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Report of the Comptroller and Auditor General of India

for the year ended March 2006

Union Government
Scientific Departments
(Performance Audit)
No. 2 of 2007

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CONTENTS

PREFACE

This report for the year ended March 2006 has been prepared for submission to the President of India under Article 151 of the Constitution.

This Report contains the results of one Performance Audit each pertaining to the Department of Telecommunications under the Ministry of Communications and Information Technology, Indian Council of Medical Research under Ministry of Health & Family Welfare and Department of Scientific and Industrial Research under the Ministry of Science and Technology as shown below:

1.	Performance Audit on Development of Telecommunication Technology by Centre for Development of Telematics and transfer thereof for manufacturing and commercialisation	Department of Telecommunications
2.	Performance Audit on National Institute of Malaria Research	Indian Council of Medical Research
3.	Performance Audit of Modernisation in select laboratories of CSIR	Department of Scientific and Industrial Research

OVERVIEW

This Report contains the results of one Performance Audit each pertaining to the Department of Telecommunications under the Ministry of Communications and Information Technology, Indian Council of Medical Research under Ministry of Health & Family Welfare and Department of Scientific and Industrial Research.

MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGY

Performance Audit on Development of Telecommunications Technology by C-DOT and transfer thereof for manufacturing and commercialisation

The Centre for Development of Telematics (C-DOT) was established in August 1984 with the key objective of building a centre for excellence in the area of telecom technology. Audit observed that the internal revenue generated by C-DOT declined by 78.5 *per cent* i.e. from Rs 33.11 crore in 2000-01 to Rs 7.12 crore in 2005-06. The sharp decline, particularly in generation of revenue by transfer of technology (TOT) and royalty, was 95.7 *per cent* and 96.1 *per cent* respectively. It was noticed that an amount of Rs. 37.66 crore due to be received by C-DOT on account of TOT and royalty from 12 industries was outstanding (December 2006). During the period of audit, it was observed that the attrition rate of manpower, particularly engineers, was significant thus adversely impacting completion of projects. The time overrun observed in completion in respect of 16 projects was ranging from six months to 70 months and cost overrun was between Rs. 0.85 crore to Rs. 22.48 crore in 11 projects. Although C-DOT developed technologies in 15 out of 23 projects, due to its inability to offer technology at competitive rates, TOT and commercialisation was done fully in only three projects. Thus in the absence of notable success of C-DOT in development, transfer and commercialisation of technology, the relevance of C-DOT in today's global competitive scenario needs to be reviewed by DOT.

INDIAN COUNCIL OF MEDICAL RESEARCH

Performance Audit on National Institute of Malaria Research

Malaria is a serious public health problem all over the world. It is a vector borne disease caused by a kind of parasite and transmitted by mosquitoes. In 2005 alone, 13 lakh malaria cases and 646 deaths due to malaria were reported in the country.

The National Institute of Malaria Research (NIMR), Delhi, a constituent unit of Indian Council of Medical Research, is a premier institution for research on malaria. Audit observed that during the period 2001-06, NIMR did not conduct adequate mosquito fauna surveys in the malaria endemic areas to know the prevalence of different mosquito species and to develop cost effective strategies to control malaria. The major objectives of the malaria parasite bank which was established at a cost of Rs. 1.13 crore, were not achieved fully. Project analysis revealed several deficiencies like partial achievement of objectives, non-receipt of feedback information, lack of follow up action, midway closure, non-documentation and non-maintenance of project-wise budget in intramural projects. Audit also observed that the collaboration with state government authorities in the activities of controlling malaria was insufficient. Transfer and commercialisation of technology developed by NIMR was also inadequate. Besides, improper utilisation of scientific manpower, insufficient training and inadequate system of publication of research results were also noticed.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Performance Audit of Modernisation in select laboratories of CSIR

Council of Scientific and Industrial Research (CSIR), New Delhi was established in 1942 to conduct research and development and for continuous improvement of indigenous technologies to substitute imported ones through its 39 constituent Laboratories/Institutes. To improve its infrastructure and enhance the generation of external cash flow (ECF), a modernisation plan for Rs. 250 crore was sanctioned by the government for the Ninth Plan period. Although CSIR incurred a total expenditure of Rs. 262.38 crore on modernisation of its laboratories, it earned a negative incremental ECF of Rs. 15.06 crore against the expected incremental ECF of Rs. 361.09 crore. There was a shortfall of 43 and 45 *per cent* in achievement of targets for

publication of research papers and filing of patents respectively. The equipment purchased by the laboratories/institutes of CSIR under modernisation programme were mismanaged. There were cases of non installation (four equipment valuing Rs. 0.57 crore in three laboratories), delay in installation for the period ranging between one year to more than three years (25 equipment costing Rs. 8.41 crore in eleven laboratories), non repair (eight equipment valuing Rs. 1.47 crore in five laboratories) and non utilisation/under utilisation (14 equipment costing Rs. 7.38 crore in eight laboratories). Further, there was no effective mechanism to monitor the implementation of the programme and achievement of the targets. Thus, CSIR failed to implement the modernisation programme efficiently.

MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGY

DEPARTMENT OF TELECOMMUNICATIONS

Performance Audit on Development of Telecommunication Technology by Centre for Development of Telematics and transfer thereof for manufacturing and commercialisation

CHAPTER-1
MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGY

Department of Telecommunications

Centre for Development of Telematics (C-DOT)

Performance Audit on Development of Telecommunication Technology by C-DOT and transfer thereof for manufacturing and commercialisation

Highlights

- **Non-adherence of original project implementation plan was observed in 18 projects out of 23 projects selected. This had resulted in time overrun ranging from 6 months to 70 months in 16 projects and cost overrun ranging from Rs. 0.85 crore to Rs. 22.48 crore in 11 projects.**
  (Paragraph 1.6.3)

- **Out of 23 projects, technology was developed only in 11 projects. While it was partially developed in four projects (Rs. 55.17 crore), technology was not developed in five projects (Rs. 34.69 crore).**
  (Paragraph 1.6.4)

- **Of the technologies developed under 15 projects (including partially developed in four projects), technologies could be transferred and commercialised fully only in three projects.**
  (Paragraph 1.6.5 & 1.6.6)

- **Internal revenue generation of C-DOT has declined by 78.5 *per cent* from Rs. 33.11 crore in 2000-01 to Rs. 7.12 crore in 2005-06. The sharp decline in royalty was by 96.1 *per cent* from 28.65 crore in 2001-02 to Rs. 1.12 crore in 2005-06. Revenue from TOT declined by 95.73 *per cent* from Rs. 3.98 crore in 2000-01 to Rs. 0.17 crore in 2005-06.**
  (Paragraph 1.6.1)

- **An amount of Rs. 37.66 crore was outstanding on account of TOT and royalty as on 31 December 2006 from 12 industries including ITI and BEL. In addition, an amount of Rs. 42.11 crore was not received from BSNL and MTNL under three reimbursement projects.**
  (Paragraph 1.6.1.1)

Summary of Recommendations

- *C-DOT should plan for increase in its internal revenue generation in order to become self-financing.*
- *DOT needs to review the manpower constraint of C-DOT in the context of the future relevance of C-DOT in the fast changing field of telecom technology development.*
- *In the absence of any protective clauses to promote indigenous technologies, C-DOT needs to develop cost effective technologies providing services and features at par with those being offered by other global players.*
- *Projects should be taken up after conducting thorough and focused market survey of demand and supply. C-DOT should actively involve industry while taking up and during implementation of the project.*
- *In the absence of notable success of C-DOT in development, transfer and commercialisation of technology, DOT may review the relevance of C-DOT in today's global competitive scenario.*

1.1 Introduction

The Centre for Development of Telematics (C-DOT) is the Telecom Technology Development Centre of the Government of India. It was established in August 1984 for a period of three years as an autonomous body. In May 1988, C-DOT was made as a permanent society and placed under the Department of Electronics and subsequently placed (June 1989) under the Department of Telecommunications (DOT), Ministry of Communication (now Ministry of Communications and Information Technology).

The key objective was to build a centre for excellence in the area of telecom technology. While the initial mandate of C-DOT in 1984 was to design and develop digital exchanges and facilitate their large scale manufacture by the Indian industry, the development of transmission equipment was also added to its scope of work in 1989. The primary objectives of C-DOT are to:

- Work on telecom technology products and services.
- Provide solutions for current and future requirements of telecommunication and converged networks[1] including those required for rural applications.
- Provide market orientation to R&D activities and sustain C-DOT as a centre of excellence.

[1] Networks which carry data, voice and video services together

- Build partnerships and joint alliances with industry, solution providers, telecom companies and other development organisations to offer cost effective solutions.

The management of C-DOT has a three-tier structure consisting of the Governing Council, Steering Committee and the Project Board. The Governing Council provides policy guidelines and approves the annual budget of C-DOT. The Steering Committee is headed by Chairman (Telecom Commission) and alongwith its members has the role of reviewing and monitoring the performance of C-DOT.

A Project Board is responsible for the implementation of C-DOT's projects and the day-to-day functioning of the Centre. An Executive Director heads the Project Board and all directors of C-DOT constitute its members. The four support Divisions of the Project Board are Project Monitoring & Process Management Division, Technology Development & Technical Support Division, Finance Division and Administration & Purchase Division.

1.2 Scope of audit

The projects implemented by C-DOT during 2000-06 were divided into three categories (completed, dropped and on-going projects) based on the information provided by C-DOT. Out of a total of 46 projects, 23 projects ***(Annexure A)*** were selected for audit scrutiny on the basis of continued relevance and resources deployed. The sample selected was as given below:

TABLE 1

Sl. No.	Particulars	Total number of Projects	Number of projects selected	Selection *per cent* of total projects
1	Projects dropped #	15	8*	53.33
2	Projects completed	21	10^	47.62
3	Projects ongoing	10	5	50.00
	Total	**46**	**23**	**50.00**

 # including one project merged.
**including one project commenced from 1997-98 and dropped in March 2004.*
^ including five projects commenced from 1996-2000 and completed by March 2003

1.3 Audit objectives

The projects implemented by C-DOT were studied to assess whether:

- Projects are completed timely in a cost effective and efficient manner;

- The objectives proposed under each project are achieved;
- The developed technology is transferred for manufacturing; and
- The transferred technology is successfully commercialised.

1.4 Audit Criteria

The following audit criteria were fixed to assess the projects:

- Adherence to procedures for selection and approval of projects;
- Formulation of project proposals after conducting feasibility study and market survey for assessment of demand;
- Implementation of projects as per implementation plan and sanctioned cost;
- Adherence to system of periodic monitoring and preparation of progress reports including completion report; and
- Development and transfer of technologies to industry/user agencies for manufacturing/ commercialisation and generation of revenue.

1.5 Audit methodology

The audit scope, criteria and objectives were discussed with C-DOT in the Entry Conference held on 15 June 2006. 23 projects selected by Audit were analysed in detail during June-September 2006. Findings were communicated to C-DOT for verification of facts and figures and an Exit Conference was held on 24 January 2007. The replies of C-DOT and DOT have been incorporated wherever relevant and necessary.

1.5.1 Acknowledgement

The co-operation of C-DOT during the entry conference, course of audit and exit conference was satisfactory and the same is acknowledged with thanks.

1.6 General audit findings

The general audit findings relating to financial management and manpower management for C-DOT and delay in implementation of projects, non-development, transfer and commercialisation of technology in respect of 23 projects selected by Audit are given below:

1.6.1 Financial Management

C-DOT receives grants mainly from DOT. It generates the major share of its internal revenue from transfer of technology (TOT) and royalty earned by

successful commercialisation of technology developed. The position of year-wise receipt and expenditure for the period 2000-2006 is given below:

(Rupees in crore)

TABLE 2

Year	Receipt			Expenditure		
	Grants from DOT (grants as a % of total expenditure)	Other receipts*	Total receipts	Capital	Revenue	Total
2000-01	110.66 (88.34)	38.81	149.47	26.56	98.70	125.26
2001-02	108.00 (109.95)	52.70	160.70	30.40	67.83	98.23
2002-03	108.80 (111.98)	63.21	172.01	33.65	63.51	97.16
2003-04	47.66 (37.75)	21.67	69.33	57.40	68.86	126.26
2004-05	56.50 (58.73)	33.53	90.03	31.15	65.06	96.21
2005-06	78.98 (76.16)	11.41	90.39	41.36	62.33	103.69

**Other receipts include receipts towards TOT, royalty, field support activities, reimbursement projects, interest on fixed deposit and other miscellaneous income.*

The Tenth Five Year Plan document had envisaged that C-DOT needed to focus more on generating internal resources through consultancy, royalty etc., to reduce its dependence on Government support and become self financing. However, it was seen that the dependence on Government grants continued to be high. During the period from 2000-01 to 2005-06, the Government grant constituted 78.82 *per cent* of the total expenditure of C-DOT.

Year-wise details of internal revenue generated (excluding reimbursement projects and interest on fixed deposits) by the Centre during the last six years are given below:

(Rupees in crore)

TABLE 3

Year	Actual Internal Revenue Generation					Projected Internal Revenue Generation	Shortfall *(in percentage)*
	TOT	Royalty	Field Support Receipts[2]	Other Misc. Income	Total		
2000-01	3.98	22.72	5.30	1.11	33.11	20.00	No shortfall
2001-02	3.16	28.65	6.99	0.67	39.47	35.55	No shortfall
2002-03	1.89	16.73	4.67	2.54	25.84	35.00	26.17
2003-04	1.16	10.13	2.29	3.35	16.93	35.00	51.6
2004-05	1.02	2.23	23.64	3.51	30.40	40.00	24
2005-06	0.17	1.12	3.93	1.90	7.12	40.00	82.2
Total	**11.38**	**81.58**	**46.82**	**13.08**	**152.87**	**205.55**	**25.63**

Source-Figures provided by C-DOT

[2] Field support receipts are inclusive of Technology support receipts and receipts from BSNL, card repair, card tester, SCSI cables, PCB cards and R&D retrofit reimbursements.

Thus, it can be seen from the figures of internal revenue generation that:

- There was a steep decline in revenue generation from Rs. 33.11 crore in 2000-01 to Rs. 7.12 crore in 2005-06 i.e. by 78.5 *per cent*.
- There was a continued shortfall in achievement of revenue generation during the last four years from 2002-03 to 2005-06. The shortfall during 2005-06 was 82 *per cent* i.e. Rs. 32.88 crore.
- Revenue from TOT declined by 95.7 *per cent* from Rs. 3.98 crore in 2000-01 to Rs. 0.17 crore in 2005-06.
- Royalty registered a sharp decline of 96.1 *per cent* during the period.

In January 2007, DOT and C-DOT stated that the income under TOT/royalty had come down mainly on account of paradigm shift in the telecom market from fixed line based products to mobile. Further, if the internal income is accounted for on accrual basis, the total revenue for the period 2000-06 would be close to Rs. 230.09 crore, as against the projected internal revenue generation of Rs. 205.55 crore, besides receipts of dues from other software intensive projects and field support receipts. Further, Memorandum of Understandings (MoUs) for the services rendered by C-DOT at Bharat Sanchar Nigam Limited (BSNL) sites for 2004-05 and 2005-06 were being finalised. In December 2006, BSNL released an ad hoc payment of Rs. 7.50 crore for each of the financial years of 2004-05 & 2005-06. If the above is taken into account, the total internal revenue of C-DOT during the period 2000-06 is expected to be around Rs. 280 crore.

The reply is not tenable in view of the fact that C-DOT has not been following the accrual policy uniformly for accounting of TOT/royalty receipts. Even if the receipt for internal revenue generation is accounted for on accrual basis, the actual internal revenue accrued during 2000-06 would have been Rs. 167.34 crore after excluding TOT/royalty pertaining to the years prior to 2000-01 (but received during 2000-06). Further, C-DOT should have finalised the MoUs with BSNL to recover its dues in time.

1.6.1.1 Outstanding dues

C-DOT had transferred technologies to various industries and also provided field and operational support to BSNL and Mahanagar Telephone Nigam Limited (MTNL) on payment basis. An amount of Rs. 37.66 crore was outstanding on account of TOT and royalty as on 31 December 2006 from 12 industries including Indian Telephone Industry (ITI) and Bharat Electronics Limited (BEL) for the last two to five years. In addition, an amount of

Rs. 42.11 crore was not received from BSNL and MTNL under three reimbursement projects.

In January 2007, DOT and C-DOT stated that (i) in adjustment of pending dues of Rs. 22.80 crore from M/s ITI, C-DOT has taken over land & building belonging to M/s ITI at Bangalore since August 2005. The Centre is awaiting valuation of the same. Once the value is ascertained by the competent authority, the dues could be formally adjusted in the books of account, (ii) C-DOT had been in regular correspondence with other licensees/ Public Sector Organisations, and (iii) on C-DOT's claim for Rs. 31.55 crore (IMPCS project) BSNL has constituted a committee to look into the pending payments.

However, as of January 2007, the dues outstanding to C-DOT are Rs. 79.77 crore.

Recommendations

- *C-DOT should plan for increase in its internal revenue generation in order to become self-financing.*
- *C-DOT should make efforts to recover the outstanding dues. MoUs with user organisations should be signed timely and a penalty clause should be incorporated therein for non-payment of dues on time.*

1.6.2 Manpower Management

The position of sanctioned manpower and persons-in-position as on 1st April for the period 2000-01 to 2005-06 is given below:

TABLE 4

Year (Position as on 1st April)	Sanctioned Manpower				Person-in-position				Vacancy
	Engineers	Technical	Administrative	Total	Engineers	Technical	Administrative	Total	
2000-01	1360	450	230	**2040**	903	279	130	**1312**	**728**
2001-02	1360	450	230	**2040**	732	323	123	**1178**	**862**
2002-03	829	334	131	**1294**	744	336	125	**1205**	**89**
2003-04	866	309	129	**1304**	843	308	124	**1275**	**29**
2004-05	765	282	129	**1176**	763	282	118	**1163**	**13**
2005-06	765	282	129	**1176**	571	243	118	**932**	**244**

Both sanctioned manpower and persons-in-position declined drastically during the last six years. Out of 23 selected projects, it was noticed that in 21 projects,

C-DOT could not deploy the planned manpower due to shortage. Further, a large number of employees (ranging from 94 i.e. 7.37 *per cent* to 286 i.e. 21.80 *per cent* each year), particularly engineers, involved in the project had left C-DOT during critical phases of implementation of the project, which hampered the project work and led to delays.

In October 2003, C-DOT submitted a 'White Paper' on 'Strategies for Managing Employee Turnover' to its Steering Committee including possible steps to be taken by it for managing the employee turnover. However, it was observed that despite the remedial steps, there has been a significant outflux of personnel (particularly engineers) during the period 2004 to 2006. The following reasons were given by DOT for manpower leaving C-DOT:

(i) Monetary/financial reasons: Salary and perks in C-DOT are perceived to be lower in comparison to other competitor organisations in the industry within the country.

(ii) Employees' inclination towards pursuing higher studies and desire for opportunities to work abroad for international exposure and career opportunities enhancement.

In the absence of an effective plan to retain talent, the completion and development of projects/technology continues to be adversely affected.

Recommendation
DOT needs to review the manpower constraint in the context of the future relevance of C-DOT in the fast changing field of telecom technology development.

1.6.3 Delay in implementation of projects

Out of 23 projects examined in audit, in 16 projects the original target dates for each activity of the project were not adhered to and these were revised subsequently ***(Annexure A).*** This resulted in time overrun ranging from 6 months to 70 months as detailed below:

TABLE 5

Time overrun	Number of projects
Six months – one year	3
One to two years	6
Two to three years	3
More than three years	4
Total	**16**

The original sanctioned cost of 23 projects was Rs. 385.67 crore, which was revised to Rs. 554.92 crore. Against this, C-DOT had incurred an expenditure of Rs. 356.17 crore upto March 2006. The cost overrun ranged from Rs. 0.85 crore to Rs. 22.48 crore in 11 projects ***(Annexure A)***. The percentage of cost overrun is detailed in the table below:

TABLE 6

***Percentage* cost overrun**	**Number of projects**
Nil	12
Upto 50 *per cent*	4
Between 51 to 100 *per cent*	2
Between 101 to 300 *per cent*	3
Between 501 to 1200 *per cent*	2
Total	**23**

While accepting the facts, DOT stated in January 2007 the following reasons for time overrun and cost overrun:

- Change in the scope of the research projects during the development cycle and/or for field requirements,
- Initial estimates, especially those for timeframes involve some amount of uncertainty of work and hence prone to errors, and
- Attrition of experienced manpower in key positions.

DOT further stated that C-DOT has taken certain measures to narrow the gap between projected and the actual delivery. Positive results are expected from these measures during the Eleventh Five Year plan period.

However, the fact remains that C-DOT did not adhere to its original implementation plans in terms of time and cost which resulted in inordinate delays and huge cost overruns. The impact of delay in implementation was obsolescence of technology, availability of cheaper alternatives in the market leading to reduction in market demand and revision of scope.

Recommendation

C-DOT should ensure that the scope and implementation plan of projects should be framed after due consideration and milestones should be set for each project to ensure timely completion.

1.6.4 Non-development of technology

The objectives for development of envisaged technology/product are specified in all the projects undertaken by C-DOT. On examination of 23 projects selected by Audit, it was observed that:

- Technology was not developed in five projects despite incurring an expenditure of Rs. 34.69 crore as four of these projects were dropped and one merged.
- Technology was developed in 11 projects (including project 'Operation Support System', which is ongoing to provide required enhancements). However, in one project (expenditure of Rs. 19.05 crore) inordinate delay led to loss of relevance and obsolescence of the technology developed.
- Technology was partially developed in four projects (expenditure of Rs. 55.17 crore) including the project 'IN enhancements & IN Based Services' where certain deliverables were already developed although the project was still ongoing to provide new services as per the emerging market requirements.
- The remaining three projects were still under implementation.

Details are given in ***Annexure B.***

1.6.5 Non-transfer of technology

Out of 23 selected projects, technology was developed in 15 projects (including partially developed in four projects). Of these, TOT was done in three cases, partially done in five cases and not yet done in six cases. In the remaining one case, signing of TOT agreement was under process ***(Annexure B)***. Thus, C-DOT was not successful in transferring technologies to the end users.

