (KSCSTE) main objectives are: Plan and formulate science technology and innovation policy pertaining to the development of the state; Create excellence in basic as well as applied research; Establish strong infrastructure for research in science, technology and environment; Develop a high quality science education system in state; Propagate the application of science and technology; facilitate the dissemination of scientific knowledge; leverage the cooperation of international leaders; Strengthen ecosystem and promote indigenous practices; enhance the academia-industry interactions. The major programmes and initiatives of the Council are: Human Resource Development in S&T; Environment and Ecology; Science and Popularization; Infrastructure Development in S&T; Technology Development and Transfer; Women in Science; Biotechnology; Information Technology.

The educational achievements in Kerala are well known but the alarming decline in the standard of science education at all levels has led to many serious consequences. Sastraposhini is a scheme planned by the Kerala State Council for Science, Technology and Environment and launched by the Council in association with the State Education Department for strengthening science education among the High Schools of the State. This program plans strengthening of the High School science laboratories of the State and an effective interaction among the students and teachers. Since this requires a new setting of culture in science education, it is being tried at the grass root level. The present proposal of establishing one model science laboratory in each educational district is a pilot program planned by the Council in consultation with the state education department.

Rajiv Gandhi Science & Technology Commission (RGSTC) by Maharashtra

Government of Maharashtra has formed Rajiv Gandhi Science & Technology Commission (RGSTC) by Maharashtra Act No XV 2004. The Government constituted the Commission in April 2005; Maharashtra is the only state in the country to set up such a statutory Commission and indicates its priority for Science and Technology Sector.

RGSTC facilitates and plays an active role to identify and develop innovations in technologies and formulate projects for implementation; Undertake studies and surveys to identify the technology gaps; Identify technologies for non-conventional sources of energy that are replicable; Set up and supervise centres of excellence; Project funding, implementation, monitoring and review; Provide financial and other support; Consultancy service; Conduct training programs to upgrade skills and to inculcate scientific temper; and to disseminate information. Technologies ready for transfer by the commission are:

Solar Plant for Drying of Fruits Vegetables; Nutritious Dehydrated Vegetables Drink; Nutritious Supplementary Foods from Edible Food Wastes; Hatchery Technology for Quality Prawn Seed; Fluoride Free Drinking Water; Arsenic Free Drinking Water and Biogenic Silver Nanoparticles.

Design and Development of S&T Policy for the State of Uttar Pradesh Study done by CSIR-NISTADS

The study commissioned by Uttar Pradesh Council of Science & Technology (UPCST), Lucknow to CSIR-NISTADS, New Delhi is an indicative of willingness of the state for S&T based governance & societal development. It was observed from the study, that innovation governance is about the way public authorities make and deliver policy and how the policy cycle is organized. Hence, the governance was analyzed both in terms of the links/coordination, its output (policy making) as well as in terms of tools (benchmarking, evaluation and learning). The idea was not to focus on organizations but on institutions and functioning of the system.

Uttar Pradesh Council of Science & Technology established in 1975, aims to promote overall development of S&T in the State. It sponsors time bound and result-oriented programmes relevant to the state to various Universities, Colleges, Technical Institutions, R&D Laboratories, Voluntary Organisations (VOs) Non-Government Organisations (NGOs) and Individual Innovators. Research Promotion; Technology Development, Upgradation and Transfer; Entrepreneurship Development; and S&T Communication and Popularisations are the main activities of the Council. Considering the size of the state, UPCST established four regional centres of council at Agra, Varanasi, Moradabad and Ghaziabad (due to administrative reasons Ghaziabad centre got transferred to Bareilly) during 1994-1995 with the financial support of DST, New Delhi. To link the innovators, traditional knowledge holders particularly artisans, farmers, students, traditional medicine practitioners and people from unorganised sectors, one Innovation Foundation Cell has also been established at UPCST in 2012 by the Government of U.P. The cell has provided support to get micro venture innovation fund to help convert innovations into enterprises and to increase the social esteem of grassroot innovators.

