

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 shortcomings 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 laboratories¹ 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/Institutes² proposed to derive an incremental ECF benefit³ 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.

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 modernisation 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 Journal⁶	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/Institutes⁷ 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 Centrifuge⁹. 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 five¹⁰ 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 ten¹¹ 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 items¹². 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 MCCRCS, 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 synthesizer 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 synthesizer procured another synthesizer 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 combichem¹³ 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&M¹⁴ 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 DNA¹⁵ 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 eight¹⁶ laboratories did not formulate any mechanism on its own for monitoring of the programme, six¹⁷ 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 shortcomings 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.

New Delhi
Dated:

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

Countersigned by

New Delhi
Dated:

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