Regarding non-transfer of developed technology, DOT stated in January 2007 that:

- The L_1 scenario of the present day tenders does not foster indigenous manufacturing,
- Certain restrictive clauses in the tender, regarding provenness of technologies to be deployed, discourage the prospective indigenous manufacturers to enter into TOT agreements for C-DOT technologies, and
- C-DOT had taken certain steps to address the above issues.

The Tenth Plan document had envisaged C-DOT to make efforts for development of cost effective technologies providing services and features at par with those being offered by other global players. However, the reply of DOT on the L_1 scenario not fostering indigenous manufacturing is a tacit acceptance of C-DOT's inability to be competitive in the market.

1.6.6 Non-commercialisation of transferred technology

Out of 23 selected projects, technology was transferred in eight projects. Of these transferred technologies, in three cases, manufacturing/ commercialisation was started and in two cases, commercialisation was done partially ***(Annexure B)***.

Regarding non-commercialisation of transferred technology, DOT stated in January 2007, that certain technology developments, though completed and successfully transferred to the manufacturers, were not being commercialised due to the restrictive clauses in the tender regarding the provenness of the technology to be manufactured.

The reply is not tenable as C-DOT should have made efforts for development of cost effective technologies providing services and features at par with those being offered by other global players as envisaged in the Tenth Plan document. In the absence of significant success of C-DOT in commercialisation of technology, the very purpose of development and transfer of technology is defeated.

Recommendation

In the absence of notable success of C-DOT in development, transfer and commercialisation of technology, DOT may review the relevance of C-DOT in today's global competitive scenario.

1.6.7 Inadequate documentation of projects

There was no prescribed proforma for submission of Project Completion Reports. In six out of ten completed projects, C-DOT submitted the extract from its Annual Plan and Budget instead of a Project Completion Report. Although there was an approved format for projects discontinued midway, no such report had been prepared in respect of the seven discontinued projects. DOT stated in January 2007 that in future, efforts would be made to submit Project Completion Report in a certain prescribed format as suggested by Audit.

1.7 Detailed audit findings: Project Analysis

The 23 projects selected by Audit were examined and significant findings in respect of seven projects are discussed below:

1.7.1 Fibre Access System

In 1994, C-DOT undertook a project "Fibre Access System" (FAS) to develop fully optical fibre access networks. The prime motivation of FAS was the proven cost effectiveness over traditional copper and DLC (digital loop carrier) access and the future-proof nature of investment in fibre. While initiating the project, C-DOT estimated that during 1995-2000, India would have a vast growth in the network of about 3 to 4 crore lines from a present seventy lakh (September 1993). To exploit the advantages of fibre and cost-effectiveness of Fibre in the loop (FITL) systems, most of the access lines would use FITL systems. As the market of FAS was directly linked with the rapid expansion of the telecom network, a good and growing market would absorb these systems (FAS). In addition to improved performance, wide coverage, rapid provisioning for widespread subscribers, long repeater span, single ended maintenance and universal interface were other potential benefits of FITL equipment.

The project cost was Rs. 2.67 crore and the project was to be completed (including initiating TOT) by January 1998. The objectives of the project were to design and develop FITL equipment for telephony service, which should be upgradeable for digital TV and broadcast services and distribution.

The audit findings with regard to this project are given below:

(i) The project was completed only in March 2003 with a time overrun of five years and two months. The sanctioned cost was revised five times and it escalated from Rs. 2.67 crore in 1994-95 to Rs. 17 crore in 2001-02. The total expenditure finally incurred on the project was Rs. 19.05 crore resulting in an overall cost overrun of Rs. 16.39 crore, i.e 614.84 *per cent*.

(ii) By March 2003, the technology was developed and its internal validation was in progress. However, it was observed that neither internal validation of the FAS was completed nor was it offered to Telecommunication Engineering Centre (TEC) for obtaining Technological Approval Certificate till January 2007.

(iii) Inspite of the estimated good and growing market of FITL as assessed by C-DOT while initiating FAS, the technology developed under the FAS

project was neither transferred nor commercialised. In October 2003, C-DOT reported to its Steering Committee that FAS had not found applications in Indian network and also in the global network as anticipated earlier mainly due to other broadband alternatives and need of mobility in subscriber access part. Hence, as FAS has lost its relevance due to its narrow band set and availability of parallel technologies in the market, the technology developed under FAS has not been transferred.

C-DOT stated (August 2006) the following reasons for the delay in implementation of project:

(a) Under-estimation of the magnitude of the project and amount of time required;

(b) Lack of clear-cut specifications;

(c) Non-availability of sufficient experienced manpower;

(d) Coordinating Engineers left the project at its critical stage;

(e) Non-availability of some important components from outside vendors and expertise;

(f) Non-improvement of the architecture envisaged since 1994-95; and

(g) Lack of thorough review process especially in software.

Thus, the technology developed under FAS could not be utilised. Lack of proper planning and adequate monitoring including midcourse correction resulted in:

- Time overrun for more than five years.
- Cost overrun of Rs. 16.39 crore; and
- Obsolescence and loss of relevance of technology developed due to several other parallel technologies already being there in the market.

While accepting the facts, C-DOT intimated in January 2007 that parallel technologies viz. Asymmetrical / High Speed Digital Subscriber Loop – copper-enhancement basic technology and Enhanced Data rates for GSM Evolution / CDMA wireless technology for narrow band access arrived in the market in 2000. DOT stated that inspite of it taking long time to develop FAS technology, it did not miss the market as no other vendor could also find its application in the market. Even as on date, fibre access from any source has not found significant place in the BSNL network.

However, the fact remained that by the time C-DOT developed the FAS technology, it was no more relevant as there were several other cheaper

alternatives in the market. Therefore, finding a place in the market for FAS by the time it was developed did not have any meaning. Thus, the expenditure of Rs. 19.05 crore incurred on this project by C-DOT did not yield the desired results.

1.7.2 Radio Access Network based on WCDMA for IMT 2000

During 1997-98, C-DOT initiated a project entitled "CDMA Technology Development". The original objectives of the project were to develop CDMA access technology with a view to utilise the same for Wireless Local Loop/Wireless LAN products. In 2001-02, the objectives were revised to develop CDMA access technology for Broadband Wireless International Mobile Telecommunication (IMT)-2000[3]. The project was renamed (2002-03) as Radio Access Network (RAN[4]) based on WCDMA for IMT 2000 and included under the scheme Second & Third Generation Mobile Communication in 2003-04.

As per the original project plan, the project was to be completed by May 1998. However, the project was discontinued after March 2004. The original sanctioned cost of the project was Rs. 1.92 crore.

The audit findings with regard to this project are given below:

(i) The objectives and targets of the project were revised several times and C-DOT could not adhere to the targeted time schedule resulting in considerable delay (five years and ten months). The cost of the project was revised thrice from Rs. 1.92 crore to Rs. 37 crore between 1997-98 and 2002-03.

(ii) The project was discontinued after March 2004 after incurring an expenditure of Rs. 23.22 crore. The reasons cited for closure of the project were:

- The system dimension for 3G-RAN decided by C-DOT (due to several limitations) was not enough to cater to the competitive market requirements. Even if C-DOT came out with a solution in the year 2006, there might not be any market relevance.

[3] IMT-2000 is an initiative of the International Telecommunication Union popularly known as third generation (3G) mobile systems. 3G networks provide access to a wide range of telecommunications services supported by the fixed telecommunication networks and to other services which are specific to mobile users.

[4] RAN is a transmission system in the 3G network. The RAN comprises of two elements namely, Node-B which connect mobile station (user) to the 3G network and the Radio Network Controller for the management of Node-B terminal.

- The spectrum for 3G operations was not clear and the spectrum regulatory body's intention as well as the operators' intention was not known.
- C-DOT was not working on GSM, which was required under 3GPP standards (release 6).
- The 3G handsets and the multi-standard handsets were quite highly priced with respect to their GSM and CDMA counterparts, which may be a hindrance for their mass acceptance.
- There was a lot of pressure from the funding agencies as well as Finance Ministry to develop a solution for rural mobile application that would be able to cater for Voice, Tele-medicine, Multimedia, e-Governance, Distance education and other socially beneficial programmes for the vast rural masses of India. The basic voice service with SMS and mobility with a standard handset and C-DOT RAX[5] had to be proven within one year.
- Overlay on the existing GSM and CDMA infrastructure as well as utilisation of the massive installed base of RAX will be commercially more viable rather than deploying fresh 3G infrastructure.

Hence, C-DOT decided to discontinue the project and switch over to 4G and Rural Wireless projects, so that no further time would be lost in entering the new markets along with other competitors.

Thus, it is clear that:

- The project was taken up without ascertaining the actual requirement of the technology/ product in the country.
- C-DOT could not foresee the required system dimension and scope of the project; and
- As a result, the project was discontinued midway resulting in an unfruitful expenditure of Rs. 23.22 crore.

In January 2007, DOT replied that at the time of project conception, ITU-Telecom was developing new standards for the next generation of wireless access systems under IMT 2000 program for 3G network and therefore, the efforts in initial years of the project had been towards studying and understanding the basic CDMA standards. The development activity was started only in 2000-01. Further, since the project commencement timing was almost in parallel to choice of standards being evolved, the project outlays had

[5] Rural Automatic Exchange

to increase progressively. DOT also stated that this discontinuation may be viewed as shifting the emphasis of technology development towards priority sectors like rural areas requiring a cost-effective mobile technology.

The reply was not tenable as at the time of initiation of the project, C-DOT should have made realistic time and cost estimates taking into account the fact that the required standards were still evolving. Moreover, C-DOT undertook the Second and Third Generation Mobile Communication scheme keeping in alignment with the shift to mobile technology. However C-DOT could not foresee the sluggish demand of 3G technology and the scheme had to be foreclosed within one year of its initiation.

The fact remains that the RAN project was discontinued after seven years and after incurring 62.76 *per cent* of the sanctioned cost.

1.7.3 Wireless Access System

Subsequent to closure of Second and Third Generation Mobile Communication Scheme and due to pressure from the funding agencies, C-DOT initiated a project entitled "Wireless Access System (WAS)" during 2004-05. The objective of the project was to develop a cost effective "Rural Wireless Solution (RWS)" for improving rural tele-density, providing broadband services and facilitating mobility services for the rural subscribers at affordable prices. The application was to be for tele-medicine, disaster management, educational and vocational courses and setting up internet kiosks for rural masses. This project was taken up since the traditional high capacity large-scale wireless networks were not cost effective in remote and low-density areas. The total sanctioned cost of the project was Rs. 19 crore. As per the original project plan, the project was to be conducted in two phases over 18 months:

- In the first phase (10 months) RWS was to be developed with the help of outsourced components and sub-systems.
- In the second phase (additional eight months), the outsourced components/ sub-systems had to be replaced with their indigenous equivalents to gain the low cost advantage of an in-house design.

During 2006-07, the objective was revised to develop a Software Defined Radio (SDR)[6] based mobile wireless and cognitive radio based broadband

[6] A software defined radio system is a radio communication system, which can tune to any frequency band and receive any modulation across a large frequency spectrum by means of a programmable hardware, controlled by software.

(fixed) wireless access with specific focus on rural applications. In this regard C-DOT had signed MoU/ agreements with strategic partners for procurement of components. During 2006-07, the sanctioned cost was revised from Rs. 19 crore to Rs. 25 crore. C-DOT had incurred an expenditure of Rs. 15.58 crore on the project till 31 March 2006.

The audit findings with regard to this project are given below:

(i) The goals of this project (WAS) were to be set by BSNL's rural planning cell. However, no record of any communication between C-DOT and BSNL was available. Moreover, it was envisaged that the funding agency for this program would be USO (Universal Services Obligation) Fund, an attached office of the DOT, Ministry of Communications & Information Technology. However, no evidence of C-DOT having provided such proposal to USO was available on record.

(ii) As per the original (2004-05) targeted implementation plan, the project was to be implemented by the fourth quarter of 2004-05. However, C-DOT could not adhere to these targets and these were postponed twice during 2005-06 and 2006-07. In April 2006, the equipment procured had been moved to Vallalkundam, Salem in Tamil Nadu. However, since C-DOT did not have necessary approval of statutory/ government authorities for conducting trials in the desired frequency band, the pilot trials could not take place till date (January 2007). In July 2006, C-DOT applied to Wireless Planning Commission (WPC) for experimental wireless licence but the same was still awaited as of January 2007.

Thus, due to the delay in implementation of the scheme by more than one and half years, C-DOT is yet to fulfill its primary objective of providing affordable mobile and internet services to the rural masses. As the project was still ongoing, the impact of this delay towards loss of market share/ obsolescence of technology could not be ascertained.

In January 2007, DOT stated that C-DOT has sought special permission from WPC for conducting trials in a band, which is presently occupied by Indian Space Research Organisation (ISRO) in India. C-DOT is in discussions with WPC and ISRO for permission to conduct trials, which is a tedious process.

The reply is not tenable as C-DOT applied to WPC for experimental wireless licence only in July 2006 although it had originally planned for pilot trial (GSM and Broadband System) in March 2005. The delay in pilot trials could have been avoided if C-DOT had anticipated and taken prior approval from

the statutory/ Government authorities. Moreover this project was taken up on a priority basis after discontinuation of 3G scheme as discussed above in paragraph 1.7.2.

1.7. 4 Asynchronous Transfer Mode[7]

By mid 1990s, Asynchronous Transfer Mode (ATM) was an emerging technology, which was recommended by International Telecommunications Union for setting up a very high-speed broadband integrated services digital network (B-ISDN). Having assessed the promise of ATM, C-DOT decided to develop a new generation of switching systems based on packet technology as an upgrade for its ageing circuit switched solutions. The replacement market alone amounted to more than 50 lakh lines of equipment.

Accordingly, C-DOT sanctioned a project 'ATM' in 1996-97 with the objectives of developing an ATM based Broadband Integrated Digital Switching Platform. The project was to be implemented during 1996-2000 in four phases. In 1998-99, all the four phases were merged and the project was to serve as the first roadmap. The deliverables were ATM Switch (CAX 16 technology with 2.5 Gbps i.e. Giga bytes per second), frame relay and network management. After completion of first roadmap by end of year 2000, the second roadmap was estimated (2000-01) to develop CAX 32 technology (starting with 5Gbps, 40 Gbps and expandable upto 160 Gbps) by 2003. The sanctioned cost for the two roadmaps was Rs. 65 crore.

The audit findings with regard to this project are given below:

(i) The original sanctioned cost of project for the first roadmap was Rs. 35 crore and was revised to Rs. 65 crore for both roadmaps. The first roadmap was completed by end of year 2000 with an expenditure of Rs. 33.79 crore against the sanctioned cost of Rs. 35 crore. The second roadmap was also completed by the end of year 2003 with an expenditure of Rs. 33.21 crore against the sanctioned cost of Rs. 30 crore (second revised cost). As such, there was a cost overrun of Rs. 2 crore (3.07 *per cent*) under both roadmaps of the project.

(ii) By March 2003, C-DOT completed the development of 2.5 Gbps ATM switch and Multiplexers (first roadmap), which were installed for field

[7] ATM is a high-bandwidth switching and multiplexing technology that combines the benefits of circuit switching (ensuring minimum transmission delay and guaranteed bandwidth) with the benefits of packet switching (providing flexibility and efficiency in handling intermittent traffic).

trials at five cites (Delhi, Bangalore, Mumbai, Kolkata and Chennai) as part of the national broadband network. TEC validation of the product was completed and service trials were in progress. The CAX 32 (second roadmap) was architecturally designed in such a way that the first delivery was made for 5 Gbps switch that is scalable upto 40 Gbps in multi-module configuration. However, integration work of ATM Switch for 40 Gbps of CAX 32 technology expandable upto 160 Gbps was left midway due to reduced demand for high capacity ATM switches.

(iii) The products (ATM core switch with 2.5 Gbps and Multiplexers) were not transferred for civil telecom networks as envisaged, though the market for replacing traditional PSTN alone amounted to more than 50 lakh lines of equipment. It was utilised only for defence application, after customisation of developed ATM technology. In October 2003, C-DOT reported to its Steering Committee that the product developed under ATM project had not found commercial success in the telecommunication networks of BSNL and MTNL etc. for which the project was originally conceived because of availability of cheaper alternative technologies to ATM. By the time C-DOT came out with the ATM, it had a promise only in the defence market and not in the civil telecom networks.

(iv) To transfer the developed ATM technology to the defence sector, C-DOT signed two agreements with Bharat Electronics Limited (BEL) in July 2001 and March 2002. Accordingly, C-DOT undertook two new projects for ATM customisation in the defence and naval telecom network and incurred an expenditure of Rs. 7.63 crore (2003-05) and Rs. 2.20 crore (2005-06) respectively. C-DOT received Rs. 1 crore as first and second installment of TOT fee (till July 2006) under both the agreements and subsequent installments (Rs. 3.75 crore) were still pending as the minimum required numbers of system were yet to be manufactured by BEL. The product developed still remains to be fully commercialised.

Since its initiation of the project in 1996-97, there was lack of proper planning, assessment of the market demand, and timely and effective monitoring. As a result:

- Integration work of ATM switch for 40 Gbps and expandable upto 160 Gbps of CAX 32, which was one of the key deliverables, was discontinued midway due to reduced demand.

- The 2.5 Gbps ATM switch could not be utilised for civil telecom networks as envisaged due to availability of cheaper alternatives in the market.
- The technology could be transferred only partially for defence applications, that too after customisation at an additional expenditure of Rs. 9.83 crore.
- The cost overrun involved was Rs. 2 crore (3.07 *per cent*).

DOT stated in January 2007 that during the course of development, the fast changes in internet technology led to cheaper alternatives to ATM and the ATM market share declined.

However, the fact remained that C-DOT took seven years to develop the ATM technology. Moreover, it could not assess the market scenario during the course of project implementation, thus, resulting in only partial commercialisation of its product.

1.7.5 Single Base Module Exchange[8] catering up to 4000 subscribers

During 1998-99, C-DOT initiated the Single Base Module Exchange (SBM) 4K project by merging two of its ongoing projects (i) '256 Port Terminal Unit' since 1994-95 and (ii) 'Compact Digital Trunk BM' since 1997-98. SBM-4K project was primarily for enhancing the connectivity and performance of existing SBM- XL (which could cater up to 2000 subscribers) to cater to 4000 subscribers. It also addressed the obsolescence of some components and reduced the floor space of the existing MAX switches by 50 *per cent* with enhanced processing capacity.

The original sanctioned cost of Rs. 10.50 crore of the above two projects and their expenditure of Rs. 5.69 crore for the year 1997-98 were also merged with the new project. The project was due to be completed (including commencement of validation of technology) by March 1999. The estimated demand of the SBM-4K technology was quite high as C-DOT's existing technology was deployed in 21.72 lakh lines as on March 1998, which could be upgraded to SBM-4K.

The audit findings with regard to this project are given below:

[8]A Single Base Module is a stand-alone exchange that can be deployed for rural local switch applications to service a number of subscribers.

(i) The project was completed only in March 2003 with a time overrun of four years. The cost of the project was revised to Rs. 20 crore in 1998-99 and Rs. 25 crore in 2001-2002. Total expenditure incurred was Rs. 22.51 crore involving a cost overrun of Rs. 12.01 crore (114.38 *per cent*) including cost of two merged projects.

(ii) The development of the technology under the project was completed and it was internally validated. TEC testing of the technology in the laboratory was started from July 2002 for different phases and successfully completed in the field between March 2003 and January 2004.

(iii) Prior to TEC testing of the technology, C-DOT signed (between December 2001 and February 2002) separate agreements with 12 industries (manufacturers) for transfer/manufacture of the developed technology. As per agreements, C-DOT received first installment of know-how fee of Rs. 1.85 crore on signing of agreement. However, the second installment of know-how fee of Rs. 1.85 crore which was due between December 2002 and February 2003 from all the industries is still outstanding. As there was no production/ sales, royalty at the rate of four *per cent* on net sales was also not received till January 2007.

Though the technology was developed at a cost of Rs. 22.51 crore and transferred to 12 industries, it could not be manufactured /commercialised in the wake of reduced demand of fixed landline switches. No royalty could be generated as a result of non-commercialisation of the product.

In reply, C-DOT stated in October 2006 that SBM-4K technology required up-gradation of both existing hardware and software. Hardware upgradation required capital expenditure for which the operator (BSNL) had not yet taken a decision. Further, due to reduced requirement of landline switches in BSNL network, the SBM 4K technology could not be proliferated in the field.

While accepting the facts, DOT stated in January 2007 that the estimated demand of the SBM-4K technology was quite high at the stage of commencement as C-DOT's existing technology was deployed in 49.89 lakh lines (includes MAX- L / XL and SBM - RAX). However, the shift of focus from fixed lines to mobile lines was unprecedented.

The reply needs to be viewed in light of the fact that the product development was delayed by four years by which time the market demand had reduced due to shift to mobile technology.

Recommendation

Projects should be taken up after conducting thorough and focused market survey of demand and supply. C-DOT should actively involve industry while taking up and during implementation of the project.

1.7.6 C-DOT 32 Channel Dense Wavelength Division Multiplexing System

During 2000-01, C-DOT initiated a project "Wavelength Division Multiplexing (WDM)" to provide a solution to increase the transmission capacity of transport networks. With Dense Wavelength Division Multiplexing (DWDM) technology, multiple data signals using different wavelengths of light could be transmitted through a single fibre increasing the total data rate on one fibre to one terabit (10^{12} bits) per second.

The original sanctioned cost of the project was Rs. 10 crore and the project was to be completed (including offer for validation) by February 2002. The objective of the project was to develop DWDM equipment that would transport simultaneously 32 wavelengths (channel) each carrying data up to 2.5 Gbps rate on single fibre to provide a throughput of 80 Gbps on the fibre.

In January 2005, the system had been offered to TEC and in July 2006, TEC issued Technology Approval Certificate to C-DOT for CDWDM 3200.

The audit findings with regard to this project are given below:

(i) The system was offered to TEC for validation in January 2005 against the targeted date of February 2002 after a delay of about three years. In October 2006, C-DOT replied that the original objectives were enhanced and after considering this, the actual delay in execution of the project was around six months.

