Project Completion Report

Scientific Research Infrastructure in India: A Pilot Study

Implemented by

Dr. Nirmalya Bagchi

Dean of Research and Management Studies

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Contact
Dr. Nirmalya Bagchi
Dean of Research and Management Studies, Professor
Administrative Staff College of India
Bella Vista, Raj Bhavan Road
Hyderabad 500082
bagchinirmalya@gmail.com
9866994407

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Academy for Science, Policy Implementation and Research (ASPIRE)

ASPIRE was launched in 2010 by Department being incubated in project mode at the Administrative Staff College of India (ASCI), Hyderabad. It aims to provide a common platform for interconnecting and enhancing competencies in policy development and implementation emphasizing Science Technology and Innovation across various stakeholders and arms of the Government leading to evidence based decision making.

Some of the areas in which policy studies have been carried under ASPIRE include food price inflation, R&D in agriculture, pharmaceuticals, patents, steel related R&D and Innovation etc. Efforts are on to upscale the level of engagement of socio-economic ministries and public sector industries in ASPIRE for R&D management, Innovation and Policy including capacity building. During 2015-16, new studies apart from conducting a workshop on science technology and innovation ecosystem will be planned for evidence based policy interventions.

Acknowledgement

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Dr. Nirmalya Bagchi

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Abbreviations

AAS	African Academy of Science
ACTREC	Advanced Centre for Treatment, Research and Education in Cancer
AEAMT	Academy of Excellence for Advanced Manufacturing Technology
AMC	Annual Maintenance Contract
AVD	Approved Vendor Directory
B. Pharm	Bachelor of Pharmacy
BC/OU	Bangalore Centre/Other Unit
BE	Bachelor of Engineering
BEL	Bharat Electronics Limited
BEST	Bioengineering Summer Training
BKMD	Business, Knowledge, Management & Development
BLiSc	Bangalore Life Science Cluster
BRNS	Board of Research in Nuclear Sciences
BTech	Bachelor of Technology
CAG	Comptroller and Auditor General
C-CAMP	Centre for Cellular And Molecular Platforms
CCE	Centre for Continuing Education
CCMB	Centre for Cellular and Molecular Biology
CDFD	Centre for DNA Fingerprinting and Diagnostics
CIF	Central Instruments Facility/Central Instrumentation Facility
CMC	Comprehensive Maintenance Contract
CMTI	Central Manufacturing Technology Institute
CPP	Central Procurement Portal
CSIR	Council of Scientific & Industrial Research
CU	Calcutta University
D&E	Development and Engineering
DACR	Deposit At Call Receipt
DAE	Department of Atomic Energy
DBT	Department of Biotechnology
DD/BC	Demand Draft/Banker's Cheque
DeITY	Department of Electronics & Information Technology
DG	Director General
DGS&D	Directorate General of Supplies & Disposals
DIPP	Department of Industrial Policy and Promotion
DoD	Department of Defence
DSIR	Department of Scientific and Industrial Research
DST	Department of Science and Technology
ECM	Exchange Control Manual
EMD	Earnest Money Deposit
EMI-EMC	Electromagnetic Interference-Electromagnetic Compatibility
EPSRC	Engineering and Physical Sciences Research Council

ERP	Enterprise Resource Planning
ETDC	Electronics Test and Development Centre
FEMA	Foreign Exchange Management Act
FOB	Free On Board
GeM	Government e-Marketplace
GFR	General Financial Rules
GM	General Manager
Govt	Government
HEFCE	Higher Education Funding Council for England
ICAR	Indian Council of Agricultural Research
ICMR	Indian Council of Medical Research
IFS	International Foundation for Science
IISER	Indian Institute of Science Education and Research
IIT	Indian Institute of Technology
IP	Intellectual Property
IPR	Intellectual Property Rights
ISO	Internation Organization for Standardization
IT	Information Technology
ITI	Industrial Training Institute
ITJ	Indian Trade Journal
IUAC	Inter-University Accelerator Centre
JRF	Junior Research Fellow
JSA	Joint Secretary(Administration)
JU	Jadavpur University
LCM	Least Cost Method
LPTA	Lowest Price Technically Acceptable
M. Pharm	Master of Sciences of Pharmacy
M.Sc.	Master of Science
MCA	Master of Computer Applications
ME	Master of Engineering
MIS	Management Information Systems
MMG	Materials Management Group
MoU	Memorandum of Understanding
MPhil	Master of Philosophy
MSc	Master of Science
MSME	Ministry of Micro, Small and Medium Enterprises
MSP	Managed Service Provider
MSTC	Metal Scrap Trade Corporation Limited
MTech	Master of Technology
NAAC	National Assessment and Accreditation Council
NABL	National Accreditation Board for Testing and Calibration Laboratories
NAL	National Aerospace Laboratories
NCBS	National Centre for Biological Sciences
NCL	National Chemical Laboratory

NEGD	National E-Governance Division
NIC	National Informatics Centre
NISD	National Institute of Skill Development
NIT	National Institute of Technology
NRDC	National Research Development Corporation
NSTMIS	National Science and Technology Management Information System
OEM	Original Equipment Manufacturers
PC	Purchase Committee
PCB	Pollution Control Board
PhD	Doctor of Philosophy
PI	Principal Investigator
PLM	Product Lifecycle Management
POC	Proof of Concept
PPP	Public Private Partnership
PSU	Public Sector Units
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
QMS	Quality Management System
R&D	Research & Development
RBI	Reserve Bank of India
RC	Rate Contracts
RFQ	Request for Quote
RMF	Research Maintenance Fund
RSIC	Regional Sophisticated Instrumentation Centre
S&P	Stores and Purchase
S&T	Science and Technology
SAIF	Sophisticated Analytical Instruments Facility
SBU	Strategic Business Unit
SC/ST	Scheduled Caste/Scheduled Tribe
SDC	Standing Disposal Committee
SERC	Structural Engineering Research Centre
SPO	Stores and Purchase Officer
T&PC	Technical and Purchase Committee
TA	Technical Assistant
TSC	Technical Sub-Committee
UGC	University Grants Commission
UK	United Kingdom
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPS	Uninterruptible Power Supply
USA	United States of America

Executive Summary

Creating and managing scientific research infrastructure in any country hold the key to the progress of development of the nation. While Governments actively pursue policies to promote research and development areas by means of funding and grants, the management of these resources is now being given its due importance. The Prime Minister in his speech at 104th Indian Science Congress on 3rd January, 2017 stressed that

"Building a strong Science and Technology infrastructure that is accessible to academia, start-ups, industry and R&D labs is a priority of the government. We need to address the problems of ease of access, maintenance, redundancy and duplication of expensive equipments in our Scientific Institutions. The desirability of establishing professionally managed, large regional centers in PPP mode housing high value scientific equipment should be examined.

We also need to foster a strong culture of collaboration between institutions and across disciplines to take advantage of developments, innovations and expertise in diverse areas…

I will ask our ministries to make collaborations a critical requirement for their institutions and for supporting funding requests for research…"

Recent years have seen a growth in both production and acquisition of equipment. However, these equipments lie idle or underutilized for long periods both before and after the actual usage. If the equipment has a limited usage for the conceived project, it continues to add to the depreciation budget. Also, in similar settings where there a need for the same equipment but monetary or other constraints prevent acquisition of newer equipment lead to losses both in terms of monetary and intellectual gains. According to a recent study by NSTMIS, DST (2013), 94% of the equipments are imported while only 6% are being manufactured indigenously. This adds to the burden of research infrastructure costs. While the rate of innovation is driving companies and laboratories to invest in newer and advanced technologies, the older equipment are facing obsolescence even before the age of depreciation is reached. Devising a means to utilize this equipment in a way that benefits not only the researcher but also the owner of the equipment can help bring down the cost of research and technology acquisition, as well as provide a pool of equipment that can best meet the intended purpose.

A National Scientific Research Infrastructure Policy is therefore proposed which will aim to provide a set of common guidelines that will not only ease the process of procurement and installation of scientific research infrastructure but also address various issues faced in the maintenance, sharing and disposal of these equipments. Here, the national scientific research infrastructure pertains primarily to research equipments used in non-strategic research organizations and educational institutions. It excludes strategic sector and industry.

The Department of Science and Technology had entrusted the ASPIRE to prepare a quick assessment study to analyze the many issues associated with scientific research infrastructure development so that this study may feed into the formulation of this proposed policy.

Therefore, the current study starts with an overview of the existing guidelines in the leading organizations both at the national level (GFR 2005) and at the organization level (CSIR, ICMR, ICAR) to provide an understanding of the existing procedures in procurement, maintenance, sharing and disposal of research equipments.

The study covered 40 research organizations including Government funded and private research laboratories, central & state universities, educational institutions and Public Sector Unit (PSU) organizations.

The scope of the study was to understand the procedures for procurement, maintenance, sharing and disposal of scientific research infrastructure in non-strategic S&T sector. Scientific Research Infrastructure, here it relates mainly to the scientific equipments used for research.

However, given the small study size, the study only provides a glimpse of the scientific research infrastructure in the non-strategic sector and is not intended to provide a comprehensive view of the entire nation's scenario in the S&T sector.

A questionnaire, prepared in consultation with CHORD, Department of Science & Technology (DST), was the primary research instrument for this study.

The questionnaire that is being used for the survey has two parts-qualitative and quantitative. The quantitative questionnaire was used to collect the data on the following aspects of equipment like Basic Profile of the Organization, Policies related to procurement, maintenance, sharing, disposal, training, health and safety, inventory. The quantitative data was used to provide insights on various aspects like segregation of labs, funding patterns etc.

The study draws insights from the overview of existing policies prevalent in leading scientific research organizations. A pilot study of the 40 research institutes provided primary research inputs of the sample including government funded and private laboratories, educational institutes and public sector systems engaged in S&T activities in the R&D domain in the country. Apart from this, 34 individual cases were prepared on the basis of the inputs from the questionnaire and interactions and feedbacks of the critical stakeholders from diverse domains of research. The case studies tried to deliberate on different processes of procurement, operation and maintenance, disposal and sharing.

This section describes the best practices and recommendations coming out of 34 case studies, questionnaires and workshop deliberations.

Database Development

- A comprehensive database/ portal for scientific equipment to help students and researchers locate alternative sources and provide greater transparency is desirable. This would also promote networking among R&D labs and allow on-line booking of facilities. Any high value (costing more than Rs. 5 lakhs) R&D equipment sponsored by any department or agency of central/ state

government should be registered with centralized database. In addition to this, the institute/ organization must be bound to share the equipment with others and upload all the relevant information in their website.

- Creation of a comprehensive database of indigenous research equipment manufacturers to promote domestic manufacturers
- Creation of a national portal for vendors with provision of vendor rating mechanism
- Creation of dedicated national portal for sharing of scientific equipments across the research organizations
- Archiving of data from R&D equipments with a provision to transfer unutilised or idle equipment to other labs
- Creation of a national portal for surplus items
- Creation of database of inventory at institutional level
- Creation of web platform for materials/ storage/ purchase officials to exchange best practices and information.
- An MIS reporting tool for research organizations can help to get a clear picture of Government spending and usage at any instance would be very useful. Moreover, it can be used to evaluate the utilization of the Government funded equipment.

Procurement

- Uniform procurement policy across all scientific organization including universities.
- Adoption of comprehensive procurement policy with provision for warranty, extended warranty, AMC and buy back of equipment. A provision to include peripheral units that supplement the main unit like chillers, UPS, stabilizers, and Air dryers as part of the equipment.
- Promoting e-procurement and linking of National Scientific Research Infrastructure Policy (NSRIP) with Government e-Marketplace (GeM) to bring in transparency, efficiency and ease of access. However, there should be provision for purchase of spares of equipment to be bought from non-DGS&D Indian agents, in cases, as may be required.
- Establishment of professional procurement cell across the organization or regional basis to take care of all procurement related activities. This agency would be equipped to handle procurement of all types of scientific equipment - high, medium and low end, each with its own set of guidelines. Given the growing numbers of imported equipment, there should also be a push for the OEM to setup inventory of spares in India by the central government to reduce the cost of maintenance and spares procurement as well as reduce down time.
- Reverse auction as a practice among successful technical bidders to achieve price competitiveness

- Involving specialized people in procurement process for negotiations and management of procurement process would reduce the burden of the scientists in the procurement process.
- In case of shipping of imported high end equipment, organization should rely on OEM/ Supplier of equipment. It saves time and OEM/ Supplier is liable to attend any problem related to freight and equipment during shipping of the equipment.

Maintenance & Sharing

- Most organizations find that maintenance of high-end equipment requires specialized handling and know-how and therefore usually adopt the Annual Maintenance Contract model whereby a third party, in some cases the original vendor from whom the equipment is purchased, is engaged on a contractual basis to provide maintenance services that include both routine as well breakdown maintenance. Some organizations have small teams that can deal with routine maintenance for low value equipment. This model works fine when the party providing services is able to respond in a timely manner to request for maintenance or repair. But more often than not, the organizations are faced with a problem of non-responsive contractors and delay in repairs. The reasons for delay include:
  - Lack of trained manpower at the contractor's end: This happens with slightly older equipment, where the people who had the knowledge for repairs of such systems have since moved on and the contractor is unable to find trained people to send for repairing the equipment.
  - Lack of spares: While it is a norm for vendors to usually stock spares for upto 5 years after the equipment has been declared obsolete, sometimes there is lack of adequate number of spares, thereby leaving the contractor in difficult position to provide timely help. Though the spares may be sourced from a local vendor, it may take more time than the original spares.
  - Failure of tie-up between AMC provider and international vendor: In case of imported parts, it has been observed that the vendor companies tie-up with a local service provider to provide maintenance locally. As a part of the initial contract agreement at the time of purchase of equipment, these local companies agree to all the conditions of maintenance. However, at times these tie-ups breakdown due to lack of consensus between the parent vendor company and local service provider. This becomes a roadblock for those organizations that are refused service by the local service provider citing breakup with the parent vendor company.

  However, this has been overcome by one of CSIR's lab that the team visited, CCMB. Right from its inception, the founders envisioned the need for an in-house instrumentation team. The instrumentation team was supposed to provide round the clock service for the laboratories and equipments housed within. The in-house instrumentation team comprises of people from the Physics and Electronics background. The team is constantly sent on trainings to vendor locations for Service Training Programmes that are also attended by service people from the vendor's company.

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This ensures that the instrumentation team has first-hand knowledge of the equipment, its parts, maintenance and handling before actually touching it at CCMB[1]. This also ensures they receive the best quality of training for maintenance. Similarly, the instrumentation team also attends the user training that is conducted at the time of installation of the machine. There is also other training that are provided by in-house experts for the instrumentation team. Every member of the instrumentation team handles only particular types of specialized equipment besides regular maintenance activities and they are available on call all through the day. This model has ensured that there is hardly any down time, a rare claim for a scientific organization[2]. The delay is only in getting spares. The part is immediately procured if available locally otherwise it is placed for procurement. There is no down time due to non attending of calls. This is the reason that some of the equipment at CCMB, is very old and yet usable because they are well maintained. At CDFD and SERC3 too, the Instrumentation department takes care of the instruments[4]. Some of the sophisticated equipments are earmarked for AMC while smaller ones are maintained in-house.

IUAC also has a dedicated in-house maintenance support system comprising of scientists and engineers. The scientists and engineers are properly and regularly trained by OEM (original equipment manufacturer) and suppliers. At the time of procurement, the in-house maintenance

[1] The satellite structure of CCMB is designed with a central instrumentation facility that is located centrally and the various labs are located in each of the wings. The instruments in the central instrumentation facility and the individual laboratories are open for all the CCMB scientists to use by booking slots. This creates an open environment for all to work. However, to eliminate one of the primary causes of failure by inappropriate handling of equipment, all the people are required to undergo training under the supervision of the Instrumentation team termed the Authorization Procedure. This procedure ensures the operators are completely aware of the equipment they handle before they actually use it. Anybody wishing to use any equipment has to request the Instrumentation Team for the Authorization Procedure and once they are authorized, they are allowed to use the equipment. The procedure training a new user by the member of the instrumentation team based on the request sent to the instrumentation head. This procedure is mandatory for medium range equipment. The team member in charge trains them and explains the use and safety etc. Their name is entered in the log book. Only then they are allowed to use the machine.

[2] If there is a breakdown in any machine, there is an online ticket system where the ticket is raised by the scientist. The instrumentation head then assigns the issue to a member of the group who is trained to repair the machine. No one in the instrumentation group can handle all the equipment. There are in-charges for types of equipment who handle issues related to that equipment. Since the engineers are trained on service of the equipment, there is also an understanding of the possible causes of failure of the machine and so spares are stocked accordingly. This ensures that there is a stock of spare parts for frequent problems thereby reducing downtime. The spares for a lot of common instruments that are there in duplicates are also procured and stored so in case of failure of any of them, they can be easily replaced. Once the stock level diminishes, an indent is raised and the stocks are replenished. This ensures low downtime. That is why the machines are also of the same make to ensure that spares are easy to maintain. Calibration standards and maintenance routines are regularly performed. After every repair the calibration is done again.

[3] At SERC, a dedicated work force for the maintenance of the equipment is hired. SERC appoints two different groups of engineers for operating and maintaining the facility. Most of the hired people are engineers of varying subject specialization like instrumentation, electronics, electrical, mechanical, civil etc. One set of people is hired with ITI training or diploma in engineering and another set of people are graduate engineers or post graduate degree holders. Fresh candidates are scrupulously trained to handle the high-tech equipments.

[4] There are 22 groups of scientists. The group that is sent for training during installation and also other special trainings includes the instrument group representative. During installation, the vendor company trains them and give necessary routine maintenance tips. Troubleshooting training is additionally provided to the instrumentation team. The user committee of the instrumentation facility oversees the problems and issues of the scientists to ensure faster redressal. The pay scales of the instrumentation team are higher than the industry scales, so attrition is not a problem.

team is commissioned and they are engaged with the installation process right from the very beginning[5]. While some of the hi-tech high value equipments are maintained through AMC, the in-house maintenance team is responsible for maintaining the facility.

Another maintenance model that can be adopted is the model of Centre for DNA Fingerprinting and Diagnostics (CDFD) known as the equipment operation contract model that has proved very profitable for the organization. CDFD has identified a company based on advertisement and due tender process etc. and entrusted them with 14-15 high-value instruments that are operator based and where sample preparation is required and an analysis is involved. This company ensures smooth maintenance of all the equipment and the laboratory. While there is an in-house instrumentation team that deals with minor repairs, the team that handles the equipment is completely in charge of the maintenance. A scientist, junior scientist and technical assistants comprise the dedicated team from the company that operates the equipment. The external agency charges the users from CDFD at a notional rate while outsiders are charged at a higher rate for conducting the analysis of the samples[6]. The various components of the rate charged include:

- Cost of the consumables
- Notional value of the operator's salary
- A component of depreciation
- Electricity charges

This model also reduces conflicts. In organizations where equipment is open for sharing, there arise instances of conflict of interests on the Intellectual Property so generated. When users, besides the Principal Investigator, use the equipment, they are required to share the IP with the organization or the Principal Investigator. This is an accepted practice. But sometimes the scientists/private industry may not been keen to share the IP of their research in exchange for mere sample testing. So they prefer to buy the equipment rather than share the IP. The model used by CDFD ensures that such a conflict never arises. The sample testing is done merely on a paid basis and so the IP does not have to be shared with CDFD. This ensures that interests of all the parties involved are protected.

[5] A comprehensive in-house maintenance support has resulted in huge cost benefits and created a skilled work force as well. This is supported by the fact that several maintenance and monitoring tools are regularly being designed by the scientists of the IUAC itself. The engineering team is also encouraged to develop their own instruments and funds are provided to support their development activity. The maintenance engineering team of IUAC has already designed high voltage power supply instruments and UPS (uninterrupted power supply) that are used in different projects of IUAC. The central monitoring system of the accelerator has also been designed by the in-house team.

[6] Organizations and individuals outside CDFD are however charged a higher rate depending on the nature of the institutions i.e. Educational institutions are charged less than research organizations which in turn are charged less than private organizations. Priority is given to CDFD users and during idle time it is given to other academic institutes and private companies. This helps not only in generation of revenue but also reduces the idle time of machines. This policy has been in place since 2009 and has led to 100% utilization of equipment with benefit to not only the organizations but people outside the organization as well.

- Promoting Academic/Scientific Social Responsibility in the academic and research circles. For e.g. Provision for laboratories to be kept open for school students twice a year
- Comprehensive guidelines for up gradation of scientific equipments.
- Provision of guidelines for utilization of income generated from equipment sharing for maintenance of the equipments and facility.
- Provision of parking funds for AMC and procuring spares beyond project period. A component of grant sanctioned by funding agency may be additionally provided for maintenance. Some organizations like, IIT Madras, keep aside 2-3% of the project value as the maintenance fund for maintaining the equipment after completion of the project.
- Financing the maintenance activity is another key area. For example, CDFD sets aside a fixed amount from the core fund for periodic preventive maintenance.

  A similar practice is followed in IIT Chennai. Most of the high-end and sophisticated equipment are maintained through AMC. In case of sponsored research, the maintenance and AMC charges are considered while framing the costing of the project. To ensure proper maintenance of high-end sophisticated equipment beyond the completion of the project, SAIF accumulates a fund, known as "Research Maintenance Fund"[7].
- Incentivizing laboratories that encourage sharing
- Legalize leasing and renting of R&D equipment.
- Rating mechanism based on resource sharing potential
- There should be separate slots for startups to test their samples at these central facilities or at the laboratories that share their equipment.
- To maintain a sharing facility, dedicated management is required. A proper management system for allocating time slots and marketing of the facility can help improve the visibility of facility. At NCBS, this is handled by C-CAMP (Incubation Centre) which manages the visibility of sharing facility of NCBS leading to 200 organizations having used the facility of NCBS. The Online portal for searching and booking equipment is being maintained by C-CAMP. 20-25% of the users of the sharing facility are external to NCBS. Among the non-academic organizations, a fair share of start-ups and MSMEs has been observed. The marketing team of C-CAMP consists of senior personnel with managerial

[7] 2% of the project value is kept to RMF. This fund is used to maintain equipment beyond the project life cycle. In the case of government funded projects, Government is providing high value equipment for research. The ancillary instruments and consumables are funded by the accumulated user fees. In addition to AMC of the equipment, a small maintenance team is retained for maintaining the facility and equipment. The equipment is retained by the institute after the completion of project. The institute continues to quote projects using the used but in good condition equipment. It results in lowering the project cost and also ensuring the utilization of equipment. This is a win-win situation for both the parties i.e. institute and sponsor.

and marketing skills, so it is convenient for NCBS as the scientists do not have to bother in managerial issues.

- Another model in operation at SERC has a central facility to share equipment with other research laboratories, academic institutes and industry. The Business, Knowledge Management & Development (BKMD) division of SERC is guiding the sharing process of SERC[8]. BKMD facilitates the marketing and publicity of sharing facility to attract customers and manage the booking of the equipment. Any organization, government or private, can approach SERC to use their shared service. The service is open to all and the cost of sharing is determined by the Business Knowledge Management & Development (BKMD) division. The equipments are operated by the dedicated operators and scientists. EBoss, the online booking facility of shared equipments was launched by SERC in August, 2016 is helping to improve the visibility of their sharing facility by allowing online booking.
- Create a zone specific grid with dedicated transportation from where commonly used consumables can be sourced quickly as and when required.
- A minimum user cost must be introduced as a policy to avoid unwanted use of high end equipment.

Disposal

- A good guideline or policy on disposal of equipment.
- Centralized disposal unit is need of the hour to facilitate gifting and sharing of equipment between organizations. Electronics Test and Development Centre (ETDC) can be used as disposal and testing units for the disposed equipments. This will help achieve transparency, efficiency, cost benefit and professional approach in the disposal of scientific equipments. Engaging dedicated management professionals for the disposal process will allow the scientists to concentrate only on research rather than wasting time managerial issues.

Startups

- Promoting startups for developing indigenous scientific equipment
- Establishment of nodal agencies for maintenance of high-end equipments. Promotion of start-ups may be a way forward to this.
- Promoting startups to dispose research equipments

[8] BKMD is involved in R&D planning, performance monitoring & management and facilitates the project team / leaders in estimating project cost in terms of manpower, material, capital and other items.

Training & Awareness

- Organizing Workshops and training related to operation, health and safety of scientific equipments and new technologies
- Creating provision for human resource up gradation, capacity building, skill development. One such practice at CCMB has helped reduce failure of equipment due to lack of trained hands. The standard procedure requires that as soon as systems are installed, there is an applications specialist who trains the users on how to use the equipment, to operate and analyze samples using the equipment. Additionally, a day's training programme is provided to users for the high value equipment by the instrumentation team to each member of requesting to use the equipment before allowing actual usage. The training does not involve user training, as it maybe domain specific, but ensures that the users are trained on handling the equipment safely.
- Revamping and popularization of Instrumentation as a discipline across all premier academic institutions like IITs for ensuring the success of Make in India initiative.
- Arranging awareness workshops on safe and environment friendly disposal of consumables, residual and high end equipments to popularize safe and environment friendly disposal of high end scientific equipments
- Conducting seminars throughout the country to publicize the E-Waste (Management) rules 2016 for the green disposal of electronic goods.
- Conducting High-end equipment related workshops at least twice a year to discuss issues and create awareness
- Exempting training facilities from service tax.
- A talent pool has to be created to handle sophisticated equipments. For example, imaging is a highly specialized job which requires considerable expertise. Imaging has several specialized fields. To get a trained person in all fields of imaging in nearly impossible. One way to solve this problem is to tie-up with research institutes who have expertise in these fields and can train people. Now the trained people can be appointed in the central facilities. Reputed institutes should be engaged for National Skill Mission to provide training to the talent pool. In some cases, organizations have created a pool of 7-8 skilled technicians who are well trained to handle multiple high-end equipments like proteomics, genomics, and flow-cytometer. This has allowed the organization reducing the down time of the equipment by ensuring availability of skilled operator at every time when there is a equipment failure. Training at reputed institutes like NISD should help create a dedicated talent pool that would be able to handle multidisciplinary equipments of a particular area.

Monitoring of scientific infrastructure

- Creation of a strong mechanism of checks and evaluation to ensure good laboratory practices and adopting mandatory compliance to the guidelines across all boundaries of laboratory activities.
- Careful scrutiny of space utilization, allocation and effective spending of funds.
- In some cases scientists have their own brand preference. In such cases, scientists prepare technical specification in accordance with the specification of their desired brand which leads to single bidder situation increases procurement time. It is recommended to allow the preference of scientist's brand up to certain limit like Rs. 50 Lakhs or Rs. 1 Crore. However, stringent checks could be put in place like performance of the equipment (past cases/ reference of other organizations), reference of publication indicating usage of the brand/ make, undertaking of the scientist about the experience of using that brand/ make to prevent misuse of the liberty.
- More stringent guidelines and monitoring for disposal of environment hazardous equipment and consumables.

Infrastructure

- Formation of cluster of colleges to create a central instrumentation facility that could be made available to all colleges within a 25-30 km radius. This would not only reduce redundancy in neighbouring colleges but also help in acquiring more variety of equipment with the funds received and thereby invite more expertise. Moreover, central facility guided by professionals can ensure the quality of equipment and vendor through active vendor evaluation, feedback archive and rate contracts. The success of this model has been established in the case of the zonal ecosystem of Mumbai-Pune.
- Strengthening of the regional Scientific research infrastructure in remote places through PPP model
- Most small educational institutions and industries do not find the requisite budgetary allocation to procure and maintain sophisticated analytical instruments. Creation of common infrastructure facilities is one approach to provide access to high-end equipment for research. One such initiative by DST, is setting up of Sophisticated Analytical Instruments Facilities (SAIF)[9] in different parts of the

[9] The main objectives of SAIF facilities are –

- To provide for guidance acquisition of data using Sophisticated Instruments.
- To organize workshops on the use and application of various spectroscopic and analytical techniques for students, teachers and personnel from other Laboratories, Universities and Industries.
- To provide facilities of sophisticated analytical instruments to scientists and other users from academic institutes, R&D laboratories and industries to enable them to carry out measurements for R&D work.

Development of new measurement/analytical techniques: Efforts are made by the SAIF to develop new techniques/ methods of analysis to put the instruments to their full use and offer them to the scientists for exploring new dimensions in research in various areas of science and technology.

country including those at IIT Mumbai[10], IIT Chennai etc. However, these shared facilities face their own issues:

- Lack of trained personnel (both in terms of numbers and their quality) is a common problem for most of the research organizations and academic institutions that were interviewed.

- Attrition: When people who are trained on using the equipment choose to move on to other organization without adequately training other people, it leaves the organization without trained manpower. This leaves the equipment lying idle for lack of users.