A Biotechnology Park with the sponsorship of Department of Biotechnology, Govt. of India and in collaboration with UPCST, Department of Science and Technology, U. P. Govt., CSIR and other agencies was setup in Lucknow. In order to provide forward linkages to the farmers, a Biotech Networking Facility Centre is also established by UP Council of Science & Technology on an agriculture farm provided by U.P. State Institute of Rural Development, Lucknow. To harness the benefits of biotechnology for the prosperity of the State, the Govt. of U.P. has chartered a Biotech Policy in 2004. The Council proposes to redraft the Biotech Policy and introduce new developments in the field of Biotechnology that would create an investor-friendly environment. The proposed changes are required in view of various new initiatives being undertaken by the government. The State would encourage growth of R&D, development of manpower and resources in key areas like bioinformatics, plant and animal biotechnology by networking with the existing institutions, universities and medical institutes. It would also set up Centres for Excellence in different thrust areas of biotechnology. The State would develop institutional mechanism to carry the fruits of Biotech R&D being pursued at research institutions and technology incubators of the Biotech Park to farmers for employment generation through tissue culture and macro propagation. It would provide better quality and high yielding variety of crops and plants to the farmers. The State has not been able to do much in the health, dairy and food sectors, in spite of available resources. Through application of tissue culture, productivity of horticulture, floriculture and agriculture can be enhanced and made economically beneficial. With the application of Biotechnology, it would be possible to enhance the productivity as well as management of food, utilizing unused and waste into value added food, milk and induct health care through nutraceuticals and pharmaceuticals.

The major action points and recommendations[6] emerged from the study of CSIR-NISTADS of S&T Council of UP are given below.

- For better governance of UP Science and Technology System "UP State Advisory Commission on Science and Technology" will be constituted headed by Chief Minister and Vice Chairman, Minister of Science and Technology, UP Government, along with other eminent Scientists of the country.
- Establishing world class infrastructure for R&D in UP for gaining global leadership in select frontier areas of science.
- UP Innovation System will be strengthen by establishing R&D Institutes in the area of Physical Sciences, Biological Sciences, Earth Science, Engineering Sciences, ICT and Agricultural Sciences, Research Centres will be established in the top ten Universities of the State to promote R&D in Universities. The proposed institutes will be under the umbrella of the Council. The UP State Council for S&T (UPCST) will initiate programs to strengthen linkages with R&D institutions, industry and Academia
- UPCST will be re-organized, strengthen with the scientific and technical staff and headed by a scientist. The Council will be responsible for training of the Scientists in India and abroad working in State Universities and UP State Research Institutions. An International Collaboration Division will be created in the UPCST to coordinate with International Agencies working for promotion of S&T like UNESCO, British Council, European Union, National Science Foundation, USA, DAAD, Germany etc.
- UPCST will establish linkages with existing R&D Institutions in UP controlled by the Central Government to promote research in the areas relevant to UP development. Director UPCST will be on the Research Advisory Council of the CSIR Institutes as well as other central government institutes based in UP. That will become mandatory for CSIR institutes as well as other institutes to nominate Director UPCST to be on their Research Advisory Councils.
- An Institute of Science, Technology and Innovation Policy Research will be established by UP Government to increase the interaction of R&D Institutes with industry and streamline transfer of technology.
- Linking contributions of science, research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.

[6] Final Report: Uttar Pradesh Science and Technology Policy 2013, CSIR-NISTADS, 2013

- Emphasis will be given to bridge the gaps between Science Technology System and socioeconomic sectors by developing symbiotic relationships with economic and other policies.
- New structural mechanisms and models are needed to address the pressing challenges of poverty alleviation, population growth, basic infrastructure, energy and environment, food and nutrition, water and sanitation, habitat and affordable system of heath care and skill building and unemployment.
- Small and Medium Enterprises (SMEs) generally have low R&D intensity, special schemes to support R&D as well as related services at the firm or collective level, will be devised and put up in place.
- UP Science and Technology Foundation will be established as a public private partnership for investing critical levels of resources and ambitious projects.
- Special and innovative mechanisms for fostering academic-research–industry partnerships will be devised. Mobility of experts from academia to industry and vice-versa will be facilitated.
- Leveraging traditional knowledge through modern science for finding solutions to the UP State's problems and promoting interdisciplinary research.
- Participation of women in Science and Technology activities is important. New and flexible schemes to address the mobility challenges of employed women scientists and technologists will be put in place. A broad scope for re-entry of women into R&D and facilitation mechanisms for special career paths in diverse areas will be sought.