The sanctioned cost of the project was revised to Rs. 15.70 crore during 2003-04 due to enhancement of its scope. Till completion of the project in March 2005, C-DOT had incurred an expenditure of Rs. 17.77 crore i.e. Rs. 2.07 crore (13.18 *per cent*) more than the sanctioned cost. The total cost overrun involved was Rs. 7.77 crore, i.e. 77.69 *per cent*.

In March 2006, BSNL proposed to retain the CDWDM 3200 system installed for field trial by C-DOT on its New Delhi – Jaipur route. C-DOT agreed to BSNL's offer of Rs. 2.30 crore (its earlier purchase price) for the equipment although the actual production cost of C-DOT was higher by Rs. 85 lakh at a

cost of Rs. 3.15 crore. Thus, the commercial viability of CDWDM 3200 system developed by C-DOT could not be ascertained due to its higher pricing. In October 2006, C-DOT replied that it was interacting with various vendors to get the prices of critical components reduced for making the system commercially viable. Simultaneously, C-DOT was also trying to replace some of the high-end optical components from alternative vendors by way of testing the same in the laboratory. In January 2007, DOT replied that the cost gets substantially reduced and can be negotiated with component vendors if there is a significant requirement for the finished system in the field.

(ii) In September 2005, C-DOT had accepted BEL's request for TOT for CDWDM 3200. However, the TOT agreement was yet to be signed with BEL. In October 2006, C-DOT replied that BEL's management was actively considering taking up the TOT. As such, successful transfer and commercialisation of CDWDM 3200 system was yet to be made. In January 2007, DOT replied that the restrictive clause in the tender, with respect to provenness of technologies, discourages the prospective indigenous manufacturers to enter into TOT agreements.

In this regard, C-DOT should have made efforts to develop cost effective technologies and associate manufacturing industries for commercialisation of its developed technology. Thus, the DWDM technology developed at a cost of Rs. 17.77 crore was yet to be transferred and successfully commercialised. Also, the economic viability of the technology in the open market was uncertain due to its higher pricing.

Recommendation

In the absence of any protective clauses to promote indigenous technologies, C-DOT needs to develop cost effective technologies providing services and features at par with those being offered by other global players.

1.7.7 Next Generation - Synchronous Transport module 1/ 4[9]

C-DOT had earlier undertaken the following projects and developed CSTM-I[10], which had been field tried successfully.

[9] Synchronous Digital Hierarchy forms the platform for the future transport networks to provide connectivity in the trunk, junction and local networks. NG-STM1/4 is multiplexing equipment based on SDH technology and constitutes a Network Element.

[10] CSTM I was a 155 Mbps Multiplexer (Compact version) for efficient transmission in the access loop as well as in the trunk lines.

(Rupees in crore)

TABLE 7

Sl. No.	Name of the project	Year of start	Year of completion	Total cumulative expenditure
1	SDH Programme	1992-93	2001-02 end	41.36
2	CSTM-1	2002-03	2002-03 end	0.91
3	STM-1 Support	2003-04	Not applicable	3.96

However, for complete TEC approval, compliance to the amendment 3 to Generic Requirement was required which involved re-engineering of the CSTM-1. Hence in continuation of these projects, C-DOT initiated another project entitled Next Generation - Synchronous Transport module 1/4 (NG-STM1/4) during the Revised Estimates (RE) stage of 2003-04.

The original sanctioned cost of the project was Rs. 2.25 crore. The key deliverables under the project were the development of products STM-1 (155.52 Mbps) and STM-4 (622.08 Mbps). During the year 2003-04, the projected demand of BSNL for STM-1 and STM-4 were 2370 and 2172 respectively. Further, in the coming years it was expected that requirements would remain same or decline gradually which would still be a substantial number.

The audit findings with regard to this project are given below:

The project did not progress as per the targeted time schedule resulting in time overrun of nine months in implementation of the project. The project was discontinued from 2005-06 onwards, after completing NG STM-1 part of the project. The system integration, testing and offer for internal validation was not taken up. C-DOT had incurred an expenditure of Rs. 3.10 crore i.e. Rs. 0.85 crore more than the sanctioned cost till 31 March 2005.

In September 2006, C-DOT replied that the technology of CSTM-1 was transferred to three manufacturers. There was no separate TOT for NG-STM1/4. The product had not been deployed till date (September 2006). However, one of the manufacturers (M/s VXL Technologies Limited) had got an educational order from BSNL for Type-1 of the equipment.

Thus, it was seen the STM-4 technology, which was envisaged as one of the deliverables in the project was not required and hence not developed. Though

the STM-1 technology was developed and transferred, it could not be commercialised as stand alone equipment.

In January 2007, DOT stated that although the demand for STM-1 and STM-4 from BSNL existed at the commencement of the project, during the course of development in 2004-05, the STM-4's requirement was considerably reduced due to higher capacity systems like STM-16, DWDM etc. Consequently, the NG-STM 1/4 system with stand alone STM-1 functionality did not appear to be cost effective system for commercialisation.

The reply was not tenable as it illustrates that projections regarding market requirements of STM 1 and 4 made by C-DOT during RE stage of 2003-04 proved off target in the very next year (2004-05).

1.8 In response to the above audit findings, DOT stated in the Exit Conference (January 2007) that C-DOT has adopted a more aggressive approach for commercial exploitation of its technologies in cognizance of challenges arising from the changed telecom scenario in the country, including liberalisation and increased global competition. They further stated that C-DOT is entering into strategic alliances and partnerships with other technology organisations and industries both in the public and private sector and providing technical consultancy to clients. Further, current and near future programmes of C-DOT are of shorter duration (18-24 months) and they being market focused, are expected to generate sufficient internal revenues during the next 2-3 years.

The reply of C-DOT needs to be viewed in the light of the fact that C-DOT has not enjoyed notable success in commercialisation of the technology in the recent past.

1.9 Conclusion

The management of projects was not cost effective and efficient as time and cost overrun were observed in 70 *per cent* of the projects selected by Audit for scrutiny. There was time overrun ranging from 6 months to 70 months and cost overrun ranging from Rs. 0.85 crore to Rs. 22.48 crore. These delays resulted in obsolescence of technology in one project and reduction of market demand in five projects. Further, a continuous attrition of technical manpower adversely impacted the timely completion of projects.

The objectives as envisaged in the projects were not achieved in more than 50 *per cent* of the projects. Eight projects out of the 23 selected by Audit were dropped after incurring an expenditure of Rs. 36.89 crore.

Technology developed could not be transferred in more than 50 *per cent* of projects due to reduction in market demand by the time of development and presence of cheaper alternatives.

Commercialisation of the technology was made fully in 27 *per cent* of the projects due to lack of sufficient response from industries/users and cost ineffectiveness of the developed technology with respect to other global players in the market. As a result, C-DOT failed to generate any royalty from these 23 projects. Thus, C-DOT could not develop cost effective technologies providing services and features, as envisaged in the Tenth Plan document, at par with those being offered by other global players.

The revenue generation by C-DOT has declined significantly from Rs. 33.11 crore in 2000-01 to Rs. 7.12 crore in 2005-06, i.e. by 78.5 *per cent*. The sharp decline in royalty was by 96.1 *per cent* from 28.65 crore in 2001-02 to Rs. 1.12 crore in 2005-06. Although it was envisaged in the Tenth Five Year Plan that C-DOT needed to focus more on generating internal resources through consultancy, royalty etc. to reduce its dependence on Government support, it has still not become self financing.

In the context of the fast changing field of telecom technology development and the presence of global competition, DOT needs to review the future relevance of C-DOT particularly considering its performance with respect to the projects taken up in the recent past.

ANNEXURE- A

(Referred to in para 1.6.3)

Delay in implementation of projects (Time/ cost overrun)

(Rupee in lakh)

Sl. No.	Name of Project	Year of Sanction	Year of closure (dropped/ completion)	Time overrun	Original Sanctioned Cost	Revised Sanctioned Cost	Expenditure up to closure/ 31 March 2006	Cost overrun*	Percentage cost overrun
PROJECTS DROPPED (including one merged)									
1.	Radio Access Network based on WCDMA for IMT 2000 (3G RAN)	1997-98	31 March 2004 (dropped)	Five years and Ten months	192.00	3700.00	2322.09	2130.09	1109.42
2.	Internet Point of Presence	2000-01	31 March 2002 (dropped)	One year and two months	500.00	-	113.32	-	-
3.	Voice Messaging System (VMS) & Unified Messaging System (UMS)	2002-03	31 March 2004 (dropped)	One year	150.00	500.00	91.54	-	-
4.	Multi Protocol Label Switching (MPLS)	2003-04	31 March 2004 (merged with NGN)	No as merged with NGN	700.00	-	114.14	-	-
5.	Fixed SMS	2003-04	31 March 2004 (dropped)	No	600.00	-	91.86	-	-
6.	2G NSS Enhancements, 2.5G & 3G circuit switched NSS	2003-04	31 March 2004 (dropped)	No	10000.00	-	810.13	-	-
7.	2G & 3G Packet Switched NSS (GPRS)	2000-01	31 March 2004 (dropped)	Two years and eleven months	1000.00	-	109.77	-	-

Sl. No.	Name of Project	Year of Sanction	Year of closure (dropped/ completion)	Time overrun	Original Sanctioned Cost	Revised Sanctioned Cost	Expenditure up to closure/ 31 March 2006	Cost overrun*	Percentage cost overrun
8.	NG-STM1/4	2003-04	31 March 2005 (dropped)	Nine months	225.00	-	309.95	84.95	37.76
PROJECTS COMPLETED									
9.	SBM Exchange Catering up to 4K Subscribers	1997-98	2002-03	Four years	1050.00	2500.00	2250.91	1200.91	114.37
10.	ATM	1996-97	2002-03	No	6500.00	6500.00	6699.56	199.56	3.07
11.	Development of Personnel Communication System (PCS)	1998-99	2002-03	Two years and five months	1500.00	4000.00	3747.68	2247.68	149.85
12.	Fibre Access System	1994-95	2002-03	More than five years	266.51	1700.00	1905.13	1638.62	614.84
13.	Intermediate Data Rate-VSAT	2000-01	2002-03	Two year and eight months	1944.00	2540.00	559.74	-	-
14.	C-DOT 32 Channel Dense Wavelength Division Multiplexing System (C-DWDM 3200)	2000-01	2004-05	Six months	1000.00	1570.00	1776.94	776.94	77.69
15.	IMPCS Project	1999-2000	2002-03	One year and five months	4380.00	7127.00	5863.00	1483.00	33.86
16.	ATM Customisation for Defence	2003-04	2004-05	Three months	409.00	1000.00	762.73	-	-
17.	Multi Technology Network Management System (MTNMS)	2003-04	2004-05	No	200.00	-	348.23	148.23	74.12

Sl. No.	Name of Project	Year of Sanction	Year of closure (dropped/ completion)	Time overrun	Original Sanctioned Cost	Revised Sanctioned Cost	Expenditure up to closure/ 31 March 2006	Cost overrun*	Percentage cost overrun
18.	Network Reliability Optimization for AISDN-17 Navy	2005-06	2005-06	Three months	450.00	-	219.62	-	-
PROJECTS ONGOING									
19.	Broad Band Transport Via Satellite (BBTS)	2001-02	Ongoing	Three years and six months	950.00	1400.00	1052.12	102.12	10.75
20.	IN Enhancements & IN based Services	2002-03	Ongoing	One year and eight months	350.00	2050.00	1367.96	1017.96	290.85
21.	Operation Support System (OSS)	2003-04	Ongoing	One year and six months	1800.00	2230.00	1691.27	-	-
22.	Next Generation Network (NGN)	2004-05	Ongoing	One year and six months	2500.00	-	1851.55	-	-
23.	Wireless Access System	2004-05	Ongoing	One year and six months	1900.00	2500.00	1557.79	-	-
				Total	38566.51	55492.00	35617.03	11030.06	

** Cost overrun is worked out by subtracting Original Sanctioned Cost from Progressive expenditure.*

ANNEXURE- B

(Referred to in para 1.6.4)

Status of development of technology, transfer of technology and commercialisation thereof

S. No.	Name of Project	Status of development of technology	Transfer of technology (TOT) status	Present commercialisation status	Remarks
1.	Radio Access Network based on WCDMA for IMT 2000 (3G RAN)	Not developed as dropped	No	No	-
2.	Internet Point of Presence	Not developed as dropped	No	No	-
3.	Voice Messaging System (VMS) & Unified Messaging System (UMS)	Partially developed (UMS not developed)	TOT not done	No	Due to availability of similar products in competitive market, project development closed.
4.	Multi Protocol Label Switching (MPLS)	Not developed as merged with NGN	No	No	-
5.	Fixed SMS	Developed	TOT not done but solution deployed on trial basis in BSNL site at Kolkata	No	AMC for use of solution not yet finalized as BSNL had not shown any interest to replace the required server.
6.	2G NSS Enhancements, 2.5G & 3G circuit switched NSS	Not developed as dropped	No	No	-
7.	2G & 3G Packet Switched NSS (GPRS)	Not developed as dropped	No	No	-

S. No.	Name of Project	Status of development of technology	Transfer of technology (TOT) status	Present commercialisation status	Remarks
8.	NG-STM1/4	Partially developed (NG-STM 4 not developed)	TOT done partially (TOT done for STM 1 and not for STM 4)	Not done	During the course of development, the STM-4's requirement was considerably reduced.
9.	SBM Exchange Catering up to 4K Subscribers	Developed	TOT done	Not done	Not commercialised due to reduced market demand.
10.	ATM	Developed	TOT done partially	Commercialisation started and manufacturing for three ships done	TOT not done for civil applications and TOT done for defence only
11.	Development of Personnel Communication System (PCS)	Partially developed	TOT not done	The technology was partially developed & implemented in the field as IMPCS project.	-
12.	Fibre Access System	Developed	TOT not done	No	Not commercialised due to obsolescence/ non relevance of technology.
13.	Intermediate Data Rate- VSAT	Developed (Modem 8Mbps not developed due to non requirement)	TOT done	Not done	Not commercialised due to restrictive clauses in BSNL's Tender
14.	C-DOT 32 Channel Dense Wavelength Division Multiplexing System (C-DWDM 3200)	Developed	TOT not done	No	Deployed in BSNL's New Delhi – Jaipur route

S. No.	Name of Project	Status of development of technology	Transfer of technology (TOT) status	Present commercialisation status	Remarks
15.	IMPCS Project	Developed	TOT not done	Turn key pilot project completed to launch GSM services for BSNL in 13 cities. However, C-DOT's services were subsequently withdrawn by BSNL within a period of 14 months to 29 months.	-
16.	ATM Customisation for Defence	Developed	TOT done	Commercialisation started and manufacturing for three ships done	-
17.	Multi Technology Network Management System (MTNMS)	Developed	TOT done partially	Commercialisation started	MoU signed in June 2006 for 'C-DOT GNMS solution' and signing of MoU for 'NNMS solution' was under progress.
18.	Network Reliability Optimization for AISDN-17 Navy	Developed	TOT under process	No	TOT agreement yet to be signed
19.	Broad Band Transport Via Satellite (BBTS)	Ongoing	Not applicable as it is an ongoing project	Not applicable as it is an ongoing project	-

S. No.	Name of Project	Status of development of technology	Transfer of technology (TOT) status	Present commercialisation status	Remarks
20.	IN Enhancements & IN based Services	Various deliverables developed. However, the project was ongoing to provide new services as per the emerging market requirements.	TOT partially done	Partially done	Deployed in MTNL Mumbai and Delhi. Also deployed in BSNL network but subsequently withdrawn.
21.	Operation Support System (OSS)	Developed but ongoing to provide required enhancements	TOT partially done	Partially done	Deployed in BSNL site (Bangalore) and MTNL, (Mumbai)
22.	Next Generation Network (NGN)	Ongoing	Not applicable as it is an ongoing project	Not applicable as it is an ongoing project	-
23.	Wireless Access System	Ongoing	Not applicable as it is an ongoing project	Not applicable as it is an ongoing project	-

List of Acronyms

Abbreviations	Explanation
3G	Third Generation
3GPP	Third Generation Partnership Programme
ABP	Annual Business Plan
ATM	Asynchronous Transfer Mode
BBTS	Broadband Transport via Satellite
CAX	C-DOT ATM Switch
CDMA	Code Division Multiple Access
CSTM	Compact Synchronous Transport Module
CWDM / DWDM	Coarse / Dense Wavelength Division Multiplexing
EMI/EMC	Electro Magnetic Interference/ Electro Magnetic Compatibility
FAS	Fibre Access System
FITL	Fibre in-the-local-loop
FSMS	Fixed Short Message Services (SMS)
Gbps	Giga byte per second
GPRS	General Packet Radio System (Related to 3G Program)
GSM	Global for System Mobile
IDR VSAT	Intermediate Data Rate VSAT
IF & RF	Interface & Radio Frequency
IMPCS	India Mobile Personal Communication Services
IMT	International Mobile Telecommunication
IN	Intelligent Network
IPOP	Internet Point of Presence
ITU-T	International Telecommunication Union - Telecom
MAX/ XL	Main Automatic Exchange/Extra large
Mbps	Mega byte per second
MPLS	Multi Protocol Label Switching
NG SDH	Next Generation SDH

Abbreviations	Explanation
NGN	Next Generation Network
NMS	Network Management System
NSS	Network Sub-System (Related to 3G Program)
OSS	Operation Support System
PCS	Personal Communication System
PMT	Project Management Team
PSTN	Public Switching Telephone Network
R&D	Research and Development
RAN	Radio Access Network (based on WCDMA standard for IMT 2000)
SBM-XL	Single Base Module- Extra Large
TEC	Telecommunication Engineering Centre
TOT	Transfer of Technology
VMS / UMS	Voice / Unified Messaging System
VSAT	Very Small Aperture Terminal
WPC	Wireless Planning Coordination

MINISTRY OF HEALTH AND FAMILY WELFARE

INDIAN COUNCIL OF MEDICAL RESEARCH

Performance Audit on National Institute of Malaria Research

CHAPTER-2
INDIAN COUNCIL OF MEDICAL RESEARCH

National Institute of Malaria Research

Highlights

- **NIMR did not conduct Mosquito Fauna Surveys in the malaria endemic areas to know the prevalence of different mosquito species and to develop cost effective strategies to control malaria.**

  (Paragraph 2.6.1)

- **Malaria parasite bank established at a cost of Rs. 1.13 crore from the funding of Department of Bio-technology (DBT) was taken over by NIMR in October 1998 without the approval of Ministry of Health and Family Welfare. The objectives of malaria parasite bank were not fully achieved.**

  (Paragraph 2.6.2)

- **Of the 74 projects with potential for technology development, NIMR developed only two technologies during 2001-02 to 2005-06 and could not transfer any of these two technologies.**

  (Paragraph 2.6.5)

- **Collaboration among NIMR, National Vector Borne Disease Control Programme and State Programme Officer was inadequate.**

  (Paragraph 2.6.3)

- **In extramural projects, there was partial achievement of objectives (four projects), lack of follow up action (three projects) and midway closure (one project).**

  (Paragraph 2.6.4.1 and 2.6.4.2)

- **One third of the 51 scientists of NIMR were not involved in any project for a period ranging from one to five years.**

  (Paragraph 2.6.6)

- **Research project files containing preliminary survey/study progress reports and final reports and comments of monitoring bodies and action taken reports were not maintained for intramural projects.**

  (Paragraph 2.6.4.4)

- **Only 15 training programmes for State government health officials were conducted over a period of five years. No annual action plan for conducting training was prepared.**

  (Paragraph 2.6.8)

Summary of Recommendations

- *The fauna survey needs to be conducted for all areas of malaria incidence and ecological zones in a phased manner.*
- *Activities of Malaria parasite bank needs to be strengthened for effective utilisation of the facility for malaria research.*
- *NIMR should identify the areas where technologies could be transferred and target should be fixed for each field station of NIMR in coordination with appropriate authorities. Efforts should also be made to ensure patenting and commercialisation of the technologies developed.*
- *NIMR should strengthen its activities in the areas where malaria cases were higher in collaboration with State Programme Officers for effective control of malaria in the country.*
- *NIMR should formulate and adopt appropriate procedure for project-wise budgeting of intramural projects for effective financial control and monitoring.*
- *NIMR should undertake appropriate remedial measures to achieve the objectives of the projects fully, fix targets for health assessment and to undertake necessary follow-up action on the conclusion of the projects.*
- *NIMR should document research project files adequately as per available best practices in leading scientific institutions.*
- *There should be logical distribution of research projects to scientists with broad timeline and results peer reviewed before publication.*
- *Proper guidelines for achieving the objective of human resource development and preparation of annual action plan for the training and achievement thereof needs to be prepared.*

2.1 Introduction

Malaria is a serious public health problem all over the world and about 30 to 50 crore cases and 15 to 27 lakh deaths occur annually. Malaria is a vector[1] borne disease caused by a parasite[2] of genus Plasmodium and transmitted by anopheline mosquitoes. There are about 58 species of anopheles mosquitoes of

[1] Insects which transmit disease from one host to another
[2] The organisms which depend on others for food, shelter and survival

which only six are major vectors of malaria in India. The other vector borne diseases in India are dengue, chikungunya[3], filariasis[4] and kala-azar[5].

Malaria Research Centre (MRC), one of the permanent institutes of the Indian Council of Medical Research (ICMR) was established in 1977 and was renamed as National Institute of Malaria Research (NIMR) in November 2005. The primary task of NIMR is to find short term as well as long term solutions and support the National Vector Borne Disease Control Programme (NVBDCP) of the Ministry of Health & Family Welfare (Ministry) for control of malaria through basic, applied and operational field research. This apart, one project namely "Integrated Diseases Vector Control (IDVC) of malaria, filariasis and other vector borne diseases" was assigned to NIMR in 1985 by the Ministry to undertake research on basic aspects of transmission dynamics of malaria, evaluation of new insecticides and support NVBDCP. NIMR has 10 field stations in different states to conduct field operations to control malaria. However the major executing agencies for control of malaria are the State Governments.

NIMR is financed mainly by grants received from the Ministry through ICMR. Further, NIMR receives funds from other government departments and World Health Organisation (WHO) for specific schemes and from the Ministry for implementation of plan scheme namely IDVC through ICMR. NIMR also receives funds for consultancy services and contract research. During 2001-02 to 2005-06, against the revised estimates of Rs. 17.68 crore, Rs. 23.31 crore and Rs. 20.24 crore under plan, non-plan and IDVC plan heads, NIMR spent Rs. 12.02 crore, Rs. 21.92 crore and Rs. 18.98 crore respectively.