- Lack of time availability of dedicated operators: The people who are trained as dedicated operators are also staff and scientists on the team. These people have their own projects for which they are required to dedicate time and hence are not in a position to spare time for operation, even if the equipment were free for sharing

Given the above issues, SAIF, IIT Mumbai has devised a novel way to ensure that there is never dearth of trained operators for high end scientific equipment. SAIF, IIT-Mumbai's model ensures availability of skilled technicians to handle the SAIF equipments. In this model, each equipment is assigned to a scientist and one or more operators. These operators are called Technical Assistant (TA) and recruited from the pool of students who are pursuing their PhD under IIT-B. Usually, these TAs are appointed on a contract basis for two years. They are trained by professors & senior PhD students as well as external experts and manufactures. The TAs have to spend minimum 4 hours in a week in the laboratory against which they get incentives[11]. Performances of these TAs are strictly evaluated by SAIF committee. Apart from these, several workshops are conducted to train these bright students. All kind of samples come for testing, internal or external, are chargeable. A similar model may be adopted by similar such central instrumentation facilities.

- Another approach is for funding agencies to force the state universities to build central facilities and shift the funded equipment to the facility after completion of the project for shared use.

- Another way of financing equipment at the common instrumentation facility by setting aside a fund annually, as is in vogue in CDFD. Every year a part of the organization's fund is set aside for buying equipment in the common instrumentation facilities. Scientists and investigators in the organization provide their input along with justification on the number of users who would be using this system. An internal committee then examines this list and sanctions for ordering of equipment based on the benefit and the cost components.

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[10] The Sophisticated Analytical Instrument Facility (SAIF), formerly known as the Regional Sophisticated Instrumentation Centre (RSIC), was established at the Indian Institute of Technology, Bombay, in the year 1976, with the support of the Department of Science & Technology, Government of India, New Delhi. SAIF, IIT Bombay houses a variety of major analytical instruments which are operated and maintained by a dedicated and qualified group of Scientists and Engineers. It is an integral part of IIT Bombay, and operates with an "open access policy". The result of this policy is that all can benefit from the services of SAIF.

11 Recently IIT is considering a policy where these students could avail the instruments of SAIF freely for two hours for their PhD work against the service of four hours in a week.

Others

- R&D Audit/Scientific Audit has to be different in the S&T context wherein the PI is not compelled to inflate the utilization of equipment figure on the commercialization scale(that of the ICT industry). One must understand that the equipment is being used for research purposes and there may be instances of minimal usage and non-sharing because of the sanctity of the research or with focus on research (and not 'commercial purpose'). As the purpose of the research is not the commercial usage of equipments per se. It's different from creating an equipment/instrument facility for its usage by large number of researchers.
- Introducing Target driven and award based system to ensure that the Principal Investigator will be duly awarded for successful completion of project in due time, generation of intellectual property, designing research application that can be transferred to market, sharing of equipment with other project/ research activity to fully utilize the efficiency of the equipment, proper maintenance of equipment and several other parameters.
- Introducing the concept of "cost of ownership" in place of "capital cost" to determine the user cost for accessing the shared equipment.
- National standard rates for different products
- One of the key reasons for equipment failure was cited as lack of clean power. This has been overcome by CSIR's laboratory, CCMB by installing a high capacity UPS for ensuring clean power to all the sensitive equipment and samples at all times. This is very essential considering the domain of the work of the laboratory.
- Constitution of committee in every organization to examine ways for further use of public funded research equipment.
- A comprehensive insurance policy for both the operator and the equipment is much needed for the organizations.
- The key to sustainability of any knowledge ecosystem is knowledge dissemination and sharing. IUAC has initiated some activities to help improve the Physics laboratory facilities in universities like designing and providing table top equipments that are used in M.Sc level. For example, a low cost Radiation detection and Analysis System has been developed which is useful to carry out some of the Nuclear Physics experiments at M. Sc level. This has been distributed to thirty universities after proper training on the instrument usage. While major high-end equipment at IUAC are used till their end of life and utilized in different ways, the old equipment that are obsolete or having less capacity are used for training purpose. IUAC gifts their old equipment to other research organizations if the

equipment is in running condition and any organization shows interest in taking the equipment[12]. Similar activities can add to knowledge creation and motivating of the community at large.

[12] For instance, once IUAC had to buy one large nitrogen liquid plant despite of having a smaller one to increase the capacity and meet the increasing demand of the equipment. After buying the new and large facility, IUAC gifted the old and small nitrogen liquid plant to UGC-DAE Consortium For Scientific Research, Indore which was fully functional in those days.

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Chapter 1: Introduction

Science and Technology research is not possible without suitable infrastructure. In fact, advancement of science and global positioning of a nation's scientific abilities are rooted in the availability of advanced and well maintained infrastructure. In this study, scientific research infrastructure refers to scientific equipments used for research in non-strategic sector like Government funded and private research laboratories, central & state universities, educational institutions and Public Sector Unit (PSU) organizations purely for scientific purposes. It includes the equipment, consumables, housing and climatic conditions in which it can better be maintained. It also includes human resources required for operating the equipment in a safe and efficient environment. All the four S&T policies (SPR 1958, TPS 1983, S&T policy 2003 and STI policy 2013) of independent India have stressed on the need for suitable scientific research infrastructure to attain the objectives of S&T for societal benefit.

Recent years have seen a growth in both production and acquisition of equipment. However, in many cases, these equipments lie idle or underutilized for long periods. According to a recent study by NSTMIS, DST (2013), 94% of the equipments are imported while only 6% are being manufactured indigenously. Further this study showed that large number of equipment are not shared and are marred with issues related to maintenance and want of spares. This adds to the burden of research infrastructure costs. While the rate of innovation is driving companies and laboratories to invest in newer and advanced technologies, the older equipment are facing obsolescence even before the age of depreciation is reached.

Devising means to utilize the equipment in a way that benefits not only the researcher but also the owner of the equipment can help bring down the cost of research and development. There is a consensus in informed circles that for efficiency of expenditure on equipments and costs, Scientific research infrastructure can be increased by using suitable policy interventions that facilitate greater use of technology in procurement, enables sharing and collaboration of Science and Technology infrastructure, development of domestic ecosystem for manufacturing of such infrastructure and skill development of technical manpower. A National Scientific Research Infrastructure Policy would bridge

this gap by facilitating exchange of equipment on suitable terms and thereby encouraging optimal utilization of expensive resources for research.

Similar initiatives have shown significant results in different parts of the world.

For example in the **UK**, eight very research intensive universities namely: Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York, titled **N8** are collaborating on two key areas namely AgriFood and Urban & Community Transformation.

At the University of Leicester, an online equipment database of high capital research equipment, specialist machines across the Midlands Universities Consortium and campus facilities provides students and staff with an easy overview, allows cost reduction by creating awareness of the available equipment, attracting new talent and generation of income from latent equipment by hiring it to industries and others. This model is based on Open Source Software designed by University of Loughborough's Centre for Engineering and Design Education and IT services with Professor Rachel Thompson of the Materials Research School.

Another interesting endeavor is being conducted by **International Foundation for Science (IFS)** and the **African Academy of Sciences (AAS)** and funded by the MacArthur Foundation titled "Developing an enabling scientific equipment policy in Africa"[13]. The initiative aims to provide scientific equipment to universities and research institutes in Africa. The studies were carried out in Ethiopia, Ghana and Kenya.

Another interesting initiative, **Science Exchange** was founded in 2011 by Dr. Elizabeth Iorns and was backed by Y Combinator. The idea for Science Exchange grew from the premise that laboratories excel in

[13] Some of the recommendations of the report are

- Procurement: Developing strategies for scientific equipment based on the needs of the scientists and the priority research areas of the organization or country's agenda for research and sourcing from local agents to ensure accountability and timely service
- Maintenance: Obtaining service contracts for regular maintenance, repair and calibration. Record keeping of all these activities should be enforced.
- Institutions: Generation of income by facilitating equipment use and forming collaborations between institutions to share expensive equipment thereby aiding in cost cuts.
- Government's role: Reduction in bureaucratic delays of clearances to obtain equipment.
- Disposal: The onus of developing disposal policies and procedures lies on the committees established by the institutions by detailing the time, safety parameters and usage of proceeds in tune with the directives of the government and globally accepted safe disposal protocols. Environment and health risks of disposal should also be studied.

some areas at one time. So the creation of a marketplace to infuse interaction and tie-ups based on strengths may prompt faster and better research. The facilities at Johns Hopkins University, the Mayo Clinic and Harvard Medical School are all a part of this exchange. Unlike contract research, this model uses speedier and simplified agreements. The model encourages laboratories to provide a list of facilities (currently this is around 6500) and researchers obtain bids for work. Currently there are 1,000 labs with almost $43.6m in quotations, $21.5m of that in the first nine months of 2014.

Given this global trend of benefits arising from an infrastructure sharing model, it is imperative that India adopts a suitable scientific infrastructure policy to effectively utilize its research infrastructure. This policy would bring more clarity on procurement, maintenance, disposal and sharing of scientific research equipments. The policy should also establish necessary linkages with other Government initiatives like Make in India, Skill India and Startup India to foster innovation and entrepreneurship in the country and to create skilled technicians/manpower to utilize the scientific equipments in a better and efficient manner.

Effort form the Indian Government is already evident. As an initiative of the National Science and Technology Management Information System (NSTMIS) Division of the Department of Science and Technology (DST), a study for development of database of equipment funded under extramural R&D projects during the period 2003-04 to 2007-08 was conducted by The Energy Research Institute (TERI). The study has resulted in the creation of a web- based database presenting details of 394 EMR projects having significant equipment each costing Rs 10 lakhs and above located across the country. The study has also analyzed the data received from project investigators and prepared a report covering the funding pattern of equipment, city and state-wise distribution, and gender representation, among others. Later, a workshop was organised by TERI in New Delhi on 16th August, 2016 to provide a forum for the stakeholders involving government, scientist, academicians and researchers including industry to share views and provide inputs leading to policy actions for strengthening equipments utilization and thus fostering scientific innovation in the country. Major objectives of the workshop were to

- Provide an opportunity to project investigators and scientists to share experiences related to scientific equipments

- Promote the Equipments Database and facilitate a culture of sharing scientific equipments thereby promoting scientific collaboration among institutions
- Evolve a standardized interoperable database of scientific equipments

It was also discussed in the workshop how the database of scientific equipments can be effectively shared among the various stakeholders.

In further continuation of this process, the present study, catalyzed and supported by NSTMIS, is aiming at establishment of a set of guiding principles related to procurement, maintenance, disposal and sharing of scientific equipments that can be utilized across the universities/Higher Education institutes/ Research laboratories to increase efficiencies and ensure optimal utilization of research infrastructure. Interaction with various research organizations, laboratories (both private and public), and academic institutions under this study has provided not only an understanding of the existing practices but also of best practices in vogue and the issues plaguing the system. A workshop was also conducted under the study at IIC, Delhi on 9th and 10th February, 2017 which was attended by various heads of research organizations, scientific laboratories, universities, colleges, IITs, etc was inaugurated by the Secretary, DST. The workshop came out with a set of suggestions that have been factored into the recommendations of this study for drafting the new National Scientific Research Infrastructure Policy.

Before attempting to suggest new policy recommendations, we have studied the existing policies[14], and standard practices on scientific research infrastructure in CSIR, ICAR, ICMR along with the GFR 2005. Even though the policy template followed by all scientific research organizations stem from GFR 2005, in some institutions under these organizations, certain practices have been tried and tested which we consider as best practices, which will be elaborated in later chapters. Following this chapter we elaborate the research methodology in chapter 3, which is followed by chapter 4 on the main findings of the study. The recommendations are given in chapter 5. The report shall enable to draw policy lessons and the best practices shall facilitate us to come up with the implementation guidelines of the same.

[14] A summary table of common policy provision in scientific research organizations is given in Appendix 1. We have only highlighting the common and major policy and standard practice regime that is prevalent in these scientific organizations. GFR 2005 is the main policy document of the Government of India that has shaped the policies (mainly of procurement and disposal) of the scientific departments and hence we have highlighted the main provisions of GFR 2005 too in the summary.

Chapter 2: Research Methodology

Clearly, a study of this nature involving research organizations[15] cannot reply on quantitative tools alone. In fact, much of the knowledge and wisdom of (best) practices can only be gathered and agreed upon through qualitative tools. Hence, the study relied more on interviews and stakeholder consultations to arrive at the recommendations. Individual (34 case studies out of 40 organizations selected for the study) case studies were also conducted of the responding organizations to gain greater understanding of the systems. This required physically staying in all the organizations for a certain period of time to interview various stakeholders.

However, to make a representative sample of stakeholders from whom qualitative data was collected, we conducted an exercise to include all major classes of institutions in various scientific departments. Geographical considerations were also taken on board while selecting the institutions and the country was divided into 4 zones for this. This was done to ensure that the institutions covered in the study did not reflect any geographical bias.

Institutions covered:

The study covered 40 research organizations including Government funded and private research laboratories, central & state universities, educational institutions and Public Sector Unit (PSU) organizations.

The 40 institutes/organizations in different zones of the country and falling in different categories are:

Table 1: Sample profile

	CSIR	Academic		PSU/Government Funded Institutions		Private Labs/Research Centers	Total
		IIT	Non IIT	PSU	Government Funded		
North	2	1	0	0	3	1	7
East	2	1	2	0	0	0	5
West	0	1	7	0	2	0	10
South	5	1	3	1	6	2	18
Total	9	4	12	1	11	3	40

[15] Research organization defines an entity that is endowed to conduct fundamental research, industrial research or experimental development. The organization is entitled to disseminate research results in the way of knowledge sharing (teaching, publication of technology transfer).

Questionnaire

A questionnaire, prepared in consultation with Department of Science & Technology (DST), was the primary research instrument for this study. The questionnaire prepared for National Scientific Research Equipment Policy was influenced by 'Assessment Tools for Laboratory Services and Supply chains (ATLAS)[16], Deliver Project, USAID and 'The N8 Equipment Sharing Toolkit (N8 EST)[17] .

The questionnaire that was used for the survey has two parts-qualitative and quantitative. The quantitative questionnaire was used to collect the data on the following aspects of equipment like Basic Profile of the Organization, Policies related to procurement, maintenance, sharing, disposal and training. The quantitative data was used to provide insights on various aspects like funding patterns etc.

The qualitative data was aimed at collecting information on the following aspects.

Procurement:

1. Details of the funding agencies
2. Details about the bidding system
3. Steps to ensure transparency of the bidding system
4. Details about e-procurement or online procurement and disposal system
5. How DBT/DST funded equipments are purchased (procedure of purchase)

Maintenance:

1. Procedures to monitor equipment health and maintenance procedures
2. Frequency and nature of maintenance checks
3. Details about maintenance support service (24*7 or any other)
4. Possible reasons for equipment failure
5. Alternatives during down time

Sharing:

1. The number of equipment shared
2. Proportion of time that is set aside for sharing

[16] **ATLAS:** The Assessment Tool for Laboratory Services and Supply Chains (ATLAS) is a comprehensive data gathering tool developed by the USAID - DELIVER PROJECT for assessing national laboratory systems. The ATLAS, a diagnostic and monitoring tool, is used for a baseline survey and for completing subsequent assessments for measuring changes in the laboratory logistics system or as an integral part of the work planning process. The information collected by using the ATLAS is analyzed to identify challenges and opportunities for improvement in the laboratory logistics system and to outline next steps, such as supplementary assessment or additional interventions.

[17] **N8 Equipment Sharing Toolkit**: Eight research intensive universities in U.K. namely Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York, are titled 'N8 Research Partnership' group to conduct collaborative research and equipment sharing. The assessment tool, The N8 Equipment Sharing Toolkit (N8 EST), is intended to support and assist the capacity of effective and efficient sharing of equipment.

3. Policy for sharing
4. Cost management of sharing
5. Reasons for not sharing other equipment

Disposal:
1. Disposal policy.
2. Health and safety standards are maintained during disposal

Linking training with National Skill Registry
1. Possibility of linking trainings with National Skill Mission
2. Possibility of designing a curriculum for training to use these types of sophisticated equipments.

Field Visits

Each questionnaire was filled in during the course of visit to various organizations and their views were collected on the same. As a part of the study, ASCI team visited 40 different research organizations/universities/academic institutions. The people interviewed included various cadres of people including directors, vice-chancellors, scientists, stores and purchase officers, procurement committees, instrumentation heads, central instrumentation facility in-charges and other key stakeholders. None of the questionnaires were emailed or mailed to the stakeholders and the team physically sat down with the stakeholders in these organizations and noted their views. This was done to ensure greater accountability and accuracy for the collected data and in the interest of speed.

Case Studies

The case study approach, as a part of research method, allows in-depth, multi-faceted understanding of complex issues. Case study helps to extend the knowledge and experiences. Case studies also help to find the relationships between different events or conditions. This approach also throws insights on gaps in present system and defines proper implementation strategy over others. The value of case study approach is well accepted in fields of business, law and policy.

34 individual cases were prepared on the basis of the inputs from the questionnaire and interactions and feedbacks of the critical stakeholders from diverse domains of research. The case studies tried to deliberate on different processes of procurement, operation and maintenance, disposal and sharing.

Chapter 3: Findings from the pilot study

This chapter has been segregated into following sections

3.1 Quantitative findings based on the outcome of the questionnaire: The study has covered 40 institutions, out of which the team has 35 filled-in questionnaires. Questionnaire data is analyzed and quantitative findings are reported in this section

3.2 Common Findings based on case studies: This section is prepared based on findings from 34 case studies and deliberates on the issues and recommendations on procurement, maintenance, disposal, sharing, training and the existing practiced models of these organizations.

3.3 Best Practices based on interviews and case studies.

3.4 Linkage with other flagship programmes of the government of India.

3.1 Quantitative findings

The study has covered 40 institutions, out of which the team has 35 filled-in questionnaires. The institutions visited can broadly be categorized into four major types namely, CSIR institutes, Academic institutions, Government or PSU research organizations and Private research laboratories.

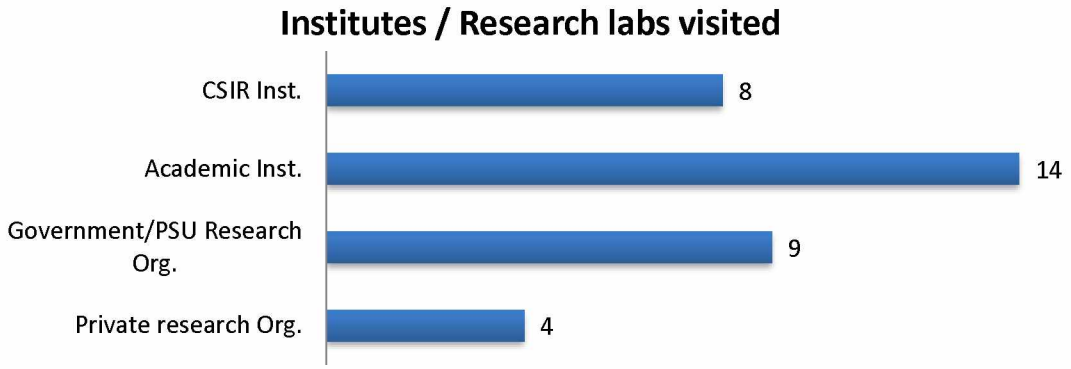

Figure 1: Institutes / Research labs visited under the study

Figure 1 shows the number of institutions visited among which 8 CSIR laboratories, 14 academic institutions, 9 Government research organizations and 4 private research organizations.

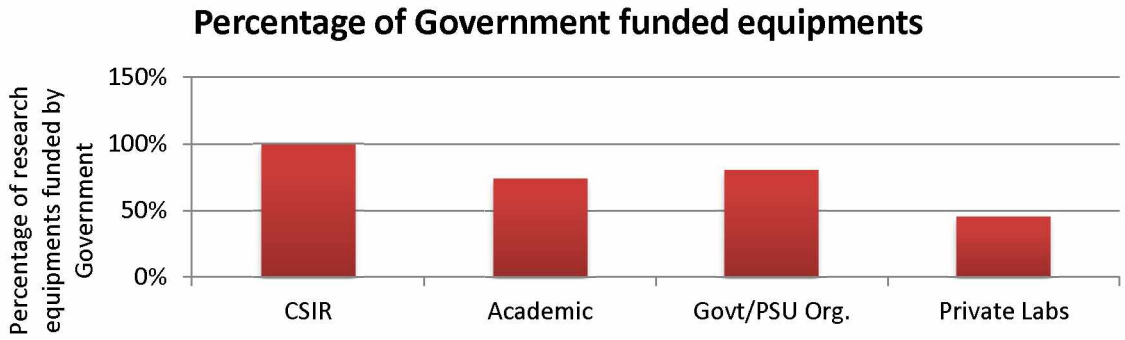

Figure 2: Percentage of Government funded equipment in sample

99% of the equipments purchased by the CSIR laboratories within the sample are Government funded. This share is around 80% for Government or PSU organizations. Academic institutions covered under the study procure 74% of the equipments through Government fund. While private laboratories within the sample studied purchase only 45% of the research equipments through government fund.

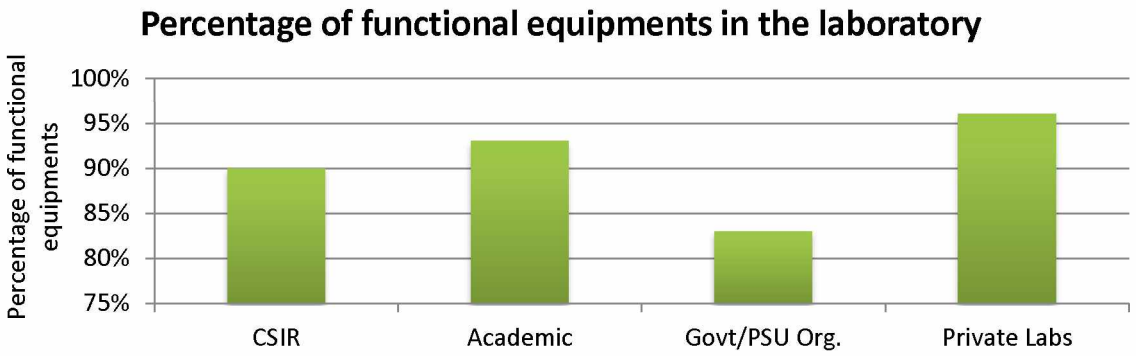

Figure 3: Percentage of functional equipments in the sample

On an average 95% of the equipments of CSIR labs within the sample are functional. The numbers are 83%, 93% & 96% for Government or PSU organizations, Academic institutions and Private research laboratories within the sample respectively.

Reasons for non-functionality of equipments:

- **a.** Non-availability of spare parts
- **b.** Equipment outdated and needs replacement
- **c.** Consequent to project completion, equipment not operated due to lack of skilled manpower
- **d.** Others (viz. Repairing cost not economical)

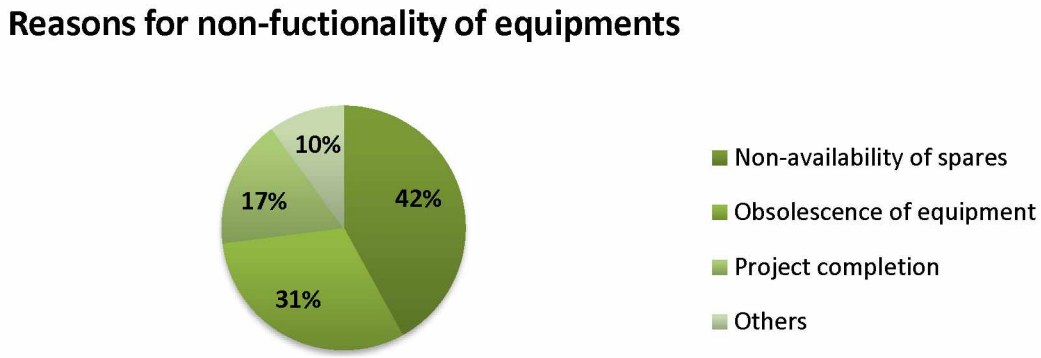

Figure 4: Reasons for non-functionality of equipment in the sample

In 42% cases, equipments are non-functional due to non-availability of spare parts. In 31% of the cases, expiration of life of the equipment is the major reason behind non-functionality. 17% of the respondents mentioned that most of their scientific equipments are project specific. Hence, it is hard to get skilled technicians to operate these equipments after project completion. It eventually leads to equipment failure. 10% of the respondents raised other issues like high maintenance cost of the equipments in post-warranty period as the reason of equipment failure.

Procurement:

- **Use of online procurement system:** Online procurement facility is not much prevalent in the organizations that were surveyed. **Only 8 out of 35 institutions covered under the study follow e-procurement for scientific equipment purchases.**

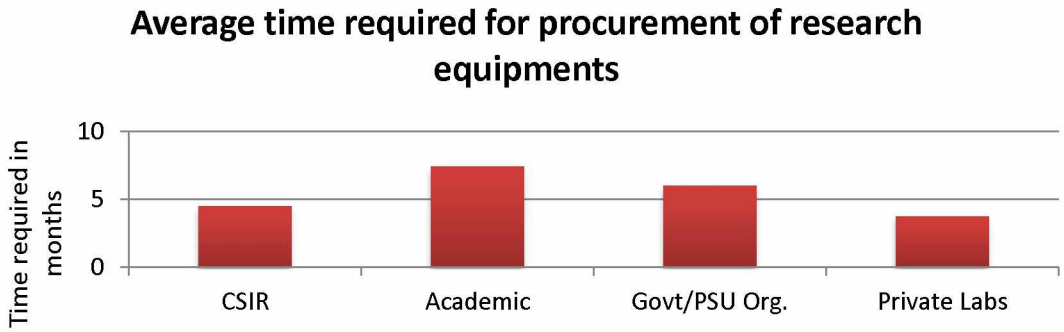

Figure 5: Average time required for procurement of research equipment in the sample

The time required to procure equipments indicates average time the procurement process takes from raising an indent to placing the equipment in the laboratory. CSIR laboratories within the sample take 4.5 months on an average to procure research equipments. Academic institutions covered under the study take longest time, average of more than 7 months. The numbers are 6 months and around 4

months for Government/PSU organizations and private laboratories covered under the study respectively.

Maintenance:

- 37% of visited organizations have dedicated maintenance team for research equipments.

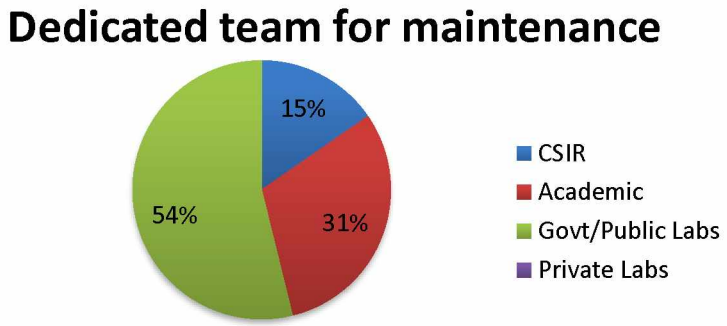

Figure 6: Availability of dedicated team for maintenance in the sample

54% of Government or public research organizations within the sample visited have dedicated in-house maintenance team. 31% of academic institutions covered under the study have dedicated team for equipment maintenance. 15% of CSIR labs within the sample studied have dedicated maintenance team. No private lab within the sample has in-house maintenance team. Majority of them go for Annual Maintenance Contract (AMC).