(C) Issues that need attention from policy perspective

- The councils need to develop effective linkage with S&T institutions and State Government line departments to ensure better effectiveness.
- Regional centers may be encouraged for better spread of council activities. They should take up programmes of societal appreciation in addition to awareness programmes.
- S&T Councils need to have effective interaction with development departments, Panchayats and some of the active NGOs to take stock of the local problems for S&T intervention in areas of health, environment, traditional skills etc.
- States should vigorously take follow up action in the areas of interest to them with the concerned States and Central S&T Agencies/Departments.
- State S&T Councils may attempt to prepare an atlas of problems so that some need based research efforts could be initiated by the Central agencies/research institutions. Techno-economic & marketing surveys and other relevant studies to identify the problems as well as possible S&T interventions for socio-economic development could facilitate this effort.
- State S&T Councils should put in greater and more systematic efforts towards replication of successful experiences elsewhere as well as field trials of successful technologies.
- States should pro-actively make use of promotional programmes of Central S&T Agencies, having State S&T orientation/relevance.
- State S&T Councils may consider taking up immediate initiative to document traditional knowledge regarding the use of various herbs and plants used as medicines and artisanship.
- States may take initiative in sharing of experiences with other states belonging to similar territorial zone such as mountainous, arid etc. to evolve joint programmes involving more than one state. Horizontal interaction between State S&T Councils should be strengthened utilizing advances in the field of information technology.
- To ensure continuity of activities, there is need to have strong professional S&T secretariat to serve the State S&T Council and also the State Department of Science & Technology with fairly senior level scientific manpower. Considerable stress may be placed on emulating the experience of center in the key organization features of State S&T bodies.
- The State S&T bodies should have enough flexibility and operational freedom for smooth and effective implementation of various S&T programmes.
- In order to make use of scientific and technological knowledge generated in the scientific infrastructure created so far, it is necessary that a plan for utilization of S&T at State level is carefully drawn keeping in view the development priorities of the State involving scientists, technologists, planners and decision makers in the process. The S&T infrastructure existing in the States may be used optimally.

- Specific S&T based schemes, projects and programmes for employment generation in terms of training, re-training, skill development, entrepreneurship development etc. would not only help in the creation of employment opportunities at the State level but would also help in improving the productivity and efficiency of various services and production sectors.
- Structure and Governance mechanisms of various state Science and Technology Councils vary significantly at present. Some State Councils are effective and performing. There is a possibility to spread the best practices of governance across the country. Annual meeting of State Science, Technology and Innovation Councils would enable such spread of best practices.
- Manpower structure and implementation systems of the state Councils may need to be matched for the assisting the enlarged state vision for science. Assistance from DST for Core grant to the state councils may be linked to state's aspirations for promotion of science-led innovation.
- State based science vision in alignment with the National Vision is necessary. Department of Science and Technology, Government of India may be needed to fund the development of such state specific visions.
- Chairmanship of professional scientists for the state S&T Council seem to be beneficial as learnt from the experience of various states. Hence, States may consider the re-constitution of the governance structure and mechanisms for the Council accordingly.
- Performance related incentive system for State councils may be introduced by the Ministry of Science and Technology, Government of India. An award system for performing state councils may be introduced and suitable recognition packages to be positioned.
- As science and technology sector has been provided an opportunity to showcase technology assets available with public funded institutions with the help of a state S&T Councils which evolved technology partnership concept, the state Councils should initiate a mechanism to create special fund for competitive bidding by states for technology deployment.

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