In India, malaria ranks at number one among vector borne diseases. The annual number of malaria cases is around 20 lakh for the last 10 years in India. In 2005, there were 13 lakh cases with 646 deaths reported. A study conducted by NIMR during 2004-05 however suggests that the actual number of cases of malaria and deaths is significantly higher than those reported by the State Health departments.

In the Tenth Five Year Plan (2002-2007), NIMR highlighted the primary task of finding short term as well as long term solutions to the problem of malaria through the following objectives:

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[3] dengue and chickungunya are caused by viruses and transmitted by aedes mosquitoes
[4] filariasis is caused by a parasite and transmitted by culex and mansonia species of mosquitoes
[5] kala-azar is caused by *Leishmania donovani* parasite transmitted by sand flies

- Research activities on vector biology and control, genetics, cellular and molecular biology and epidemiology[6];
- Conducting mosquito fauna[7] survey in different zones of India to establish present day bio-diversity;
- Maintaining and utilising malaria parasite bank;
- Undertaking Geographical Information System (GIS) based study at micro level to digitise thematic maps and prediction of malaria using satellite remote sensing;
- Facilitating transfer of technology to state/district health departments and organising malaria control demonstrations in endemic areas; and
- Developing health education material and organising activities like trainings, health camps, exhibitions, audio-visual shows and meetings with the community.

NIMR undertakes intramural projects (i.e. projects/schemes funded by ICMR) and extramural projects (i.e. sponsored by other Government Departments/agencies and International agencies like WHO). NIMR implements one IDVC project having several sub-activities. It also provides consultancy services and executes contract projects. The details of these projects undertaken and completed during the period from 2001-02 to 2005-06 are indicated below:

TABLE 1

Type of project	Projects undertaken	Projects completed	Projects ongoing
Extramural	89	61*	28
Intramural	37	28	9
IDVC sub activities	89	69	20
Total	**215**	**158**	**57**

**** Includes one project of mid-way closure.***

2.2 Scope of Audit

The present performance audit covering the period from 2001-02 to 2005-06 was undertaken to review the outcome of activities of NIMR in the areas of project planning, implementation, monitoring, technology development and transfer, impact assessment and follow up action. The activities of mosquito

[6] The science which deals with transmission dynamics of disease in population
[7] Distribution of animal life in a particular region

fauna surveys, utilisation of malaria parasite bank, imparting trainings, organising health camps, exhibitions and meetings with the community were also reviewed. For the sake of completeness, periods prior to 2001-02 were also covered wherever pertinent and relevant.

Out of 158 completed projects, 46 projects i.e. 24 extramural (11 sponsored projects, seven contract/collaborative projects, six externally aided projects), seven intramural and 15 IDVC sub activities were selected by Audit. Further, eight out of 57 ongoing projects were also selected by audit. These projects were selected on the basis of their monetary value and significance of thrust areas of research and development (R&D) activities.

2.3 Audit Objectives

Performance audit of NIMR was conducted with a view to assess whether:

- NIMR conducted mosquito fauna surveys in the areas of high malaria incidence, malaria outbreaks and in all ecological zones of the country for planning sustainable vector control strategy for effective control of malaria;
- The envisaged objectives of the malaria parasite bank as a national repository were achieved;
- Effective co-ordination existed amongst NIMR, State Health Departments and NVBDCP for formulation of projects and sharing of feedback for further research and development activities;
- Proper system of formulating proposal, approval, progress reporting, monitoring of projects, evaluation/review of research results, proper documentation of research files existed;
- Technologies were developed and transferred;
- Trainings/workshops were organised for raising awareness of malaria;
- Adequate consultancy and collaborative projects were undertaken; and
- System of proper utilisation of scientific manpower in research projects existed.

2.4 Audit Criteria

The following criteria were adopted for assessing the performance of NIMR:

- Basis of selection of sites for mosquito fauna surveys and action plan to cover all high malaria prevalent areas in their surveys in different zones of the country during different seasons;
- Targets and achievements in collection, characterisation and adaptation of samples of malaria parasites from different zones of the country in order to meet the requirements of scientific community;
- Adherence to guidelines in regard to collaboration with State Government authorities and NVBDCP in implementing projects and getting feedback for effective control of malaria;
- Formulation of projects with specific aims and objectives after conducting feasibility study/survey, achievement of objectives, monitoring and evaluation and their documentation;
- Impact assessment of technology development and transfer;
- Achievement of trainings/workshops to be organised with reference to action plan for raising awareness on malaria and malaria control technologies;
- Adherence to procedures for consultancy and contract services; and
- Existence of norms for the number of projects that were to be undertaken by scientists at any one point of time.

2.5 Audit Methodology

The audit plan including the audit objectives and audit criteria was discussed in the Entry Conference held on 6 July 2006 with NIMR/ICMR. Project files, records and minutes of meetings of monitoring bodies were examined and discussions were held with the Director, NIMR and Project Investigators/Scientists concerned. The audit team visited villages/field sites where technologies were transferred by the NIMR's field stations, i.e Bangalore and Haridwar. The audit findings were presented and discussed with NIMR/ICMR in the Exit Conference held on 1 February 2007.

2.5.1 Acknowledgement

The co-operation of NIMR during the entry conference, course of audit and exit conference was satisfactory and the same is acknowledged with thanks.

2.6 Audit Findings

As a result of test check of records, audit observed inadequate mosquito fauna surveys, system deficiencies like non-documentation of project files in

intramural projects and IDVC projects and non-adherence of procedure in contract projects. Audit also observed partial achievement of objectives in sponsored projects including malaria parasite bank, externally aided projects, non-receipt of feedback information, lack of follow up action, besides midway closure. This apart, inadequate technology transfer and non-commercialisation of technology, improper utilisation of scientific manpower, inadequate system of publication of research results and organising of trainings were also noticed. These are all discussed in detail under appropriate topics of the succeeding paragraphs.

2.6.1 Inadequate Mosquito Fauna Surveys

One of the objectives of NIMR was to maintain parasite and vector repositories as a national facility for conducting research to control malaria in the country. In this context, mosquito fauna survey (survey) was essential to identify the prevalence of different mosquito species, especially vectors, in various parts of the country and during different seasons. The criteria used by NIMR for selection for surveys and collection of isolates[8] were the areas where malaria outbreaks had occurred and areas of high malaria endemicity. 450 malarial districts were identified by NIMR with varying prevalence of malaria in the country. The research activities for NIMR approved by the Ministry under the Tenth Plan (2002-07) provided for collection of isolates from 20 districts in the country located in four ecological zones.

Audit observed that States of Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Gujarat, Tamil Nadu, Rajasthan, Orissa, Chhattisgarh and West Bengal were the top ten states where malaria positive cases reported were high. Malaria outbreaks had occurred in the districts of Kheda, Bhuj, Anand and Surat in Gujarat, Betul and Raipura districts of Madhya Pradesh, Haridwar district of Uttaranchal, Mazbat circle of Darrang, Sonitpur, Tinsukia, Lakhimpur and Golaghat districts of Assam and Bangalore district of Karnataka during 2001-02 to 2005-06. Thus, these districts were to be surveyed on priority basis.

Audit examination disclosed that:

- NIMR had not maintained any database to indicate districts that were surveyed so far in order to prepare the future survey plan effectively.
- Only seven districts of four states of top ten malaria affected states were covered in the surveys to be conducted during Tenth Plan.

[8] Single species of parasites picked up from a natural populations and established in culture

- None of the districts where malaria outbreaks occurred during 2001-06 were covered in the surveys under Tenth Plan.
- Of 20 districts targeted to be covered, the surveys were conducted in 18 districts as of January 2007. In two districts, survey had not been completed as yet.

This indicated that NIMR had not properly focused on high malaria prevalence areas for conducting surveys.

NIMR stated in December 2006 that there was no project exclusively for surveys and those undertaken so far were part of other projects undertaken in different ecological zones of the country. Further, it stated that it is not necessary to conduct survey in each and every district of India since sample from different ecological zones would provide the desired information. NIMR also stated that it was planning to submit a detailed project for funding to Department of Biotechnology / Department of Science and Technology/ Ministry of Environment and Forests for carrying out surveys to cover more districts in arid/semi arid and deciduous wet zones. The reply is not acceptable since as per the criteria used by NIMR, it was required to collect isolates from areas of high malaria endemicity. NIMR's reply confirms that it had not adequately planned to conduct surveys in highly malaria-affected states even though conducting fauna surveys was an important objective of NIMR.

However, ICMR stated in January 2007 that there was no target of 20 districts to be covered by March 2007 and that further surveys would be planned in a phased manner. The contention that there was no target for 20 districts to be covered is not correct as the target had been clearly mentioned in Tenth plan document of NIMR.

Recommendation

The mosquito fauna survey needs to be conducted in the highly malaria affected states and districts. NIMR should also plan to conduct mosquito fauna survey in all the ecological zones of the entire country in a phased manner.

2.6.2 Malaria Parasite Bank

Maintaining parasite and vector repositories as a national facility was one of the objectives of NIMR. In this context, the malaria parasite bank (Bank), a national resource for malaria research, was established during the year 1992-

93 at a total cost of Rs. 1.13 crore funded by the Department of Biotechnology (DBT). Its major objectives were:

- To collect and cryopreserve[9] isolates of human plasmodial[10] species, with an emphasis on parasites Plasmodium falciparum[11] and Plasmodium vivax[12];
- To characterise[13] isolates for drug sensitivity and genetic markers; and
- To supply biological material to the scientific community.

The observations of audit with regard to the functioning of the Bank are given below:

2.6.2.1 Non-approval of Malaria Parasite Bank Project

NIMR took over the malaria parasite bank in October 1998 from DBT and continued it as an extramural project with the funding of ICMR on ad hoc basis. A sum of Rs. 44.03 lakh had been incurred by NIMR during 1998-99 to 2005-06 on the project. A proposal to include the activities of the malaria parasite bank as a regular activity of NIMR was sent to the Ministry in March 2000. However Ministry's approval has not been received as of December 2006. Despite "maintaining and utilising malaria parasite bank" being one of the major objectives of NIMR as per Tenth Plan, delay of more than six years on the part of the Ministry to approve the project as a regular activity of NIMR was not justified.

ICMR stated in January 2007 that approval of its executive committee had been obtained for continuation of this project as an extramural project beyond five years with its funding on ad hoc basis. Therefore, there was no need to send the extension proposal to the Ministry. The reply does not address the audit comments related to the approval of the Ministry to include the activities of Malaria Parasite Bank as regular activity of NIMR. It is not related to extension of the project as contended by ICMR.

[9] Preservation of the malaria parasites (with cryopreservatives/ cryoproctent) in living condition at ultra low temperature (i.e. in liquid Nitrogen (-196^0 C)
[10] Species of genus Plasmodium causing malaria in human beings
[11] Plasmodium falciparum (P. falciparum) – Species of malarial parasite
[12] Plasmodium vivax – (P.vivax) – Species of malarial parasite
[13] Assessment of the character of a given parasite

2.6.2.2 Partial achievement of objectives

(i) The criteria of collection of malaria isolates had been one of the objectives in the malaria outbreak affected areas and high malaria endemicity. NIMR, in its long term plan proposed to cover all the states for collection of the isolates for mapping of genetic variation in malaria parasites. Under the short term plan, collection of isolates from out break affected areas was envisaged.

NIMR collected 636 species of Plasmodium falciparum, 68 species of Plasmodium vivax and five species of Plasmodium malariae[14] from 13 different states of the country during 1992 to 2006. However, among the top 10 states affected by malaria, only one district each of Andhra Pradesh, Chhattisgarh, Karnataka and Madhya Pradesh, two districts in each of Gujarat, Orissa, West Bengal, Assam, Tamil Nadu and three districts in Rajasthan were covered for collection of mosquito species upto April 2006. Maharashtra, which was one of the top ten states of malaria incidence, was not covered for collection of mosquito species. This apart, none of the districts except Anand and Kheda districts of Gujarat, where malaria outbreaks had occurred during 2001-02 to 2005-06 were covered for collection of mosquito species. Audit also observed that NIMR did not fix annual targets for the collection of isolates.

(ii) All the 709 species collected were to be cryopreserved, characterised for anti-malaria drug sensitivity and adapted[15]. It was observed that while all the 636 species of Plasmodium falciparum were cryopreserved, only 257 species were characterised and 180 were adapted. The rest of the species were not cryopreserved, characterised and adapted although these were collected between 1992 and 1996. Further, isolates characterised for anti-malarial drug sensitivity (257 species) were required to be further characterised/analysed to find out molecules which could be used as vaccine or as molecules for drug targeting. However, it was observed that these activities were not carried out by NIMR.

While accepting the facts, NIMR stated in July 2006 that due to non-availability of parasites, inadequate staff and non-availability of funds from ICMR, isolates from other states could not be collected and would be collected as early as possible. NIMR also stated that parasites collected could not be characterised fully due to technical reasons and target could be fixed only after

[14] A species of malarial parasite
[15] Cultivated in-vitro for a period of time

re-establishing the parasite bank in the new building at Pappan Kalan, New Delhi (expected to be completed by June 2007). However, ICMR stated in January 2007 that during the last five years, malaria outbreaks were rare in the country. Therefore, there was no scope of collecting isolates from such areas. ICMR further stated that characterisation/ adaptation had been done as per availability of human blood and sera as procuring blood and serum was difficult. Reply is not tenable as malaria outbreaks occurred in 13 districts of five states during 2001-02 to 2005-06 but the isolates were collected only in two districts. The reply also confirms that NIMR failed in its objectives of collecting and characterising of isolates for drug sensitivity and genetic markers.

(iii) Supplying biological material to the scientific community was also another objective of malaria parasite bank. Scrutiny revealed that NIMR supplied biological materials to 54 organisations during 2000-2006. However, it was observed that no guidelines for the supply of biological materials and for obtaining feedback from the Institutes to whom the species were supplied for research were formulated. Therefore, no feedback could be obtained from the institutes/organisations.

ICMR stated in January 2007 that biological materials were supplied for collaborative projects for which published results were in the nature of a feedback. The reply needs to be viewed in the light of the fact that procedure for supply of biological material and direct feedback from recipient institutes is essential to improve the services of the Bank, the quality of biological material maintained by NIMR and to serve as a reliable resource for further research to control malaria.

Thus, the objectives of the malaria parasite bank, established at a total cost of Rs. 1.13 crore, were not fully achieved 14 years after its establishment.

Recommendation

Activities of Malaria parasite bank needs to be strengthened to ensure effective utilisation of the facility for malaria research.

2.6.3 Inadequate Collaboration with the NVBDCP and State Health Departments

NIMR was required to provide solutions to the technical problems faced by NVBDCP of the Ministry and organise cost effective malaria control demonstrations in endemic areas. NIMR was also required to facilitate transfer

of technology to state/district health departments, to develop health education material and organise activities like health camps, exhibitions, audio-visual shows and meetings with the community in collaboration with the State Governments. In this regard, audit observed that:

2.6.3.1 Absence of action plans/targets

NIMR did not formulate any action plan/fix targets to conduct meetings regularly with the State Programme Officers (SPO). In this regard, NVBDCP also observed in November 2004, that there was no effective collaboration between the NIMR field stations and SPOs due to which the research priority of these field stations was not directed towards area specific needs of the programme. Therefore, NVBDCP issued instructions to NIMR (November 2004) and all SPOs to conduct monthly meetings to identify problematic areas for operational research by NIMR to provide evidence based technical support. However, monthly meetings were not held regularly after November 2004 despite clear instructions of NVBDCP.

NIMR stated in October 2006 that there was no fixed schedule of meetings between its field stations and SPOs. However frequent meetings had taken place. ICMR stated in January 2007 that NVBDCP never observed that there was no effective collaboration between NIMR field stations and SPOs. The reply was not correct as NVBDCP observed inadequate collaboration and ICMR by way of evidence could only produce schedules of some training programmes for one state.

2.6.3.2 Non receipt of feedback

As per the instructions of NVBDCP, NIMR was required to provide feedback of its activities/recommendations to SPOs to chalk out a detailed action plan for priority research areas in the State for improvement in the performance of the programme strategy. As a result of epidemic investigations carried out by NIMR in certain districts of 15 states during 1999 to 2001, field analysis in the context of roll back malaria[16] undertaken during 2000-01 to 2002-03 (expenditure Rs. 24.45 lakh) and investigation of reported deaths due to malaria in the district of Karbi-Anglong of Assam, NIMR made recommendations like strengthening surveillance systems, provide training to medical officers and technicians, establishment of malaria cells and inclusion of syrup medicines for children in the National Drug Policy etc. to SPOs and NVBDCP to improve the effectiveness of the programmes. It was observed

[16] WHO initiative to bring down malaria incidence

that NIMR did not evolve any system for impact assessment or getting feedback from states/NVBDCP.

ICMR stated in January 2007 that a system of obtaining feedback from the NVBDCP will be evolved.

Recommendation

NIMR should strengthen its activities in the areas where malaria cases were higher in collaboration with State Programme Officers for effective control of malaria in the country.

2.6.4 Project Analysis

Test check of 46 completed projects and eight ongoing projects revealed the following:

2.6.4.1 Partial achievement of objectives

There were partial achievements of objectives in three sponsored project whose expenditure was Rs. 83.68 lakh and one externally aided project whose expenditure was Rs. 24.76 lakh. In seven completed intramural projects test checked, it was observed that no project-wise budget was estimated and maintained. Due to non-achievement of the objectives, consequent remedial strategies could not be developed to control malaria despite total expenditure of Rs.1.08 crore. A few sponsored/externally aided projects with significant audit findings are discussed below:

(a) NIMR undertook a sponsored project **"Application of Remote Sensing (RS) & Geographical Information System (GIS) for decision support in malaria control"** in March 2000 and completed it in March 2003 at a total cost of Rs. 15 lakh. The objectives of the project were to map the distribution of India anophelines[17] with reference to ecological parameters, mapping of malaria receptivity in Koraput district of Orissa based on ecological profile and other attribute information, study spatio-temporal[18] evaluation of malaria in reference to recent epidemics: a case of Mewat region (Haryana and Rajasthan). The work was to be done on scale 1:50,000 for district and 1:2,50,000 for the state against which the work was carried out using topographical sheet on scale 1:60,00,000 resulting in insufficient projection of malaria receptivity and distribution area in the map. Further,

[17] Species of Anophelines in India
[18] Distribution in space time

necessary equipment were not procured for mapping of malaria receptivity and study spatio-temporal evaluation of malaria. This apart, study was undertaken in Mewat region of Haryana only. Thus the objective of preparing thematic maps for ecological parameters which mainly govern the distribution of malarial species - forest cover, rainfall, altitude, soil type and temperature could not be digitised even after an expenditure of Rs. 15 lakh. Thus, prediction of malaria using remote sensing and GIS remains to be achieved.

NIMR stated in October 2006 that when the work was started, the Survey of India was contacted and it was found that topographical sheets on scale 1: 50,000 and 1:2,50,000 were not available and hence the study was started with the scale 1:60,00,000. NIMR further stated that only Rs.15 lakh was made available by ICMR against the sanctioned project cost of Rs. 24.50 lakh. ICMR stated in January 2007 that the scale of 1:60,00,000 was taken after discussion with Indian Space Research Organisation (ISRO) experts and that equipment could not be purchased due to non-availability of funds. It further stated that the objective of the study was to cover only Mewat region. The reply is not tenable as the project had been taken up without proper planning and ascertaining the availability of specific topographical sheets. Further, funds were not provided and the state of Rajasthan was not covered as planned.

(b) NIMR undertook a sponsored project **"Process Development for production of a recombinant malaria vaccine based on Plasmodium Vivax Duffy binding protein**[19]**"** in July 2001 and completed it in 2004 at a total cost of Rs. 38.10 lakh. The objectives of the project were to develop protocols for production of Pv rII[20], to characterise Pv rII and test its immunogenicity[21] and to determine the sequence diversity. Scrutiny revealed that toxicology studies were in progress to achieve the objective of testing the immunogenicity of Pv rII. The evaluation of process for consistency and study of stability and potency of Pv rII were yet to be undertaken. Thus, the objectives of the project were not achieved.

NIMR stated in September 2006 that vaccine was produced for clinical trial and the toxicology studies of the vaccine were in progress at Bangalore and final report would be available in October 2006. ICMR stated in January 2007 that the points raised related to the collaborative institute International Centre for Genetic Engineering and Bio-Technology (ICGEB) and that the work of

[19] Protein which can bind to the duffy antigen of erythrocytes
[20] Pv rII – P.vivax region 2: a species of malarial parasite
[21] the property enabling a substance to provoke an immune response

NIMR was completed in 2004. The reply is to be viewed in the light of the fact that NIMR, being the lead centre of the project, should have collaborated with ICGEB effectively and ensured completion of the project and achievement of its objectives.

(c) NIMR undertook a collaborative sponsored project on **"Health impact assessment of Indira Sagar Dam and resettlement and rehabilitation colonies in Sardar Sarover Project (SSP) reservoir impoundment areas in Narmada Valley in Madhya Pradesh"** in 1999 for a period of seven years. The objectives of the project were to (i) raise data on the incidence of vector borne diseases (VBD), (ii) assess the adverse health impact of reservoir in the command area, (iii) assess risk factors related to malaria and other vector borne diseases, (iv) assess the quality of drinking water, and (v) make recommendations for mitigation measures for each component. The project was completed in 2006 after an expenditure of Rs. 30.58 lakh.

NIMR suggested developing mitigating measures like channelisation of pools into the main river, leveling of pools by filling, construction of mosquito-proof houses and spraying pyretheroids[22] as per NVBDCP guidelines to control the vector borne diseases and recommended the use of larvivorous fish[23] in the water stagnation and seepages areas. However, the assessment of adverse health impact of reservoir in the command areas was not undertaken. The microbial contamination in the canal drinking water sources was also not undertaken. Besides, the results of the cross-sectional survey of other vector borne diseases like dengue, japanese encephalitis and filaria conducted in December 2005 and January 2006 were also not recorded. Thus, the health impact assessment was not done fully.