Disposal:

Disposal of research equipments can be handled by –

a. Auction of spares
b. Gift to academic organizations
c. Parts recycled
d. Sold as scrap

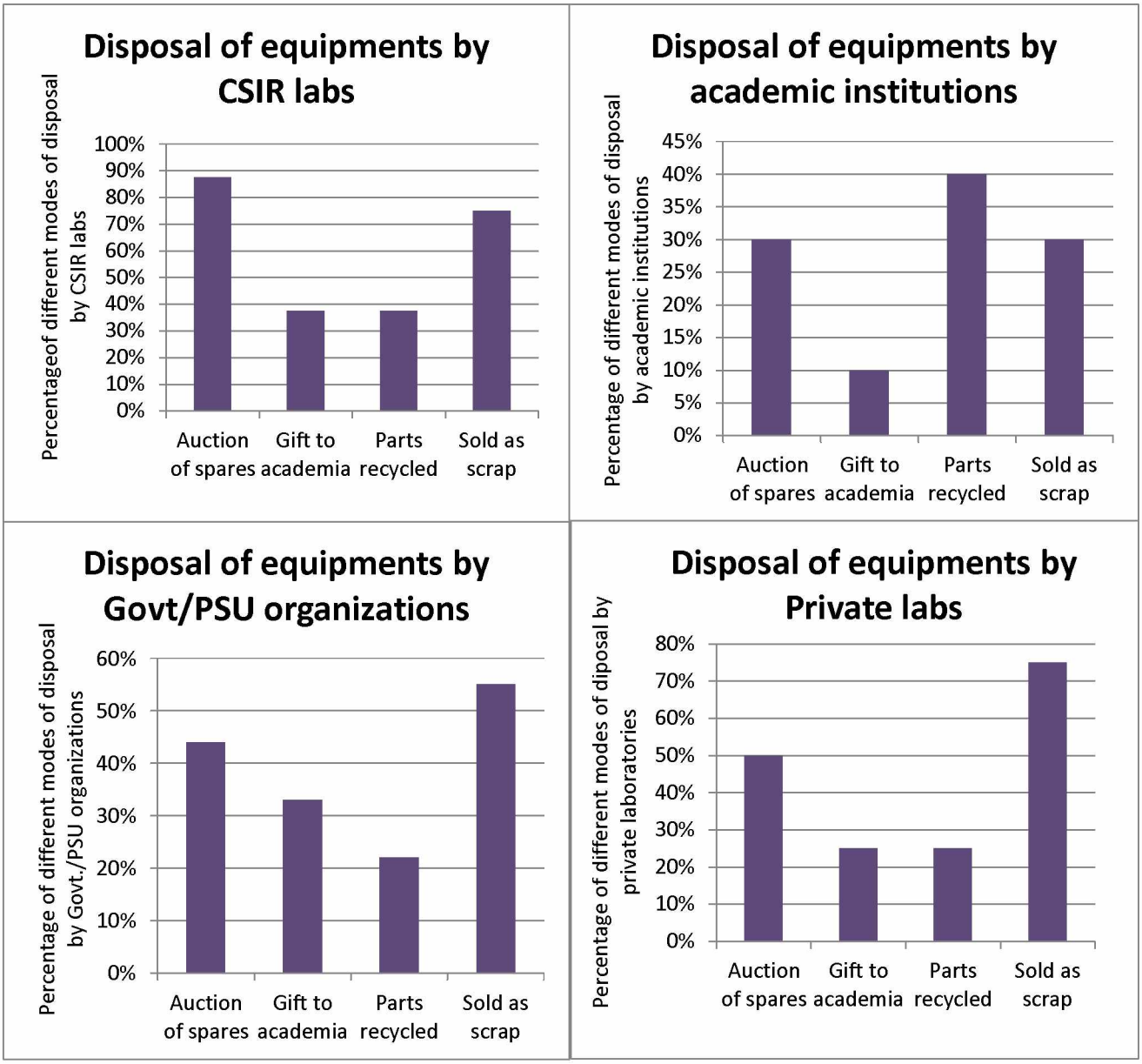

Figure 7,8,9, 10 Modes of disposal by various organizations

Most of the CSIR labs follow one or more methods of disposal. It is evident from the result that auction of spares is the most commonly practiced method of disposal in CSIR labs covered under the study. 83% of CSIR labs within the sample dispose the equipments through public auction, 17% by gift to academic institutes, 50% by recycling the parts of the equipments and 67% by selling as scrap.

30% of academic institutes covered under the study dispose of equipments through scrap selling and public auction. 40% of the institutes within the sample recycle the parts and 10% of institutes gift the equipments to other academic institutions.

Auction of spares and sold as scrap are two major equipment disposal methods in Government or public research labs. 44% and 55% of labs within the sample follow auction of spares and scrap selling respectively. Only 22% of the labs covered under the study recycle equipment parts.

Scrap selling is main disposal method for private research labs. 75% of the labs within the sample dispose the equipments through scrap selling. 50% of the labs within the sample go for public auction for disposal of equipments while 25% opt for gifting to academia and recycle of parts for disposal.

Sharing of equipments:

- 33 out of 35 organizations within the sample share their equipments.
- All the CSIR labs covered under the study share their equipments with academia, Government research labs and private companies.
- 93% of academic institutions within the sample share their research equipments.
- All the Government and Public research labs within the sample share their equipments with other organizations.
- 75% of Private research labs covered under the study share equipments with other organizations.

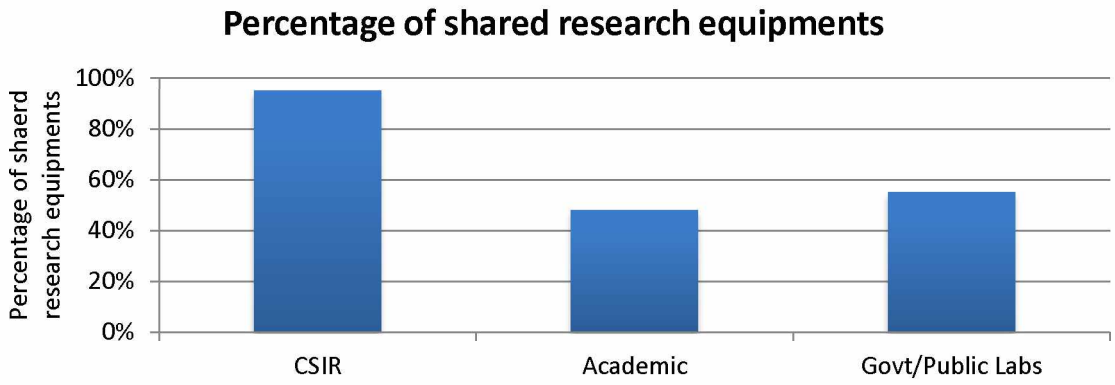

Figure 8: Percentage of shared research equipment in the sample surveyed

95% of the equipments in CSIR labs within the sample are shared with other institutions. The percentage of shared equipments in academic institutions and Government/PSU organizations within the sample are 48% and 55% respectively.

Training:

Training is mostly provided by in-house experts, resource sharing, collaboration with other organizations and by external experts.

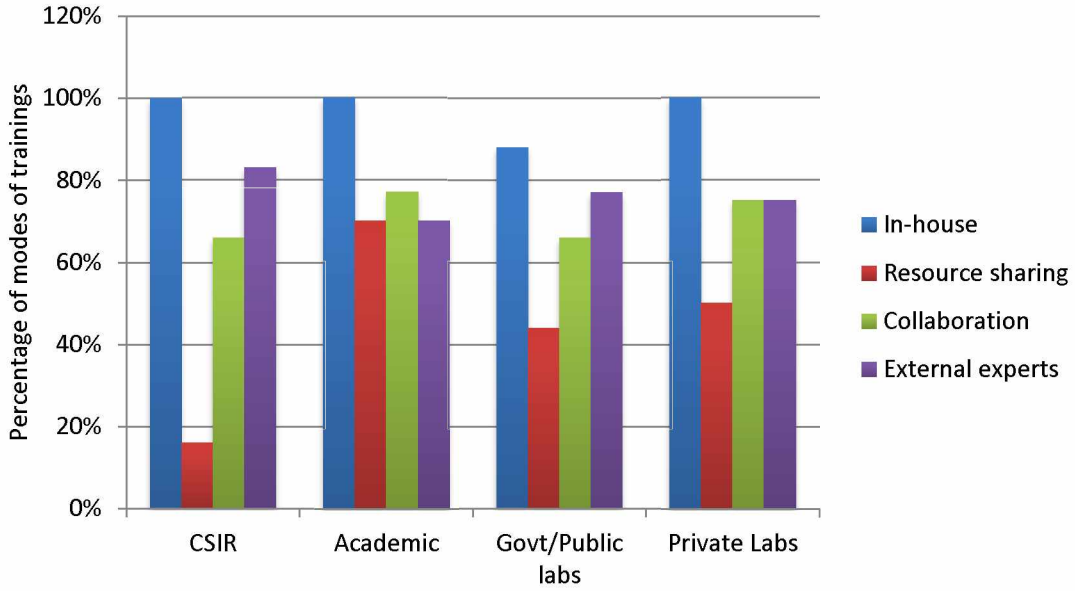

Figure 9: Training Methods in various types of organizations in the sample surveyed

Figure 12 shows training methods (in-house, resource sharing, collaboration & external experts) and percentage of organizations provide trainings in each method.

CSIR: All the CSIR labs covered under the study provide training through in-house experts. Only 16% of these labs have facility of resource sharing whereas 66% labs provide training through collaboration. 83% of CSIR labs within the sample impart training through hiring external experts.

Academic: Like CSIR, all the academic institutions within the sample also train their resources in-house. 70% of the institutions covered under the study provide training through resource sharing and external experts. 77% of academic institutions within the sample provide training via collaboration with research organizations and other academic institutions.

Government/PSU organizations: 88% of the Government or public research labs covered under the study impart training by means of in-house experts whereas only 44% of the labs access resource sharing for training purposes. 66% of the organizations within the sample opt for collaboration as a way of providing training. 77% of the organizations within the sample allow employees to get trained via external experts.

Private Labs: All the private laboratories covered under the study provide in-house training whereas only 50% opt for resource sharing. 75% of the private labs within the sample offer training through collaboration & external experts.

3.2 Common Findings based on case studies

This section is prepared based on the outcomes of 34 case studies prepared under the study. The case studies were prepared based on the qualitative interviews with the key persons like directors, vice-chancellors, scientists, stores and purchase officers, procurement committees, instrumentation heads, central instrumentation facility in-charges and other key stakeholders of various organizations. This section deals with the issues and recommendations on procurement, maintenance, disposal, sharing, training and the existing practiced models of these organizations.

Procurement

Standard Procedure

- Most of the organizations purchase equipments using the guidelines in GFR 2005.
- CSIR, ICAR, ICMR and IITs use the procurement rules derived from GFR 2005.
- For low value equipments (less than Rs. 1 Lakh) the organizations allow direct purchase. For medium value equipments organizations follow limited tender (two-bid system - both technical & financial bids). For the high value equipments, these are purchased through global tender.
- Very few organizations have implemented e-procurement systems.

Issues

- Larger lead time for high-end equipments due to delayed clearance at customs.
- In some organizations, shipping of imported goods is done through a logistics company which creates a delay. The OEM has to ship the equipment to the nearest store of the logistics company which in turn dispatches the equipment only when their containers are full leading to unnecessary wastage of time.
- Absence of manufacturers of high-end equipments forces import of most research equipment.
- Selection of bids as per L1 often compromises the quality as in some cases has been noted with Chinese manufacturers of equipment, who provide the equipment at cheaper rates, thereby qualifying for L1, but the quality is not as expected.
- Scientists have brand preference and prepare technical specification in accordance with the specification of their desired brand. It leads to single bidder situation and takes more time to procure.
- Procuring spares from the OEM is costly and time consuming. Indian or local agents having capabilities to supply that spare may not be authorized agent to the OEM and not registered to DGS&D.
- In case of imported equipments if there is any issue - small or big - the arbitration has to happen in the place of origin of the equipment. This leads to time delays.
- In case of ICMR, the approval for procurement comes from the purchase committee. The Institute Director is only allowed to purchase equipments costing up to Rs. 5 Lakhs which in the present scenario is a small amount for high-end equipments.
- Duplication of purchase - instead of sharing, some organizations are buying same equipment repeatedly.

Maintenance

Standard Procedure

- Most of the organization use AMC model for maintenance. Usually the AMCs are given to the vendors from whom the equipments are purchased. Sometimes third parties are also involved.
- Some organizations use the outsourcing model where a third party is completely responsible for the maintenance of the equipment including testing, analysis, and routine maintenance of the equipment. In turn the organization enjoys notional rates for utilizing the equipment and earns substantial revenue on individual sample testing. The Instrumentation team deals with the breakdown repairs or employs the AMC for maintenance of highly specialized equipment.
- Some organizations have their own instrumentation group comprising of skilled engineers and technical operators who are completely responsible for the maintenance of the equipment including testing, analysis, routine & breakdown maintenance of the equipment. Regular trainings are provided to this team through various workshops and training sessions. The team is also provided service trainings at the vendor site at par with the company's own service engineers. This ensures reduced down-time. The organization has a high power UPS ensuring clean power to all the labs and reducing breakdowns.
- Some academic institutions follow a model to operate the equipment by recruiting several technical assistants dedicated for the central facility. These technical assistants are PhD students of different institutions and well trained in handling the equipments. They are responsible for carrying out sample testing, analysis and daily maintenance of the instruments. Breakdown maintenance is taken care of by the vendors through AMC.
- In some other cases, a dedicated team has been created who is responsible to take care of all equipment related activities of both common instrument room and central facility. The team comprises of 4-5 people including general engineer, biomedical engineer and 4-5 technicians to support. The engineers are responsible to inform institute about purchasing spares and other necessary parts.

Issues

- Fund is the major constraint to maintain equipments after completion of the project. State universities do not have enough funds and are mainly sponsored by state governments and UGC. State government provides fund for maintenance of the infrastructure and creation of infrastructure.
- Funding agencies only provide cost of the equipment. Receiving organizations request OEM to raise bill of equipment in such a way so that it includes Warranty and AMC for 2-3 years to cover maintenance at least for the project duration. But in several cases, OEM does not provide maintenance and leaving third party maintenance as the only option. In such scenarios, the organization has to bear the maintenance cost after the warranty period.
- Most of the high end equipments are imported. So the technical know-how, specification and everything lies with OEM which creates heavy dependency.
- Several parts of high end equipments supplied by OEM are manufactured by third parties. While changing those parts OEM does not provide Proprietary Certificate of the parts and organization is not ready to accept any spare without proprietary certificate.
- Vendors take long time to respond leading to longer down-time and impacts on project.
- Lack of clean power supply is the major reason of equipment failure.
- Unavailability of skilled technical local manpower to operate and maintain equipments.
- In case of tie up breakdown between global vendor and local maintenance company, the buyer faces serious issues.

- Duplication of equipments unnecessarily increases expenses like electricity, manpower cost etc.
- Obsolescence of the equipment often leads to scarcity of spare parts and servicing personnel.
- Vendors often offer buy-back just after 2-3 years of purchase, instead of repairing it, citing obsolescence.

Disposal

Standard Procedure

- Most of the organizations use the write off policy.
- Come organizations sell the equipments as scrap.
- Some organizations use the service of MSTC for disposal.
- For specific materials like those with radioactive emissions standard procedures are followed.
- Some organizations use their obsolete equipment as exhibits.

Issues

- Due to lack of proper disposal policy some of the organizations face unavailability of space in the laboratories.
- Gifting of high end equipment is not practiced.

Training

Standard Procedure

- Most of the institutes train in-house, at vendors' location or are trained by the vendor at the installation site
- Some organizations send their instrumentation team for training at the vendor's site for service training which is at par with the vendor company's own service maintenance engineering team's training. This gives them hands on experience with understanding the internals of the machine and thereby providing better service in case of breakdown.
- The vendor usually trains the scientists and research students on using the system appropriately at the time of the purchase of the equipment either at the buyer's site or at the vendor's site.
- In some organizations, new entrants into the organization are given a basic training on use of equipment called authorization procedure. This applies when they enter the organization, as well as when they request for using the equipment. This involves training on actual usage, health and safety of usage as well.

Issues

- A common issue is attrition in case of instrumentation team as well as users. When the main users of the system who are trained to use the system, leave the organization without training any new people, then the equipment lies unused for lack of operators.
- As per government rule, service tax is levied @ 15% on bill amount for providing services. Some training institutes and other government institutions and research organizations are dedicating their training facility for meeting the shortage of trained and skilled resources. Central government is also taking several initiatives to train people to meet the gap. In such scenario, enforcing as high as 15% of service tax on training bills do not align well with the mission and vision of the Government and highly rated government institutes to achieve Skill India.

Sharing

Standard Procedure

- Most organizations share their equipment internally amongst their scientists, faculty and students.
- When sharing with outsiders, most organizations charge minimally for their sister organizations, at a small price for academic, government and research institutes and at a premium for private organizations/labs.
- Organizations ensure only dedicated operators use the equipment and outsiders are allowed to only bring the sample and take away the results/analysis.
- Usually sharing of equipment in a central facility is allowed in most organizations to ensure lesser maintenance issues.
- Slots are booked for using the equipment and the PI who indents the equipment gets longer slots in some of the organizations.
- The zonal ecosystem of **Mumbai - Pune** allows sharing of equipments between different kinds of organizations like IIT Mumbai, NCL (CSIR), IISER (Central University), Pune University etc.
- Some organizations receive huge requests for testing samples especially in niche domains. The parties have to bear certain cost for consumables. Outside sharing does not exist for specific equipments like flow-cytrometer, proteomics, genomics due to internally high demand. However, the sharing on payment basis is allowed in sister locations.
- IITs promote research societies and different science and technology clubs to promote R&D among students. The societies are interactive in nature that operates by organizing workshops and competitions which automatically creates a spirit of sharing.

Issues

- Some organizations like CSIR Laboratories and IITs get tax exemptions in procuring R&D equipments. They get excise duty waiver in indigenous equipment and custom duty waiver in procuring imported items. While procuring R&D equipment, clear declaration has to be made that the equipment will not be used in commercial purpose. So after completion of project, legally that equipment cannot be used commercially in sharing facility.
- State Universities like CU and JU do not have any central facility and sharing of equipment is very low.
- In organizations where the Principal Investigator owns the equipment, a lack of interest to share the equipment can hamper the process. Additionally, the PI would be held responsible in case of failure, so they are wary of sharing the equipment for fear of damage to the equipment during the course of the project or even otherwise.
- Some organization structures like universities with multiple colleges under them do not encourage sharing and promote standalone equipments so as to ensure lesser audit objections and clean balance sheets.
- Culture of sharing of scientific equipment is not prevalent in India. Equipments are not shared even within two departments of the same organizations. The most common model of equipment sharing is that the outsiders book a slot in the central instrument facility to test their sample whereas the sample is run by internal technicians of the institute. Most of the institutes run their shared facilities through their faculty members. Most of these faculty members are engaged in their own project. Hence it is difficult for them to provide dedicated time for central instrument facility. It often compels the leading laboratories to deter outsiders from using their equipment citing 100% usage or

lack of time on the part of the dedicated operator.

- Lack of manpower to manage shared facilities.
- Most of the institutes run the shared facility through their faculty members and this adds to their responsibilities.
- In some cases, within the organization the sharing is free of cost leading to instances where students and researchers request for using the equipment (to test their sample) not related to their study or not required for their research.
- Sharing of equipment is a facility and any facility needs managerial approach to maintain and run. But in most of the organizations, scientists have to serve the purpose and it is clearly the wastage of manpower or human resource.

3.3 Linkages with Central Government Initiatives

The new National Scientific Research Infrastructure Policy (NSRIP) should be connected with the initiatives of Central Government e.g. Make in India, Skill India and Start-Up India. A suitable linkage between the new policy and these initiatives will definitely foster innovation and entrepreneurship in the country, create employment opportunities and will establish a set of skilled manpower to handle sophisticated research equipments in a better and efficient manner.

Make in India: Absence of manufacturers of high-end equipments forces import of most research equipment. A recent study conducted by NSTMIS revealed that majority of the scientific equipment in India is imported (94% at a total cost of Rs 50504.50 Lakhs) as against indigenously manufactured equipment (6% at a total cost of 1770.38 Lakhs). This adds to the burden of research infrastructure costs. The figures also support the argument that India needs a separate manufacturing industry to indigenously develop scientific equipments. This could link the National Scientific Research Infrastructure Policy with Government's flagship program "Make in India".

Skill India: Skill takes centre stage in maintenance of scientific equipments. Sophisticated equipments call for greater technical expertise for operation and maintenance. It is necessary to complete testing, analysis and report within shortest possible time for which laboratories need expert technical operators. Unfortunately, in India, skill is the biggest impediment to operation and maintenance of scientific equipments. Hence, there is a need to link National Scientific Research infrastructure Policy (NSRIP) with National Skill Mission. A pool of expert technicians especially dedicated to handle sophisticated multidisciplinary equipments needs to be created under National Institute for Skill Development (NISD).

Startup India: Majority of the scientific equipments become obsolete due to lack of maintenance. These outdated equipments are sold in the market at a minimum value as scrap or through public auction. Startups can be engaged for maintenance and disposal of equipments. After project completion, unutilized/idle equipments can be given to the startups, which would create entrepreneurial opportunities. Thus, maintenance and training will no longer be the burden of the research organization. This process has two fold advantages. Firstly, it will solve the problem of maintenance and disposal and on the other hand, it will contribute to "Startup India".

Chapter 4: Recommendations

This section describes the best practices and recommendations coming out of 34 case studies, questionnaires and workshop deliberations.

Database Development

- A comprehensive database/ portal for scientific equipment to help students and researchers locate alternative sources and provide greater transparency is desirable. This would also promote networking among R&D labs and allow on-line booking of facilities. Any high value (costing more than Rs. 5 lakhs) R&D equipment sponsored by any department or agency of central/ state government should be registered with centralized database. In addition to this, the institute/ organization must be bound to share the equipment with others and upload all the relevant information in their website.
- Creation of a comprehensive database of indigenous research equipment manufacturers to promote domestic manufacturers
- Creation of a national portal for vendors with provision of vendor rating mechanism
- Creation of dedicated national portal for sharing of scientific equipments across the research organizations
- Archiving of data from R&D equipments with a provision to transfer unutilised or idle equipment to other labs
- Creation of a national portal for surplus items
- Creation of database of inventory at institutional level
- Creation of web platform for materials/ storage/ purchase officials to exchange best practices and information.
- An MIS reporting tool for research organizations can help to get a clear picture of Government spending and usage at any instance would be very useful. Moreover, it can be used to evaluate the utilization of the Government funded equipment.

Procurement

- Uniform procurement policy across all scientific organization including universities.
- Adoption of comprehensive procurement policy with provision for warranty, extended warranty, AMC and buy back of equipment. A provision to include peripheral units that supplement the main unit like chillers, UPS, stabilizers, and Air dryers as part of the equipment.
- Promoting e-procurement and linking of National Scientific Research Infrastructure Policy (NSRIP) with Government e-Marketplace (GeM) to bring in transparency, efficiency and ease of access.

However, there should be provision for purchase of spares of equipment to be bought from non-DGS&D Indian agents, in cases, as may be required.

- Establishment of professional procurement cell across the organization or regional basis to take care of all procurement related activities. This agency would be equipped to handle procurement of all types of scientific equipment - high, medium and low end, each with its own set of guidelines. Given the growing numbers of imported equipment, there should also be a push for the OEM to setup inventory of spares in India by the central government to reduce the cost of maintenance and spares procurement as well as reduce down time.
- Reverse auction as a practice among successful technical bidders to achieve price competitiveness
- Involving specialized people in procurement process for negotiations and management of procurement process would reduce the burden of the scientists in the procurement process.
- In case of shipping of imported high end equipment, organization should rely on OEM/ Supplier of equipment. It saves time and OEM/ Supplier is liable to attend any problem related to freight and equipment during shipping of the equipment.

Maintenance & Sharing

- Most organizations find that maintenance of high-end equipment requires specialized handling and know-how and therefore usually adopt the Annual Maintenance Contract model whereby a third party, in some cases the original vendor from whom the equipment is purchased, is engaged on a contractual basis to provide maintenance services that include both routine as well breakdown maintenance. Some organizations have small teams that can deal with routine maintenance for low value equipment. This model works fine when the party providing services is able to respond in a timely manner to request for maintenance or repair. But more often than not, the organizations are faced with a problem of non-responsive contractors and delay in repairs. The reasons for delay include:
  - Lack of trained manpower at the contractor's end: This happens with slightly older equipment, where the people who had the knowledge for repairs of such systems have since moved on and the contractor is unable to find trained people to send for repairing the equipment.
  - Lack of spares: While it is a norm for vendors to usually stock spares for upto 5 years after the equipment has been declared obsolete, sometimes there is lack of adequate number of spares, thereby leaving the contractor in difficult position to provide timely help. Though the spares may be sourced from a local vendor, it may take more time than the original spares.
  - Failure of tie-up between AMC provider and international vendor: In case of imported parts, it has been observed that the vendor companies tie-up with a local service provider to provide

maintenance locally. As a part of the initial contract agreement at the time of purchase of equipment, these local companies agree to all the conditions of maintenance. However, at times these tie-ups breakdown due to lack of consensus between the parent vendor company and local service provider. This becomes a roadblock for those organizations that are refused service by the local service provider citing breakup with the parent vendor company.

However, this has been overcome by one of CSIR's lab that the team visited, CCMB. Right from its inception, the founders envisioned the need for an in-house instrumentation team. The instrumentation team was supposed to provide round the clock service for the laboratories and equipments housed within. The in-house instrumentation team comprises of people from the Physics and Electronics background. The team is constantly sent on trainings to vendor locations for Service Training Programmes that are also attended by service people from the vendor's company. This ensures that the instrumentation team has first-hand knowledge of the equipment, its parts, maintenance and handling before actually touching it at CCMB[18]. This also ensures they receive the best quality of training for maintenance. Similarly, the instrumentation team also attends the user training that is conducted at the time of installation of the machine. There is also other training that are provided by in-house experts for the instrumentation team. Every member of the instrumentation team handles only particular types of specialized equipment besides regular maintenance activities and they are available on call all through the day. This model has ensured that there is hardly any down time, a rare claim for a scientific organization[19]. The delay is only in getting spares. The part is immediately procured if available locally otherwise it is placed for procurement. There is no down time due to non attending of calls. This is the reason that some of the equipment at CCMB, is very old and yet usable because they are well maintained. At CDFD and

[18] The satellite structure of CCMB is designed with a central instrumentation facility that is located centrally and the various labs are located in each of the wings. The instruments in the central instrumentation facility and the individual laboratories are open for all the CCMB scientists to use by booking slots. This creates an open environment for all to work. However, to eliminate one of the primary causes of failure by inappropriate handling of equipment, all the people are required to undergo training under the supervision of the Instrumentation team termed the Authorization Procedure. This procedure ensures the operators are completely aware of the equipment they handle before they actually use it. Anybody wishing to use any equipment has to request the Instrumentation Team for the Authorization Procedure and once they are authorized, they are allowed to use the equipment. The procedure training a new user by the member of the instrumentation team based on the request sent to the instrumentation head. This procedure is mandatory for medium range equipment. The team member in charge trains them and explains the use and safety etc. Their name is entered in the log book. Only then they are allowed to use the machine.

[19] If there is a breakdown in any machine, there is an online ticket system where the ticket is raised by the scientist. The instrumentation head then assigns the issue to a member of the group who is trained to repair the machine. No one in the instrumentation group can handle all the equipment. There are in-charges for types of equipment who handle issues related to that equipment. Since the engineers are trained on service of the equipment, there is also an understanding of the possible causes of failure of the machine and so spares are stocked accordingly. This ensures that there is a stock of spare parts for frequent problems thereby reducing downtime. The spares for a lot of common instruments that are there in duplicates are also procured and stored so in case of failure of any of them, they can be easily replaced. Once the stock level diminishes, an indent is raised and the stocks are replenished. This ensures low downtime. That is why the machines are also of the same make to ensure that spares are easy to maintain. Calibration standards and maintenance routines are regularly performed. After every repair the calibration is done again.

SERC20 too, the Instrumentation department takes care of the instruments[21]. Some of the sophisticated equipments are earmarked for AMC while smaller ones are maintained in-house.

IUAC also has a dedicated in-house maintenance support system comprising of scientists and engineers. The scientists and engineers are properly and regularly trained by OEM (original equipment manufacturer) and suppliers. At the time of procurement, the in-house maintenance team is commissioned and they are engaged with the installation process right from the very beginning[22]. While some of the hi-tech high value equipments are maintained through AMC, the in-house maintenance team is responsible for maintaining the facility.

Another maintenance model that can be adopted is the model of Centre for DNA Fingerprinting and Diagnostics (CDFD) known as the equipment operation contract model that has proved very profitable for the organization. CDFD has identified a company based on advertisement and due tender process etc. and entrusted them with 14-15 high-value instruments that are operator based and where sample preparation is required and an analysis is involved. This company ensures smooth maintenance of all the equipment and the laboratory. While there is an in-house instrumentation team that deals with minor repairs, the team that handles the equipment is completely in charge of the maintenance. A scientist, junior scientist and technical assistants comprise the dedicated team from the company that operates the equipment. The external agency charges the users from CDFD at a notional rate while outsiders are charged at a higher rate for conducting the analysis of the samples[23]. The various components of the rate charged include:

- Cost of the consumables
- Notional value of the operator's salary

[20] At SERC, a dedicated work force for the maintenance of the equipment is hired. SERC appoints two different groups of engineers for operating and maintaining the facility. Most of the hired people are engineers of varying subject specialization like instrumentation, electronics, electrical, mechanical, civil etc. One set of people is hired with ITI training or diploma in engineering and another set of people are graduate engineers or post graduate degree holders. Fresh candidates are scrupulously trained to handle the high-tech equipments.

[21] There are 22 groups of scientists. The group that is sent for training during installation and also other special trainings includes the instrument group representative. During installation, the vendor company trains them and give necessary routine maintenance tips. Troubleshooting training is additionally provided to the instrumentation team. The user committee of the instrumentation facility oversees the problems and issues of the scientists to ensure faster redressal. The pay scales of the instrumentation team are higher than the industry scales, so attrition is not a problem.

[22] A comprehensive in-house maintenance support has resulted in huge cost benefits and created a skilled work force as well. This is supported by the fact that several maintenance and monitoring tools are regularly being designed by the scientists of the IUAC itself. The engineering team is also encouraged to develop their own instruments and funds are provided to support their development activity. The maintenance engineering team of IUAC has already designed high voltage power supply instruments and UPS (uninterrupted power supply) that are used in different projects of IUAC. The central monitoring system of the accelerator has also been designed by the in-house team.

[23] Organizations and individuals outside CDFD are however charged a higher rate depending on the nature of the institutions i.e. Educational institutions are charged less than research organizations which in turn are charged less than private organizations. Priority is given to CDFD users and during idle time it is given to other academic institutes and private companies. This helps not only in generation of revenue but also reduces the idle time of machines. This policy has been in place since 2009 and has led to 100% utilization of equipment with benefit to not only the organizations but people outside the organization as well.

- A component of depreciation
- Electricity charges

This model also reduces conflicts. In organizations where equipment is open for sharing, there arise instances of conflict of interests on the Intellectual Property so generated. When users, besides the Principal Investigator, use the equipment, they are required to share the IP with the organization or the Principal Investigator. This is an accepted practice. But sometimes the scientists/private industry may not been keen to share the IP of their research in exchange for mere sample testing. So they prefer to buy the equipment rather than share the IP. The model used by CDFD ensures that such a conflict never arises. The sample testing is done merely on a paid basis and so the IP does not have to be shared with CDFD. This ensures that interests of all the parties involved are protected.

- Promoting Academic/Scientific Social Responsibility in the academic and research circles. For e.g. Provision for laboratories to be kept open for school students twice a year
- Comprehensive guidelines for up gradation of scientific equipments.
- Provision of guidelines for utilization of income generated from equipment sharing for maintenance of the equipments and facility.
- Provision of parking funds for AMC and procuring spares beyond project period. A component of grant sanctioned by funding agency may be additionally provided for maintenance. Some organizations like, IIT Madras, keep aside 2-3% of the project value as the maintenance fund for maintaining the equipment after completion of the project.
- Financing the maintenance activity is another key area. For example, CDFD sets aside a fixed amount from the core fund for periodic preventive maintenance.

  A similar practice is followed in IIT Chennai. Most of the high-end and sophisticated equipment are maintained through AMC. In case of sponsored research, the maintenance and AMC charges are considered while framing the costing of the project. To ensure proper maintenance of high-end sophisticated equipment beyond the completion of the project, SAIF accumulates a fund, known as "Research Maintenance Fund"[24].
- Incentivizing laboratories that encourage sharing
- Legalize leasing and renting of R&D equipment.
- Rating mechanism based on resource sharing potential

[24] 2% of the project value is kept to RMF. This fund is used to maintain equipment beyond the project life cycle. In the case of government funded projects, Government is providing high value equipment for research. The ancillary instruments and consumables are funded by the accumulated user fees. In addition to AMC of the equipment, a small maintenance team is retained for maintaining the facility and equipment. The equipment is retained by the institute after the completion of project. The institute continues to quote projects using the used but in good condition equipment. It results in lowering the project cost and also ensuring the utilization of equipment. This is a win-win situation for both the parties i.e. institute and sponsor.

- There should be separate slots for startups to test their samples at these central facilities or at the laboratories that share their equipment.
- To maintain a sharing facility, dedicated management is required. A proper management system for allocating time slots and marketing of the facility can help improve the visibility of facility. At NCBS, this is handled by C-CAMP (Incubation Centre) which manages the visibility of sharing facility of NCBS leading to 200 organizations having used the facility of NCBS. The Online portal for searching and booking equipment is being maintained by C-CAMP. 20-25% of the users of the sharing facility are external to NCBS. Among the non-academic organizations, a fair share of start-ups and MSMEs has been observed. The marketing team of C-CAMP consists of senior personnel with managerial and marketing skills, so it is convenient for NCBS as the scientists do not have to bother in managerial issues.
- Another model in operation at SERC has a central facility to share equipment with other research laboratories, academic institutes and industry. The Business, Knowledge Management & Development (BKMD) division of SERC is guiding the sharing process of SERC[25]. BKMD facilitates the marketing and publicity of sharing facility to attract customers and manage the booking of the equipment. Any organization, government or private, can approach SERC to use their shared service. The service is open to all and the cost of sharing is determined by the Business Knowledge Management & Development (BKMD) division. The equipments are operated by the dedicated operators and scientists. EBoss, the online booking facility of shared equipments was launched by SERC in August, 2016 is helping to improve the visibility of their sharing facility by allowing online booking.
- Create a zone specific grid with dedicated transportation from where commonly used consumables can be sourced quickly as and when required.
- A minimum user cost must be introduced as a policy to avoid unwanted use of high end equipment.

Disposal

- A good guideline or policy on disposal of equipment.
- Centralized disposal unit is need of the hour to facilitate gifting and sharing of equipment between organizations. Electronics Test and Development Centre (ETDC) can be used as disposal and testing units for the disposed equipments. This will help achieve transparency, efficiency, cost benefit and professional approach in the disposal of scientific equipments. Engaging dedicated management professionals for the disposal process will allow the scientists to concentrate only on research rather than wasting time managerial issues.

Startups

[25] BKMD is involved in R&D planning, performance monitoring & management and facilitates the project team / leaders in estimating project cost in terms of manpower, material, capital and other items.

- Promoting startups for developing indigenous scientific equipment
- Establishment of nodal agencies for maintenance of high-end equipments. Promotion of start-ups may be a way forward to this.
- Promoting startups to dispose research equipments

Training & Awareness

- Organizing Workshops and training related to operation, health and safety of scientific equipments and new technologies
- Creating provision for human resource up gradation, capacity building, skill development. One such practice at CCMB has helped reduce failure of equipment due to lack of trained hands. The standard procedure requires that as soon as systems are installed, there is an applications specialist who trains the users on how to use the equipment, to operate and analyze samples using the equipment. Additionally, a day's training programme is provided to users for the high value equipment by the instrumentation team to each member of requesting to use the equipment before allowing actual usage. The training does not involve user training, as it maybe domain specific, but ensures that the users are trained on handling the equipment safely.
- Revamping and popularization of Instrumentation as a discipline across all premier academic institutions like IITs for ensuring the success of Make in India initiative.
- Arranging awareness workshops on safe and environment friendly disposal of consumables, residual and high end equipments to popularize safe and environment friendly disposal of high end scientific equipments
- Conducting seminars throughout the country to publicize the E-Waste (Management) rules 2016 for the green disposal of electronic goods.
- Conducting High-end equipment related workshops at least twice a year to discuss issues and create awareness
- Exempting training facilities from service tax.
- A talent pool has to be created to handle sophisticated equipments. For example, imaging is a highly specialized job which requires considerable expertise. Imaging has several specialized fields. To get a trained person in all fields of imaging in nearly impossible. One way to solve this problem is to tie-up with research institutes who have expertise in these fields and can train people. Now the trained people can be appointed in the central facilities. Reputed institutes should be engaged for National Skill Mission to provide training to the talent pool. In some cases, organizations have created a pool of 7-8 skilled technicians who are well trained to handle multiple high-end equipments like

proteomics, genomics, and flow-cytometer. This has allowed the organization reducing the down time of the equipment by ensuring availability of skilled operator at every time when there is a equipment failure. Training at reputed institutes like NISD should help create a dedicated talent pool that would be able to handle multidisciplinary equipments of a particular area.

Monitoring of scientific infrastructure

- Creation of a strong mechanism of checks and evaluation to ensure good laboratory practices and adopting mandatory compliance to the guidelines across all boundaries of laboratory activities.
- Careful scrutiny of space utilization, allocation and effective spending of funds.
- In some cases scientists have their own brand preference. In such cases, scientists prepare technical specification in accordance with the specification of their desired brand which leads to single bidder situation increases procurement time. It is recommended to allow the preference of scientist's brand up to certain limit like Rs. 50 Lakhs or Rs. 1 Crore. However, stringent checks could be put in place like performance of the equipment (past cases/ reference of other organizations), reference of publication indicating usage of the brand/ make, undertaking of the scientist about the experience of using that brand/ make to prevent misuse of the liberty.
- More stringent guidelines and monitoring for disposal of environment hazardous equipment and consumables.

Infrastructure

- Formation of cluster of colleges to create a central instrumentation facility that could be made available to all colleges within a 25-30 km radius. This would not only reduce redundancy in neighbouring colleges but also help in acquiring more variety of equipment with the funds received and thereby invite more expertise. Moreover, central facility guided by professionals can ensure the quality of equipment and vendor through active vendor evaluation, feedback archive and rate contracts. The success of this model has been established in the case of the zonal ecosystem of Mumbai-Pune.
- Strengthening of the regional Scientific research infrastructure in remote places through PPP model
- Most small educational institutions and industries do not find the requisite budgetary allocation to procure and maintain sophisticated analytical instruments. Creation of common infrastructure facilities is one approach to provide access to high-end equipment for research. One such initiative by DST, is setting up of Sophisticated Analytical Instruments Facilities (SAIF)[26] in different parts of

[26] The main objectives of SAIF facilities are –

- To provide for guidance acquisition of data using Sophisticated Instruments.
- To organize workshops on the use and application of various spectroscopic and analytical techniques for students, teachers and personnel from other Laboratories, Universities and Industries.

the country including those at IIT Mumbai[27], IIT Chennai etc. However, these shared facilities face their own issues:

- Lack of trained personnel (both in terms of numbers and their quality) is a common problem for most of the research organizations and academic institutions that were interviewed.

- Attrition: When people who are trained on using the equipment choose to move on to other organization without adequately training other people, it leaves the organization without trained manpower. This leaves the equipment lying idle for lack of users.

- Lack of time availability of dedicated operators: The people who are trained as dedicated operators are also staff and scientists on the team. These people have their own projects for which they are required to dedicate time and hence are not in a position to spare time for operation, even if the equipment were free for sharing

Given the above issues, SAIF, IIT Mumbai has devised a novel way to ensure that there is never dearth of trained operators for high end scientific equipment. SAIF, IIT-Mumbai's model ensures availability of skilled technicians to handle the SAIF equipments. In this model, each equipment is assigned to a scientist and one or more operators. These operators are called Technical Assistant (TA) and recruited from the pool of students who are pursuing their PhD under IIT-B. Usually, these TAs are appointed on a contract basis for two years. They are trained by professors & senior PhD students as well as external experts and manufactures. The TAs have to spend minimum 4 hours in a week in the laboratory against which they get incentives[28]. Performances of these TAs are strictly evaluated by SAIF committee. Apart from these, several workshops are conducted to train these bright students. All kind of samples come for testing, internal or external, are chargeable. A similar model may be adopted by similar such central instrumentation facilities.

- Another approach is for funding agencies to force the state universities to build central facilities and shift the funded equipment to the facility after completion of the project for shared use.

- Another way of financing equipment at the common instrumentation facility by setting aside a fund annually, as is in vogue in CDFD. Every year a part of the organization's fund is set aside for buying equipment in the common instrumentation facilities. Scientists and investigators in the organization

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- To provide facilities of sophisticated analytical instruments to scientists and other users from academic institutes, R&D laboratories and industries to enable them to carry out measurements for R&D work.

Development of new measurement/analytical techniques: Efforts are made by the SAIF to develop new techniques/ methods of analysis to put the instruments to their full use and offer them to the scientists for exploring new dimensions in research in various areas of science and technology.

[27] The Sophisticated Analytical Instrument Facility (SAIF), formerly known as the Regional Sophisticated Instrumentation Centre (RSIC), was established at the Indian Institute of Technology, Bombay, in the year 1976, with the support of the Department of Science & Technology, Government of India, New Delhi. SAIF, IIT Bombay houses a variety of major analytical instruments which are operated and maintained by a dedicated and qualified group of Scientists and Engineers. It is an integral part of IIT Bombay, and operates with an "open access policy". The result of this policy is that all can benefit from the services of SAIF.

28 Recently IIT is considering a policy where these students could avail the instruments of SAIF freely for two hours for their PhD work against the service of four hours in a week.

provide their input along with justification on the number of users who would be using this system. An internal committee then examines this list and sanctions for ordering of equipment based on the benefit and the cost components.

Others

- R&D Audit/Scientific Audit has to be different in the S&T context wherein the PI is not compelled to inflate the utilization of equipment figure on the commercialization scale(that of the ICT industry). One must understand that the equipment is being used for research purposes and there may be instances of minimal usage and non-sharing because of the sanctity of the research or with focus on research (and not 'commercial purpose'). As the purpose of the research is not the commercial usage of equipments per se. It's different from creating an equipment/instrument facility for its usage by large number of researchers.
- Introducing Target driven and award based system to ensure that the Principal Investigator will be duly awarded for successful completion of project in due time, generation of intellectual property, designing research application that can be transferred to market, sharing of equipment with other project/ research activity to fully utilize the efficiency of the equipment, proper maintenance of equipment and several other parameters.
- Introducing the concept of "cost of ownership" in place of "capital cost" to determine the user cost for accessing the shared equipment.
- National standard rates for different products
- One of the key reasons for equipment failure was cited as lack of clean power. This has been overcome by CSIR's laboratory, CCMB by installing a high capacity UPS for ensuring clean power to all the sensitive equipment and samples at all times. This is very essential considering the domain of the work of the laboratory.
- Constitution of committee in every organization to examine ways for further use of public funded research equipment.
- A comprehensive insurance policy for both the operator and the equipment is much needed for the organizations.
- The key to sustainability of any knowledge ecosystem is knowledge dissemination and sharing. IUAC has initiated some activities to help improve the Physics laboratory facilities in universities like designing and providing table top equipments that are used in M.Sc level. For example, a low cost Radiation detection and Analysis System has been developed which is useful to carry out some of the Nuclear Physics experiments at M. Sc level. This has been distributed to thirty universities after proper training on the instrument usage. While major high-end equipment at IUAC are used till their end of life and utilized in different ways, the old equipment that are obsolete or having less capacity are used for training purpose. IUAC gifts their old equipment to other research organizations if the

equipment is in running condition and any organization shows interest in taking the equipment[29]. Similar activities can add to knowledge creation and motivating of the community at large.

[29] For instance, once IUAC had to buy one large nitrogen liquid plant despite of having a smaller one to increase the capacity and meet the increasing demand of the equipment. After buying the new and large facility, IUAC gifted the old and small nitrogen liquid plant to UGC-DAE Consortium For Scientific Research, Indore which was fully functional in those days.

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Appendix 1: Summary of existing policies

Table summarizes existing policies (GFR 2005, CSIR 2008, ICAR, ICMR) and provides a comparison of entailment and pitfalls of these policies.

	GFR 2005	CSIR 2008	ICMR	ICAR
Applicable to	All the Ministries/ Departments/ Organizations using goods for public service	CSIR Laboratories	ICMR Institutes	ICAR Institutes
Powers for procurement of equipments/goods	Ministries/ respective Departments	DG of CSIR/JSA /Directors of CSIR Laboratories /Institutes or any other Scientist /officer	Institute director /ICMR DG/ICMR Technical and Expert Committee	Head of the Institute
General Rule of Procurement	• Limited Tender can be used for goods up to Rs. 25 Lakhs. • Open Tender is used for procurement of goods of estimated value Rs. 25 lakhs and above. The two-bid system comprises of: (a) Technical bid consisting of all technical details along with commercial terms and conditions; (b) Financial bid indicating item-wise price for the items mentioned in the technical bid. • Single tender in case of emergency or in case there exists only one manufacturer.	• Direct purchase of R&D related items costing up to Rs. 1 Lakh. • For R&D goods having worth between Rs. 1 Lakh and Rs. 5 Lakhs, purchase is allowed as per recommendations of local purchase committee, on cash or credit basis. • The project leader has authority to procure R&D goods of Rs. 5 Lakhs to Rs. 25 Lakhs through single tender. • In case of procuring goods worth up to Rs. 25 Lakhs, limited tender can be floated within the registered vendors through the Purchase Committee (PC). • Global tender is called by the Technical & Purchase Committee (T&PC) to procure goods above Rs. 25 Lakhs and upto Rs. 50 Lakhs. Any purchase costing more than Rs.	• Director has power to purchase equipments/items costing up to Rs. 5 lakhs following GFR. • For equipment costing between Rs. 5 to Rs. 25 lakhs, duly completed proposal including all the steps as per GFR is sent to the ICMR for administrative, financial concurrence and DG's approval. • For equipment costing more than Rs. 25 lakhs, duly completed proposal including all the steps as per GFR is sent to ICMR for approval of the ICMR Technical Committee and Expert Committee.	• Equipments costing up to Rs. 15,000 may be purchased on the basis of a certificate in the prescribed format by the competent authority, without inviting quotation or bids. • Purchase of equipment costing above Rs. 15,000 and upto Rs. 1,00,000 on each occasion may be made on the recommendations of a duly constituted Local Purchase Committee consisting of three members of an appropriate level as decided by the lead of the Department.

	GFR 2005	CSIR 2008	ICMR	ICAR
		50 Lakhs is sanctioned by the Director of the Institute. After Director's sanction, T&PC procure the equipment through global tender.		
Purchase of goods directly under rate contract	In case a Ministry or Department directly procures rate contracted goods from suppliers using Central Purchase Organisation (for eg. DGS&D), the prices to be paid for such goods cannot exceed those stipulated in the rate.	CSIR and its laboratories/Institutes may conclude their rate contract in respect of goods & services and AMCs wherever required in a transparent manner with due regard to canons of financial proprietary. Labs/Institutes of CSIR may utilize the DGS&D concluded rate contracts.	As per GFR	As per GFR
Advertised/open Tender Enquiry	• Used for procurement of goods of estimated value Rs. 25 lakhs and above. • Advertisement has to be given in the Indian Trade Journal (ITJ), published by the Director General of Commercial Intelligence and Statistics (DGCIS), Kolkata and at least in one national daily having wide circulation. It has to be published in the organization's own website. • Minimum time for submission of bids is set at three weeks from the date of publication of the tender notice or availability of the bidding document for sale, whichever is later.	This method is resorted to when the Purchase value is above Rs. 25 lakhs. Global tenders may be recommended if it is felt that bidding from the indigenous source through open tendering shall not result in competitive prices.	As per GFR	As per GFR

	GFR 2005	CSIR 2008	ICMR	ICAR
Limited Tender Enquiry	• Used for procurement of goods up to Rs. 25 Lakhs. • The number of supplier firms in Limited Tender Enquiry should be more than three. • Purchase through Limited Tender Enquiry may be adopted even where the estimated value of the procurement is more than Rs. 25 Lakhs if a competent authority in the Ministry or Department certifies that the demand is urgent and any additional expenditure involved by not procuring through advertised tender enquiry is justified in view of urgency.	This method may be adopted for purchases of up to Rs. 25 lakhs and may be sent to the prospective bidders by FAX/speed post/registered post/courier/e-mail simultaneously, free of cost. However limited tender enquiry can also be used when value of purchase exceeds Rs. 25 Lakhs in case: • The Indenting Officer certifies that the demand is urgent and any additional expenditure incurred through open advertisement shall not be fruitful. • When the sources of supply are definitely known and the possibility of fresh sources of supply being available is remote.	As per GFR	As per GFR
Two bid system	For purchasing high value plant, machinery etc. of a complex and technical nature, bids may be obtained in two parts as under :- (a) Technical bid consisting of all technical details along with commercial terms and conditions; (b) Financial bid indicating item-wise price for the items mentioned in the technical bid. The technical bids are to be opened by the purchasing Ministry or Department at the first instance and evaluated by a competent committee or authority. In the second stage, financial	• Two-bid system is the common practice for purchase of equipments valuing above Rs. 25 Lakhs. • Purchase of equipments valuing between Rs. 5 Lakhs to Rs. 25 Lakhs may be made using a single bid-system in accordance with the delegation of the approving authorities. • Under 2-bid system, the techno-commercial un-priced bid (technical bid) are opened first and evaluated by the Technical Sub-committee (TSC) of the Technical & Purchase Committee (T&PC) with respect to the qualification criteria and the technical	As per GFR	As per GFR

	GFR 2005	CSIR 2008	ICMR	ICAR
	bids of only the technically acceptable offers should be opened for further evaluation and ranking before awarding the contract.	specifications as spelt out in the tender. The committee doing the evaluation also draws a Technical comparative chart. The tenders meeting the qualification criteria and technical specifications are shortlisted for financial evaluation. Then, the financial bids of the short listed parties are opened and evaluated for lowest responsive offer (L1).		
Single Tender Enquiry	It is floated when • Only one particular firm is the manufacturer of the required product. • In a case of an emergency, the required goods have to be purchased from a particular source with due approval from a competent authority for the reason. • For standardization of machinery or spare parts to be compatible to existing sets of equipment, the required item is purchased only from a selected firm.	Provision for this is given by providing written enquiries to a single vendor. In case of non-availability of other manufacturers in the market for particular equipment the institute can opt for single tendering mode. In due course of single tendering the project leader and purchase committee are required to take approval of the sanctioning authority after justifying the unavoidable nature of the procurement.	As per GFR	As per GFR
Maintenance Contract	• Used especially for sophisticated and costly equipment and machinery. • Equipment or machinery is maintained free of charge by the supplier during its warranty period • Paid maintenance commences only thereafter.	• Maintenance contracts are prepared especially for sophisticated and costly, equipment and machinery. • The equipment or machinery is maintained free of charge by the supplier during its warranty period or such other extended periods as per the contract terms. • Paid maintenance commences only thereafter.	The maintenance contract clauses include: • 3 years comprehensive warranty and 2 years non comprehensive services for equipment free of cost. • Non-comprehensive annual maintenance from 6th to 10th years • as decided by the appropriate Technical Committee. • Provision for spare	

	GFR 2005	CSIR 2008	ICMR	ICAR
		• A separate tender enquiry has to be floated for entering into maintenance contract with a competent and eligible supplier. • The details of the services required for maintenance of the goods, the required period of Maintenance and other relevant terms & conditions including payment terms must be incorporated in the tender document. Generally, payment for maintenance is made on half-yearly or Quarterly basis. • A suitable provision should be incorporated in the tender document and in the resultant Maintenance contract indicating that the prices charged by the maintenance contractor should not exceed the prevailing rates charged by it from others for similar services. • The tender document for maintenance contract must include a suitable provision to withdraw the maintenance contract due to any unforeseen reasons. Depending on the cost and nature of the goods to be maintained, suitable notice period for such cancellation to come into effect is to be provided in the documents. • The Purchase Committee (PC) may decide on the merits of each case the necessity	parts to ensure maintenance of equipment for up to 10 years. • Discount on list price for all spare parts up to 10 years. • Provision of 2 preventive maintenance visits per year and also breakdown visits as and when required. • Submission of Performance bank guarantee of 10% of the FOB value of the order and which will be retained by the Council till the end of warranty period. • The duration of warranty period will start after, proper installation of the equipment and submitting users satisfactory report. • The maximum response time should also be specified in consultant with the Expert/ Technical Committee. • 0.1% of FOB as penalty per week during the warranty period, if the instrument remains in non working condition for more than 18 days. • When the equipment is under warranty/comprehensive maintenance, it would be the responsibility of the manufacturer/dealer/	

	GFR 2005	CSIR 2008	ICMR	ICAR
		of entering into maintenance contracts on comprehensive basis or on call basis or on non comprehensive basis.	agent to procure spare parts and the Institute will not incur any expense on duty or handling charges. • The detailed circuit diagram along with trouble shooting procedure and operational manual would be provided to the Institute/Centre along with the equipment. • Efforts to obtain onsite training for the users.	
Buy-Back Offer	• Incorporation of a suitable clause in the bidding document so that the prospective and interested bidders may formulate their bids accordingly. • Suitable provision in the bidding document to enable the purchaser either to trade or not to trade the item while purchasing the new one.	• In order to replace an existing old item(s) with a new and better version, the department may trade the existing old item while purchasing the new one. For this purpose, incorporating a suitable clause in the bidding document so that the prospective and interested bidders formulate their bids accordingly. • Decision depending on the value and condition of the old item to be traded, the time as well as the mode of handing over the old item to the successful bidder and incorporation of the relevant details in the bidding document.	• As per GFR	

	GFR 2005	CSIR 2008	ICMR	ICAR
Modes of Disposal	• Disposal of goods above Rs. 2 Lakhs by obtaining bids through advertised tender or public auction. • For Goods with residual value less than Rs. 2 Lakhs, the mode of disposal determined by competent authority, keeping in view the necessity to avoid accumulation of such goods and consequential blockage of space and, also, deterioration in value of goods to be disposed of. • Disposal of goods such as expired medicines, food grain, ammunition etc., which are hazardous or unfit for human consumption, immediately by adoption of a suitable mode. • Disposal of Surplus or obsolete or unserviceable goods, equipment and documents, which involve security concerns (e.g. currency, negotiable instruments, receipt books, stamps, security press etc.) in an appropriate manner.	Decision of the Standing Disposal Committee (SDC) on the modes of disposal: • By gift to Education Institute within the State • By transfer to other CSIR Labs. • By public action • By limited tendering • By press tender	Not Documented	Not Documented
Disposal through tender	• Preparation of bidding document followed by invitation of tenders for the surplus goods to be sold. • Opening of quotations followed by analysis and evaluation to identify the highest responsive bidder. • Collection of sale value	• Limited Tendering: The SDC can recommend disposal of stores costing upto Rs.5 Lakhs by limited tendering for sale of the stores. The tender enquiry to include a condition of EMD as 10% of the quoted price in the shape of DD/BC. Immediate return of the EMDs of unsuccessful bidders in any case within 15 days	• Not Documented	• Not Documented

	GFR 2005	CSIR 2008	ICMR	ICAR
	from the selected bidder and issuance of Sale release order to the selected bidder followed by release of sold surplus goods to the selected bidder.	from the date of opening. • Opening of tenders by the Tender Opening Committee in the presence of the bidders. • The Standing Disposal Committee ensures fixation of reserve price after the bids have been received but before they are opened. The time limit for the bidders for taking delivery of the goods after payment of the bid value including amount of penalties for late lifting may be decided on case to case basis by the SDC. EMD of unsuccessful bidders is refunded immediately. • Press Tender: The SDC can recommend disposal of stores costing more than Rs.5 Lakhs by open tendering following the normal procedure. In addition a charge of Rs.100/- to Rs. 200/- depending upon the cost of disposal may be levied from the bidders towards the cost of tender document.		
Disposal through public auction	• Auction of goods may be undertaken by a Ministry/Department either directly or through approved auctioneers. • Auction plan includes details of the goods to be auctioned and their location, applicable terms and conditions of the sale etc. • Before starting the auction process, the condition and location of	• The lab may consider disposal by public auction if the SDC is of the opinion that this is the most suitable course of action for disposal and the chances of forming a cartel is not there. The decision of engaging a Government recognized auctioneer to conduct a public auction may also be taken by the competent authority if the value of disposal is substantial. Every bidder in the public	Not Documented	Not Documented

	GFR 2005	CSIR 2008	ICMR	ICAR
	the goods to be auctioned, applicable terms and conditions of sale etc., announced again for the benefit of the assembled bidders. • Immediate announcement of acceptance or rejection of a bid on the stroke of the hammer. If a bid is accepted, earnest money (not less than 25% of the bid value) to be immediately taken on the spot from the successful bidder either in cash or in the form of Deposit-at-Call-Receipt (DACR), drawn in favour of the Ministry/ Department selling the goods. • A competent authority decides the composition of the auction team so as to include an officer of the Internal Finance Wing.	auction would deposit caution money to become eligible for bidding. The SDC fixes the amount of caution money. An EMD of 25% to be paid by the successful firm at the fall of hammer after adjustment of the caution money. The caution money of the unsuccessful bidders immediately refunded after the auction. The highest bidder to pay the balance 75% within 5 days before handover of the goods. The SDC may attend the public auction or nominate a subcommittee to attend.		
Disposal through scrap selling	• With the approval of the competent authority in consultation with finance division equipments can be sold at its scrap value. • Disposal including destruction of the item in an eco-friendly manner is also permissible.	Not Documented	Not Documented	Not Documented

	GFR 2005	CSIR 2008	ICMR	ICAR
Disposal through transfer to other labs	NA	• A list of surplus/obsolete stores is to be circulated among all CSIR Labs after the SDC recommends the items as surplus or obsolete. The transfer of these stores from one lab to the other would be made on book transfer basis. The SPO is required to furnish the copy of approval of the competent authority along with copy of transfer voucher to accounts branch to make necessary adjustment in the Balance sheet. However, the confirmation regarding adoption of the value of such assets by the receiving lab is ensured.	No organization specific policy	No organization specific policy
• **Disposal through gift**	Not Documented	The items that have been declared as Surplus or Obsolete and are in working order can only be gifted to other recognized educational institutions on the following terms & conditions: • The items of equipment will be offered as gift on "as is where is basis". • Imported items can be gifted to an educational institution as per the provisions of FEMA/Exchange Control manual (ECM) of RBI. • The title of the equipment will pass on to the receiving organizations on receipt of a formal acknowledgement • Any cost associated with transfer shall be borne by the receiving organization. • Equipments received as	Not Documented	Not Documented

	GFR 2005	CSIR 2008	ICMR	ICAR
		gift under agreement with the international bodies like UNDP/UNESCO etc. would be disposed only in accordance with the terms and conditions agreed to between CSIR & such bodies. • Preference may be given to schools situated within the campus of CSIR labs, Central Govt/ State Govt schools/ training institutes.		