Reply of ICMR in January 2007 stated that there was no delay on the part of NIMR in taking up the project, but did not deal with the issue of impact assessment.

(d) NIMR undertook an externally aided project **"Population genetic analysis of Anopheles culicifacies[24] species-A"** in May 1999 and completed it in October 2004 at a total cost of Rs. 24.76 lakh. The specific objective of the project was to develop molecular markers, microsatellite for species-A, to construct a genetic map[25] and to screen species-A populations from north,

[22] A group of insecticides
[23] A fish eating larvae of mosquitoes
[24] Anopheles culicifacies – vector of malaria
[25] A graphic representation of the arrangement of genes or DNA sequences on a chromosome

north-west and southern India for polymorphism[26] and hitherto unnoticed genetic barriers.

WHO reviewed the progress report in September 2003 and observed that no comments appeared in the report on the significance of the results or what the next steps of the project would be. WHO also observed that physical mapping by in-situ hybridisation[27] had been initiated but the procedure needed to be optimised. However, the final report of the project did not disclose whether the recommendations of WHO made in September 2003 were complied with by NIMR. Thus, it is evident that the objectives were not fully achieved despite an expenditure of Rs. 24.76 lakh.

ICMR stated in January 2007 that the technique was standardised and could be used as foolproof technique for studies on in-situ hybridisation. It further stated that more studies could not be conducted as the term of project had been over and that the objective of the project was to ascertain the diversity in the genetic structure of the population. The reply is not tenable since the objective was to screen species-A population to construct a genetic map.

2.6.4.2 Lack of follow-up action

In the following projects, follow up actions as suggested in the final report were not undertaken resulting in non-fulfillment of objectives of the projects:

(a) NIMR completed a project titled **"Phase II evaluation of Bifenthrin[28] 10 per cent and Fipronil[29] 80 per cent WDG[30] indoor residual spraying for malaria vector control in India"** in March 2000 in collaboration with the WHO Pesticide Evaluation Scheme (WHOPES), after incurring an expenditure of Rs. 71.94 lakh. The project aimed to test efficacy of Bifenthrin 10 per cent and Fipronil 80 per cent WDG against An. culicifacies, the most important vector of malaria in rural India to determine the best application dose for the future. The trial was to be carried out in an area in central Gujarat where An. culicifacies was the major vector. The completion report revealed that since Bifenthrin was highly effective against mosquitoes, houseflies and other domestic insects, more detailed studies such as nerve conduction test, lung function test, haematological and urological tests were required to be conducted for the spray men and occupants of sprayed rooms. However, no follow-up action was taken on the conclusion of the project resulting in non-

[26] many forms of any species
[27] to make hybrids of any animal/plant species at their native location
[28] Name of insecticide
[29] Name of insecticide
[30] WDG – Water Dispersible Granules of bio-larvicide

achievement of some of the important objectives of the project.

ICMR stated in January 2007 that follow up action was not part of the objectives. The reply is not acceptable as one of the objectives of the project was to record perceived side effects on spray men and occupants of the sprayed rooms, which was not achieved.

(b) NIMR undertook a project **"Operational activity for the assessment of therapeutic efficacy of chloroquine[31] and/or sulfa pyrimethamine[32] in uncomplicated falciparum malaria in Orissa, Rajasthan and Goa"** funded by WHO from 2003 to 2005 at a total cost of Rs. 9.60 lakh. The specific objective of the project was to evaluate therapeutic efficacy of chloroquine and/or sulfa-pyrimethamine in P.falciparum malaria in India using standard methodology.

The final report revealed that in Orissa, the treatment of chloroquine was not effective. All patients responded to the second line drug namely sulfa-pyrimethamine (SP). As chloroquine was still effective in Rajasthan and was ineffective in Goa, immediate change of drug policy was suggested. Further, therapeutic efficacy of SP after its introduction was required to be monitored to ascertain resistance. The suggestions have however not been implemented so far.

NIMR stated in September 2006 that further monitoring could be taken as a new project after approval by Scientific Advisory Committee. The reply confirmed that no project proposal to this effect was prepared even after completion of the project in 2005. However, ICMR stated in January 2007 that the study would be planned only if state authorities or NVBDCP requested NIMR. The reply is not acceptable since no follow up action was taken to monitor the therapeutic efficacy of SP resulting in non achievement of the objectives of the project fully.

(c) NIMR undertook a project **"Assessment of therapeutic efficacy of anti-malarial drugs against uncomplicated P. falciparum malaria in West Bengal as part of Indo-Nepal cross border activity"** in October 2003 and completed it in February 2004 at a total cost of Rs. 18 lakh. The objective of the project was to assess therapeutic efficacy of chloroquine and sulfa-pyrimethamine (SP) in uncomplicated P.falciparum malaria in district Darjeeling of West Bengal.

[31] Anti malarial drug
[32] Anti malarial drug

The study proved that the first line drug chloroquine was no longer effective in this border district. Although the drug policy had been changed in some PHCs of the state, the project report suggested that there was an urgent need to review the policy for additional sites also. To prevent further spread of resistance, issue of introduction of artemisinin[33] based combination therapy should be seriously considered and debated. The conclusion of the completion report revealed that there was a need to monitor the efficacy of SP for 28 treatment days to detect late failures. It was observed that NIMR did not take follow up action on the conclusion of the project.

ICMR stated in January 2007 that deployment of additional staff for two months was required. It further stated that the main objective of the study was achieved. The reply revealed that no follow up action was taken by NIMR to monitor efficacy of SP to detect late failures.

Recommendation

NIMR should undertake appropriate remedial measures to achieve the objectives of the projects fully, fix targets for health assessment and to undertake necessary follow-up action on the conclusion of the projects.

2.6.4.3 Midway closure of Project

NIMR undertook a project entitled **"Genetic polymorphism of T-helper cell[34] epitopic regions of circumsporozoite protein of Plasmodium falciparum isolates from India: Relevance for Vaccine development"** sponsored by the Council of Scientific and Industrial Research (CSIR) between January 2002 and January 2005 at a total expenditure of Rs. 8.69 lakh. The objectives of the project were to study the extent of genetic variation in T-helper cell and its relevance for vaccine development.

Although the research fellow associated with the scheme left NIMR in November 2004, NIMR undertook the same project as a new project in the name of same research fellow in February 2006 for a period of three years at a total cost of Rs. 16.56 lakh sponsored by Department of Science and Technology (DST) which was irregular. NIMR received Rs. 8.50 lakh from DST in March 2006 and discontinued the project after incurring an expenditure of Rs. 0.33 lakh in August 2006 as the research fellow had already left NIMR, with the result that the important work of vaccine development

[33] plant based anti malarial drug

[34] a kind of white blood cells derived from thymus and are able to provide defence mechanism to the body

could not be undertaken. Thus, the entire expenditure of Rs. 9.02 lakh (Rs. 8.69 lakh + Rs. 0.33 lakh) proved unfruitful. NIMR did not surrender the balance of Rs. 8.17 lakh as of September 2006.

NIMR stated in October 2006 that the two projects had relevance for vaccine development and accepted that the project funded by DST could not be completed.

2.6.4.4 Systems Deficiencies

(a) Non-maintenance of project-wise budget in intramural projects

In seven completed intramural projects test checked, it was observed that no project-wise budget was estimated and maintained. NIMR booked expenditure of the projects in its common heads like research contingencies, travelling allowance and pay and allowances. In the absence of project-wise budgeting, the control management exercised on individual projects was not clear and the fruitfulness of the expenditure for each project could also not be vouchsafed in audit.

ICMR stated in January 2007 that project-wise budgeting for intramural projects would be done for effective financial control.

(b) Inadequate Project Documentation

(i) Intramural Projects/IDVC sub-activities

Test check of records of seven completed projects, 15 IDVC sub-activities and two on-going projects revealed that documents like project proposal and approval of the project by the competent authority and comments of monitoring body alongwith action taken report, evaluation of the final report of the project were not kept in the project files. Only a copy of the progress report or final report was kept in the project file.

In the absence of proper documentation of project files, it could not be ascertained as to whether (i) feasibility study/survey was conducted, (ii) the activities planned in the plan document were covered, (iii) justification for extension of project, if any, was presented and approved by the competent authority, (iv) comments of monitoring body were acted upon and proper implementation of the project as a whole were carried out, (v) objectives of projects were achieved, and (vi) follow-up action on the conclusions/suggestions made in the reports was promptly taken. In the absence of these documents and their review, the adequacy of management control cannot be vouched.

In this connection, it is pointed out that other scientific and research organisations like Indian Council of Agricultural Research (ICAR) had prescribed formats for presentation of project proposal, annual progress report of the project and final report for strict compliance. No such instructions/ procedures/ norms were in existence in NIMR.

ICMR, while accepting the fact, stated in January 2007 that project files would be maintained properly in future for appropriate financial controls.

(ii) Contract Projects

In terms of guidelines of contract research issued by ICMR, for every contract project, approval of ICMR is to be obtained after approval of SAC of NIMR by furnishing project details in the prescribed format. Also, an agreement was required to be signed with the sponsor. Scrutiny of four contract projects revealed that neither the approval of SAC or ICMR was obtained nor was agreement signed with the sponsors of the project.

ICMR stated in January 2007 that the matter would be reviewed.

Recommendations

- *NIMR should formulate and adopt appropriate procedure for project-wise budgeting of intramural projects for effective financial control and monitoring.*
- *NIMR should document research project files adequately as per available best practices in leading scientific institutions.*

2.6.5 Inadequate technology transfer and commercialisation

NIMR, during 2001-02 to 2005-06, completed 61 extramural projects, 28 intramural projects and 69 sub-projects/sub-activities of IDVC project. Out of these, 74 projects were identified by NIMR as potential for technology development and transfer. However, it was observed that NIMR developed only two technologies and evaluated eight technologies during 2001-02 to 2005-06.

2.6.5.1 Inadequate technology transfers

Neither of the two technologies developed during 2001-02 to 2005-06 was transferred resulting in unfruitful expenditure of Rs. 36.62 lakh. NIMR replied in October 2006 that there was no need for transfer of technology for the research work that had been published. The contention of NIMR was contrary to its own identification of 74 projects as potential for transfer of technology

and as one of its objectives to control malaria in addition to publishing research papers.

Inadequate transfer of technologies developed prior to 2001, was also observed in following cases:

(i) The Field station of NIMR at Bangalore transferred the technology **"Use of larvivorous fish to control malaria"** in the year 2002-03 to four districts in Karnataka, namely, Tumkur, Hassan, Chickmagalur and Chitradurga. Although the technology was effective, it was not transferred in the whole state, nor was it transferred to the state of Andhra Pradesh (A.P.) which is also to be covered by this field station. Thus, transfer of technology was confined only to the areas around Bangalore.

ICMR stated in January 2007 that the State Government was planning to extend the technology transfer in a phased manner throughout the State.

(ii) Field station of NIMR at Goa undertook a project **'Bio-environmental Control of Mosquitoes in Mormugao Port – A Transfer of Technology Project'** in February 1998 with the primary objective to transfer bio-environmental control technology to the Mormugao Port. In 2001, bio-environmental control technology was transferred to the Port medical and civil engineering departments. Port personnel, including doctors and engineers were trained (November 2001 to Feb 2002) in the field by NIMR on all the necessary technical aspects of the programme. The impact assessment carried out (August 2001 to Feb 2002) showed that the number of malaria cases in 2001 was almost double the cases of the year 2000 (from 19 in 2000 to 36 cases in 2001). The project was completed in January 2002 at a total cost of Rs. 29.09 lakh sponsored by Mormugao Port Trust, Goa. However no further impact assessment was carried out by NIMR after completion of the project in January 2002.

ICMR stated in January 2007 that the increasing trend was due to transmission period from 2001 to 2002 when the technology was transferred to the Port.

2.6.5.2 Non-commercialisation of technology

During 2001-02 to 2005-06, NIMR patented two technologies of which final patenting was under process for one technology and the other technology was not commercialised as yet as discussed below:

NIMR undertook an in-house project **"Studies on larvicidal properties of leaf and seed extract of Solanum nigrum"** in 2000 and completed it in 2002.

The objective of the project was to assess the mosquito larval efficacy of different extract of plant part of Solanum nigrum[35]. The report produced to audit revealed that Solanum nigrum seed powder, when mixed in water for spray, was effective in causing 100 per cent mortality in the mosquito larvae. Accordingly, the technology **"use of Solanum nigrum extract as larvicidal agent"** had been patented in June 2004. However, this technology has not yet been commercialised for use of malaria control.

NIMR stated in October 2006 that commercialisation of technology would be done with an accepting sponsor, for which attempt would be made. The reply showed that no efforts had been made to commercialise the technology though the technology was patented in 2004. ICMR stated in January 2007 that efforts would be made to commercialise the technology.

Recommendation

NIMR should identify the areas where technologies could be transferred and target should be fixed for each field station of NIMR in coordination with appropriate authorities. Efforts should also be made to ensure patenting and commercialisation of the technologies developed.

2.6.6 Improper utilisation of scientific manpower

Scrutiny of the records of the projects undertaken by all 51 scientists of NIMR during 2001-02 to 2005-06 revealed the following differential in the number of projects being handled by scientists:

- Two scientists did not undertake any project during the last five years;
- 15 scientists were not having any project for a period ranging from one year to four years;
- Nine scientists were having only one project each;
- Eight scientists were handling two projects each; and
- 14 scientists were engaged in four or more projects, of which seven scientists were handling seven to 11 projects at one time in a year.

A system for monitoring of involvement in the projects and percentage of time spent for each project by the project investigator and project associate as it exists in the other organisation like Indian Council of Agricultural Research (ICAR), did not exist in NIMR, resulting in some of the scientific manpower

[35] Raspberry plant weed

remaining idle. Thus, one third of the 51 scientists of NIMR were not involved in any project for a period ranging between one to five years. This indicated that the distribution of projects among scientists was not rational or optimised.

ICMR stated in January 2007 that the issue needed to be discussed and finalised in the SAC meeting.

Recommendation

There should be logical distribution of research projects to scientists with broad timeline and results peer reviewed before publication.

2.6.7 Inadequate system of appraisal for publication of research papers

The Institute did not have any measurable targets for the number of research papers to be published by scientists for projects undertaken. It was observed that:

- Prior approval of Director General (DG) of ICMR for publishing the papers was not found on record. Further, in other organisations like ICAR, research papers are published first in the journals of ICAR with the approval of DG and only then they are published in other journals. This is essential to ensure that the research papers involving technology development and new scientific innovation are not published before patenting. In NIMR, none of the research papers were published in ICMR/NIMR journals. They were published only in other journals.

- Peer review system of research papers which is an independent scrutiny of scientific research papers by other qualified scientific experts (peers) before they are made public, was not found on record in NIMR.

NIMR stated in October 2006 that scientists themselves decided the publication of research papers in Indian or Foreign journals. It further stated the research papers were peer reviewed and the comments were kept confidentially between the authors and editors of the journals. The reply is not tenable as there should be a system for appraisal of research papers before their publication. Comments of the peer review should also be kept on record for ensuring transparency.

2.6.8 Training

(i) Establishing linkages and networking with the national and international laboratories for advance research and training and participating in the human resource development by organising training course, workshops and meeting with personnel were among the objectives of NIMR. However it was observed that NIMR did not formulate any annual action plan or fix any targets for training courses. NIMR did not conduct training courses during the years 2002 and 2003.

Further, as per the instructions of NVBDCP, integrated vector borne diseases control was to be implemented in areas where more than one disease was prevalent. Hence, there was a need to reorient the training schedules not only to cover malaria but also other vector borne diseases endemic in such areas. The existing training modules for different tiers of personnel were to be modified suitably. The task was to be undertaken by NVBDCP, National Institute of Communicable Diseases, NIMR, Vector Control Research Center (VCRC) and other central and state training institutions. The revised training modules were to be field-tested and capacity building was to be augmented to meet the needs of the programme for integrated control of vector borne diseases. However, no information on fulfillment of this need was on record. In the absence of the information, the achievement of objectives of NIMR in this context could not be verified in audit.

(ii) In 24th SAC meeting held in March 2004, it was stated that there was a need for training of scientists in their respective and related fields. The Director, NIMR was empowered to decide the need and accord approval for short term training at national and international levels and the matter was to be referred to ICMR for approval. However, this was not acted upon and as a result, training could not be imparted to the scientists. Further only 15 training programmes were held for State Government officials during the period 2001-06.

ICMR stated in January 2007 that presently NIMR is not able to develop action plan for training programmes, as there is no infrastructure for training and hostel facility. Once NIMR's own building is ready, annual plans for training would be developed.

Recommendation

Proper guidelines for achieving the objective of human resource development and preparation of annual action plan for training and achievement thereof needs to be prepared.

2.7 Conclusion

R&D projects undertaken by NIMR revealed partial achievement of objectives, non-receipt of feedback information and lack of follow up action besides midway closure. Mosquito fauna survey, one of the important activities of the NIMR to establish present day bio-diversity was not carried out in all the states where malaria incidences had occurred during 2001-02 to 2005-06.

The functioning of malaria parasite bank, a national facility for malaria research, was ineffective as its objective of collecting, characterising, cryopreserving and adaptation of malaria isolates was not achieved fully due to lack of infrastructure facilities. There was no proper planning in GIS based study at micro level to digitise thematic maps and prediction of malaria using satellite remote sensing. Consequently the objectives of mapping malaria receptivity were not achieved fully.

Only two technologies were developed during 2001-06 and there was no technology transfer. Two viable technologies patented were not commercialised. Collaboration among NIMR, NVBDCP and SPOs was inadequate as meetings were not held regularly. Further, there was no exchange of feedback and follow up action on the recommendations of NIMR.

Keeping in view the prevalence of malaria in the country, NIMR should strengthen its activities in priority research areas for development of effective strategies for control of malaria.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Performance Audit of Modernisation in select laboratories of CSIR

CHAPTER-3
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Performance Audit of Modernisation in select laboratories of CSIR

Highlights

- **Council of Scientific and Industrial Research (CSIR) spent Rs. 262.38 crore on modernisation of 39 laboratories /institutes but could not achieve the main objective of generating additional revenue. Against the expected incremental External Cash Flow (ECF) of Rs. 361.09 crore, CSIR earned negative incremental ECF of Rs. 15.06 crore. Eighteen laboratories had earned negative incremental ECF of Rs. 294.67 crore. (Paragraph 3.6.1.1)**

- **The equipment purchased by the laboratories/institutes of CSIR under modernisation programme were mismanaged by the laboratories. There were cases of non/delayed installation of equipment, non-repair of equipment, non/under utilisation of installed equipment and injudicious planning in procurement of equipment.**
  - **CBRI, NIO and CMERI could not install four equipment valuing Rs. 0.57 crore. (Paragraph 3.6.2.1)**
  - **Eight equipments purchased by NEERI, RRL Bhopal, CLRI, NAL and SERC after incurring Rs. 1.47 crore were lying un-repaired due to lack of efforts by these laboratories. (Paragraph 3.6.2.2)**
  - **14 equipment costing Rs. 7.38 crore were not utilised/underutilised by NAL, CFTRI, CDRI, RRL, CBRI, IICT, CMERI and NML. (Paragraph 3.6.2.4)**
  - **25 equipment costing Rs. 8.41 crore were installed after delays ranging between one year to more than three years by 11 laboratories. (Paragraph 3.6.2.5)**

- **The targets in respect of publication of research papers and filing of patents were not fixed for all the laboratories. When compared to the targets fixed by Performance Appraisal Board, there were shortfalls of 43 and 45 *per cent* respectively. (Paragraph 3.6.1.2, 3.6.1.3)**

- **CSIR did not have an effective monitoring mechanism to watch the achievement of the targets and consequent remedial action on the shortcomings in execution of the programme. (Paragraph 3.8)**

Summary of Recommendations

- *The proposals for seeking funds from the Government should be based on a proper feasibility study conducted after assessing needs of the industry.*
- *The projections for generation of ECF should be realistically assessed and equipment wise projections for ECF should be indicated in the project proposals.*
- *The instances of non-installation, non/delayed installation, non-repair of installed equipment should be minimised to make them operational without delay.*
- *The equipment installed should be used optimally to derive maximum benefit from their operation.*
- *The impact of the programmes on increase in publication of research papers and filing of patents should be quantified for each laboratory involved.*
- *An effective monitoring mechanism for proper execution of programmes and their evaluation to check the return on investment on each instrument in particular and projects in general should be evolved by CSIR.*
- *The monitoring system should provide for mid term and periodical appraisal of the programme with respect to the achievement of targets during execution of programmes and remedial actions on the short-comings observed in execution of such programmes.*

CSIR appreciated the recommendations in January 2007 and stated that action on specific points was being initiated.

3.1 Introduction

Council of Scientific and Industrial Research (CSIR), New Delhi was established in 1942 to conduct research and development and for continuous improvement of indigenous technologies to substitute imported ones through its constituent Laboratories/Institutes. The Council has the Prime Minister of

India as its President, Minister in-charge of the Ministry of Science and Technology as the Vice-President and 13 other members. The affairs of the Council are administered by an 11-member Governing Body with the Director General, CSIR (DG-CSIR) serving as Chairman. The DG-CSIR is responsible for coordinating all scientific and industrial research and exercising general supervision over the Council, and is assisted by an Advisory Board. He is also assisted by a Performance Appraisal Board (PAB), which is responsible for evaluating the performance of the Laboratories/Institutes functioning under CSIR. There are 38 Laboratories/Institutes ***(Annexure A)*** under CSIR which are headed by Directors, who in turn are assisted by the respective Research Councils and the Management Councils.

The need for modernising the laboratories of CSIR was recognised in 1986 by the Abid Hussain Committee, which recommended in December 1986 that the Government provide a one-time grant to CSIR. The recommendation of the Committee was considered at several internal fora of CSIR. In 1994, the Standing Parliamentary Committee (SPC) on Science and Technology realising the inadequacy of annual grants, recommended a one time grant of Rs. 200 crore for CSIR for modernisation over a phased period of time. The Planning Commission was appreciative of CSIR's need and had, in fact, made an allocation of Rs. 10 crore for selective modernisation of CSIR laboratories during 1995-96. This enabled CSIR to minimally replace some obsolete equipment. Ultimately, CSIR assessed in December 1996 that Rs. 350 crore would be required for modernisation. Of the total requirement, CSIR sought only Rs. 250 crore from the government and the balance amount was to be made up through internal sources. The Modernisation Plan for Rs. 250 crore was sanctioned by the Government for the Ninth Plan period (1997-2002).