Appendix 2: Details of Quantitative Analysis

Table 2: Perception of the respondents about total equipment cost in the laboratory

Type / Scientific equipment cost in the laboratory								
			Total Scientific Equip Cost Per Institute					Total
			Less than Rs. 10 Cr	Rs. 10 to 50 Cr	Rs. 50 to 100 Cr	Rs. 100 to 500 Cr	More than Rs. 500 Cr	
Type	Academic	Count	3	3	2	4	2	14
		% within Type	21.4%	21.4%	14.3%	28.6%	14.3%	100.0%
	CSIR	Count	0	0	3	4	1	8
		% within Type	0.0%	0.0%	37.5%	50.0%	12.5%	100.0%
	Govt./PSU organizations	Count	0	1	3	4	1	9
		% within Type	0.0%	11.1%	33.3%	44.4%	11.1%	100.0%
	Private Laboratories	Count	1	2	0	1	0	4
		% within Type	25.0%	50.0%	0.0%	25.0%	0.0%	100.0%
Total		Count	4	6	8	13	4	35
		% within Type	11.4%	17.1%	22.9%	37.1%	11.4%	100.0%

Total cost of the scientific equipments has been segregated in five baskets. Table 2 shows –

- 43% of the academic institutions covered under the study mentioned that total cost of equipment in their laboratories is more than Rs. 100 Cr.
- Aggregated value of the equipments present in each CSIR Laboratory covered under the study is more than Rs. 50 Cr.
- 56% of the Government/PSU organizations covered under the study mentioned that total cost of equipment in their laboratories is more than Rs. 100 Cr.
- Only 25% of the private laboratories covered under the study have total equipments worth Rs. 50 Cr or more.

Table 3: Organization type wise percentage of functional equipment in the laboratory

Type / Equipment functional in the laboratory						
			Equipment functional percentage			Total
			Less than 85%	85 to 95%	95% or more	
Type	Academic	Count	3	7	4	14
		% within Type	21.4%	50.0%	28.6%	100.0%
	CSIR	Count	0	4	4	8
		% within Type	0.0%	50.0%	50.0%	100.0%
	Govt/PSU organizations	Count	1	4	4	9
		% within Type	11.1%	44.4%	44.4%	100.0%
	Private Laboratories	Count	0	1	3	4
		% within Type	0.0%	25.0%	75.0%	100.0%
Total		Count	4	16	15	35
		% within Type	11.4%	45.7%	42.9%	100.0%

The percentage of functional equipments has been segregated into three major baskets. Table 3 shows –

- 11 out of 14 academic institutions covered under the study have more than 85% functional equipments.
- All the CSIR labs within the sample have more than 85% functional equipments.
- Approximately 90% of the Government/PSU organizations covered under the study have more than 85% functional equipments.
- 75% of the private laboratories within the sample have more than 95% functional equipments.

Table 4: Organization type wise non-functional equipments due to unavailability of spares

Type / Equipment Non-functional due to unavailability of spares					
			Non-functional for spares		Total
			No	Yes	
Type	Academic	Count	7	7	14
		% within Type	50.0%	50.0%	100.0%
	CSIR	Count	3	5	8
		% within Type	37.5%	62.5%	100.0%
	Govt/PSU organizations	Count	3	6	9
		% within Type	33.3%	66.7%	100.0%
	Private Laboratories	Count	3	1	4
		% within Type	75.0%	25.0%	100.0%
Total		Count	16	19	35
		% within Type	45.7%	54.3%	100.0%

Table 4 shows non-functionality of equipments due to unavailability of spares.

- 50% of the academic institutions covered under the study cited unavailability of spares as the major reason for non-functionality of research equipments. 5 out of 8 CSIR laboratories covered under the study shared the same thought.
- 67% of the Government/PSU organizations within the sample identified unavailability of spares as the main reason for equipment failure. 25% of the private organizations within the sample shared the same view.

Table 5: Organization type wise non-functional equipments due to obsolescence

Type / Equipment Non-functional due to obsolescence					
			Non-functional outdated		Total
			No	Yes	
Type	Academic	Count	7	7	14
		% within Type	50.0%	50.0%	100.0%
	CSIR	Count	5	3	8
		% within Type	62.5%	37.5%	100.0%
	Govt/PSU organizations	Count	4	5	9
		% within Type	44.4%	55.6%	100.0%
	Private Laboratories	Count	3	1	4
		% within Type	75.0%	25.0%	100.0%
Total		Count	19	16	35
		% within Type	54.3%	45.7%	100.0%

Table 5 shows non-functionality of equipments due to obsolescence of technology.

- 50% of the academic institutions covered under the study mentioned that their research equipments are non-functional due to obsolescence of technology. Only 3 out of 8 CSIR labs within the sample are facing the same problems. 56% of the Government/PSU organizations and 25% of the private organizations covered under the study are facing the problem of obsolescence leading to non-functionality of the equipment.

Table 6: Organization type wise non-functionality of equipments after project completion

Type / Equipment Non-functional due to absence of scope for further use after project completion					
			Non-functional project completed		Total
			No	Yes	
Type	Academic	Count	10	4	14
		% within Type	71.4%	28.6%	100.0%
	CSIR	Count	6	2	8
		% within Type	75.0%	25.0%	100.0%
	Govt/PSU organizations	Count	8	1	9
		% within Type	88.9%	11.1%	100.0%
	Private Laboratories	Count	4	0	4
		% within Type	100.0%	0.0%	100.0%
Total		Count	28	7	35

	% within Type	80.0%	20.0%	100.0%

Table 6 shows –

- Only 4 out of 14 academic institutions within the sample mentioned that lack of scope for further use after project completion makes the equipments non-functional. 2 out of 8 CSIR laboratories and 1 out of 9 Government/PSU organizations covered under the study shared the same view.

Table 7: Organization type wise percentage of e-procurement

Type / Use of e-procurement					
			Online procurement		Total
			No	Yes	
Type	Academic	Count	13	1	14
		% within Type	92.9%	7.1%	100.0%
	CSIR	Count	6	2	8
		% within Type	75.0%	25.0%	100.0%
	Govt/PSU organizations	Count	6	3	9
		% within Type	66.7%	33.3%	100.0%
	Private Laboratories	Count	4	0	4
		% within Type	100.0%	0.0%	100.0%
Total		Count	29	6	35
		% within Type	82.9%	17.1%	100.0%

Table 7 has segregated organization type wise use of online procurement facility. The table shows –

- Only 1 out of 14 academic institutions covered under the study follows e-procurement system.
- 25% of CSIR labs and 33% of Government/PSU organizations within the sample follow e-procurement.
- No private laboratory within the sample follows e-procurement system.

Table 8: Organization type wise average lead time to procure equipment

Type / Average lead time to procure research equipment						
			Procurement lead time average			Total
			0 to 3 months	3 to 6 months	6 to 12 months	
Type	Academic	Count	0	5	9	14
		% within Type	0.0%	35.7%	64.3%	100.0%
	CSIR	Count	3	3	2	8
		% within Type	37.5%	37.5%	25.0%	100.0%
	Govt/PSU organizations	Count	0	6	3	9
		% within Type	0.0%	66.7%	33.3%	100.0%
	Private Laboratories	Count	1	3	0	4
		% within Type	25.0%	75.0%	0.0%	100.0%
Total		Count	4	17	14	35
		% within Type	11.4%	48.6%	40.0%	100.0%

Table 8 has segregated average procurement lead time into three major baskets.

- Around 65% of the academic institutions within the sample take 6 months or more to procure research equipments.
- 75% of the CSIR labs covered under the study procure their research equipments within 6 months.
- All the Government/PSU organizations within the sample take at least 3 months to procure research equipments.
- All the private laboratories covered under the study take at most 6 months to procure research equipments.

Table 9: Organization type wise dedicated maintenance team

Type / dedicated maintenance team					
			Dedicated maintenance team		Total
			No	Yes	
Type	Academic	Count	10	4	14
		% within Type	71.4%	28.6%	100.0%
	CSIR	Count	6	2	8
		% within Type	75.0%	25.0%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	4	0	4
		% within Type	100.0%	0.0%	100.0%
Total		Count	22	13	35
		% within Type	62.9%	37.1%	100.0%

Table 9 shows organization type wise availability of dedicated maintenance team.

- Only 28% of the academic institutions and 25% of the CSIR laboratories covered under the study have dedicated maintenance team. This percentage is high for Government/PSU organizations where 78% of the organization covered under the study has dedicated maintenance team. However, private laboratories within the sample do not have dedicated maintenance team. It was observed that AMC through third party is the most common practice among the private laboratories.
- Overall 63% of the organizations covered under the study do not have dedicated maintenance team.

Table 10: Organization type wise availability of skilled manpower

Type / Skilled manpower for operation and maintenance					
			Skilled manpower		Total
			Available	Unavailable	
Type	Academic	Count	4	10	14
		% within Type	28.6%	71.4%	100.0%
	CSIR	Count	3	5	8
		% within Type	37.5%	62.5%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	0	4	4
		% within Type	0.0%	100.0%	100.0%
Total		Count	9	26	35
		% within Type	25.7%	74.3%	100.0%

Table 10 shows organization type wise availability of skilled manpower.

- Around 72% academic institutions under the study face problem of skilled technicians to handle research equipment.
- 63% CSIR labs, 78% Government/PSU organizations & 100% private laboratories under the study are facing the same problem.
- As a whole around 74% institutes covered under the study are facing problems of having skilled technicians to maintain & operate the scientific equipments.

Table 11: Organization type wise view to link NSRIP with National Skill Registry

Type / stakeholders view to link NSRIP with National Skill Registry					
			Link National Skill Registry		Total
			No	Yes	
Type	Academic	Count	9	5	14
		% within Type	64.3%	35.7%	100.0%
	CSIR	Count	0	8	8
		% within Type	0.0%	100.0%	100.0%
	Govt/PSU organizations	Count	0	9	9
		% within Type	0.0%	100.0%	100.0%
	Private Laboratories	Count	1	3	4
		% within Type	25.0%	75.0%	100.0%
Total		Count	10	25	35
		% within Type	28.6%	71.4%	100.0%

Table 11 shows –

- 71% of the respondents within the sample argued in favour of linking NSRIP with National Skill Registry. They advised to create a cluster of skilled technicians under skilled registry, which can be hired by the organization to operate & maintain scientific equipments.
- Same is suggested by 75% private laboratories, 100% Government/PSU & CSIR labs covered under the study.
- However only around 36% academic institutions within the sample argued in favour of this argument. It is not unexpected given the fact that academic institutes like IITs get steady inflow of manpower via utilizing their PhD students.

Table 12: Disposal through public auction

Type / Equipment disposal through public auction					
			Disposal public auction		Total
			No	Yes	
Type	Academic	Count	3	11	14
		% within Type	21.4%	78.6%	100.0%
	CSIR	Count	1	7	8
		% within Type	12.5%	87.5%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	1	3	4
		% within Type	25.0%	75.0%	100.0%
Total		Count	7	28	35
		% within Type	20.0%	80.0%	100.0%

Disposal through public auction is the most common practice of the institutions covered under the study. Almost 80% of the institutions visited under the study dispose of their equipments through public auction.

Table 13: Disposal through gift

Type / Equipment disposal through gift					
			Disposal gift		Total
			No	Yes	
Type	Academic	Count	13	1	14
		% within Type	92.9%	7.1%	100.0%
	CSIR	Count	5	3	8
		% within Type	62.5%	37.5%	100.0%
	Govt/PSU organizations	Count	5	4	9
		% within Type	55.6%	44.4%	100.0%
	Private Laboratories	Count	3	1	4
		% within Type	75.0%	25.0%	100.0%
Total		Count	26	9	35
		% within Type	74.3%	25.7%	100.0%

Gifting as a mode of disposal is not very prevalent among the organizations visited. Only 26% institutes covered under the study gift their instruments to academic institutions or other organizations. Percentage of gifting is relatively higher in Government/PSU organizations or CSIR laboratories. This is mainly attributed to a separate gifting policy of CSIR.

Table 14: Disposal through part recycling

Type/ Equipment disposal through parts recycling					
			Disposal parts recycled		Total
			No	Yes	
Type	Academic	Count	10	4	14
		% within Type	71.4%	28.6%	100.0%
	CSIR	Count	7	1	8
		% within Type	87.5%	12.5%	100.0%
	Govt/PSU organizations	Count	6	3	9
		% within Type	66.7%	33.3%	100.0%
	Private Laboratories	Count	4	0	4
		% within Type	100.0%	0.0%	100.0%
Total		Count	27	8	35
		% within Type	77.1%	22.9%	100.0%

Disposal through recycling of part is not a common practice of the institutions within the sample. Only 23% of the institutions covered under the study use this mode of disposal.

Table 15: Disposal through scrap selling

Type / Equipment disposal through scrap selling					
			Disposal sold scrap		Total
			No	Yes	
Type	Academic	Count	6	8	14
		% within Type	42.9%	57.1%	100.0%
	CSIR	Count	1	7	8
		% within Type	12.5%	87.5%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	0	4	4
		% within Type	0.0%	100.0%	100.0%
Total		Count	9	26	35
		% within Type	25.7%	74.3%	100.0%

Disposal through scrap selling is a common practice of the organizations surveyed. Almost 75% of the institutions covered under the study dispose of their equipments through scrap selling.

Table 16: Organization type of percentage of shared equipments

Type / Percentage of equipment shared with the outsiders						
			Equipment shared percentage			Total
			Less than 50%	50 to 80%	80% or more	
Type	Academic	Count	8	3	3	14
		% within Type	57.1%	21.4%	21.4%	100.0%
	CSIR	Count	1	5	2	8
		% within Type	12.5%	62.5%	25.0%	100.0%
	Govt/PSU organizations	Count	2	3	4	9
		% within Type	22.2%	33.3%	44.4%	100.0%
	Private Laboratories	Count	2	1	1	4
		% within Type	50.0%	25.0%	25.0%	100.0%
Total		Count	13	12	10	35
		% within Type	37.1%	34.3%	28.6%	100.0%

Percentage of shared equipments has been segregated in three baskets. Table 16 shows –

- Majority of the academic institutions within the sample share less than 50% of the research equipments with the outsiders.
- 5 out of 8 CSIR labs covered under the study share 50-80% of their research equipments with outsiders.

- 4 out of 9 Government/PSU organizations covered under the study share more than 80% of their research equipments with outsiders.
- As a whole almost 29% of the institutions covered under the study share more than 80% of their research equipments with outsiders.

Table 17: Dedicated training policy

Type / Dedicated Training Policy					
			Training policy		Total
			No	Yes	
Type	Academic	Count	3	11	14
		% within Type	21.4%	78.6%	100.0%
	CSIR	Count	0	8	8
		% within Type	0.0%	100.0%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	2	2	4
		% within Type	50.0%	50.0%	100.0%
Total		Count	7	28	35
		% within Type	20.0%	80.0%	100.0%

80% of the organizations within the sample have dedicated training policy to train their manpower to handle scientific research equipments. Training is provided mainly through in-house experts, resource sharing, collaboration and external experts.

Type/Modes of training

Table 18: Training through in-house experts

Type / Training through in-house experts					
			Training in-house		Total
			No	Yes	
Type	Academic	Count	0	14	14
		% within Type	0.0%	100.0%	100.0%
	CSIR	Count	0	8	8
		% within Type	0.0%	100.0%	100.0%
	Govt/PSU organizations	Count	1	8	9
		% within Type	11.1%	88.9%	100.0%
	Private Laboratories	Count	0	4	4
		% within Type	0.0%	100.0%	100.0%
Total		Count	1	34	35
		% within Type	2.9%	97.1%	100.0%

Training through in-house experts is the most common practice of the organizations covered under the study. All the CSIR labs, academic institutions and private laboratories covered under the study train their manpower through in-house training.

Table 19: Training through resource sharing

Type / Training through resource sharing					
			Training resource sharing		Total
			No	Yes	
Type	Academic	Count	6	8	14
		% within Type	42.9%	57.1%	100.0%
	CSIR	Count	6	2	8
		% within Type	75.0%	25.0%	100.0%
	Govt/PSU organizations	Count	6	3	9
		% within Type	66.7%	33.3%	100.0%
	Private Laboratories	Count	3	1	4
		% within Type	75.0%	25.0%	100.0%
Total		Count	21	14	35
		% within Type	60.0%	40.0%	100.0%

Resource sharing is not a common method of training within the organizations covered under the study.

- 58% of the academic intuitions covered under the study impart training through resource sharing.
- Only 25% of the CSIR labs within the sample provide training through resource sharing.

- Overall only 40% of the organizations covered under the study impart training through resource sharing.

Table 20: Training through external experts

Type / Training through external experts					
			Training external experts		Total
			No	Yes	
Type	Academic	Count	3	11	14
		% within Type	21.4%	78.6%	100.0%
	CSIR	Count	1	7	8
		% within Type	12.5%	87.5%	100.0%
	Govt/PSU organizations	Count	1	8	9
		% within Type	11.1%	88.9%	100.0%
	Private Laboratories	Count	2	2	4
		% within Type	50.0%	50.0%	100.0%
Total		Count	7	28	35
		% within Type	20.0%	80.0%	100.0%

External experts are often consulted to provide training to the employees. 80% of the organizations covered under the study train their employees through external experts. The trend is similar for all categories of institutions within the sample.

Table 21: Ownership of intellectual property

Type / Ownership of Intellectual Property					
			IP ownership		Total
			Organization	Shared	
Type	Academic	Count	2	12	14
		% within Type	14.3%	85.7%	100.0%
	CSIR	Count	0	8	8
		% within Type	0.0%	100.0%	100.0%
	Govt/PSU organizations	Count	1	8	9
		% within Type	11.1%	88.9%	100.0%
	Private Laboratories	Count	1	3	4
		% within Type	25.0%	75.0%	100.0%
Total		Count	4	31	35
		% within Type	11.4%	88.6%	100.0%

Mostly IPs are shared between individual, organization and funding agency. Almost 89% organizations within the sample support this argument.

Table 22: Availability of dedicated IPR team

Type / In-house/Dedicated IPR team					
			In-house IPR team		Total
			No	Yes	
Type	Academic	Count	3	11	14
		% within Type	21.4%	78.6%	100.0%
	CSIR	Count	0	8	8
		% within Type	0.0%	100.0%	100.0%
	Govt/PSU organizations	Count	2	7	9
		% within Type	22.2%	77.8%	100.0%
	Private Laboratories	Count	3	1	4
		% within Type	75.0%	25.0%	100.0%
Total		Count	8	27	35
		% within Type	22.9%	77.1%	100.0%

78% of the institutes covered under the study have dedicated IPR team to handle IPR related issues. This percentage is less (25%) in case of private laboratories as most of labs within the sample are dependent on third party IPR organizations.

Table 23: Academic organization & scientific equipment cost wise skilled manpower availability

Type / Skilled manpower availability / Cost of scientific equipment						
Average Scientific Equipment Cost				Skilled manpower		Total
				Available	Unavailable	
Less than Rs. 10 Cr	Type	Academic	Count		3	3
			% within Type		100.0%	100.0%
	Total		Count		3	3
			% within Type		100.0%	100.0%
Rs. 10 to 50 Cr	Type	Academic	Count	1	2	3
			% within Type	33.3%	66.7%	100.0%
	Total		Count	1	2	3
			% within Type	33.3%	66.7%	100.0%
Rs. 50 to 100 Cr	Type	Academic	Count		1	1
			% within Type		100.0%	100.0%
	Total		Count		1	1
			% within Type		100.0%	100.0%
Rs. 100 to 500 Cr	Type	Academic	Count	1	4	5
			% within Type	20.0%	80.0%	100.0%
	Total		Count	1	4	5
			% within Type	20.0%	80.0%	100.0%
Rs. 500 Cr or more	Type	Academic	Count	2		2
			% within Type	100.0%		100.0%
	Total		Count	2		2
			% within Type	100.0%		100.0%
Total	Type	Academic	Count	4	10	14
			% within Type	28.6%	71.4%	100.0%
	Total		Count	4	10	14
			% within Type	28.6%	71.4%	100.0%

For most of the academic institutes covered under the study, that have scientific equipments net worth more than Rs. 100 Cr, availability of skilled manpower is not a problem. They do not face dearth of skilled technicians to handle sophisticated equipments. 75% of such institutions stated that skilled manpower is not a problem for them to run research equipments. It is not unexpected given the fact that most of these high value equipments are placed in the central instrument facilities of IITs. IITs enjoy seamless flow of skilled manpower by utilizing their PhD students. These PhD students are appointed as technical assistants in central facilities and well trained to handle sophisticated equipments. Problem of skilled technician majorly lies with small academic institutions. Majority of CSIR labs do not face the problem of

skilled technicians as they solve their operation & maintenance problem through in-house experts/ instrumentation team.

Appendix 3: Workshop

The chapter includes the proceedings of the workshop catalyzed and supported by NSTMIS, DST and conducted by ASPIRE, on 'National Scientific Research Infrastructure Policy' on 9th & 10th February 2017 at IIC, New Delhi.

Scope & Objective of the workshop

The Prime Minister in his speech at Indian Science Congress on 3rd January, 2017 stressed that *"Building a strong Science and Technology infrastructure that is accessible to academia, start-ups, industry and R&D labs is a priority of the government. We need to address the problems of ease of access, maintenance, redundancy and duplication of expensive equipments in our Scientific Institutions. The desirability of establishing professionally managed, large regional centers in PPP mode housing high value scientific equipment should be examined.*

We also need to foster a strong culture of collaboration between institutions and across disciplines to take advantage of developments, innovations and expertise in diverse areas…

I will ask our ministries to make collaborations a critical requirement for their institutions and for supporting funding requests for research…"

The Prime Minister's statement validates the universal need among countries that the advancement of science and global positioning of a nation's scientific abilities are rooted in the availability of advanced and well maintained equipment. Recent years have seen a growth in both production and acquisition of equipment. However, these equipments lie idle or underutilized for long periods. According to a recent study by NSTMIS, DST (2013), 94% of the equipments are imported while only 6% are being manufactured indigenously. This adds to the burden of research infrastructure costs. While the rate of innovation is driving companies and laboratories to invest in newer and advanced technologies, the older equipment are facing obsolescence even before the age of depreciation is reached. Devising a means to utilize this equipment in a way that benefits not only the researcher but also the owner of the equipment can help bring down the cost of research and technology acquisition. A suitable mechanism of sharing of equipment between institutions and across disciplines would also help to bring down high cost of maintenance or duplication. A National Scientific Research Infrastructure Policy would bring in more clarity in procurement, maintenance, sharing, training, health & disposal, including institutional inventorization in national context.

Interviews with various stakeholders indicated that most of the organizations and institutes follow General Financial Rules 2005 for procurement. However, procurement faces issues in areas like lack of Indian manufacturer for specialized equipments or in case of mandatory L1 policy in global tendering that imposes selecting the lowest bidder without validating the quality of their product. The largely accepted maintenance model continues to be the AMC model where high-end equipments are maintained by vendors or third party agencies. However, there exist novel models in some organizations where a well trained in-house instrumentation team maintains and oversees the operations of all

equipment. Another interesting model followed included an external agency selected after due bidding and technical evaluation that maintains the laboratory and employs a pay for use model, the rates depending on the nature of the users. This model has been successful in generating a steady flow of income in addition to lesser maintenance hassles. Domain specific academic accelerators have also proved to be a successful model in India. However, lack of trained manpower is a widespread concern for optimum utilization of equipment leading to a possibility of creation of a pool of skilled technicians by utilizing the initiatives of the National Skills Development Council. The organizations universally provide for free internal usage and charge others for utilizing their service. The actual usage however is done by an internal user to minimize scope for breakdown. However, this is leading to a funneling of resources based on the availability of the dedicated users. Additionally, accountability and a narrow outlook to sharing acts as deterrent in sharing of equipment. Disposal of equipment is nagging issues with most organizations routinely use their equipment till the end of life of the equipment and eventually write-off. Public auction, gifting and utilizing the services of MSTC are some of the existing practices of disposal. But a need was felt for a more structured policy on disposal.

The objective of the workshop was to –

- Understand the views of the various stake holders in equipment procurement, maintenance, sharing, disposal and the best practices that can be adopted
- Discuss possible ways of overcoming the existing issues
- Consolidating the views and discussions to arrive at set of recommendations that will be primary input to the National Scientific Research Infrastructure Policy (NSRIP).

Brochure of the workshop

Workshop on

National Scientific Research Infrastructure Policy

February 9–10, 2017
at IIC, New Delhi
(Initiative of CHORD, DST, Government of India)

Catalyzed and Supported by

DEPARTMENT OF SCIENCE & TECHNOLOGY
Government of India
New Delhi

Orgnized by
Academy for Science Policy Implementation and Research (ASPIRE)

ADMINISTRATIVE STAFF COLLEGE OF INDIA
Bella Vista, Hyderabad–500 082

Contact :
Ph: (040) 6653 4268, Fax: 0091-40-66534356
Email: nirmalya@asci.org.in

The Prime Minister in his speech at Indian Science Congress on 3rd January, 2017 stressed that "Building a strong Science and Technology infrastructure that is accessible to academia, start-ups, industry and R&D labs is a priority of the government. We need to address the problems of ease of access, maintenance, redundancy and duplication of expensive equipments in our Scientific Institutions. The desirability of establishing professionally managed, large regional centers in PPP mode housing high value scientific equipmentshould be examined.

We also need to foster a strong culture of collaboration between institutions and across disciplines to take advantage of developments, innovations and expertise in diverse areas…

I will ask our ministries to make collaborations a critical requirement for their institutions and for supporting funding requests for research…"

The Prime Minister's statement validates the universal need among countries that the advancement of science and global positioning of a nation's scientific abilities are rooted in the availability of advanced and well maintained equipment. Recent years have seen a growth in both production and acquisition of equipment. However, these equipments lie idle or underutilized for long periods. According to a recent study by NSTMIS, DST (2013), 94% of the equipments are imported while only 6% are being manufactured indigenously. This adds to the burden of research infrastructure costs. While the rate of innovation is driving companies and laboratories to invest in newer and advanced technologies, the older equipment are facing obsolescence even before the age of depreciation is reached. Devising a means to utilize this equipment in a way that benefits not only the researcher but also the owner of the equipment can help bring down the cost of research and technology acquisition. A suitable mechanism of sharing of equipment between institutions and across disciplines would also help to bring down high cost of maintenance or duplication. A **National Scientific Research Infrastructure Policy** would bring in more clarity in procurement, maintenance, sharing, training, health & disposal, including institutional inventorization in national context.

Our interviews with various stakeholders indicate that most organizations and institutes follow General Financial Rules 2005 for procurement. However, procurement faces issues in areas like lack of Indian manufacturer for specialized equipments or in case of mandatory L1 policy in global tendering that imposes selecting the lowest bidder without validating the quality of their product. The largely accepted maintenance model continues to be the AMC model where high-end equipments are maintained by vendors or third party agencies. However, there exist novel models in some organizations where a well trained in-house instrumentation team maintains and oversees the operations of all equipment. Another interesting model followed included an external agency selected after due bidding and technical evaluation that maintains the laboratory and employs a pay for use model, the rates depending on the nature of the users. This model has been successful in generating a steady flow of income in addition to lesser maintenance hassles. Domain specific academic accelerators have also proved to be a successful model in India. However, lack of trained manpower is a widespread concern for optimum utilization of equipment leading to a possibility of creation of a pool of skilled technicians by utilizing the initiatives of the National Skills Development Council. The organizations universally provide for free internal usage and charge others for utilizing their service. The actual usage however is done by an internal user to minimize scope for breakdown. However, this is leading to a funneling of resources based on the availability of the dedicated users. Additionally, accountability and a narrow outlook to sharing acts as a deterrent in sharing of equipment. Disposal of equipment is nagging issues with most organizations routinely use their equipment till the end of life of the equipment and eventually write-off. Public auction, gifting and utilizing the services of MSTC are some of the existing practices of disposal. But a need was felt for a more structured policy on disposal.