CSIR instructed its Laboratories/Institutes in 1998 to prepare proposals highlighting the facilities to be modernised and the benefits accruing if the investments were made. The modernisation proposals were submitted by the Laboratories/Institutes in the same year. These highlighted the tangible benefits that would accrue towards (i) generation of external cash flow (ECF), (ii) manufacturing of products and the amount that would be received from licensing/premium on marketing the technologies, (iii) publication of research papers, and (iv) filing of patents etc. Thereafter, the laboratory-wise proposals were examined by Standing Finance Committee in its different meetings held in the same year and funds were allocated for execution of the programme in 1998 itself. A statement showing allocation for each laboratory against the approved projections of output of the programme is at ***Annexure B.***

3.2 Scope of Audit

The present audit covers the modernisation activities based on procurements made during 1997-2002 and also impact assessment of the effect of the modernisation programme during the period 1997-2006. The scope of audit here was restricted only to the tangible benefits achieved by CSIR against the benefits proposed to accrue as a result of modernisation.

Of 39 Laboratories/Institutes existing at the time of execution of the programme, 22 Laboratories/Institutes registered shortfall in generation of targeted ECF, seven achieved the target and the target in respect of 10 Laboratories/Institutes was not indicated in the modernisation proposals at all.

Audit selected 15 laboratories[1] and also CSIR-Headquarters from the above categories on the basis of regional representation and materiality and examined an expenditure of Rs. 129.76 crore (49 *per cent* of total expenditure of Rs. 262.38 crore).

3.3 Audit Objectives

The objective of the performance audit was to assess the efficiency of implementation of the modernisation programme and the impact of the support extended by the Government towards modernisation of the Laboratories/Institutes.

This objective was in turn divided into the following sub-objectives:

- Evaluate whether the equipment under the programme were procured and utilised economically, efficiently and effectively as per the modernisation plan;
- Examine whether expected benefits in terms of generation of ECF, publishing of research papers and filing of patents were achieved; and
- Examine the effectiveness of the monitoring and evaluation mechanism.

[1] Central Building Research Institute, Roorkee (CBRI), Centre for Cellular & Molecular Biology, Hyderabad (CCMB), Central Drug Research Institute, Lucknow (CDRI), Central Food Technological Research Institute, Mysore (CFTRI), Central Leather Research Institute, Chennai (CLRI), Central Mechanical Engineering Research Institute, Durgapur (CMERI), Indian Institute of Chemical Technology, Hyderabad (IICT), National Aerospace Laboratories, Bangalore (NAL), National Chemical Laboratory, Pune (NCL), National Environmental Engineering Research Institute, Nagpur (NEERI), National Institute of Oceanography, Goa (NIO), National Institute of Science, Technology And Development Studies, New Delhi (NISTADS), National Metallurgical Laboratory, Jamshedpur (NML), Regional Research Laboratory, Bhopal (RRL), Structural Engineering Research Centre, Chennai (SERC).

3.4 Audit criteria

Since the programme of modernisation sanctioned by the Government was based on the proposals of the Laboratories/Institutes of CSIR for procurement of equipment, the following criteria were fixed for assessing the impact of the programme:

- ECF projected by the Laboratories/Institutes which were made on the basis of their assessment of earnings from projects;
- Adherence to the instructions of CSIR regarding utilisation of funds;
- Adherence to the prescribed purchase procedure of CSIR while procuring equipment, thereby ensuring economy and effectiveness;
- Target of publication of research papers;
- Target of filing of patents;
- Projections for revenue to be earned through licensing/premia /product development by the Laboratories;
- Usage pattern of an equipment to ensure optimal utilisation as communicated by individual Laboratories/Institutes in project proposals;
- Maintenance of records of utilisation of equipment; and
- Monitoring and evaluation mechanism, its formulation and implementation as per project proposal.

3.5 Audit methodology

The audit objectives were discussed in an Entry Conference with CSIR management at New Delhi in July 2006 and CSIR, in principle, agreed with the objectives and methodologies of the performance audit. Scrutiny of records relating to implementation of the programme of modernisation and impact assessment of the selected laboratories/Institutes was conducted during June-August 2006. Preliminary audit findings were communicated to the appropriate field authorities of the Laboratories/Institutes for confirmation of facts. The comments of the Laboratories/Institutes were considered while finalising the audit conclusions. The Exit Conference was held on 17 January 2007.

3.5.1 Acknowledgement

The co-operation of CSIR during the entry conference, course of audit and exit conference was satisfactory and the same is acknowledged with thanks.

3.6 Audit Findings

3.6.1 Performance of the laboratories/institutes in achievement of the objectives of modernisation programme

The modernisation proposal had envisaged generation of revenue (ECF) through utilisation of the equipment purchased under the programme. Besides, the modernisation programme was also aimed at increasing publication of research papers, filing of patents and development of new products etc. Audit analysed the achievement of the targets prescribed under the modernisation programme by the laboratories/institutes. Wherever the targets were not fixed under the modernisation programme, the achievements against the targets fixed by PAB were examined. These findings are discussed below:

3.6.1.1 Generation of ECF

The Laboratories/Institutes of CSIR generate external cash flow (ECF) by undertaking projects funded by the Government/non-government organisations and from the charges collected on testing, calibration and licensing of the technologies transferred.

Under the modernisation programme, 29 Laboratories/Institutes[2] proposed to derive an incremental ECF benefit[3] of Rs. 361.09 crore during 1997-06 as shown in ***Annexure C***. As against this target, while 11 Laboratories/Institutes earned incremental benefits of Rs. 279.61 crore, 18 generated negative incremental benefit of Rs. 294.67 crore i.e., they could not even generate the envisaged ECF, which they should have earned, had the programme of modernisation not been sanctioned. Thus, overall, the net incremental ECF as a result of the expenditure of Rs. 211 crore on modernisation of 29 laboratories was (-) Rs. 15.06 crore as against the expected incremental ECF of Rs. 361.09 crore.

CSIR stated in January 2007 that a few national laboratories may not have achieved the target of ECF generation in the years immediately after modernisation but these may generate additional ECF in future years. However, the fact remains that as of March 2006, most of the CSIR laboratories could not generate ECF which was proposed in the modernisation plan.

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[2] Data related to incremental ECF in respect of 10 laboratories were not available in the proposals

[3] Incremental benefit is the difference between the figures of target of ECF with mondernisation fund and without modernisation fund

The reasons for non-generation of ECF have been analysed and discussed in paragraph 3.6.2.

3.6.1.2 Publication of research papers

Publication of research papers is considered an important performance indicator for a scientific organisation. The publications are covered by the Science Citation Index (SCI)[4] to determine their quality and impact factor (IF)[5]. The IF is graded as 'Low', 'Medium' and 'High'. CSIR, however, did not fix any target for publication in terms of the impact factor nor did it delineate a target for the number of publications as a consequence of changes following the infusion of the modernisation funds.

Out of 39 Laboratories/Institutes, only three laboratories viz. CMERI, ITRC and RRL, Jorhat fixed a target of publication of 967 research papers (in case of RRL Jorhat, the target of 597 papers was fixed for the period 2006-10) in their proposals for modernisation assistance submitted to CSIR. The remaining 36 laboratories did not fix any target despite publication being identified as one of the tangible benefits under the modernisation programme. CMERI and ITRC published 302 research papers against targeted 370 research papers.

Since 92 *per cent* of the Laboratories/Institutes did not fix any target for publishing research papers as a result of the modernisation programme, the achievement in respect of publications with reference to the target for the period 2002-2005 fixed by the Performance Appraisal Board (PAB) in 2001-02 for 38 Laboratories were examined. PAB had fixed target for publication of research papers in respect of 21 laboratories only. The position thereof for the period 2002-2005 was as under:

TABLE 1

Sl. No.	Name of the laboratory	Target for publication of papers in the SCI Journal[6]	Achievement	Percentage shortfall
1.	CRRI	120	9	93
2.	CBRI	120	23	81

[4] A Citation Index is an index of citations between publications, allowing the user to easily establish which document cite which other documents.

[5] Impact Factor is a measure of impact, a publication makes. It is a ratio of the citations received by a publication to the number of publications in the journal. It is calculated by dividing number of citations received by a publication published in a particular journal in a year by number of articles published in that particular journal in the previous two years.

[6] Figures showing Target and achievement relating paper covered by Science Citation Index

3.	CFRI	100	22	78
4.	CMERI	120	27	78
5.	CEERI	200	47	77
6.	CSIO	80	28	65
7.	SERC	100	36	64
8.	NAL	200	78	61
9.	RRL (JAM)	200	82	59
10.	CFTRI	800	395	51
11.	IIP	200	99	50
12.	CGCRI	400	200	50
13.	NPL	800	399	50
14.	RRL (BHO)	120	67	44
15.	CIMAP	200	117	42
16.	NBRI	300	189	37
17.	CECRI	400	276	31
18.	CDRI	800	616	23
19.	NGRI	400	333	17
20.	NEERI	200	175	13
21.	CMSCRI	240	232	03
Total		**6100**	**3450**	

It would thus be seen that:

- The targets for 16 laboratories were not specified either under modernisation programme or by PAB.
- 21 Laboratories/Institutes could not achieve the targeted publication of research papers.
- Against the target of 6100 research papers, there was shortfall of 2650 research papers (43 *per cent*) in respect of 21 Laboratories/Institutes. Shortfall in respect of five laboratories was in excess of 75 *per cent*. In respect of another five laboratories, the shortfall was more than 50 *per cent*.
- Out of the 15 Laboratories/Institutes covered under audit, seven Laboratories/Institutes[7] had no target while eight laboratories published 1043 research papers against the target of 2640 research papers, an average shortfall of 42 *per cent*.

[7] CLRI, Chennai, IICT, Hyderabad, NML, Jamshedpur, NCL, Pune, NIO, Goa, NISTADS, New Delhi and CCMB, Hyderabad.

- The field audit of 15 Laboratories/Institutes further revealed that the average impact factor (IF) in these laboratories was very low as compared to international standards as indicated below:

TABLE 2

Sl. No.	Name of the laboratory	Discipline	Range of Average impact factor during 1997-2006	International scenario of impact factor [8]
1.	CBRI	Engineering Material	0.454 – 1.996	19.03
2.	CDRI	Biology & Biotechnology	1.384 – 2.300	10.09
3.	CCMB	Biology & Biotechnology	2.225 – 4.345	10.09
4.	CFTRI	Biology & Biotechnology	0.918 – 1.521	10.09
5.	CLRI	Chemical	1.146 – 2.730	26.06
6.	CMERI	Engineering Mechanical	0.000 – 1.236	2.18
7.	IICT	Chemical	1.550 – 2.090	26.06
8.	NAL	Engineering Space	0.668 – 1.831	11.86
9.	NCL	Chemical	1.517 – 2.129	26.06
10.	NEERI	Engineering Environment	0.758 – 1.178	NA
11.	NIO	Physical and Earth Science	0.878 – 1.693	6.24
12.	NML	Engineering Metallurgy	0.762 – 1.106	7.17
13.	RRL, BHO	Materials	0.632 – 1.297	NA
14.	SERC	Engineering structure	0.244 – 0.696	19.03
15.	NISTADS	Information science	0.000 – 1.120	NA

- NIO proposed in October 1998 to publish research papers with a high IF in the event of procurement of equipment called the Ultra Centrifuge[9]. NIO procured the equipment costing Rs. 25 lakh in December 2000 and installed it in June 2001. After installation, though the equipment was utilised by NIO, no research paper using the equipment was published till August 2006.

Thus, though publication of research papers was a tangible output of modernisation programme, 36 out of 39 laboratories did not fix any target. Further, when compared with the targets fixed by the PAB, 21 laboratories failed to achieve the targets and a shortfall of 43 *per cent* was noticed. Besides, the average Impact Factor of the research papers was nowhere near the international standards.

[8] Journal ranking and average impact factor of basic and allied sciences Version July 2000
[9] Ultra Centrifuge helps in separation of cellular and sub-cellular genetic material

CSIR stated in January 2007 that the impact factor was available only for a limited number of S&T journals whereas it is not available for a large number of journals. CSIR also stated that scientists do publish papers in such journals also which did not mean that papers published in these journals are inferior. The reply of CSIR is to be viewed in the light of the fact that in the absence of any national criteria, the judgment on the basis of established international criteria is the only parameter against which quality of research papers can be judged.

Recommendation

The impact of the programmes on increase in publication of research papers should be quantified for each laboratory involved.

3.6.1.3 Filing of patents

Research and Development work resulting in the development of a process for the production of new compounds, compositions and development of new machinery leads to generation of intellectual property which is patented. Only five[10] out of 36 Laboratories/Institutes proposed a target of 569 patents. These laboratories filed 553 patents against this target.

Since more than 87 *per cent* of the laboratories did not indicate any target, the achievement in this sphere was examined with reference to the target fixed by the PAB in 2001-02.

Scrutiny revealed that:

- Targets were not fixed in respect of ten[11] Laboratories/Institutes which received modernisation fund totaling Rs. 67.14 crore.
- 26 laboratories/Institutes filed only 988 patents against the targeted 1788 patents which was only 55 *per cent* of the target. The details are shown in ***Annexure D.*** The shortfall in respect of 10 laboratories exceeded 75 *per cent* of the target. In six other laboratories, the shortfall was in excess of 50 *per cent.* CSIR did not intimate number of patents sealed against 988 patents filed.
- In 15 Laboratories/Institutes covered under audit, nine laboratories could file only 237 patents against the target of 620 patents, a shortfall of 62 *per cent.*

[10] CMERI, NBRI, CLRI, CFTRI and RRL, Jorhat

[11] NBRI(Lucknow), RRL(Jorhat), IICB, Kolkata, CMRI, Dhanbad, CGCRI, Kolkata, NIO, Goa, NCL, Pune, IICT, Hyderabad, CFTRI, Hyderabad and NISTADS, New Delhi.

Thus, the laboratories were not able to meet the targets for patents fixed by the PAB indicating the lack of efforts in achieving the prescribed targets.

Recommendation

The impact of the programmes in terms filing of patents should be quantified for each laboratory involved.

3.6.1.4 Revenue generation from other sources

Only CMERI, CDRI and NEERI had fixed the targets in terms of product development, generation of revenue through licensing premia and through transfer of technology respectively as discussed below:

(a) Product development

Targets in respect of development of new products were fixed only in respect of CMERI in the modernisation proposals. It was proposed that CMERI would develop 38 new products during 1998-2004. However, during this period, CMERI could develop only 19 new products. The reasons for shortfall were not intimated by CMERI.

(b) Generation of revenue through licensing/premia

Targets for generation of revenue through licensing/premia were fixed only in respect of CDRI. CDRI proposed in 1998 to generate a total ECF of Rs. 44.70 crore during 2001-04 against which CDRI could generate only Rs. 0.45 crore. CDRI did not explain the specific reasons for this shortfall.

(c) Generation of revenue through transfer of technology

Targets for generation of revenue through transfer of technology were fixed only in respect of NEERI. NEERI proposed to generate an ECF of Rs. 4.90 crore in the event of sanction of modernisation fund of Rs. 4.56 crore through transferring technologies during the year 1999-2000 to 2004-05. Though NEERI developed 15 technologies during this period, no technology was transferred and consequently no ECF was earned. NEERI stated in June 2006 that it did not transfer any technology, as it did not have a technology utilisation division.

Thus, it can be seen that at the first instance, the targets in the areas of product development, generation of revenue through licensing/premia and generation of revenue through transfer of technology were not fixed for all the laboratories of CSIR. The targets were fixed in respect of only one laboratory

for each of these three categories. Even these targets were not met by them which led to non-generation of projected revenue through these sources.

3.6.2 Implementation of the modernisation programme

The implementation of the modernisation programme was deficient due to non-installation of equipment, non-utilisation of installed equipment, injudicious procurement and lack of response from the industry. Instances of delay in installation, non-repairing of the equipment and under-utilisation of the installed equipment were also observed. All these factors contributed to the inefficient implementation of the modernisation programme. Significant audit findings on programme implementation are discussed below.

3.6.2.1 Non-installation of equipment

CBRI, NIO and CMERI could not install four equipment costing Rs. 0.57 crore as discussed below:

(a) CBRI placed two import orders for procurement of Multi Channel Central Recording System (MCCRS) costing Rs. 11.50 lakh on M/s Kinometrics, USA whose Indian agent was based at New Delhi and Forced Balanced Accelerometers (FBA) costing Rs. 5.79 lakh on M/s Columbia Research Laboratories, USA whose Indian agent was based at Bangalore. MCCRS received by CBRI in August 1999 could not be installed due to non-supply of FBA. For delay in supplying FBA, CBRI cancelled the order in May 2000 and placed a fresh purchase order in March 2001 with the firm which had supplied MCCRS through the Indian agent based at Haryana.

In October 2001, CBRI received the FBA costing Rs. 12.40 lakh and in February 2002, it requested the Indian agent based at New Delhi, who was associated with the supply of MCCRS, to install both MCCRS and FBA. But the Indian agent refused to install the same and stated that they had closed business with the supplier. Accordingly CBRI requested the Haryana based Indian agent in June 2003, to install both the equipment. In the same month, the service engineer of the Indian agent visited CBRI but failed to install the equipment due to non-functioning of the sensor of FBA and asked CBRI to get the sensor replaced by the foreign firm. But the Indian agent did not make any arrangement for replacing the sensor.

CBRI failed to effectively pursue the replacement of the defective sensors with the supplier for more than three years. Therefore, both MCCRS and FBA procured at a total Rs. 23.90 lakh between August 1999 and February 2002 remained uninstalled and thereby the equipment could not be utilised for ECF generating activities.

(b) NIO procured Marine Magnetometer costing Rs. 16.09 lakh in October 1999 to generate ECF of Rs. 30 lakh per year. On a request for installation, the foreign supplier informed NIO in January 2001 that installation of the equipment was not the responsibility of the supplier and offered to do the work on charge basis. NIO did not accept the offer and tested the equipment as per the procedure suggested by the supplier. Though on testing, it was observed that the equipment was not working, NIO did not ask the supplier to replace the same and instead sent back the equipment to the foreign firm for repair in September 2001. The foreign firm returned the equipment to NIO in January 2002 but on testing in August 2002, it was found that the equipment was still not working. Thereafter, NIO did not take any initiative to repair the defective equipment and disposed it off in January 2005 as unserviceable equipment for a very meagre amount. Thus, failure of NIO to ensure repair/replacement of the equipment resulted in non installation of the equipment. This resulted in infructuous expenditure of approximately Rs. 16 lakh on procurement of Marine Magnetometer and also did not contribute to the generation of ECF.

(c) CMERI placed an order in August 2002 for purchasing a Universal Milling Machine and accessories at a cost of Rs. 16.72 lakh. As per terms of the order, the machine was to be supplied by January 2003 and was to remain under warranty for a period of two years from the date of installation. The machine was received in March 2003 and installed in June 2003. After installation, the machine could not be commissioned due to short supply of the certain items[12]. Though the short supplied items were received by CMERI in January 2004, the machine was not commissioned by the firm. The firm approached CMERI for release of commissioning charges in the same month. However, CMERI lodged a claim of Rs. 1.86 lakh in July 2005 for the liquidated damage on the ground of delay in supplying the machine. As a result the supplier did not turn up for commissioning of the equipment resulting in idling of the machine. CMERI stated in June 2006 that they would contact the firm to rectify the problem. Thus, equipment costing Rs. 16.72 lakh remained idle for more than three years due to failure on the part of CMERI to effectively pursue the matter.

Thus, NIO could not generate Rs. 30 lakh per year due to non-installation of Marine Magnetometer. The projections for equipment-wise generation of ECF were not made in case of MCCRS, FBA and Universal Milling Machine and hence shortfall in generation of ECF could not be quantified.

[12] viz Stub-arbor, Milling-arbor, Collet adopter, Tennon for self centering vice

3.6.2.2 Non-repair of installed equipment

RRL, CLRI, NAL, NEERI and SERC kept eight equipment costing Rs. 1.47 crore in defective condition. Of these, three cases involving Rs. 0.58 crore pertaining to RRL and NAL are discussed below and the remaining five cases involving Rs. 0.89 crore pertaining to NEERI, RRL, NAL, CLRI and SERC have been shown in ***Annexure E***:

(a) RRL, Bhopal imported a Thermal Analyser costing Rs. 24.30 lakh in May 2002 and installed it in July 2002. After being used on only 23 occasions between August 2002 and April 2003, the equipment malfunctioned in September 2003. The matter was brought to the notice of the Indian Agent in the same month and to the foreign supplier in October 2004 with the request to submit a quotation for repairing the equipment. In November 2004, the foreign supplier agreed to repair the equipment at its factory at Germany but did not agree to furnish a bank guarantee of Rs. 22.33 lakh along with the quotation as desired by RRL, Bhopal. The equipment thus, remained unrepaired till date (July 2006). Thus, an equipment costing Rs. 24.30 lakh had remained unutilised for more than three years due to RRL, Bhopal's failure to take necessary action to get it repaired.

(b) In July 2002, RRL, Bhopal procured and installed an Inductively Coupled Plasma Emission Spectrometer at a cost of Rs. 21.92 lakh. Immediately after installation, a defect developed in October 2002 in the ignitor electronics. The supplier replaced the ignitor in April 2005 but the equipment could not be utilised due to further defects developed in it. The fault could be detected by the service engineer in March 2006. As of October 2006, the fault was not repaired. Thus, the equipment costing Rs. 21.92 lakh remained unutilised for more than four years.

(c) NAL had upgraded the existing Conway Mini-Hipper, High Temperature Hot Isostatic Press at a cost of Rs. 12.48 lakh in April 2001. After upgradation, the equipment was utilised on eight occasions upto March 2002. A scrutiny of the logbook revealed that from April 2002 to December 2005, the equipment was idle and in January 2006, the graphite element of the equipment was found broken and since then, the equipment had been lying idle in defective condition. NAL stated in July 2006 that the matter would be taken up with the supplier for rectification of the defects. Therefore, prolonged non-utilisation of the equipment due to non-rectification of the defects defeated the objectives of procurement of the equipment.