Therefore the objective of the workshop is to

- Understand the views of the various stakeholders in equipment procurement, maintenance, sharing and disposal and the best practices that can be adopted
- Discuss possible ways of overcoming the existing issues
- Consolidating the views and discussions to arrive at a set of recommendations that will be a primary input to the National Scientific Research Infrastructure Policy.

ABOUT ASPIRE

ASPIRE being incubated in project mode at the Administrative Staff College of India (ASCI), Hyderabad aims to provide a common platform for interconnecting and enhancing competencies in policy development and implementation emphasizing Science Technology and Innovation across various stakeholders and arms of the Government leading to evidence based decision making..

During the year, two workshops under the title "STI for Make in India" in response to the new initiative announced by the PM were held at IIC, New Delhi and at ASCI, Hyderabad during April and November 2015 respectively. There are plans to hold many more thematic workshops engaging various stakeholders in succession across the country to discuss the various aspects for a consolidated critical inputs resulting in a brief compendium on STI for making "make in India" work. Apart from this, the policy studies such as Innovation in Large Firms including Public Sector Enterprises, Study on Identification of Constraints to Growth of Technology based Start-ups in Technology Business Incubators and Technology Parks of India etc would be completed. Further efforts are on to upscale the level of engagement of socio-economic ministries and public sector industries in ASPIRE for R&D management, Innovation and Policy including capacity building.

Workshop Schedule

National Scientific Research Infrastructure Policy

Day I - 9th February, 2017
Venue : India International Centre
40, Max Mueller Marg, New Delhi, Delhi 110003

Time (Hrs)	Session	Speakers
10:30-11:30	Inaugural Session	Opening Remarks by : Dr. Nirmalya Bagchi, Professor & Dean of Research Studies, ASCI
		Welcome address by: Dr. Parveen Arora, Advisor &Head, CHORD (NSTMIS) Division, DST, Govt. of India.
		Inaugural address by: Prof. Ashutosh Sharma, Secretary, DST, Govt. of India.
11:30-12:00	Tea	
12:00-13:00	Session I : Our findings	A presentation on Issues in Procurement, Maintenance, Sharing and Disposal in Current policies - Dr. Nirmalya Bagchi
13:00-14:00	Lunch	
14:00-15:30	Session II : Procurement	Issues in Procurement of R&D equipment
15:30-16:00	Tea	
16:00-17:30	Session - III : Maintenance and Sharing	Issues in Maintenance and Sharing of R & D Equipment
17:30-18:00	Tea	
18:00-19:00 Onwards	Round Table on Procurement, Maintenance and Sharing	
19:30	Cocktails followed by Dinner	

Day II - 10th February, 2017,
Venue : India International Centre,
40, Max Mueller Marg, New Delhi, Delhi 110003

Time (Hrs)	Session	Speakers
10:30-12:00	Session IV: Disposal	Issues of Disposal of Equipment
12:00-13:00	Session V:	Existing Best Practices
13:00-14:00	Lunch	
14:00-15:00	Round Table for gathering views of stakeholders	
15:00-15:30	Tea	
15:30-16:30	Road Map and Vote of Thanks	

Please inform your interest of participation to:

Dr. A.N. RAI,
Director, CHORD Division
DST, Govt. of India, New Delhi - 110016
Ph : 011-26519518, Email : anrai@nic.in

Mrs. K. VENKATA RAMANI,
Academic Assistant
Administrative Staff College of India
Bella Vista, Rajbhavan Road, Khairatabad, Hyd - 500 082
Phone : 040 - 6653 4268; E-Mail : ramani@asci.org.in

Balaram Graphics : 040-23706626

Workshop proceedings

The workshop was organized on 9th and 10th February, 2017 at India International Centre (IIC), New Delhi. It was attended by 39 participants (all senior scientists or academicians dealing with scientific infrastructure issues) from all across the country including principals, heads and head of division of various organizations. The prominent organizations represented in the workshop were Directorate General of Supplies and Disposal, Department of Science and Technology, Inter University Accelerator Centre, National Institute of Nutrition, Central Manufacturing Technology Institute, IIT Bombay, IIT Madras, C-DAC, Confederation of Indian Industry, Indian Institute of Chemical Technology, Centre for DNA Fingerprinting and Diagnostics, Structural Engineering Research Centre, IISER Pune, Molecular and Cellular Biology Laboratory, National Aeronautics Laboratory, Centre for Cellular and Molecular Platforms, Indian Institute of Foreign Trade, Bennet University, Ferguson College, TERI, and others.

Dr. Nirmalya Bagchi, Dean of Research and Management Studies of Administrative delivered the opening remarks which was followed by the Welcome Address by Dr. Parveen Arora, Advisor and Head of CHORD Division of DST. Prof Ashutosh Sharma, Hon'ble Secretary, Department of Science and Technology delivered the Inaugural Address Secretary.

The workshop had four technical sessions besides the inaugural session and issues of procurement, maintenance, sharing and disposal were discussed. The workshop also enabled discussions on best practices and the need to standardize procedures across all scientific departments and academia. Hence a new policy of scientific infrastructure policy has been recommended by all the participants of the workshop. The broad contours of this new policy has also been discussed the participants.

Inaugural Address was delivered by Prof. Ashutosh Sharma, Hon'ble Secretary, Department of Science and Technology. The Secretary started by discussing the vision behind the Prime Minister's speech at the Indian Science Congress at Tirupati earlier this year and its relevance in today's context. Broadly he stressed on the following:

DST has helped establish the infrastructure in the country by way of grants, programmes, proposals, FIST, funding etc. but to keep it sustainable would require professional management by creating teams of people who are full time employed and trained both operationally and scientifically on using these equipment. These people would need to understand everything about the equipment, its operation, its maintenance and interpretation of results. They ought to be able to help the user saying these are the focus points. This would eliminate the possibility of running the facility based on the whims and fancies of a group of scientists who would give priority to their own work before helping others. PPP mode could be favoured to ensure ease of access to all including MSME, startups and private sector.

Tapping of dormant scientific manpower at universities is an important priority. People often do research in institutions that may not have the capacity to support the work (like in colleges in districts). So this capacity can be activated by making use of neighbouring research infrastructure, by creating some motivation for the researcher in the college, by giving fellowship and then connecting him/her to

scientific infrastructure nearby. Linking the scientists and infrastructure and bring them to the fore would unleash the dormant talent.

The foremost question right now is, how to connect people and infrastructure as we are conditioned to work in very small silos, we cannot envisage what exists outside the silos. Working together is a culture. We can't wait for a century or millennium for the culture changes, so therefore some measures have to be put in place to encourage people to collaborate and work together.

Introducing Scientific Social Responsibility is the need of the hour. He elaborated on the need to share knowledge and engaging with college and school students through this measure to popularize science and help students improve their quality of education.

The fact that 94% of the equipment is imported, goes very contrary to Make in India and initiatives are urgently needed to create a domestic eco system for scientific equipment manufacturing. **It is not just about Making in India, it is also about Maintaining in India**. Since we cannot make it, we cannot maintain it, leading us to forever depend on people who supply us the equipment.

It is clear that in the agreements that we sign for import of equipment, we ought to include strong clauses for maintenance and skill development.

We need to create startups on each of the campuses that have scientific infrastructure.

Prof. Sharma stressed on 5 strong pillars of doing R&D and one needs intervention and policy for each of these pillars.

- Capacity building: We need effective trained scientists.
- Quality of scientists:
- Availability of scientific infrastructure for doing research.
- Networking
- Presentation of our R&D results and connecting to them to our users.

He opined that this workshop on NSRIP should bring in more clarity to certain aspects of infrastructure development. He also informed the audience that an ambitious project is underway to start a national S&T portal which is envisaged to be the parent portal for every institution and manufacturer to provide a 360 degree overview of the S&T ecosystem. This portal is envisioned to be a comprehensive point of interface for not only providing an overview of the system but also provide information on all the facilities like scholarships and infrastructure would be available which is currently lacking. It would be fed by every institute's portal and would include accomplishments and projects.

The session that followed the Secretary's remarks was that of Dr. A Mukhopadhyay, Head/Scientist 'G', Fund for Improvement of Scientific research infrastructure. In his brief speech, he highlighted the various efforts made by FIST in strengthening and providing much needed support to higher education

institutions in building a strong innovation infrastructure and thereby providing impetus to foster newer ideas.

Dr. Nirmalya Bagchi's session set the tone for the workshop by discussing the existing practices in the sample that was surveyed as a part of the study. The best practices, issues and recommendations were presented, along with key findings from the analysis of the interactions.

The panel discussions that followed were structured to bring forth the various recommendations and ideas of experts and were divided into 4 parts – procurement, maintenance and sharing, disposal and finally a round table. Each panel comprised of a select group of invitees with deep expertise in their respective domains and a key vision to help improve the process. The views and recommendations that have been captured are outlined in the following part of this section.

Session on Procurement

The session was chaired by Dr. O P Wali, Professor & Head, Centre for International Trade in Technology, Indian Institute of Foreign Trade. He opined that equipments are an asset and their management is critical to ensure the full potential of the asset is utilised. Detailing the various stages of the equipment lifecycle beginning with nature of the equipment, its need, format of the transaction, quality of the equipment, value addition brought about by acquisition of the equipment and its installation, he outlined the importance of all these stages in procurement. A key point that he outlined was that what is termed disposal for one organization could be procurement for another. This is being made possible by organizations like EquipNet which is the world's leading equipment auctioneer. It has a facility in India called EquipNet (India) Private Limited. It helps sell/auction lab equipment online. They have 2 types of sales-managed sales and auction sales. Another interesting initiative that was outlined was Government eMarketplace (GeM)

The first of the panelists to present in the session was Dr. Sameer Terdalkar, Coordinator, Internal Quality Assurance Cell, Fergusson College, Pune. Dr. Sameer observed that the nature of issues faced by colleges was different from those faced by labs. Since the government only provides for salary, to ensure growth both in the academic and research aspects, he said that, various schemes by the Government are providing the inputs.DST FIST is one such scheme that has funded a lot of colleges. The range of the funding varied from Rs. 50-70 lakhs and in some cases even upto Rs. 1 crore. At the college level, the process of procurement has very less hassles, he felt, and standard procedures are followed. However, he felt that the funding and the relatively easy procurement procedure led to a lot of repetition of instruments which funding agencies like DST, DBT and UGC need to look into. He stressed that available space, electricity, type of space and facility for housing the equipment should be carefully studied by the agencies. He was of the opinion that most colleges ask for very high-end equipment but their utilization must be examined in terms of how many users and teachers are trained to use these instruments. Another key aspect, he felt, was that how many colleges are financially well off to maintain these high end equipments. The funding agency is provided with a utilisation certificate thereby ending the procurement cycle abruptly. But he felt, maintenance is the real issue as the recurring costs can be high

and so the real value of the equipment can be gauged after 3-4 years. He suggested formation of a regional cluster of colleges to create a central instrumentation facility that would be made available to all colleges within a 25-30 km radius as this would not only reduce redundancy in neighbouring colleges but also help in acquiring more variety of equipment with the funds received and thereby invite more expertise. He also advocated promotion of industry academia linkages to reduce the gap between academic curricula and industrial requirement. He suggested that overhead charges of equipment and training charges could be a component of the scheme. He strongly expressed the need for a database of equipment to be made available to funding agencies like UGC, DST and DBT.

The next panelist was Shri Rajesh Gupta, Director, C&T-I, DGS&D. While outlining the benefits of the Government e-Market place and its history and evolution, he clearly outlined how the marketplace was envisioned to reduce the extraordinarily long procurement time in government organizations. He explained how the Government was keen on ensuring that the burden of procurement is minimised and scientists/doctors can focus on their work without worrying about procurement procedures. His presentation brought out various aspects of the Government e Marketplace like registration, cashless transactions, electronic signature for all transactions, using PFMS or other online banking systems , customisation, direct access for government buyers, provisions to offer multiple products, maximum of 10 days online after product delivery, complete end to end log sheets and transaction audit trails, grievance redressal system. He stressed that transparency in procurement transactions would be a great feature of the system. Shri Gupta explained the amendment that has been made in Section 141(a) the General Financial Rules to enable buying through e-marketplace. As per the amendment:

For any purchase of upto Rs.50000, any item that suits the requirement can be purchased instead of just picking the L1.He explained how the total procurement time would not be more than 30 minutes the first time as registration would be required but 10 minutes would be the time required next time onwards. He stressed that the price and satisfaction were the onus of the user buying the equipment.

For items above Rs.500000 the L1 approach could be adopted. After specifying the details of the requirement, the vendors meeting the requirements will be displayed.

There is also an option for e-bidding and reverse auction, if L1 does not yield satisfactory results. He explained that the difference between e-bidding and reverse auction is that the other prices are known in reverse auction though the sellers are not known. However, even the prices remain confidential in e-bidding. He explained that it is possible to complete within 7 days e-bidding and reverse auction.

The user thus has the choice to use any of these methods to suit his requirement. There is an option to reject within 10 days following which it would be deemed accepted. Once accepted the payment would have to be made within 10 days.

Explaining the vulnerability of the manual systems by depending on the efficiency of the human key players, he outlined how the new system will improve procurement time without any interaction between the supplier and the user. Another benefit he outlined was that the cartels that were forming

in a manual system which prevented external entrants can now be avoided. He urged everyone to encourage new vendors who provide goods and services at cheaper rates to register at GeM to bring down prices as if there are single vendors then the value would be dictated by their whims and they may sell at higher values. If there are more sellers, he felt, the prices will stabilize. Integration with various databases e.g. Aadhar Database etc, he noted, would act as a validation at the time of registration.

Since the concept of e-marketplace is in vogue in 3 other countries in the world, USA (GSA Advantage), Korea (Koneps) and Singapore(GeBiz) their best practices and inputs were studied before designing GeM. The idea of GeM, he explained is to bring out the price discovery mechanisms and empower the buyer as well as make items of common and wide usage available at the fingertips.

A member of the audience raised a query about how when an equipment is put on AMC and there are associated equipment that act as accessories which sometimes fail. Then the main equipment's AMC does not include these side things which are not a part of the AMC and so the main vendor asks for the peripheral equipment to be repaired before touching his equipment. This sometimes takes even 2 to 3 years. Shri Gupta explained how covering all the perpipheral equipment in the AMC should be made mandatory and ways in which GeM is doing this. It was widely felt that contracting has to be done with lot of care.

Some members of the audience felt that there are instances when companies are providing products at very low costs on DGS&D but after their warranty period if a repair arises, they are quoting very high rates and citing reasons like cheap cost of the equipment at time of purchase. Ensuring the terms are clear at the time of purchase to ensure nominal rates later was the solution suggested by Shri Gupta.

The next panelist of the session was Dr. G Raghava, Chief Scientist & Head, Fatigue & Fracture Laboratory, CSIR - Structural Engineering Research Centre. Dr. Raghava explained the standard procurement procedure of most CSIR labs where the purchase of equipment is prioritised at the beginning of the financial year based on the funding expected and available. Though CSIR guidelines require constitution of technical purchase committee for equipment above Rs. 25 lakhs and a purchase committee for less than Rs. 25 lakhs, at SERC there is permanent technical committee with scientists from different backgrounds. This committee helps first time scientists and others as well in improving their indents after taking into account the challenges they may face. He explained how the AMC committee looks after the maintenance of equipment and external expertise is sought if a need is felt. Sometimes for very high value equipment there is EOI and there arises a problem where some sellers come up with proposals containing excellent documentation and specification that completely match the requirement. They are then reviewed by a committee comprising of Purchase officer, finance officer and BKMD officer among others. Sometimes when the value of the equipment is very high and the group requesting for it, declares it as proprietary, the claim is examined in detail. The Director and Project Leader are empowered to take decisions based on their sanctioned budget, without seeking approval from the headquarters. There are checks on redundancy . Readiness of the site for housing the

equipment is another parameter that is addressed well by the CSIR policy which ensures the site is ready when the equipment arrives and can be commissioned easily.

The next presentation was jointly presented by Dr. V Vasudeva Rao, Co Coordinator AINP on Vertebrate Pest Management and Dr. Sreedhar M, Principal Scientist & Technical Manager, Quality Control Laboratory., Professor Jayashankar Telangana State Agricultural University (PJTSAU). In their presentation they explained the routine procurement procedure at their university where the focus is on procuring equipment with wider research applications. Appropriate vendor profiling i.e. background checks for equipment performance and after sale service backup were done before short listing vendors. The University mandated a professional Audio Visual presentation by the vendor for product competence. Typically a two bid procurement system with emphasis on compliance to technical specifications is in place. There is a concept of pooled procurement to cut costs. Availing custom duty exemption and other concessions for academic institutions, they expressed, were routinely done. Other key aspects he felt was strict implementation of vendor accountability through EMD/SD/BG and extended warranty / inbuilt AMC for initial period of operation. Some of the key technical aspects highlighted by Dr. Sreedhar included Customized machine specifications, SOP compatible with Standard Test Methods, Repository of accessories at the point of procurement, Matching local supplies like certified UHP gases, exhaust ducts etc., Matrix based method development support, Principals commitment for on / off site training for Lab personnel and Remote / online support of Applications Engineer during initial lag period.

They felt that an Institution based apex committee to examine equipment needs and monitor procurement process was the need of the hour. There was provision for buffer amount to counter the prices escalation during procurement process especially in the cases of imported equipment where foreign exchange transactions were involved. Dr. Sreedhar explained how procurement did not end with merely getting the equipment but installation and operationalization are key parts of procurement as well. He explained how the User's TOR need to be on priority during entire process of procurement and how qualifying the equipment (IQ, OQ, PQ) for research use would be beneficial. He stressed the need for tamper proof, upgradable software (21 CFR compliant).

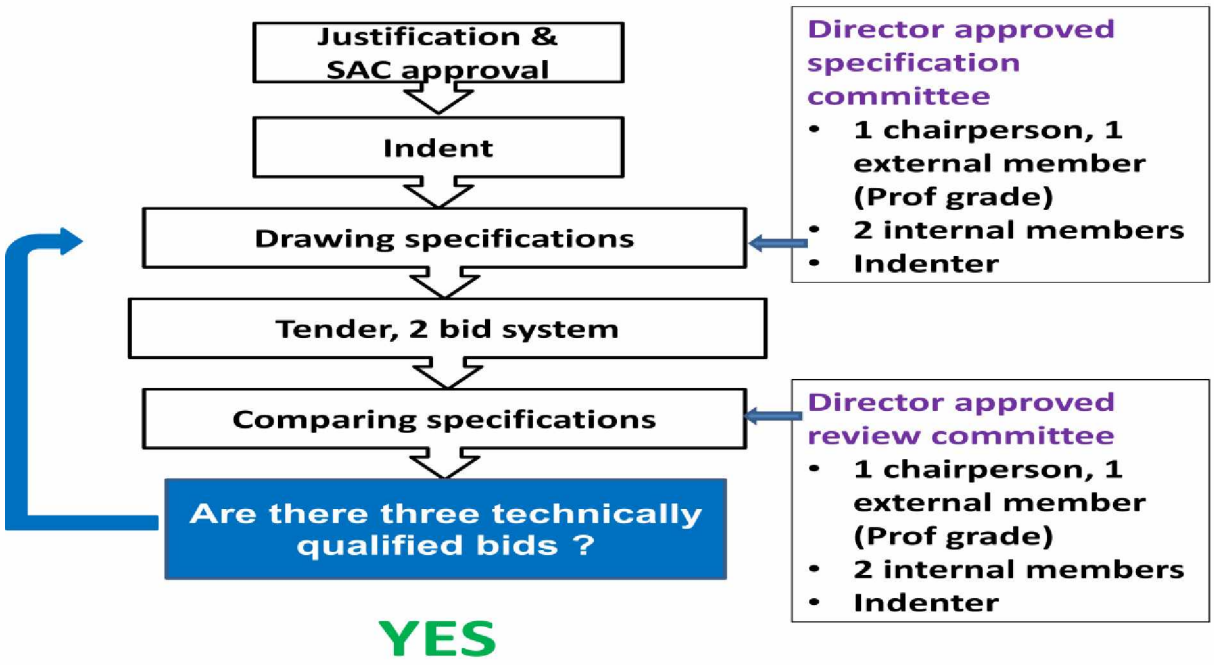
They stressed the need for maintaining appropriate civil infrastructure facilitating recommended environmental conditions to ensure long life of equipment. Ensuring dedicated clean power with sufficient backup and soft water and trained human resources were other key aspects of good maintenance. The scientist duo felt that initializing analytical operations with Standard Test Methods and CRM's of highest traceability and compliance to safety and regulatory requirements would streamline laboratory functioning and equipment usage to optimize it. They felt the need for an eco friendly waste disposal.

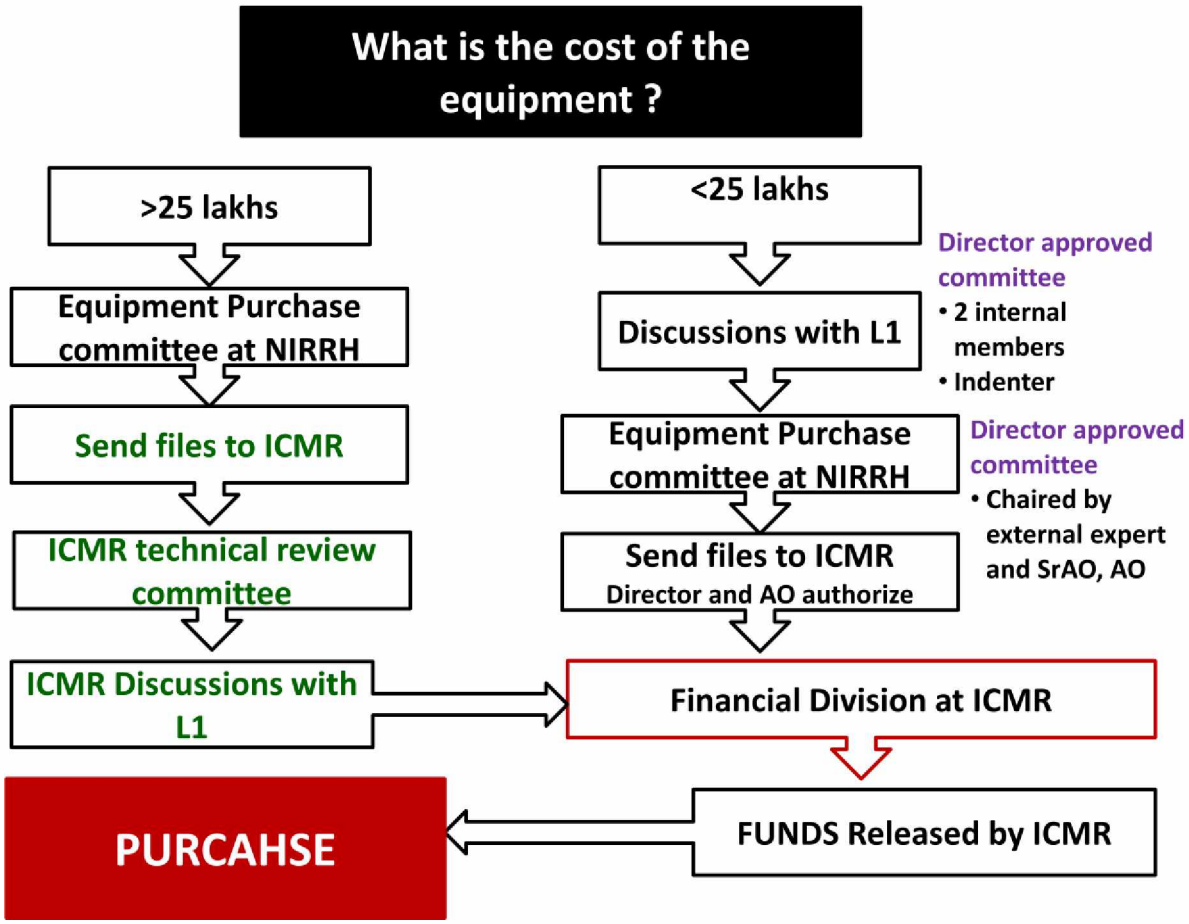
They highlighted some of the key initiatives at PJTSAU like setting up of two premier NABL accredited Labs , ISO/IEC 17025: 2005 Quality Management System that have ensured clear and systematic procedures for training and maintenance in the labs. A Central Instrumentation Cell has just been

introduced to facilitate housing of common equipment and sharing between the departments and colleges. There is an active vendor evaluation, feedback archive and rate contracts to ensure that only competent vendors deliver the equipment. There are trained competent testing staff. The Periodical technical audits of the Labs have ensured that the laboratories are in very good condition. The University has ensure revenue generation through customer sample analysis. The university has also managed to foster a network by building partnerships with elite R&D agencies like ICRISAT, UNICEF, APEDA, IICT, BARC, BRNS, BRIT and ICAR. The University is also providing consultancy for establishment and accreditation of Labs in other Universities / Private sector to help improve their processes. The indirect impact of the accreditation of the labs has been cultivation of an expertise in internal audits.

Dr. Deepak Modi, Scientist E and Head, Molecular and Cellular Biology Laboratory, National Institute for Research in Reproductive Health was the next panelist to present. Dr. Modi explained the standard procurement procedure of ICMR organizations where global tenders are invited for equipment of value Rs. 25 lakhs and above and global tender or limited inquiry can be used for equipment below Rs. 25 Lakhs. For equipment below 5 lakhs a limited inquiry is sufficient but a tender is encouraged if the numbers are more. The budget allocated for local purchases is Rs.5 lakhs.

The typical processes for procurement as outlined by him are as follows.





He also explained exceptions in the tender rule. Outlining the process for limited enquiry he detailed the following steps:

- Items below 25 lakhs and not receiving appropriate bids after two tenders
- Routine items where more than 5-7 vendors are available
- Emergency
- Repeat order (last 6 months purchase within ICMR)
- Technical specification
- Comparison with that purchased by another Institute
- Approval by local equipment committee
- Examined by ICMR technical review committee
- If found satisfactory proposal sent to finance
- Proprietary items
- Proprietary certificate from company
- Examined by an internal committee
- Examined by ICMR technical review committee

- If found satisfactory proposal sent to finance

Detailing some of the important considerations in the procurement procedure he cited that all committees have to be director approved and members to be selected based on the type of the equipment and all tenders have to be of the following type like two bid system, EMD, News paper advertisement, ICMR and NIRRH websites, E-tender and Indian Trade Journal. It was mandatory to have a minimum three technically qualified bids even before the review.

The ICMR system's stringency ensured that three years warranty and two years AMC compulsory and tenders rejected if vendors do not agree. The AMC/CMC prices for 7th till 10th years to be fixed at time of purchase ensuring that vendors do not take undue advantage of the cessation of the original AMC. The price of consumables also fixed and the payment terms are now strictly in Indian Rupees to ensure undue inflation based on foreign exchange rates. There is also a component that if the equipment costs more than 1cr manpower or salary for a technician (for 5 years) would be provided. The system, in his view, had managed to ensure rigorous assessment, fair competition, no biases or favouritism and transparency.

But the limitations of the system include the long time delays sometimes due to lack of more than 1 vendor or the frequency of the committee meetings. The system also does not take in to account service component, specific exclusive features of equipment. The vendors tend to form nexus and decide fate of purchase by disallowing newer vendors from bidding. Any form of complaints by vendors forfeits the tendered item and reprocessing happens. There are also cases where same items come from multiple vendors and while awarding AMCs, it proves to be very expensive.

While procurement is slow, there are more issues in maintenance with lack of manpower to run the equipment and relying on Students/JRFs/TAs. If it is core facility equipment, there are no separate budgets allocated for consumables/routine maintenance or manpower.

Some of the recommendations by Dr. Modi included a uniform nationwide purchase policy. He stressed that there should be a mechanism by which equipment can be purchased based on quality and suppliers after sales performances. There should be some liberty given to end users and make steps fewer especially if there have been repeat orders from any government organizations not just within ICMR as the quality and other evaluation of the equipment would already have been evaluated. As a part of a

recent JNU initiative, he explained how tie-up with vendors/companies/startups to use the equipment with an understanding of sharing and maintaining the facility could act as a good case to emulate. He outlined the importance of identifying such partners before purchase and having clear terms and conditions. He opined that a single window listing of existing equipment in government labs nationally and regionally would act as a great help

Session on Sharing and Maintenance

The third season titled "Issues in maintenance and sharing of equipments" was chaired by Dr. Sunit Tuli , ex Dean R&D of IIT Delhi and currently the Dean of Bennett University, School of Engineering & Applied Sciences. Dr. Tuli stressed on the need to establish a professional body that would take care of all the procurement related activities. This would allow the scientists to concentrate only on research rather than wasting time in complex procurement related processes. A strong mechanism of checks and evaluation has to be created which would ensure good laboratory practices. Preparation of compliance chart should be made mandatory across all boundaries of laboratory activities. Space utilization, allocation and use of funds should be properly examined. Absence of skilled professional is the major impediment to maintenance of scientific equipments. This problem cannot be solved instantaneously. He strongly recommended that instrumentation which is so much critical for the success of Make in India, should be given its due priority in all premier academic institutions like IITs. Bargaining is the most sought after skill in procurement. It is necessary to involve specialized people in procurement process. Professional persons like scientific cadres needs to be recruited across IITs to mange efficient procurement process. The new policy should look into the provision of redefining the function of some of the existing instrument bodies like Electronics Regional Test Laboratories (ERTL) and involving them more into the system. More regional testing facilities in Public Private Partnership (PPP) mode needs to be established. For sharing of equipments, there is a call to develop a dedicated database that would allow the researchers to locate the available resources (both equipment and manpower) available for sharing. The Government should seriously think to link this policy with other skill development programme that would solve the problem of manpower in the long run. The upcoming policy should address how technology can be effectively used to access the research infrastructure across the country.