Thus eight equipment costing Rs. 1.47 crore remained unrepaired due to the failure of these laboratories to take corrective action which led to non-

generation of ECF. The projections for equipment-wise generation of ECF were not made in these cases and hence shortfall in generation of ECF could not be quantified.

3.6.2.3 Injudicious planning for procurement

The plan of procurement of three equipment costing Rs. 2.99 crore in NML, CDRI and NIO did not contribute to the generation of ECF as discussed below:

(a) CDRI procured an Image Analyser (Proteomics) and accessories at a total cost of Rs. 188.43 lakh in December 2002 for estimating gene expression at the level of translation. The equipment's warranty was extended for three years from the date of installation. Even after installation in December 2002, the equipment could not be utilised for want of adequate space for working. After shifting to the new location, a snag developed in January 2005 in the key component (ProXpress) of the equipment. Though the system was under warranty upto November 2005, CDRI did not approach the firm to replace the system. The reasons for not approaching the supplier for replacement of the equipment were not made known. Scrutiny revealed that in June 2006, CDRI procured the replacements for defective parts on payment of Rs. 4.16 lakh. The said parts were not fitted in the equipment till July 2006. Thus the equipment costing Rs. 188.43 lakh remained unutilised for more than four years due to CDRI's failure to initially arrange proper space for working and subsequently not replacing the defective components of the equipment.

(b) NML proposed to import a High Temperature Thermal Conductivity Apparatus in July 2001 at a cost of Rs. 85.33 lakh for determination of thermal conductivity of refractory/ceramic bricks. In August 2001, the foreign supplier, while submitting an offer for the equipment, indicated that a computer of specified configuration would be required for operation of the equipment. NML submitted the purchase order for the equipment in December 2001 without asking the supplier to provide the required computer.

The equipment was received in November 2002. NML floated a tender enquiry for the computer in December 2002. Since no positive response was received, NML re-floated enquiries again in May 2003 and December 2003. Despite these attempts, a computer of desired specification could not be selected by NML. However, it was seen in May 2004 that the desired computer was already available with a Division of NML and the equipment was installed finally in August 2005. Even after delayed installation, the equipment could not be utilised by NML in the absence of projects sponsored by any industry. Therefore, an equipment costing Rs. 85.33 lakh procured

under the modernisation programme did not earn any ECF for four years after its procurement (July 2006) due to injudicious decision of NML.

(c) In March 2000, NIO placed an import order costing Rs. 25 lakh for procurement of a Virtual Reality System and received the same in July 2000. Despite installation and commissioning of the equipment in April 2001, the system could not be utilised as no qualified staff was available to operate the equipment. NIO, in August 2006, accepted the facts and stated that the facility was being used as a workstation for internet links. Thus, NIO's inability to ensure availability of qualified person for operating the instrument before procurement led to its utilisation merely as a workstation and consequent non-generation of ECF.

Thus, due to injudicious planning, three equipment costing Rs. 2.99 crore purchased by CDRI, NML and NIO could not be utilised for the intended purpose. The projections for equipment-wise generation of ECF were not made in these cases and hence shortfall in generation of ECF could not be quantified.

3.6.2.4 Non/under utilisation of installed equipment

NAL, CFTRI, CDRI, RRL, CBRI, IICT, CMERI and NML under-utilised 14 installed equipment costing Rs. 7.38 crore. Of these, four cases involving Rs. 2.93 crore in CFTRI and CDRI are discussed below. The remaining 10 cases involving Rs. 4.45 crore pertaining to RRL, CBRI, IICT, NML, CMERI and CDRI are shown in ***Annexure F***:

(a) NAL signed an agreement with the Indian Air Force in April 2002 for the "Total Technical Life Enhancement of an aircraft through full scale fatigue testing" project. For this purpose, NAL imported a Smart Control System at a cost of Rs. 45.97 lakh in July 2002 for use with the existing 32 channel analogue full scale fatigue test control system. The equipment was installed and commissioned in November 2002. Scrutiny revealed that after procurement, the equipment was not utilised by NAL at all. On this being pointed out, NAL stated in July 2006 that the equipment would be used after receiving an aircraft at the end of 2007.

Thus, equipment procured at a cost of Rs. 45.97 lakh remained unutilised even after four years resulting in non generation of ECF.

(b) CDRI was synthesizing 600 new chemical entities annually for biological evaluation. In order to ensure its competitiveness, CDRI sought to accelerate the process by creating and exponentially increasing the number of distinct molecules to produce 50,000 new chemical structures annually.

Accordingly, CDRI proposed in 1998 to procure two synthesizers in 1999 and 2001, each synthesizing 25,000 chemical structures. A synthesizers costing Rs. 85.79 lakh was procured in June 1999 but was not installed immediately due to the defects in the mother-board of the processor. Despite the apparent requirement to speed up synthesis, the synthesizer was installed only in October 2001 after a delay of two years. Moreover, CDRI, without watching the performance of the first synthesiser procured another synthesiser at a cost of Rs. 105.93 lakh in October 2001 which was installed in January 2002. Upto June 2006, while the first synthesizer could produce 31,625 molecules as against the targeted 1,18,750 molecules (27 *per cent*), the second one produced even lesser 28,762 molecules as against 1,12,500 targeted molecules (26 *per cent*).

CDRI stated in October 2006 that the shortfall of screening of samples occurred due to discontinuance of combichem[13] concept from the year 2001 by the drug industries. The reply of CDRI needs to be viewed in the light of the fact that CDRI did not assess the need of the drug industries before taking the decision of procurement of the equipment and went ahead and procured the second synthesizer in October 2001. Thus, the objective of procurement of two equipment costing Rs. 191.72 lakh remained unachieved due to inadequate assessment which ultimately led to the non-generation of ECF.

(c) CFTRI placed an order in March 2001 for procurement of Pilot Aseptic Steriliser and Filling System costing Rs. 54.99 lakh. The system was received in August 2001. It was proposed to utilise the equipment 12 hours per day. After receipt of the equipment it could not be installed immediately as CFTRI had not arranged the required infrastructure and the service engineer of the Indian agent made unsuccessful visits to CFTRI in May 2002 and September 2002 to rectify defects in the operator interface terminal. The equipment was installed in February 2003. A scrutiny of the logbook revealed that since installation, the equipment was utilised only for 144 hours against available 4320 hours upto July 2004. The equipment was not used at all from August 2004 to July 2006. Thus, the equipment costing Rs. 54.99 lakh could not be utilised as per projections made by CFTRI.

Thus, failure of NAL, CFTRI, CDRI, RRL, CBRI, IICT, CMERI and NML to optimally utilise 14 installed equipment costing Rs. 7.38 crore led to non-generation of ECF. In the absence of projections for equipment-wise ECF, the shortfall in generation of ECF could not be quantified.

CSIR stated in January 2007 that utilisation of a particular equipment

[13] Combichem concept means combinatorial concept for generating chemical libraries.

/instrument depended upon the number of R&D programmes in progress. The reply of CSIR is not accepted as the laboratories of CSIR themselves had projected equipment usage in the modernisation plan.

3.6.2.5 Delay in installation

The CSIR laboratories purchased equipment under modernisation programme to earn revenue through their utilisation. Therefore, the laboratories were required to install these equipment without any delay. A test check of the records of the laboratories was done to see the delays for the period exceeding one year in installation of the equipment. It was observed that there were delays in installation of the 25 equipment procured at a cost of Rs. 8.41 crore in CBRI, CDRI, CFTRI, CLRI, CMERI, IICT, NAL, NEERI, NIO, NML and RRL for the period exceeding one year to more than three years as per details in ***Annexure G.*** The delay in 10 cases ranged between two years (24 months) to more than three years (45 months) broadly due to the failure of the laboratories in arranging the infrastructure for installation of the equipment, non-acquisition of spare parts, accessories etc. In the absence of projections for equipment-wise ECF, the shortfall in generation of ECF could not be quantified.

3.6.2.6 Lack of response from Industry

15 selected Laboratories/Institutes could generate ECF worth Rs. 801 crore against the projected ECF of Rs. 1064 crore during 1997-2005 against an infusion of Rs. 129.76 crore under modernisation programme.

It was seen that CMERI, NISTADS, CDRI and NCL failed to achieve the desired goals as external agencies did not come forward to utilise the expertise developed by these laboratories through utilisation of modernisation grants. These cases are discussed below:

(a) Though CMERI generated an ECF of Rs. 21.49 crore in the six years (1992-93 to 1997-98), it generated a lower ECF of Rs. 21.12 crore in the eight years from 1998-99 to 2005-06. In respect of one modernisation programme for strengthening its manufacturing technology group, an investment of Rs. 3.13 crore was projected in 1998 against which an ECF of Rs. 18 crore (Rs.3.20 crore from the projects sponsored by industry and Rs. 14.80 crore by rendering services to various industries) was targeted. Against the actual expenditure of Rs. 3.35 crore upto 2002, an ECF of only Rs. 1.76 crore was generated through services during 2000-06 and no ECF was earned from any sponsored project as no industry came forward to sponsor a project in this

area. On being pointed out by Audit in June 2006, CMERI did not explain the reasons for its failure to generate the expected ECF.

(b) NISTADS proposed to develop five saleable databases during 1997-2006 with the help of modernisation funds. Though NISTADS developed five databases, these were only for in-house purpose. Thus, NISTADS failed to develop saleable databases and consequently generate any ECF despite spending Rs. 1.17 crore under its modernisation programme. NISTADS confirmed that these databases were developed for in-house purpose and therefore were not saleable.

Incidentally, while evaluating the performance of NISTADS, PAB commented in January 2002, that NISTADS had neither served the public nor the policy makers on any worthwhile issue impinging on science and technology and development basically due to lack of direction, focus and above all a 'vision' for the Institute.

(c) CMERI imported an RP&M[14] system in June 1998 from a German firm at a cost of Rs. 110 lakh to meet the requirement of developing components for bio-medical applications along with other components with thin walls and critical features. The related software, tools, accessories etc for the equipment were to be procured separately. The equipment was installed in July 1998. However, as no work was awarded by any organisation/industry, CMERI chose not to procure the related software, and the equipment could not be utilised for development of bio-medical applications. Audit observed that it was only in January 2004 that CSIR sanctioned a related in-house project (scheduled for completion by March 2007) and funds for procurement of the software for utilising this equipment. Lack of response from industry indicated that the equipment was procured without realistically assessing its potential requirement. As such no ECF could be generated from the equipment.

(d) NCL, Pune proposed in December 1998 to procure an XRD Powder System at a cost of Rs. 113.92 lakh for generation of ECF of Rs. 12 lakh per year. It also proposed to install the equipment in 2000-2001. The equipment was procured in September 2002 and installed in October 2002. After installation, NCL earned an ECF of only Rs. 9.12 lakh (8.5 *per cent*) as against the target of Rs. 42 lakh, in the three and half years up to 2005-06 due to lack of response from the industry.

[14] Rapid Prototyping and Manufacturing (RP&M) is a process from which a class of technologies with computer aided design file of an object can be converted into a physical model through special sintering, layering or deposition techniques.

(e) CSIR approved the modernisation proposals of Laboratories/Institutes with the expectation that the latter would ensure an increase in the generation of ECF and simultaneously upgrade their infrastructure for research and development. CDRI procured an Array Spotter and Scanner during 2001-02 to determine DNA[15] micro array at a cost of Rs. 120.28 lakh. Though the equipment was installed in June 2003, it was not utilised for the projects sponsored by industries and therefore earned no ECF till July 2006.

Thus, though CMERI and NCL projected ECF generation of Rs. 22.56 crore, they could generate only Rs. 1.85 crore due to the lack of response from the industry. In the case of NISTADS and CDRI, the projections for generation of ECF for the individual equipment were not made and hence shortfall in generation of ECF could not be quantified.

Recommendations

- *The proposals for seeking funds from the Government should be based on a proper feasibility study conducted after assessing needs of the industry.*
- *The projections for generation of ECF should be realistically assessed and equipment wise projections for ECF should be indicated in the project proposals.*
- *The instances of non-installation, non/delayed installation, non-repair of installed equipment should be minimised to make them operational without delay.*
- *The equipment installed should be used optimally to derive maximum benefit from their operation.*

3.7 Improper maintenance of utilisation records

The equipment procured under the Modernisation programme were to be utilised to earn ECF. Consequently a proper record of the equipment's utilisation in in-house or funded projects for testing and analytical purposes was necessary. However, a scrutiny of records of 15 Laboratories/Institutes revealed that no uniform format was maintained for indicating utilisation of the equipment procured under the modernisation programme, and the utilisation statements maintained in varied formats did not depict any meaningful position. Moreover, for 19 equipment costing Rs. 4.75 crore ***(Annexure H)***, no utilisation statement (log book) was maintained at all in CDRI, CBRI, CMERI, CLRI and IICT.

[15] De-oxyribo Nucleic Acid

Good laboratory practices also require that there should be a back up for retrieval of data in the event of partial or total failure of computer controlled equipment. Scrutiny revealed that CDRI, Lucknow purchased a Particle Size Analyser during 1998-99 at a cost of Rs. 20.54 lakh. The equipment was installed in November 1999. While operating the equipment, the data generated from it since its installation to October 2003 was lost and could not be retrieved thereafter as there was no back up. CDRI also did not maintain any logbook till date for recording the data generated during operation of the equipment.

Thus, there was a need to maintain logbooks of the equipment and also keep a back up of data for retrieval as per good laboratory practices.

CSIR stated in January 2007 that as a result of performance audit, most of the laboratories have started maintaining the utilisation records and the Internal Audit team had been instructed to verify the same.

3.8 Monitoring and evaluation

While approving modernisation programme of CSIR in January 1998, the Expenditure Finance Committee (EFC) of the DST emphasised the need to create a monitoring mechanism to ensure that the commitments and conditions were being adhered to in spirit. Therefore, as per the instructions of EFC, CSIR was to formulate a monitoring mechanism for the programme so as to ensure fulfillment of the commitments by the laboratories. Scrutiny revealed that CSIR did not formulate any monitoring mechanism for observance by the laboratories.

Scrutiny of records of 15 laboratories revealed that while eight[16] laboratories did not formulate any mechanism on its own for monitoring of the programme, six[17] laboratories proposed to monitor the programme by a Steering Committee (SC) and a Monitoring Committee (MC) at the Laboratory level, and one laboratory viz. CMERI proposed monitoring only through MC.

Scrutiny of the minutes of the meetings of both the SC and MC, where formed, revealed that the meetings of the committees were not held periodically as proposed. The details of meetings of both SC and MC are at ***Annexure I.***

[16] CCMB, Hyderabad, IICT, Hyderabad, SERC, Chennai, CLRI, Chennai, NML, Jamshedpur, CBRI, Roorkee, NISTADS, New Delhi and NCL, Pune

[17] RRL, Bhopal, NEERI, Nagpur, NIO, Goa, NAL, Bangalore, CFTRI, Mysore and CDRI, Lucknow

Thus, a programme involving huge investment of funds did not have an effective monitoring mechanism to watch financial progress, periodical evaluation and consequent remedial action in cases of shortcomings.

Recommendations

- *An effective monitoring mechanism for proper execution of programmes and their evaluation to check the return on investment on each instrument in particular and projects in general should be evolved by CSIR.*
- *The monitoring systems should provide for mid term and periodical appraisal of the programme with respect to the achievement of targets during execution of programmes and remedial actions on the short-comings observed in execution of such programmes.*

3.9 CSIR stated in January 2007 that the benefits of modernisation were largely intangible and it was extremely difficult to quantify these with any degree of certitude and accuracy. CSIR also stated that benefits accruing due to modernisation may be evaluated broadly over a longer period of time and that it would be more appropriate to review these benefits at CSIR level rather than individual laboratory level.

The reply of CSIR needed to be viewed in the light of the fact that CSIR itself had projected the tangible benefits as outcome of modernisation in respect of individual laboratories of CSIR.

3.10 Conclusion

Though, CSIR spent Rs. 262.38 crore on modernisation of 39 laboratories, it could not achieve the main objective of increasing its revenue (through ECF). Against an expected incremental increase of Rs. 361.09 crore as a consequence of modernisation, CSIR could generate a net minus incremental ECF of Rs. 15.06 crore. 11 laboratories/institutes generated incremental benefits and 18 generated negative incremental benefits.

The equipment purchased under the modernisation programme were not utilised economically, efficiently and effectively as cases of non/delayed installation of equipment, non-repair of equipment, non/under utilisation of the installed equipment and injudicious procurement of equipment were commonly noticed.

For publication of research papers, as a result of modernisation, targets were fixed for only three out of 39 laboratories. In case of 21 laboratories where targets were fixed by PAB, the shortfall was 43 *per cent.*

For filing of patents, though five laboratories (for whom targets were fixed), were able to achieve 97 *per cent* of their targets, the targets in respect of the remaining laboratories were not fixed at all. When compared with the targets fixed by PAB, there was a shortfall of 45 *per cent* in case of 26 laboratories.

CSIR did not have an effective monitoring mechanism for ensuring the fulfillment of the commitments made by the laboratories under the modernisation programme.

(RAJ G. VISWANATHAN)
Pr. Director of Audit
Scientific Departments

New Delhi
Dated: 9th March, 2007

Countersigned by

(VIJAYENDRA N. KAUL)
Comptroller and Auditor General of India

New Delhi
Dated: 13th March, 2007

ANNEXURE-A

(Referred to in para 3.1)

List of Laboratories of Council of Scientific and Industrial Research

Sl. No.	Abbreviation	Full Name
1.	CBRI	Central Building Research Institute, Roorkee
2.	CCMB	Centre for Cellular & Molecular Biology, Hyderabad
3.	CDRI	Central Drug Research Institute, Lucknow
4.	CERI	Central Electrochemical Research Institute, Karaikudi
5.	CEERI	Central Electronics Engineering Research Institute, Pilani
6.	CFRI	Central Fuel Research Institute, Dhanbad
7.	CFTRI	Central Food Technological Research Institute, Mysore
8.	CGCRI	Central Glass & Ceramic Research Institute, Kolkata
9.	CIMAP	Central Institute of Medicinal & Aromatic Plants, Lucknow
10.	CLRI	Central Leather Research Institute, Chennai
11.	CMERI	Central Mechanical Engineering Research Institute, Durgapur
12.	CMRI	Central Mining Research Institute, Dhanbad
13.	CRRI	Central Road Research Institute, New Delhi
14.	CSIO	Central Scientific Instruments Organisation, Chandigarh
15.	CSMCRI	Central Salt & Marine Chemicals Research Institute, Bhavnagar
16.	CBT	Centre for Biochemical Technology, New Delhi▼
17.	IHBT	Institute of Himalayan Bioresource Technology, Palampur
18.	IICB	Indian Institute of Chemical Biology, Kolkata
19.	IICT	Indian Institute of Chemical Technology, Hyderabad
20.	IIP	Indian Institute of Petroleum, DehraDun
21.	IMT	Institute of Microbial Technology, Chandigarh
22.	INSDOC	Indian National Scientific Documentation Centre, New Delhi■
23.	ITRC	Industrial Toxicology Research Centre, Lucknow
24.	NAL	National Aerospace Laboratories, Bangalore
25.	NBRI	National Botanical Research Institute, Lucknow
26.	NCL	National Chemical Laboratory, Pune
27.	NEERI	National Environmental Engineering Research Institute, Nagpur
28.	NGRI	National Geophysical Research Institute, Hyderabad
29.	NIO	National Institute of Oceanography, Goa
30.	NISCOM	National Institute of Science Communications, New Delhi■
31.	NISTADS	National Institute of Science, Technology And Development Studies, New Delhi
32.	NML	National Metallurgical Laboratory, Jamshedpur
33.	NPL	National Physical Laboratory, New Delhi
34.	RRL(BHO)	Regional Research Laboratory, Bhopal
35.	RRL(BHU)	Regional Research Laboratory, Bhubaneswar
36.	RRL(JAM)	Regional Research Laboratory, Jammu
37.	RRL(JOR)	Regional Research Laboratory, Jorhat
38.	RRL(TVM)	Regional Research Laboratory, Thiruvananthapuram
39.	SERC	Structural Engineering Research Centre, Chennai

▼ renamed as Institute of Genomics and Integrative Biology (IGIB), New Delhi

■ merged and renamed as National Institute of Science Communication and Information Resources, New Delhi

ANNEXURE – B

(Referred to in para 3.1)

Statement showing expenditure under modernisation plan and targets fixed by the laboratories in 1998

Sl. No.	Name of the laboratory	Moderni-sation expenditure (97-03) Rs. in lakh	Proposed ECF (Rs. in lakh)	Publi-cation	Products	Patents	Licensing Premium (Rs. in lakh)	Tech-nology transfer
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
1.	CGCRI, Kolkata	494.52	3930.00	0	0	0	0	0
2.	CFRI, Dhanbad	406.79	2610.00	0	0	0	0	0
3.	CFTRI, Mysore	926.64	4650.00	0	0	351	0	87*
4.	NEERI, Nagpur	492.81	19790.00	0	0	0	0	490.00#
5.	CDRI, Lucknow	1646.23	6141.36	0	0	0	4470	0
6.	CMERI, Durgapur	1200.14	7160.00	95	38	32	0	0
7.	IICT, Hyderabad	1140.29	13190.00	0	0	0	0	0
8.	RRL, Jammu	540.19	665.00	0	0	0	0	0
9.	RRL, Jorhat	555.66	2395.00	597	0	104	0	0
10.	CLRI, Chennai	828.49	5665.00	0	0	47	0	0
11.	CBRI, Roorkee	688.52	5666.81	0	0	0	0	0
12.	NGRI, Hyderabad	957.51	8050.00	0	0	0	0	0
13.	ITRC, Lucknow	553.78	1750.00	275	0	0	0	0
14.	NCL, Pune	1208.12	19727.00	0	0	0	0	0
15.	SERC, Chennai	666.39	1996.32	0	0	0	0	0
16.	CECRI, Karaikudi	493.94	2910.00	0	0	0	0	0
17.	CEERI, Pilani	421.50	4370.00	0	0	0	0	0
18.	NBRI, Lucknow	482.00	2470.00	0	0	35	0	0
19.	NAL, Bangalore	1804.99	20200.00	0	0	0	0	0
20.	RRL, Thiruvanathapuram	686.96	4950.00	0	0	0	0	0
21.	CCMB, Hyderabad	625.82	10743.00	NQ	0	0	0	0
22.	IICB, Kolkata	628.72	1385.00	0	0	0	0	0
23.	IIP, Dehradun	683.56	1812.50	0	0	0	0	0
24.	CRRI, New Delhi	486.75	1487.00	0	0	0	0	0
25.	CSIO, Chandigarh	874.79	1512.00	0	0	0	0	0
26.	NML, Jamshedpur	955.36	2709.00	0	0	0	0	0
27.	RRL, Bhopal	359.19	1930.00	0	0	0	0	0
28.	CMRI, Dhanbad	699.79	4840.00	0	0	0	0	0
29.	IMT, Chandigarh	360.91	921.18	0	0	0	0	0
30.	CSIR HQ	37.38	0.00	0	0	0	0	0

* *In number*

\# *Rupees in lakh*

Sl. No.	Name of the laboratory	Moderni-sation expenditure (97-03) Rs. in lakh	Proposed ECF (Rs. in lakh)	Publi-cation	Products	Patents	Licensing Premium (Rs. in lakh)	Tech-nology transfer
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
31.	IHBT, Palampur	150.00	0.00	0	0	0	0	0
32.	CSMCRI, Bhavnagar	519.15	0.00	0	0	0	0	0
33.	CIMAP, Lucknow	558.88	0.00	0	0	0	0	0
34.	NISCOM, New Delhi	105.62	0.00	0	0	0	0	0
35.	CBT, New Delhi	430.00	0.00	0	0	0	0	0
36.	NPL, New Delhi	870.77	0.00	0	0	0	0	0
37.	RRL, Bhubaneswar	464.75	0.00	0	0	0	0	0
38.	NIO, Goa	919.18	0.00	0	0	0	0	0
39.	NISTADS, New Delhi	125.75	0.00	0	0	0	0	0
40.	INSDOC, New Delhi	188.59	0.00	0	0	0	0	0
Total		**26237.96***	**165626.17**	**967**	**38**	**569**	**4470.00**	

NQ- Not quantifiable

(1) Since the information regarding benefit as a result of modernisation was not available in the project proposals in cases of NIO, CMSCRI, CIMAP, CBT, NPL and RRL Bhubaneswar, figures in respect of col. 4 against the above laboratories are shown as zero.

(2) The proposal of IHBT was not made available, figure in col. (4) is shown as zero

(3) INSDOC and NISCOM merged and renamed as NISCAIR in October 2002. Therefore, figure in col. (4) is shown as zero

(4) Targets were not fixed for NISTADS, New Delhi;

* the *figures for NISCAIR were* Rs. *(-) 2.48 lakhs and not shown in statement.*

ANNEXURE – C

(Referred to in para 3.6.1.1)

Statement showing projected and actual External Cash Flow (ECF)

(Rupees in lakh)

Sl. No	Name of the laboratory	Modernisation expenditure (97-03)	Total ECF proposed (with modernisation grants)	ECF (had modernisation grant not been released)	Incremental ECF from modernisation (Col. 4-5)	Total ECF actually generated during target period	Incremental benefit actually earned (Col. 7-5)	Period for which ECF targets were fixed	Percentage shortfall in generation of ECF
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
1	CBRI, Roorkee	688.52	5666.81	4917.81	749.00	2828.24	(-) 2089.57	97-06	50
2	CCMB, Hyderabad	625.82	10743.00	5154.00	5589.00	6953.00	(+) 1799.00	98-06	35
3	CDRI, Lucknow	1646.23	6141.36	5255.10	886.26	4123.44	(-) 1131.66	98-04	33
4	CFTRI, Mysore	926.64	4650.00	3400.00	1250.00	2326.65	(-) 1073.35	98-02	50
5	CLRI, Chennai	828.49	5665.00	4908.00	757.00	3074.68	(-) 1833.32	97-02	46
6	CMERI, Durgapur	1200.14	7160.00	3420.00	3740.00	2111.80	(-) 1308.20	98-06	71
7	IICT, Hyderabad	1140.29	13190.00	11025.00	2165.00	10872.24	(-) 152.76	98-06	18
8	NAL, Bangalore	1804.99	20200.00	17000.00	3200.00	31875.49	(+) 14875.49	98-06	Nil
9	NCL, Pune	1208.12	19727.00	18500.00	1227.00	12156.32	(-) 6343.68	99-06	38
10	NEERI, Nagpur	492.81	19790.00	18200.00	1590.00	7251.87	(-) 10948.13	98-05	63
11	NIO, Goa	919.18	0.00	0.00	0.00	0.00	0.00	Does not arise	Not available
12	NISTADS, New Delhi	125.75	0.00	0.00	0.00	0.00	0.00	Does not arise	Not available
13	NML, Jamshedpur	955.36	2709.00	1660.00	1049.00	2130.48	(+) 470.48	97-02	21
14	RRL, Bhopal	359.19	1930.00	1430.00	500.00	2131.49	(+) 701.49	98-04	Nil
15	SERC, Chennai	666.39	1996.32	1436.32	560.00	1357.01	(-) 79.31	97-02	32
16	RRL, Thiruvananthapuram	686.96	4950.00	3310.00	1640.00	4903.29	(+) 1593.29	98-06	01

Sl. No	Name of the laboratory	Modernisation expenditure (97-03)	Total ECF proposed (with modernisation grants)	ECF (had modernisation grant not been released)	Incremental ECF from modernisation (Col. 4-5)	Total ECF actually generated during target period	Incremental benefit actually earned (Col. 7-5)	Period for which ECF targets were fixed	Percentage shortfall in generation of ECF
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
17	RRL, Jorhat	555.66	2395.00	1300.00	1095.00	1283.23	(-) 16.77	99-06	46
18	RRL, Jammu	540.19	665.00	520.00	145.00	503.71	(-) 16.29	99-02	24
19	RRL, Bhubaneswar	464.75	0.00	0.00	0.00	0.00	0.00	98-01	Not available
20	NPL, New Delhi	870.77	0.00	0.00	0.00	0.00	0.00	98-02	Not available
21	NISCOM, New Delhi	105.62	0.00	0.00	0.00	0.00	0.00	Does not arise	Not available
22	NGRI, Hyderabad	957.51	8050.00	6860.00	1190.00	6635.57	(-) 224.43	98-04	18
23	NBRI, Lucknow	482.00	2470.00	1365.00	1105.00	2586.03	(+) 1221.03	98-06	Nil
24	ITRC, Lucknow	553.78	1750.00	1100.00	650.00	895.60	(-) 204.40	98-02	49
25	INSDOC, New Delhi	188.59	0.00	0.00	0	0.00	0.00	Does not arise	Not available
26	IMT, Chandigarh	360.91	921.18	801.18	120.00	1760.29	(+) 959.11	97-02	Nil
27	IIP, Dehradun	683.56	1812.80	935.50	877.30	3360.15	(+) 2424.65	99-06	Nil
28	IICB, Kolkata	628.72	1385.00	700.00	685.00	901.60	(+) 201.60	98-02	35
29	IHBT, Palampur	150.00	0.00	0.00	0.00	0.00	0.00	Does not arise	Not available
30	CSMCRI, Bhavnagar	519.15	0.00	0.00	0.00	0.00	0.00	97-06	Does not arise
31	CSIR Headquarters	37.38	0.00	0.00	0	0.00	0.0	Does not arise	Not available
32	CSIO, Chandigarh	874.79	1512.00	412.00	1100.00	3863.39	(+) 3451.39	98-05	Nil
33	CRRI, New Delhi	486.75	1487.00	1267.00	220.00	1530.93	(+) 263.93	97-02	Nil
34	CMRI, Dhanbad	699.79	4840.00	3990.00	850.00	3045.77	(-) 944.23	98-02	37

Sl. No	Name of the laboratory	Modernisation expenditure (97-03)	Total ECF proposed (with modernisation grants)	ECF (had modernisation grant not been released)	Incremental ECF from modernisation (Col. 4-5)	Total ECF actually generated during target period	Incremental benefit actually earned (Col. 7-5)	Period for which ECF targets were fixed	Percentage shortfall in generation of ECF
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
35	CIMAP, Lucknow	558.88	0.00	0.00	0.00	0.00	0.00	97-06	Not available
36	CGCRI, Kolkata	494.52	3930.00	2865.00	1065.00	2571.33	(-)293.67	98-04	35
37	CFRI, Dhanbad	406.79	2610.00	2180.00	430.00	1162.31	(-) 1017.69	99-03	55
38	CEERI, Pilani	421.50	4370.00	3175.00	1195.00	2237.75	(-) 937.25	98-05	49
39	CECRI, Karaikudi	493.94	2910.00	2430.00	480.00	1577.70	(-) 852.30	98-04	46
40	CBT, New Delhi	430.00	0.00	0.00	0.00	0.00	0.00	Does not arise	Not available
TOTAL		**26237.96***	**165626.47**	**129516.91**	**36109.56**	**128011.36**	**(-)1547.00**		

(1) Since the information regarding benefit as a result of modernisation was not available in the project proposals in cases of NIO, CMSCRI, CBT, CIMAP, NPL and RRL Bhubaneswar, figures in respect of col. 4 against the above laboratories are shown as zero.

(2) The proposal of IHBT was not made available, figure in col. (4) is shown as zero

(3) INSDOC and NISCOM merged and renamed as NISCAIR in October 2002. Therefore, figure in col. (4) is shown as zero

(4) Targets were not fixed for NISTADS, New Delhi;

**** The figures for NISCAIR were Rs. (-) 2.48 lakh and not shown in statement.***

ANNEXURE-D

(Referred to in para 3.6.1.3)

Statement showing target and achievement of filing of patents for the period 2002-05 as fixed by PAB

Sl. No.	Name of the Laboratory	Target	Achievement	Shortfall
1.	CDRI	80 (FP)	81	Target achieved
2.	CIMAP	120 (FP)	142	Target achieved
3.	CMSCRI	80 (FP)	182	Target achieved
4.	RRL (JUM)	80 (FP)	130	Target achieved
5.	RRL (TRI)	40 (FP)	49	Target achieved
6.	CEERI	40 (FP) 10 (IP)	1(IP)	FP – 100 % IP – 88 %
7.	CFTRI	No target fixed	DNA	DNA
8.	IICT	No target fixed	DNA	DNA
9.	NCL	No target fixed	DNA	DNA
10.	NIO	No target fixed	DNA	DNA
11.	NISTADS	Does not arise	DNA	DNA
12.	CGCRI	No target fixed	DNA	DNA
13.	CMRI	No target fixed	DNA	DNA
14.	IICB	No target fixed	DNA	DNA
15.	NBRI	No target fixed	DNA	DNA
16.	RRL (JOR)	No target fixed	DNA	DNA
17.	CRRI	60 (IP)	3	95%
18.	CBRI	40 (IP)	2	95 %
19.	NAL	80 (FP)	6	93 %
20.	NGRI	80 (FP)	7	91 %
21.	NEERI	60 (FP)	6	90 %
22.	SERC	20 (IP)	2	90 %
23.	CMERI	60 (FP)	8	87 %
24.	CCMB	80 (FP)	17	79 %
25.	IMT	80 (FP)	17	79 %
26.	RRL (BHU)	40 (FP)	10	75 %
27.	CECRI	80 (FP)	22	73%
28.	RRL (BHO)	40 (IP)	13	68 %
29.	IIP	120 (IP)	40	67 %

Sl. No.	Name of the Laboratory	Target	Achievement	Shortfall
30.	CFRI	40 (IP)	14	65%
31.	NPL	100 (FP)	40	60 %
32.	NML	80 (FP)	33	59 %
33.	CSIO	40 (IP)	23	43 %
34.	IHBT	100 (FP)	71	29%
35.	CLRI	80 (FP)	69	14 %
36.	ITRC	60 (FP)	0	100 %
Total		**1788**	**988**	

DNA-*Does not arise* **FP- *Foreign Patent*** **IP- *Indian Patent***

NISCOM merged with NISCAIR in October 2002 and CBT renamed as IGIB in October 2002. These were not shown in the statement.

ANNEXURE-E

(Referred to in para 3.6.2.2)

Statement showing list of unrepaired equipment

Sl. No	Lab/ Institute	Equipment	Cost (Rs. in lakh)	Remarks
1.	NEERI, Nagpur	Super Critical Fluid Extraction System	27.38	The equipment was procured in May 2002 and put to use in October 2002. Scrutiny of logbook of the equipment revealed that it was not working since December 2004 due to an error in pressure development. Efforts were made to repair it in February 2006. The equipment still remained in-operational as of June 2006.
2.	NAL, Bangalore	Automatic Pressure Abrasive Cutoff Machine	10.86	The equipment was procured in December 1998 and installed in February 1999. A scrutiny of the equipment's logbook revealed that after September 2000, the equipment was not utilised due to the repeated defects. NAL indented spares for the equipment only in July 2006. However, till July 2006, indented material has not been procured.
3.	SERC, Chennai	Automatic Mercury Porosimeter	22.23	The equipment was procured in December 2000 and was installed in May 2001. The equipment did not function after April 2002 due to defects developing in it. The equipment remained inoperative from May 2002 to July 2005. But the consequent utilisation of the equipment from August 2005 could not be verified since no entry was made in the logbook.
4.	RRL, Bhopal	FTIR Spectrometer System	15.04	The equipment was imported in July 1999 and installed in June 2000. After installation, a series of defects developed in the equipment from October 2001 and it remained un-repaired till July 2006. Thus, the equipment remained idle for more than four years due to the failure of RRL to take effective action for making the equipment operational.
5.	CLRI, Chennai	Heel Seat and Side Cement Lasting Machine	13.18	The equipment was procured in September 2000. The service engineer of the Indian agent visited CLRI in January 2001 but could not install the equipment due to faulty spare parts supplied with the equipment. Neither CLRI asked the supplier to replace the defective parts nor the concerned Division of CLRI expressed any dissatisfaction due to non-performing of the equipment. On this being pointed out, CLRI stated in July 2006 that the defective spares were supplied by the firm and the demonstration of the equipment was done in August 2004. CLRI, however, failed to furnish any logbook or other records showing the utilisation of the equipment. Thus due to non-submission of records showing utilisation of the equipment, the claim of CLRI regarding replacement of the defective parts and its consequent utilisation could not be verified in Audit.
Total			**88.69**	

ANNEXURE-F

(Referred to in para 3.6.2.4)

Statement showing equipment underutilised

Sl. No	Lab/ Institute	Equipment	Cost (Rs. in lakh)	Remarks
1.	RRL, Bhopal	Hydraulic Press	27.81	The equipment was procured in December 2002 for average utilisation of three hours per day. As power distribution line at site was not available, the installation of the equipment could be done in September 2003. The equipment was used for the first time in November 2005, as die, punches and fixtures were not ready. Even after making the equipment operational after three years of procurement it was used on 13 occasions upto March 2006.
2.	CBRI, Roorkee	Servo Hydraulic Actuator with 10 ton capacity	43.65	The equipment was procured in 1997-98, to provide cost effective modular growth and it was installed in July 1999. In September 2000 CBRI procured another Actuator having 50-ton capacity costing Rs. 21 lakh which was installed in January 2002. Scrutiny of logbook revealed that during 1999-06 the equipments were utilised only on 26 occasions.
		Servo Hydraulic Actuator with 50 ton capacity	21.00	
3.	NML, Jamshedpur	Parr Mini Autoclave (PMA)	14.75	NML procured PMA and MP in November 2001 and January 2002. These were installed in January 2002 and May 2002 respectively. Upto July 2006, while PMA was used on 30 occasions, MP was used only on seven occasions.
		Mercury Porositymeter (MP)	15.80	
4.	IICT, Hyderabad	GC-Mass Spectro meter	26.93	IICT procured the equipment in September 2000 for operation in electrical and chemical ionisation methods. In electrical ionisation method, the equipment was commissioned in December 2000, but the chemical ionisation method could not be pursued due to defects in heater assembly source. The defects were rectified in September 2001 but no entry in the logbook was made upto June 2004. IICT stated in August 2006 that it was utilising the equipment since September 2001. The reply of IICT, however, was not supported by the entries in the logbook.

Sl. No	Lab/ Institute	Equipment	Cost (Rs. in lakh)	Remarks
5.	CDRI, Lucknow	Scanning Electron Microscope (SEM)	72.25	CDRI procured SEM in 1999-2000 and Confocal Microscope (CM) in 2000-01 at a total cost of Rs. 72.25 lakh and Rs. 112.68 lakh respectively to conduct experiments eight hours per day per equipment. The equipment were installed in June 2001 and March 2002 respectively. While SEM was used for 2400 hours against the available 9600 hours (25 percent) during June 2002 to June 2006, CM was used for 1500 hours (18 percent) against the available 8320 hours during March 2002 to June 2006. CDRI stated in October 2006 that the time required for preparation of samples was not considered by Audit. The reply of CDRI needed be viewed in light of the fact that the aspect of requirement of time for preparation of samples was not considered at the time of preparation of the proposals.
		Confocal Microscope (CM)	112.68	
6.	CDRI, Lucknow	Parallax HPLC	90.93	Parallax HPLC costing Rs. 90.93 lakh was installed in November 2001 for screening of samples. It screened 12,774 samples against the target of 4,66,000 (three percent) during November 2001 to June 2006. CDRI stated in October 2006 that the equipment was bought to purify the libraries generated from the combichem synthesisers and since the combichem concept had been discontinued, it did not utilise the equipment optimally. The reply of CDRI need to be viewed on light of the fact that it did not ascertain the need of the industries before procurement of the equipment.
7.	CMERI, Durgapur	Injection Moulding machine	19.09	The equipment was installed in February 2000. After installation it could not be used for three years upto June 2005. While explaining the reasons for idling of the equipment, CMERI stated in June 2006 that the equipment was used regularly from July 2005 under a CSIR funded project. The reply of CMERI needs to be viewed in the light of the fact that the equipment was procured for immediate use but its non-usage indicates that no plan initially existed.
Total			**444.89**	

ANNEXURE- G

(Referred to in para 3.6.2.5)

Statement showing delay in installation of the equipment

Sr. No	Lab/ Institute	Equipment	Cost (Rs. in lakh)	Delay in installation (in months)
1.	NAL	Contour Measuring Machine	37.47	45
2.	IICT	Accessories for D-5000 X-ray Defractometer System	11.56	37
3.	CBRI	Direct Measurement Analyzer	8.45	35
4.	CLRI	Jeol Supercon Spectrometer (NMR)	129.48	34
5.	CBRI	Cyclic Tri-Axial Control System	36.00	34
6.	IICT	Speed Vac System	5.27	32
7.	RRL	Shimadzu Servo Pulser UTM Model EHF-EG-40L	36.00	29
8.	CBRI	UV VIS Spectrophotometer	14.00	26
9.	CLRI	Shimadzu UTM	26.60	24
10.	NIO	Digital Side Scan Sonar, Echo-sounder, Portable CTD System, Digital Global Positioning System	98.50	24
11.	IICT	Preparative HPLC	7.90	23
12.	NML	NETZSCH Laboratory Agitator Mill	24.50	23
13.	CFTRI	Controlled Atmosphere Storage Chamber	59.40	21
14.	CDRI	Circular Dichrograph with accessories	35.62	20
15.	CMERI	Carbon Sulphur Analyser	15.51	20
16.	CLRI	Sammying Machine	19.24	20
17.	RRL	Ultimate Analyzer	25.90	19
18.	IICT	Model 900 Max Portable Sampler	3.51	19
19.	NIO	Interactive Interpretation Seismic Processing System	39.30	17
20.	NML	Sorvall Benchtop Superspeed Centrifuge Model ST-21	10.50	15
21.	NEERI	Flow Cytometer	115.91	13
22.	CMERI	Vertical Machining Centre CVP-720	80.67	13
Total			**841.29**	

ANNEXURE-H

(Referred to in para 3.7)

Statement showing list of instruments for which log books/log files were not maintained

(Rupees in lakh)

Sl. No.	Name of the laboratory	Name of the instrument	Cost of the instrument
1.	CBRI	Impact Echo System	11.57
2.	CBRI	Cyclic Triaxial Control System	50.47
3.	CBRI	Profometer Corrosive Analyser Instrument	11.23
4.	CBRI	Foundation Pile Diagnostic System	12.80
5.	CBRI	Digital Image Processing system	25.00
6.	CDRI	Particle size analyser	20.54
7.	CDRI	Molecular Modeling Facility	77.44
8.	CDRI	Scanning Electron Microscope	72.25
9.	CDRI	HPLC System HP 1000 series	14.00
10.	CMERI	Ultrasonic Flow Detector	6.08
11.	CLRI	UV Lighting Machine	5.28
12.	CLRI	Heel Lasting Machine	13.25
13.	CLRI	Pullover and Toe Lasting Machine	14.45
14.	CLRI	Rotating Anode Generator	56.34
15.	CLRI	Rheometer	26.35
16.	CLRI	Homeogeniser	26.85
17.	IICT	Advanced Gel Permeation Chromatograph Syetem	7.50
18.	IICT	Culture Vessel with Temperature PH control	8.00
19.	CMERI	Bedtype Vertical Milling Machine	15.22
		Total	**474.62**

ANNEXURE-I

(Referred to in para 3.8)

Statement showing inadequate monitoring

Sl. No.	Laboratory/ Institute	Prescribed Frequency		Meetings held during 1998-99 to 2001-02		Shortfall		Reasons for shortfall
		Steering Committee (SC)	Monitoring Committee (MC)	SC	MC	SC	MC	
1.	RRL, Bhopal	08	16	02	06	06	10	NA
2.	NEERI, Nagpur	04	12	02	05	02	07	NA
3.	NIO, Goa	48	-	01	-	47	-	NA
4.	NAL, Bangalore	16	48	-	-	16	48	NA
5.	CFTRI, Mysore	04	08	-	01	04	07	NA
6.	CDRI, Lucknow	08	08	02	02	06	06	NA
7.	CMERI, Durgapur	Not formed	16	DNA	03	DNA	13	NA

NA- ***Not available*** **DNA-*Does not arise***