The next speaker was Dr. Taslimarif Saiyed, Director, C-CAMP. In his presentation, Dr. Taslim talked about C-Camp maintenance and sharing model that has been a success and is generating substantial revenue for them. C-Camp as a part of Bangalore Life Science Cluster (BLiSc) facilitates Bioscience

Research and Entrepreneurship by providing Research, Development, Training and Services in state-of-the-art Technology Platforms. Bangalore Life Science Cluster (BLiSc) is a hub of cutting edge research excellence and a 100% shared facility, housing three premier institutes namely NCBS, Institute for Stem Cell Biology and Regenerative Medicine (inStem) and Centre for Cellular and Molecular Platforms (C-CAMP). Sharing of equipments and technical consultations are invited through C-Camp.

Most of the equipments of this shared facility have more than 70% utilization. Niche equipments are used more than 100% (8hours per day, 20 days per month) in 20 facilities across the campus. Visibility of facility is maintained through C-CAMP. Around 200 organizations have used facility of Bangalore Life Science Cluster (BLiSc). Users have to search and book their slot through an online portal. External user comprises of 25% of total users. Among non-academic organizations, fair share of start-ups and MSMEs have been observed. The common instruments/equipments are available for use to any student or any research group in NCBS/ InStem installed at NCBS & CCAMP building. The students have equal priority to use common equipments on first come first use basis. The instruments are accessible to anyone suitably trained by the company representative/instrumentation team. They are called student in-charge. These student in-charges have been provided training by the Instrumentation team following which they get certificate. A trained "Student In-charge" is always present and assigned with registered user during testing of their sample. Equipments are shared internally between NCBS and InStem. Outside institutes approach through C-CAMP. University/ academic institutions are charged a minimum amount for using the equipments of shared facility. Private organizations are charged higher. NCBS usually trains the user who uses the instrument for longer period. One dedicated scientist and a member of instrument team is assigned with every external user, which ensures security of the high-end equipment. In the case of short term projects run by external users, NCBS provides skilled operators to operate the equipments. The shared facility is open to all. Presently, demand is much higher than the capacity of the facility. Participation is higher in niche facilities. The users are categorized in five segments like In-house scientists, students, faculty/ scientist of government organizations, MSME and private organization. Online portal for searching and booking equipment is available and NCBS is trying to develop a MIS reporting tool by the end of this financial year. Cost of sharing is calculated as follows

In house: Running cost (consumable+ maintenance cost);

External academic: Running cost+ Admin charge+ Manpower cost;

Private: Cost-to-cost

This model allows the researchers to concentrate on research only while other managerial issues is taken care of by C-Camp. Dr. Taslim suggested that this model can be replicated in other regional clusters.

The next speaker Dr. P. Sugathan, Research Co-ordinator, Inter-University Accelerator Centre (IUAC) in his presentation talked about the dedicated in-house maintenance support system of IUAC. The scientists and engineers of the team are properly and regularly trained by OEM (original equipment manufacturer) and suppliers. At procurement time, the in-house maintenance team is commissioned and they are engaged with the installation process right from the very beginning. Barring some high value equipments the in-house maintenance team is responsible for maintaining the facility. A comprehensive in-house maintenance support has resulted in huge cost benefits and created a skilled work force to effectively maintain scientific equipments. Several maintenance and monitoring tools are regularly being designed by the scientists of the IUAC itself. IUAC always encourages the engineering team to develop their own instruments for which funds are provided by the centre. The maintenance engineering team of IUAC has already designed high voltage power supply instruments and UPS (uninterrupted power supply) which are being used in different projects of IUAC. The in-house team has also designed the central monitoring system of the accelerator.

For effective maintenance of scientific instruments, Dr. Sugathan opined that technicians using instrument have to be provided adequate training for operation and routine maintenance. Clean environment and parts free of contamination has to be ensured. A machine resource manager may be appointed who would be expert of troubleshooting and has to be assigned with responsibilities like identifying procedure for trouble shooting, developing written procedures, plans for various tasks, creating logs/forms/formats & maintaining records and routine checks. The concerned person should perform other duties like identifying good machine shop to get the repair done locally, identifying a skilled electronic person in local area, keeping inventory of assets, keeping asset number/document digital archive. Refreshers training should be provided to the technicians when equipment is upgraded with new technology. To increase sharing of scientific equipments, a comprehensive database of scientific equipments has to be designed which would help students and researchers to locate alternative sources and would also provide greater transparency in using public funded resources.

Dr. Sugathan's talk was followed by a presentation of Dr Anindya Dutta, Head, Sophisticated Analytical Instrument Facility (SAIF), IIT Bombay. In his presentation Dr. Dutta talked about the approach adopted by SAIF to ensure smooth flow of trained operators for maintenance of high end scientific equipment. Sophisticated equipments call for skilled technical operators. IIT-Mumbai's SAIF working as a cell of Centre for Research in Nanotechnology & Science (CRNTS) ensures availability of skilled technicians to handle the SAIF equipments. Merger with CRNTS in 2008 has proved to be very effective for SAIF which allowed them recruiting PhD students from CRNTS. It provided a platform for collaborative research in the area of Nano technology and science. Each SAIF equipment is assigned to a scientist and one or more operators. These operators are called Technical Assistant (TA) and recruited from the pool of students who are pursuing their PhD under IIT-Bombay. It allows the IIT offering facility of SAIF beyond office hours. Usually, these TAs are appointed on a contract basis for two years. The TAs have to spend minimum 8 hours in a week in the laboratory against which they get incentives. They are provided at least 4 months intense training by professors, senior PhD students, external experts and manufactures. Performances of the TAs are strictly evaluated by SAIF committee. On every Friday, the committee evaluates the utilization percentage of each equipment with respect to each TA. Additionally, several workshops are conducted to train these students. Users can book their slot through online portal designed by IIT-B for testing their samples. Usually requests are accepted at first come first serve basis. In 2015-16, 14106 such internal samples were tested in SAIF. These numbers are 6688, 219 and 1081 for university sample, national laboratory sample and industry sample respectively. In 2015-16 the numbers of internal users were 1148 whereas 1081 external users used the equipments of SAIF. Revenue earned through internal source was Rs. 1,72,05,385 whereas income from external sources was Rs. 87,93,233.

The next speaker was Dr. Raghavendrachar, Head – Instrumentation, Centre for DNA Fingerprinting and Diagnostics (CDFD). In his presentation, Dr. Raghabendrachar talked about maintenance model of Centre for DNA Fingerprinting and Diagnostics (CDFD) known as the equipment operation contract model. CDFD has identified a company based on advertisement and due tender process etc. and entrusted them with 14-15 high-value instruments that are operator based, where sample preparation is required and an analysis is involved. This company ensures smooth maintenance of all the equipment and the laboratory .While there is an in-house instrumentation team that deals with minor repairs, the team that handles the equipment is completely in charge of the maintenance. A scientist, junior scientist and technical assistants comprise the dedicated team from the company that operates the equipment.

For the last 8 years, CDFD has earned Rs.6.4 crores in user charges alone. The external agency charges the users from CDFD at a notional rate while outsiders are charged at a higher rate for conducting the analysis of the samples. The various components of the rate charged include:

- Cost of the consumables
- Notional value of the operator's salary
- A component of depreciation
- Electricity charges

Organizations and individuals outside CDFD are however charged a higher rate depending on the nature of the institutions i.e. Educational institutions are charged less than research organizations which in turn are charged less than private organizations. Priority is given to CDFD users and during idle time it is given to other academic institutes and private companies. This helps not only in generation of revenue but also reduces the idle time of machines. This policy has been in place since 2009 and has led to 100% utilization of equipment with benefit to not only the organizations but people outside the organization as well.

Another benefit of this model has been intangible. In organizations where equipment is open for sharing, there arise instances of conflict of interests on the ownership of Intellectual Property. When users, besides the Principal Investigator, use the equipment, they are required to share the IP with the organization or the Principal Investigator. This is an accepted norm. But sometimes the scientists/private industry may not been keen to share the IP of their long toiled research in exchange for mere sample testing. Therefore, they prefer to buy the equipment rather than share the IP. The model used by CDFD ensures that such a conflict never arises. The sample testing is done merely on a paid basis and so the IP does not have to be shared with CDFD or the Principal Investigator for use of the equipment. This ensures that interests of all the parties involved are protected.

Next speaker, Dr. N. Balashanmugam, Joint Director, CMTI talked about various issues related to maintenance, sharing and operation of scientific equipments. He opined that paucity of fund, timely non-availability of fund for up-gradation, lack of skilled personnel for operation and analysis, lack of clean power and earthing are the major problems of maintenance. In sharing point of view the major problems are lack of information on availability of R&D equipments and its location, high cost of using

equipments, work culture mismatch while sharing the facilities and availability of trained manpower for operation and analysis. Lack of information on availability of spares and consumables at other places, quality of service, lack of rating for labs and lack of maintaining archives for reference and research have also emerged as impediment to sharing. He stressed on the need to establish a monitoring mechanism for labs to facilitate sharing. A rating mechanism of labs may be created based on sharing percentage of their equipments. Utilization of the equipment, status, sharing percentage should be strictly monitored. He suggested that pooled fund from various research projects can be used to buy high end research equipments. Research and analysis should clearly be segregated. While the scientist will carry out the research, analysis and operation should be left to the expert technicians who can carry out experiments in better, faster and efficient way. A national portal for sharing has to be established. Replication of Harvard's eagle-i system, a directory where researchers can list information, data and equipment they are willing to share with others – including cell lines, research mice, and equipment could be a starting point.

He strongly opined that the new policy should seriously address career path of the professionals who are operating scientific equipments in various laboratories. There should be a budget provision for procuring spares beyond project period. E-portal should have provision to know spares availability at other facilities. There should be a WEB based systems & APPs for using equipments in the laboratories. E-portal on R&D Infrastructure should show all the equipments available at different organisations. Networking among R&D Infrastructure labs has to be established. E-portal should allow on-line booking of facilities. Archiving of data from R&D equipments is recommended. Provision should be created for transferring of equipment to other labs if not required and underutilized.

Session on Disposal

The second day of the workshop started with the session on "Disposal of Scientific Equipments". The session was chaired by Dr. N V Satyanarayana, Chief Scientist & Head, Business Development and Technology Outreach of Indian Institute of Chemical Technology (IICT). Dr. A S Rao, Ex-DSIR and Founder-President of Indian Innovators Association and Dr. S Neelakantan, Associate Director- R&D, C-DAC were other panelists of this session.

Dr. Satyanarayana started his presentation by discussing the standard disposal procedure generally followed in the CSIR laboratories like IICT. The standard procedure mandates formation of a disposal

committee comprising of scientists and administrative personnel. The committee recommends whether any underlying asset is surplus, obsolete or unserviceable. In the case of surplus item IICT transfers the equipment to its sister organization where it is of use or gifts the equipment to other academic institutes. For obsolete and unserviceable items IICT generally conducts public auction through advertised tenders. Dr. Satyanarayana recommended that factors like market guiding price, asset holding cost and other financial and economic factors needs to be considered while transferring the book value or write of any equipment. In case of disposal of consumables, both toxic and non toxic consumables should be disposed of strictly following the guidelines of Pollution Control Board (PCB). Seminars and workshops on safe and environment friendly disposal of consumable, residual and high-end equipments were recommended. Dr. Satyanarayana also recommended to link startups with the process of disposal, which would create a new avenue for the aspiring entrepreneurs.

Dr. S Neelakantan, Associate Director- R&D, Centre for Development of Advanced Computing (C-DAC) talked about disposing of EEE/ electronic items. In his brief presentation, he deliberated on how the threat of e-waste has increased in last decade in India and globally. Electrical and Electronic Equiment (EEE) items contain highly toxic substances like Lead, Mercury, Cadmium, Hexavalent Chromium, polybrominated biphenyls and hence dangerous to human health and environment. Conventional waste management policy is not applicable to e-waste management. Countries like Switzerland (1998); Denmark, Netherlands and Norway (1999), Belgium, Japan and Sweden (2001), Germany (2005) has their own legislative policies in managing e-waste and strictly follows the regulations to prevent environmental degradation. Dr. S Neelakantan appreciated the initiative of Government of India to bring E-Waste (Management) rules 2016 last year. He also talked about R2 certification which is one of the leading global standards in disposal (repair and reuse) of electronic products. In this context, he mentioned the role of Sustainable Electronics Recycling International (SERI) which has come up with R2 standard that provides a common set of processes, safety measures, and documentation requirements for businesses that repair and recycle used electronics. Dr. S Neelakantan strongly recommended for enforcing this kind of standard in India for responsible disposal of e-waste. He also advocated for conducting seminars and workshops on eco friendly disposal of scientific equipments and electronic items to aware scientists, scientific organizations, institutes and common people about the environmental degradation caused by casual disposal of these goods.

Dr. A S Rao, Founder President, Indian Innovators Association, Hyderabad batted in favour of promoting startups to solve the disposal issues. He cited some instances where after the completion of the project, equipment remained idle and eventually become outdated when newer version was available in the market. He said that majority of these idle equipments become obsolete due to lack of maintenance. These outdated equipments are sold in the market at a minimum value as scrap or through public auction. Dr Rao suggested that startups could be engaged to maintain and dispose of equipments. After project completion, unutilized/idle equipments can be given to the startups, which would create entrepreneurial opportunities. Thus, maintenance and training will no longer be the burden of the research organization. This process has two fold advantages. Firstly, it will solve the problem of maintenance and disposal and on the other hand, it will contribute to "Startup India". He strongly opined that public funded equipments must have to be shared to ensure optimum utilization of public fund. Each institute must have a separate committee to examine ways of next use for research assets acquired with public funds. India faces problems of skill in maintaining scientific equipments. This problem cannot be solved instantaneously. It is necessary to provide upcoming students the opportunity to use sophisticated equipments used for research. Hence, the new policy must ensure that students getting opportunity to use the best scientific equipments for research activities.

Round Table Discussion

The workshop ended with an intense round table discussion where a number of recommendations emerged as outlined below.

Procurement:

- Creation of a national portal of scientific equipments
- Promoting e-procurement and linking of NSRIP with GeM to bring in transparency, efficiency and ease of access.
- Creation of a national portal for vendors with provision of rating mechanism
- Uniform procurement policy across all scientific organization including universities
- Adoption of comprehensive procurement policy with provision for warranty, extended warranty, AMC and buy back of equipment
- Establishment of professional procurement cell across the organization or regional basis to take care of all procurement related activities.

- Creation of a comprehensive database of indigenous research equipment manufacturers to promote domestic manufacturers.
- Promoting startups for developing indigenous scientific equipment
- Reverse auction as a practice among successful technical bidders to achieve price competitiveness

Maintenance & Sharing:

- A comprehensive procurement policy with suitable provision for warranty, extended warranty, AMC and buy back of the equipment. A provision to include peripheral units that supplement the main unit like chillers, UPS, stabilizers, and Air dryers as part of the equipment.
- Provision of parking fund for AMC and procuring spares beyond project period.
- Designing of a comprehensive database/ portal for scientific equipment to help students and researchers locate alternative sources and provide greater transparency. This would also promote networking among R&D labs and allow on-line booking of facilities.
- Archiving of data from R&D equipments with a provision to transfer unutilised or idle equipment to other labs.
- Promoting Academic/Scientific Social Responsibility in the academic and research circles. For eg: Provision for laboratories to be kept open for school students twice a year
- Comprehensive guidelines for up gradation of scientific equipments.
- Establishment of regional college consortium to promote sharing
- Nodal agencies for maintenance of high-end equipments. Promotion of start-ups may be a way forward to this.
- Strengthening of the regional Scientific research infrastructure in remote places through PPP model
- Creation of dedicated national portal for sharing
- Provision of guidelines for utilization of income generated from equipment sharing for maintenance of the equipments and facility.
- Incentivizing laboratories that encourage sharing
- Rating mechanism based on resource sharing potential

Disposal

- Creation of a national portal for surplus items
- Promoting startups to dispose equipments
- Creation of professional cell for disposal across the country
- Model like Ramky may be promoted
- Creation of database of inventory at institutional level

Other

- Organizing Workshops and training related to operation, health and safety of scientific equipments and new technologies
- Creating provision for human resource up gradation, capacity building, skill development

List of Participants

List of participants attended the workshop titled 'A Workshop on National Scientific Research Infrastructure Policy 'organized by ASPIRE on 9th & 10th February, 2017 at IIC, Delhi.

Organization	Delegate Details
DST	Dr. Ashutosh Sharma, Secretary to the Government, DST, Government of India
DST	Dr. Parveen Arora, Advisor & Head, CHORD Division
ASCI	Dr. Nirmalya Bagchi, Dean of Research Studies
ICAR	A K Vasisht, Assistant Director General (PIM) Email: amitvasisht@rediffmail.com Landline: 01123389526 Mobile: 9582898982
FIST	Dr. A Mukhopadhyay, Head/Scientist 'G' Email: tsd@nic.in Landline: (011)26590445
DST	Dr. Amalesh Mukhopadhyay, Head(R&D Infrastructure) Email: tsd@nic.in Landline: 011 26602193, 26590445

Organization	Delegate Details
IIT Bombay	Dr. Anindya Datta, Professor of Chemistry and Head, SAIF-CRNTS Indian Institute of Technology Bombay Powai, Mumbai 400076 Email: head.saif@iitb.ac.in Landline: (022)2576 7690; Fax (022)25723480 Mobile: 9769257149
Niti Aayog	Dr. Ashok A. Sonkusare, Jt. Adviser (S&T) Niti Aayog Email: a.sonkusare@nic.in Landline: 011 2309 6669 Mobile:9818508967
Indian Innovators Association	Dr. A S Rao Visiting Professor, Innovation & Incubation at Indian Institute of Technology, Hyderabad and President, Indian Innovators Association, Email: indiainvents@gmail.com Landline: Mobile: 8886711154
National Institute of Nutrition (NIN)	Dr. B. Dinesh Kumar, *FNAMS, FAPASc, FIPS,* Scientist 'F' – Deputy Director (Sr. Gr.), HOD Drug Toxicology Division & Coordinator – Centre for Advanced Research for Pre-clinical Toxicology (PCT), President – Indian Pharmacological Society (IPS) Secretary – Nutrition Society of India (NSI) National Institute of Nutrition (NIN), Indian Council of Medical Research (ICMR), Ministry of Health & Family Welfare, Govt. of India Jamai – Osmania PO, Hyderabad – 500007, T.S. INDIA, Email: nindineshpct@gmail.com, dineshpct@icmr.org.in Landline:(040) 27197322 Mobile:9849082088 Fax: +91-40-2701 9074
National Institute for Research in Reproductive Health	Dr Deepak Modi Scientist E and Head Molecular and Cellular Biology Laboratory National Institute for Research in Reproductive Health JM Street, Parel, Mumbai 400 012, India Email: deepaknmodi@yahoo.com Landline☹022) 24192034 Mobile: 9987176249

Organization	Delegate Details
CSIR- Structural Engineering Research Centre	Dr G. Raghava Chief Scientist & Head, Fatigue & Fracture Laboratory CSIR – Structural Engineering Research Centre CSIR Campus, Taramani, CHENNAI – 600 113, India Email: raghavag@serc.res.in, raghavag@yahoo.com Telephone: (044)22549139/136; Fax: (044)22541508 Mobile: 9444694680
Indian Institute of Science Education and Research(IISER), Pune	Girish Ratnaparkhi Associate Professor & Co-Chair, Biology Indian Institute of Science Education and Research (IISER) Dr. Homi Bhabha Road, Pashan, Pune, INDIA. Maharashtra 411 008 Email:girish@iiserpune.ac.in, girish.iiserpune@gmail.com Landline: +91 (0)20 2590 8053 Fax: +91 (0) 20 2588 1724
CSIR- Structural Engineering Research Centre	H V Sundar Controller of Stores & Purchase CSIR – Structural Engineering Research Centre CSIR Campus, PO – TTTI Taramani CHENNAI – 600 113 Email : puroff@serc.res.in Ph : 044-22549108/22541238 Fax: 044-22542211 Mobile: 9444572098
Centre for Cellular and Molecular Platforms	Dr. Mohammad Atif Alam, Manager, BD-PM Centre for Cellular and Molecular Platforms (A Dept. of Biotechnology, Govt. of India Initiative), NCBS-TIFR Campus, GKVK Post, Bellary Road Bangalore 560 065, India. Email: atifm@ccamp.res.in Landline: (080)67185052 Mobile:
Centre for Development of Advanced Computing	Dr. N Subramanian Associate Director (R&D) Centre for Development of Advanced Computing, Pune University Campus, Ganesh Khind Pune – 411 007 Maharashtra (India) Email: subbu@cdac.in Phone:+91-20-2570-4210 Fax: +91-20-2569 4004 Mobile: 07774036627

Organization	Delegate Details
Central Manufacturing Technology Institute (CMTI)	Dr. N. Balashanmugam Joint Director Central Manufacturing Technology Institute (CMTI) An autonomous R&D Institute under the Ministry of Commerce & Industry Government of India Tumkur Road Bengaluru-560022 E-Mail: balashanmugam.cmti@nic.in Landline: (080)23370459 Mobile: 9449842676
CSIR –Indian Institute of Chemical Technology	Dr. N V Satyanarayana Chief Scientist , CSIR-Indian Institute of Chemical Technology (Council of Scientific and Industrial Research), Ministry of Science & Technology, Government of India, Tarnaka, Hyderabad-500007, Telangana Email: nvs@iict.res.in Landline: (040) 27193196 Mobile: 9440802797
IIFT	Prof. O.P Wali, Professor & Head, CITT Email: opwali@iift.edu Mobile: 9810306827
Inter University Accelerator Centre	Dr. P. Sugathan Inter University Accelerator Centre Aruna Asaf Ali Marg, Post Box 10502 New Delhi 110067, India Email: sugathan@iuac .res.in Landline: (011)26893955 Fax: (011)26893666 Mobile: 09868891732
Centre for Knowledge, Idea and Development Studies(KnIDS)	Prof. Pradosh Nath, Director, Centre for Knowledge, Idea and Development Studies Email: pradoshnath@gmail.com Mobile: 9811283822
DST	Dr. Pratishtha Pandey, Sc E, R&D Infrastructure Division Email : pratishtha.tp@nic.in

Organization	Delegate Details
IIT Madras	Mr. R. Sundaram Chief Techno-Economic Officer Industrial Consultancy and Sponsored Research Indian Institute of Technology Madras Chennai – 600 036 Email: rsundar@iitm.ac.in Landline: (044)2257 8350 Mobile: 9444008064
Centre For DNA Fingerprinting & Diagnostics	Raghavendrachar Jois, Staff Scientist VI and Head, Instrumentation and Engineer, Research Facility Manager. Centre For DNA Fingerprinting & Diagnostics, Department of Biotechnology, Ministry of Science & Technology, Government of India Nampally, Hyderabad. Telangana, Landline: (040)24749300,27209464 Mobile: 9490792195
Fergusson College	Dr. Ravindrasinh G.Pardeshi Principal, Fergusson College, Pune – 411004 (INDIA) Email: rgpardeshi@yahoo.co.in Mobile : 9225340906 Office: (020)30866000
University of Hyderabad	Dr. S. M. Ahmed Principal Scientific Officer, Head Central Instruments Laboratory; University of Hyderabad Hyderabad Email: smahmedhyd@gmail.com Landline : (040)23132662 Mobile: 9492042609
Fergusson College	Dr. Samir S. Terdalkar Coordinator, Internal Quality Assurance Cell (IQAC)and Secretary, Academic Council , Fergusson College (Autonomous), Pune, Maharashtra Email : sterdalkar@fergusson.edu Landline: (020) 30866603; 30866666 (O) Mobile: 09822184006

Organization	Delegate Details
Professor Jayashankar Telangana State Agricultural University	Dr. Sreedhar Mulinti Principal Scientist & Technical Manager Quality Control Laboratory PJTS Agricultural University, Rajendranagar Hyderabad-500030 Email: mulisree1969@gmail.com Landline: (040) 24013456 Mobile: 9949437035
IIT Delhi	Suneet Tuli Dean R&D Email: suneet.tuli@bennett.edu.in
TERI	Mr. T P Sankar, Fellow, Knowledge Management Division TERI Email: tpsankar@teri.res.in
Centre for Cellular and Molecular Platforms	Dr. Taslimarif Saiyed, Director and COO, Centre for Cellular and Molecular Platforms (A Dept. of Biotechnology, Govt. of India Initiative), NCBS-TIFR Campus, GKVK Post, Bellary Road Bangalore 560 065, India. Email: taslim@ccamp.res.in Landline : (080)67185100 Mobile: 9620959162
Professor Jayashankar Telangana State Agricultural University	Dr. V.Vasudeva Rao Co Coordinator AINP on Vertebrate Pest Management, PJTS Agricultural University, Rajendranagar, Hyderabad – 500030 Landline: (040) Email: vasuvaidyula@yahoo.com, vasuvaidyula@gmail.com Landline: (040) 24015754 Mobile: 9440411166
DST	Dr. H B Singh CHORD Division
DU	Prof. V K Bhasin
CII	Dr. Naimuddin
KniDS	Dr. Venkatamallu

Organization	Delegate Details
ASCI	Mr. Karnak Roy, Junior Research Fellow
ASCI	Mrs. Katyayani PNS, Junior Research Fellow
ASCI	Mr. Kohinoor Chatterjee, Senior Research Associate
ASCI	Mr. Arpan Roychowdhury, Project Associate

Appendix 4: Case Studies

The case study approach, as a part of research method, allows in-depth, multi-faceted understanding of complex issues and objects in real-life settings. Case study helps to extend the knowledge and experiences. It emphasizes a detailed analysis of a specific number of events and tries to generalize the conditions to a larger set of units. Case studies also help to find the relationships between different events or conditions. Experimental design modelling tests a specific hypothesis through manipulating the environment. On the other hand, case study approach presents information in a descriptive way. It helps in visualizing real world situations. This approach also throws insights on gaps in present system and defines proper implementation strategy over others. The value of case study approach is well accepted in fields of business, law and policy.

34 individual cases were prepared on the basis of interactions and feedbacks of the critical stakeholders like directors, vice-chancellors, scientists, stores and purchase officers, procurement committees, instrumentation heads, central instrumentation facility in-charges of various organizations. The case studies tried to deliberate on procurement process, operation and maintenance models, disposal, sharing and training mechanisms of the respective organizations. The institutions visited can broadly be categorized into four major types namely, CSIR institutes, Academic institutions, Government or PSU research organizations and Private research laboratories. The list of 34 case studies include 8 CSIR research laboratories, 15 academic institutions, 8 Government research organizations and 3 private research laboratories.

Name of the Institute: Advanced Centre For Treatment, Research & Education in Cancer(ACTREC)	
Location: Mumbai	**Year of establishment: 1983**
Contact Person(s):	Dr. S. V. Chiplunkar, Director
Nature of Institute	Grant-in-aid institute under Department of Atomic Energy (DAE)
Domain	Basic research on various domains of cancer biology. The Institute focuses on translation of research i.e. focus is given on the research which is applicable to patients
Nature and sources of funding	Each PI arranges his/her own grant for research. Mostly these grants are government grant ranging between Rs. 60 Lakhs –Rs. 2 Crores. Equipments are procured under the projects. Multiple projects can be handled by one PI
Procurement	• PI applies for a project. • This should be approved by the head of the Institute i.e. Director. • When approval comes from funding agency, PI buys equipment under the project. • Before sanctioning PI's request the director examines some of the basic requirements like how space will be utilized or how maintenance cost will be borne etc • The Institute has two facilities located in-house. These are common instrument room and central facility. PI has to ensure that no duplication of purchase is happening.
Central instrumentation facility	High-end equipments like ultra-centrifuge, beta counter, gamma counter are some of the existing equipments located in the central facility. These equipments are shared- mostly internally. In central facility, institute has set-up for genomics, proteomics research. Imaging facility in this institute is one of its kinds. The organization has invested Rs. 15 Cr for this facility. A sophisticated animal facility called micro-pet city costing Rs. 4 Cr. are also located in central facility. All these equipments are chargeable even for in-house testing, especially genomics and proteomics facilities. Institute also provides a small amount ranging from Rs. 2-4 Lakhs depending upon the need for spares and routine maintenance which includes buying of spares, consumables, reagents etc. If there is a major breakdown, Institute takes care of that.
Working mechanism of each facility	• Each facility is headed by a scientist. He/she is called as Officer-in-charge of the facility. • Under Officer-in-charge scientific assistants are appointed and trained to use equipments. • They are B Sc. Or M Sc. level permanent staffs highly trained to handle those equipments. During the time of procurement, the company identifies people and nominates them for training • No scientist can run the samples individually. Most of the equipments are high-end. Lot of expertise is required to operate the same. An internal system has been created to book slot for sample testing. Samples are run by trained operators. • This is e-booking system for internal testing.

	• Before giving an approval for sample testing some of the basic checks like ethical standards, safety standards, nature of the chemicals, whether infectious or not, are checked. • In case of massive breakdown after the warranty period, the Institute has created a contingency fund to tackle the situations.
Maintenance	A dedicated team has been created which is responsible for all equipment related activities of both common instrument room and central facility. The team comprises of 4-5 people including a general engineer, biomedical engineer and 4-5 technicians.
Sharing	The organization receives huge requests for testing samples. The parties have to bear certain cost for consumables. Equipments like flow-cytrometer, proteomics, genomics are not shared with the outsiders. These equipments are of high demand and extensively used internally. The Institute has another facility called anti-cancer drug testing where sharing is prevalent on payment basis. The equipment in the common equipment room is shared. Different charges are applicable for academics, government organizations and non-government organizations and these are approved by DAE. The organization also has a gene sequencing facility.
Disposal	After end of the life of equipment vendors are called to certify the non-serviceability of the equipment. After receiving vendor's feedback about the equipment internal engineer certifies about non-functionality and it goes to condemnation committee. Disposal may take place in one of the three ways – • Gift to the academic institution. Mainly low-end, low-maintenance equipments are gifted. • The equipment or its part can be sold as scrap through auction. • The equipment can be bought back by the manufacturer. Wherever this provision is available, it is included into the purchase proposal during procurement.
Issues	• Investment on the equipments and actual usage is not at all compatible. The company is searching options to collaborate with private organizations to increase the usage of the high-end equipments. • The organization is facing difficulties to maintain NGS, high-end equipment for gene sequencing. Discussion and negotiation is still going on to work out suitable formula of maintenance and operation of high-end equipments. • The company faces difficulties in handing sophisticated equipments. The Institute needs a bioinformatics team for data analysis. It incurs huge cost. Instrument like Next Generation Sequencing (NGS) is underutilized but requires huge amount of maintenance cost. No sharing mechanism has been established to increase its utilization.
Recommendations	• There may be several reasons for lack of sharing like inefficient management of central testing facility, long queue for sample testing, lack of skilled manpower, no access to the scientist within the premises where the test is being carried out, no proper feedback mechanism for reports of the tested samples and affordability. These are the certain things that need to be taken into consideration to create central facility for sharing. • Dedicated professional team should be created to take care of equipment related activities in all central facilities

- The process of testing, analysis and report should be completed within shortest possible time and given to the scientist. Linking with the National Skill Development Mission could be a solution. One talent pool has to be created who will be absolutely dedicated to handle sophisticated equipments. As for example, imaging is a highly specialized job which requires considerable expertise. Imaging has several specialized fields. To get a trained person in all fields of imaging in nearly impossible. One way to solve this problem is to tie-up with research institutes who have expertise in these fields and can train people. These trained people can be appointed in the central facilities. Reputed institutes should be engaged for National Skill Development Mission to provide training to the talent pool.
- Absence of dedicated and skilled technical operator is the biggest problem for handling high-end equipment. The organization follows a unique approach to solve this problem. They have created a hub of 7-8 skilled technicians who can handle multiple high-end equipments like proteomics, genomics, and flow-cytometer. If any operator is absent, another person from the hub is assigned to carry out the research. Same model can be replicated under National Skill Registry.
- Skill registry should include reputed organisations for training.

Name of the Institute: Bharat Electronics Limited (BEL)	
Location: Bangalore	**Year of establishment: 1954**
Contact Person(s):	C P Suresh, General Manager (Technology and Planning)
Nature of Institute	State owned enterprise under Ministry of Defence
Domain	Designed to meet the specialized electronic equipment requirements of the Indian Defence Services and have now grown to include the civilian market
Nature and sources of funding	Government of India, Project grant, Revenue
Procurement	**Tender Committees**: To expedite the processing of tenders, the GM / SBU Head / Unit Head constitutes Tender / Purchase / Price negotiation / Technical Evaluation Committee with representatives of Purchase / Finance / D&E / Indentor as required. These committees are normally appointed for a period of one year. **Tendering process:** Open Tender: Open Tenders are invited by public advertisement in leading national daily and also published on the BEL and NIC websites. A copy of the tender is also circulated to all the "Registered Suppliers" by the Purchase Department. In case of global tenders, the notice is also published in Indian Trade Journal (ITJ) and sent to Indian Missions abroad which is considered necessary for getting adequate response in addition to the press advertisement and BEL website. For procurement of non-production materials costing Rs. 50 lakh and above, Open Tenders are invited. The time allowed for receiving quotations against Open Tenders is not less than 10 days, depending upon the geographical area covered and other relevant factors. Limited Tender: Limited tenders are floated by addressing all the parties in AVD and members of Approved List of Suppliers maintained by the Purchase Department. Generally limited tenders are not published in news papers. Restricted Tender: Restricted tenders are addressed only to some of the parties of the approved list of vendors and in all such cases the reasons for restricting the process are to be clearly recorded. Single Tender: Under some unavoidable circumstances BEL can opt for Single Tender as in case of proprietary items, the tenders are addressed by only one party, specific source indicated by collaborator/ licensor or in some cases of emergency requirement. Procurement through a single tender is allowed after taking approval

from authorized position after giving due justification.

For scientific equipments, detailed specifications of the equipments are finalised by the respective technical committees and forwarded to Material Control division. Enquiries / Tenders are issued to obtain quotation through two bid system where the techno-commercial bids are evaluated by Technical Evaluation Committee constituted for this purpose. The Technical Evaluation Committees generally consist of Purchase, Finance and nominated technical members. After evaluation of techno-commercial bids, the price bids of accepted tenderers are opened. Lowest tenderer (L1) may be called for negotiation, if required.

Table 1: Table showing the delegation of power for procuring Capital items

Level of authorized executives		Value of each case
ED/ GM/ SBU Head/ Unit Head	Single Vendor	Up to 10,00,000
	Multi vendor	Up to 10,00,000
Director (BC/ OU)	Single vendor	More than 10,00,000 op to 100,00,000
	Multi vendor	More than 10,00,000 op to 100,00,000
Committee of functional directors	Single vendor	More than 100,00,000
	Multi vendor	More than 100,00,000

Maintenance	The requirement for AMC is projected in the RFQ during the procurement of equipment. It saves time and additional expenditure to call a separate tender for the AMC of equipment. **Service beyond warranty period:** Repair of equipments beyond warranty period needing repairs is facilitated on a chargeable basis through OEM/ Authorised agent/ service centres. User /Indentor lists the details of defects and sends it to Material control / Stores to raise a Service Request to the Purchase department. **Service within warranty period:** Within the warranty period of any equipment, user can directly approach the OEM or raise service request through Purchase department for maintenance of any scientific equipment. The service agencies are asked to maintain the stipulated down time, often mentioned in RFQ. Normally all the spare of scientific equipments are not covered in the warranty. In such cases if it is required to get those spares, a separate procurement action is initiated. **AMC:** For AMC, a separate service order is issued by following works contract procedure.
Sharing	The shared facility of BEL is open to all. The list of test facilities which are available to private entities for testing of materials /sub-systems / equipments are listed in the web portal of BEL. BEL has set up shared test facilities in different locations in India, like Panchkula (Haryana), Manchilipatnam (Andhra Pradesh), Kotdware (Uttarakhand), Hyderabad (Telangana), Gaziabad (Uttar Pradesh) and Bangalore (Karnataka). Any private company that has already registered with Approved Vendor Directory of BEL can directly access the shared test facilities. The facilities provided by BEL are on testing of items, subsystems for defence application. Any new company can register for using the test facility. The new company has to submit a company profile, IT return for last 3 years, Audited B/S or P/L statement for last 3 years and PAN/ TIN. There are officiating nodal officers in every test facility across the country. The test facility request is evaluated by nodal agency and quote is communicated to the applicant depending on the availability of facility. The tests are carried out by the BEL personnel only and after completion, the job and the test result is handed over to the company. The testing charges are fixed at nominal rates taking into account all direct & setup costs (generally on hourly basis). The rates are indicative and may vary from those on the public portal; the actual rates are quoted by the respective units after going through the Test facility request. Government taxes and duties are applicable.

Disposal	• Often buy back is offered by the company providing the equipment. • Very little disposal has been conducted till date. Generally, the equipments are disposed through public auction after advertising in local and national dailies (news paper). • Only functional equipment (mainly PCs) is gifted to schools or other academic/ research organizations. BEL uses the high value critical equipment to the fullest unless the equipment or technology is obsolete. • The guidelines and regulations of PCB are strictly followed for disposal of environmentally hazardous equipment and consumables.
Recommendations	Creation of centralized disposal agency in different locations in India. Some institutions like ETDC (Electronics Test and Development Centre) can be used as central disposal unit for all the government organizations. ETDC has the testing and calibration facility to test any equipment. They have the capability to maintain high end equipment if necessary. The visibility of disposed equipments will increase if all the disposed items come under one umbrella. Moreover, before gifting any equipment to any interested organization or academic institute, ETDC can provide training that is needed to run the equipment smoothly.

Name of the Institute: University of Calcutta (CU)	
Location: Kolkata	**Year of establishment: 1857**
Contact Person(s):	Dr. Madhusudan Das, Dean, Faculty of Science
Nature of Institute	State owned enterprise under Ministry of Defence
Nature of Institute	University
Nature of work	Education and research
Nature and source for equipment funding	UGC, State Government, Project grant
Procurement	• Usually GFR 2005 is followed for procurement • Procedures for procurement include open tender (web publishing), limited tender, single tender etc., depending on the cost of the underlying equipment to procure. • High value scientific equipments are procured through two-bid system by publishing advertisement in national daily and website of organization. In two bid system, technical bid and commercial bid are made separately. • Most of the high tech scientific equipments are procured using project grants of various funding agencies.
Maintenance	• Normally the maintenance of the equipments is covered by warranty and AMC (Annual Maintenance Contract). • Operation and basic maintenance of high-tech scientific equipments is undertaken by Principal Investigators, students or research fellows of PI or operators.
Sharing	• Nowadays, some departments have started sharing with external researchers, but sharing is not generally practised. • The shared equipments of different departments can be viewed online on the website of the concern department.
Disposal	The equipments are disposed using the guidelines provided by GFR 2005.

Issues and Recommendations	• As a state run university, funds from the state are used for maintaining and building infrastructure. The funds from UGC are used for salaries. Most of the scientific (high value research equipment) equipments are funded by different funding agencies by means of project grants. In most of the cases neither the funding agencies provide any funds for maintenance nor does the state provide a maintenance fund for equipment that has not been funded by it. Accumulating fund for maintaining high value equipment is a major challenge for state run universities and a provision by funding agencies for maintenance would help • A clear cut policy about the ownership and responsibility of different stake holders of any equipment would ensure that maintenance would be systematic while promoting sharing. This is the need of the hour, given the fact that organizations/principal investigators shirk from sharing equipment for fear of ownership in case of a failure or breakdown.

Central Glass & Ceramic Research Institute (CGCRI)	
Location: Kolkata	**Year of establishment: 1950**
Nature of Institute	CSIR unit
Nature of work	Research in the fields of glass, ceramics, refractories, vitreous enamels, composites and allied materials
Nature and source for equipment funding	Government of India, Central budget of CSIR, Project grant
Procurement	• CSIR procurement manual 2008 is followed. • Any equipment, costing more than 25 Lakhs, is processed through e-publishing of tender and orders. E-tendering has been introduced to ensure transparency in the tendering and bidding process. E-procurement is expected to be introduced soon. • A user group comprising of the researcher or inventor raises the request for a piece of equipment. Once the proposal for buying the equipment has been approved by the appropriate authority, the required specification for the equipment is finalized by the user group. Most of the high-tech equipment is purchased through a two-bid system. In a two-bid system comprising of a technical bid and commercial bid, the commercial bid is only opened if the technical bid is accepted. • Tender committee comprises of scientists and administrative personnel of CGCRI. External experts and representatives of funding agencies are also invited to participate in the Tender Committee during various phases of procurement.
Maintenance	• High end scientific equipments are generally imported and maintained through AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract). Preventive maintenance of high end scientific equipment is usually adopted. • In case of AMC with an agent of OEM, the "Purchase Committee" of CGCRI validates the credentials of the Indian agent of the OEM for quality and experience of service engineers to ensure a hassle free maintenance facility. • For non critical equipment, CGCRI employs engineers of several fields to operate and maintain high end equipments. OEMs are communicated with on a call basis for huge fault or spares only thereby reducing the cost of maintenance.

Sharing	• Usually the Principal Investigator owns the high end equipment. The equipments are transferred to central facility after the completion of the project. • All the equipment in central facility can be viewed online. • The sharing facility is open to all. For the CSIR laboratories and other academic institutes, the facility is hugely subsidized. In some cases it is made available even free of cost to support path breaking research activities. • CGCRI use to send e-brochure to its customers (government organizations/ departments, academic institutes and private players) every year to promote awareness of its activities. CGCRI also uses messages and e-mails to promote wider usage of its resources.
Disposal	• CGCRI strictly follows the disposal guidelines of CSIR • Disposal of the high end scientific equipments are facilitated by a "Disposal Committee" which has the authority to recommend the disposal process and comprises of scientists and administrative personnel. This committee identifies surplus, obsolete or unserviceable equipments. • For obsolete and unserviceable items CGCRI generally conducts public auction through advertised tenders. • Disposal of surplus items happens by communicating the availability of the equipment with sister concerns and other academic institutions like Jadavpur University, with whom CGCRI shares a long term relationship of sharing knowledge and resources.
Training	• CGCRI conducts several training programs for students and research community using equipments that help the students/ researchers to obtain practical knowledge of the high end scientific equipment. • On CSIR foundation day, the laboratory is open to all school students to create and promote awareness on scientific research. Scientists and technical personnel of CGCRI guide the students on basic objectives of science, research at CGCRI and necessity of scientific research.
Issues and Recommendations	• Most of the high end equipments are imported. So the technical know-how, specification etc. are supported by the OEM thereby increasing dependence on them. However, nowadays increasing import of high end equipment leading to regular supply and a clause to setup a spares majority will be a welcome measure to reduce time and cost of maintenance. • Development of central facilities and shifting of public funded equipment to them after completion of the project would help in development and utilization of

facilities and sharing of equipment.

- A centralized database of equipment would improve the visibility of high value and high end equipments available in different research and academic organizations. A provision to view equipment in neighbouring countries like Japan and Korea would help reduce cost and time associated with travel for use of their scientific equipment.

Name of the Institute: Centre for Cellular and Molecular Biology (CCMB)	
Location: Hyderabad	**Year of establishment: 1977**
Contact Person(s):	I Asha Ramesh, Principal Technical officer and Head, Instrumentation
Nature of Institute	CSIR
Domain	Cellular and Molecular Biology
Procurement	CSIR provides the broad guidelines for procurement of equipment in the CSIR 2008 Purchase Policy. The standard procedure involves: • Global tender for high value equipment (more than 25 lakhs) wherein vendors also need to submit an EMD. This is done to eliminate small time vendors but provide major players with a genuine opportunity. There is no e-procurement portal, publicity happens only newspapers, website, emails. • For less than 25 lakhs, a two bid system is followed. • For less than 1 lakh, scientists can get directly what they want. Typically 4-6 weeks is the lead time for equipment delivery. No duplication of equipment is allowed within CSIR.
Central instrumentation facility	There is a satellite structure at CCMB. The central area has all the central facilities and wings have scientists. At the tip of the wing is another central instrumentation area with equipment that is more specific to those scientists' projects is being housed there. However, even that equipment can be used by others. No outsider is allowed to directly use the machine. Only a CCMB authorized person can handle the equipment and help the outsider analyze their sample. The equipment is kept at the central equipment facility so anyone can use the equipment irrespective of the project, by merely booking slots. There is an in-charge for facilities having high end equipment where dedicated operators are available. Additionally, separate in-charges from the scientist pool are also nominated for these high end equipment. Central facilities that are open for all to use are dust free and air conditioned atmosphere thereby reducing failures.
Working mechanism of each facility	As soon as systems are installed, there is an applications specialist who trains the users on how to use the equipment, to operate and analyse. A days training programme is provided to users for the high value equipment. User training is not provided by instrumentation team as it requires domain specific knowledge. For other equipment, an authorization procedure is carried out wherein a member of the instrumentation trains a new user who wants to use the equipment based on the request sent to the instrumentation head. This procedure is mandatory for every medium range equipment. The team member in charge trains them and explains the use and safety etc. Their name is entered in the log book. Only then they are allowed to use the machine. The people whose names are not there in the database are not authorized to use the equipment. Outsiders are not allowed to use the equipment.
Maintenance	There is hardly any down time. The delay is only in getting spares. The part is immediately procured if available locally otherwise indented. There is no down time due to non attending of calls. In fact some of the equipment is very old and

	yet usable because they are well maintained. If there is a breakdown in any machine, there is an online ticket system where the ticket is raised. The instrumentation head then assigns the issue to a member of the group who is trained to repair the machine. No one in the instrumentation group can handle all the equipment. There are in-charges for types of equipment who handle issues related to that equipment. Since the engineers are trained on service of the equipment, there is also an understanding of the possible causes of failure of the machine and so spares are stocked accordingly. This ensures that there is a stock of spare parts for frequent problems thereby reducing downtime. The spares for a lot of common instruments that are there in duplicates are also procured and stored so in case of failure of any of them, they can be easily replaced. Once the stock level diminishes, an indent is raised and the stocks are replenished. This ensures low downtime. That is why the machines are also of the same make to ensure that spares are easy to maintain. The authorization procedure ensures that unskilled people do not use the equipment. Log book systems for each machine ensure that usage is tracked. Since it is a central equipment facility, a small failure can impact a lot of users. So it is necessary to maintain log books and initiate necessary action based on that. They have very high capacity UPS systems and power is very clean ensuring that no machine fails due to power. Calibration standards and maintenance routines are regularly performed. After every repair the calibration is done again. The central monitoring system is now not in place as there was a flaw some years ago. Temperature probes were put in the freezers and the probes were connected to the central monitoring system to raise an alarm. Now the students or security guards report problems, when they spot it. But it is proposed to revive the central monitoring system. All these measure ensure 90-95% of equipment is in working condition. There is a dedicated Instrumentation team of Electronics engineers. It is a team of 15-20 engineers qualified in Physics and Electronics headed by an in-charge. They attend Service Training Programmes with vendor and train on actual equipment and attend courses along with the vendor company's own service engineers to enable understanding the machine. The strength is dwindling but not much intake in the instrumentation team. In-house training for all kinds of equipment is provided to new intakes.
Sharing	The equipment is kept at the central equipment facility so anyone can use the equipment irrespective of the project, by merely booking slots. There is an in-charge for facilities having high end equipment where dedicated operators are available. Additionally, separate in-charges from the scientist pool are also nominated for these high end equipment. Central facilities that are open for all to use are dust free and air conditioned atmosphere thereby reducing failures. The machines can be used by booking slots on the machines. There is an equipment specific flat rate. The rates for CSIR and private research organizations are separate. Interested people from outside the lab write to the Director, requesting for usage,

	who in turn marks the Instrumentation head or PI (as is the need) and conveys the rates. If the rates are accepted, then a slot is booked and the outsider brings his sample for analysis and it is done by the CCMB person and the results/analysis are given to the person. No training or authorization is done for the outsiders. Extra time will be allotted to the person who brings the money for the project but essentially it is in the central pool for anyone to use. Most of the equipment are purchased for use by scientists, so opening up of the facilities would not provide benefit as the slots are usually full and the utilization is stated to be 100%. Outsiders and private institutes approaching CCMB have to come via the IP person for utilizing the equipment.
Disposal	After 8-10 years of purchase of the equipment, if there are similar recurrent problems, then the write-off is suggested. The Disposal committee takes care of disposal. The Instrumentation team has to certify that the machine cannot be repaired and then a report is given saying it is not serviceable. Only then the Disposal Committee looks at it. Giving an obsolete equipment as a gift would not help as the organization that bought it is unable to maintain it, then even the institution getting the gift would not be able to maintain it. If there is a problem, they would not know what to do. They would like to gift only working ones, not obsolete or old equipment.
Recommendations	Most of the institutes are having high end equipment so the usage would be on a day to day basis, so accessing the service person from a pool would be difficult if the labs are far apart, rather in a single city it may be helpful. Create training centres which can be used by all labs for training of users/ instrumentation teams rather than create a pool of people.

Name of the Institute: Centre for Development of Advanced Computing (C-DAC)	
Location: Pune	**Year of establishment: 1988**
Contact Person(s):	Prof. Rajat Moona, Director General Dr. Subramanian Neelakantan, Associate Director - R&D
Nature of Institute	Society Registered Under Ministry Of Communication And Technology
Nature of work	Mainly involved in government projects
Domain	Electronics, Advanced Computing, Parallel Computing and Multilingual technologies. C-DAC also has business activities where they develop products and sell them to different customers. It also runs diploma training program.
Nature and Source for equipment funding	Funding from Ministry of Electronics and Information Technology and other ministries like Health & Urban Development. All of the equipment is mostly government funded. Some of it is private funded and those are mostly in collaboration.
Procurement	The organization follows the GFR 2005. Their policy is similar to CSIR and other government institutions. Financing part is not covered as government is the major financer of the equipments through projects. All the procurement related activities follow GFR rules where above a particular threshold, equipment purchased through open tender; below the threshold, close tenders may be applied. Multiple quotation formats has to be considered during procurement. Up to certain level, single quotation is also accepted. Sometimes C-DAC purchases equipments on behalf of other organizations. Sun simulator is one such example. This is sophisticated equipment and sometimes agency doesn't know how to procure it. C-DAC is consulted to procure this type of equipment on behalf of other companies. C-DAC has installed super computers for some companies.
Working mechanism of each facility	They use CAG audits. Legal compliances are maintained in every aspect as in India all electronics equipment should be BIS certified when they are launched in the market.
Maintenance	Usually annual maintenance contract (AMC) is used. However, in case of specialized sophisticated equipment they call for tenders in specific cases.
Sharing	This is specific to projects where two or three parties have mutually agreed to work in tandem. For example C-DAC's super computers can be accessed remotely by other organisations like ISRO, IITs etc in collaborative projects. Instead of sharing physical equipments, C-DAC shares their services. The equipments are shared with different government organizations through signing MoUs. Almost 90% equipments are functional as on date. These high end equipments require considerable expertise for operating. Trainings are mostly given in house through experts. Approximately 15-20% of the project cost accounted for buying capital goods. As on date C-DAC holds equipment worth of Rs. 800 Cr. There are some issues of sharing also. As it increases the overhead cost for scheduling, contingencies, transfer of people.
Disposal	Most of the equipments purchased through government financing belonged to

	government until last three years. The policy has changed three years ago and now as per new policy, ownership of equipment purchased through government grant has been handed over to C- DAC. After the transfer of ownership, the organization follows its own disposal policy. This policy is called write off procedure. First, the equipment has to be written off the stock. This is decided by Materials Management Group (MMG). Once the equipment is written off, write off value is determined. After write off, it is taken off from the stock and disposed through public auction. Generally they don't gift any equipment to other institutions.
Recommendations	A uniform equipment policy for procurement is welcome with more flexibility on buying specialized equipments where number of suppliers is less. Centralised lab facility should be created to foster sharing of equipments. Sometimes it is advisable to allow duplication of buying in order to speed up the work. So focus should be utilization of equipments rather than idle time of equipments. In case of academia, geographical sharing would be a good policy and government should be at the focal point. For research labs sharing policy might not be effective as it is hard to share equipments between two departments of the same institute. Hence a centralized lab facility would be the potential solution. DGS&D, the centralised government database can be used to a great extent to buy general purpose equipments. Till now lack of awareness about this facility hinders easy procurement of equipments.

Name of the Institute: Centre for DNA Fingerprinting and Diagnostics (CDFD)	
Location: Hyderabad	**Year of establishment: 1990**
Contact Person(s):	Dr. Raghavendrachar J., Head - Instrumentation
Nature of Institute	Autonomous organization funded by the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India.
Domain	Indian Biotechnology research centre
Nature and Source for equipment funding	All major equipment is purchased from core grants. Project based equipment also exists in the organization. 90% funds come from DBT. The Extramural projects that are written by scientists also add to the funds. Clients include DBT, DST, UGC, CSIR, Wellcome Trust. Some money comes from core fund that is allocated by DBT every year for the organization. Funds, at times for, include a component for personnel as well. While the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India is the main source of funds, CDFD receives funding also from other agencies on specific collaborative projects.
Procurement	GFR 2005 is used for all stages. • The procurement procedure begins with an Indent from the scientist which goes to instrumentation team who, then, identify the specifications and find out different models, vendors and make a common specification that is signed by the scientist. • This is then sent to the Stores and Purchase, who float the tender, depending on the value of the equipment. If it is more than 25 lakhs, then 2 bid system with EMD and ad in news paper is executed whereas if it is less than 25 lakhs, limited tender is used. It goes also to Common Procurement Portal as e-procurement is in place. • All quotes are received at the Stores and Purchase which are then sent to the Instrumentation team. They compare and select the one better suited for the organization, depending on the quality of instruments, after sales service etc. and grade them as L1, L2. It is mandatory to buy from L1. • An NOC needs to be procured from them and they are recommended to the Stores & Purchase. They collect all the indents and call for SPC meeting along with users. • The SPC is a standing committee made by the Director whose members include instrumentation, S&P officers, Finance related people and 2-3 scientists. The scientist himself is the chairperson of the committee. There it is discussed and sent for approval to director. • This then goes to account officer for financial concurrence. • Then approval is given and purchase order is given by S&P. • Cost of the equipment alone is taken into account for procurement and not maintenance, as there is scope for juggling costs. All vendors are put on the same plane by taking into account only the cost of the equipment.

	• In limited tender, AMC is not asked. For 2 bid system, AMC cost or 3 years extended warranty is also asked is asked. Vendors also know that they should be L1 to qualify and further negotiations are also conducted. • Till recently limited vendor system was in place. Now in the CPP portal everybody can quote. There have been instances when equipment was taken on a demo basis and was found unsatisfactory, so it was returned and a tender was floated again. Though this takes time, it prevents the organization from being stuck with unnecessary equipment. The instrument group used to send enquiries based on the past performance and reliability so limited tender system was useful. But in open system, a lot of companies provide equipment that is more like use and throw and after sales is hopeless. So while making specifications, the list of specifications is prepared based on the good quality equipment of the best vendors so as to eliminate the sub standard ones in a legal way.
Central instrumentation facility	When a fund is received, some portion is reserved for central instruments and some portion is for individual users. When more than 1 group is involved, such equipment is procured for the central facility.
Working mechanism of each facility	Some portion of the budget is allocated to all scientists. A portion for equipment (Around 3 lakhs) and the portion for consumables (around 10 lakhs) is allotted to each scientist for simple and regular usage. There is also a portion of the fund set aside for common instruments; a list of which is prepared using suggestions from scientists based on the number of people who would use it. There is a meeting where this usage is justified. Finally, some 4-5 core instruments are finalized and bought. There are 2 separate stores & purchase committees, one for Indian (SPC1) and one for imported equipment (SPC2).
Maintenance	The Core fund puts aside some money for maintenance, as periodic preventive maintenance which is done regularly, without which the instrument may fail easily. If a mechanical problem is there, it is done in-house. If electronic part fails, the instrumentation team looks out in the market for replacement and then if it is found it is replaced. Else the seller company would need to contacted to get the part Instrumentation department takes care of the instruments. Some of the sophisticated equipment are earmarked for AMC while smaller ones are maintained in-house. There are 22 groups of scientists. During installation and also for special training, the group that is sent includes the instrument group representative. It is an experienced group in the last 15 years. During the installation, the vendor company trains them and give necessary routine maintenance tips. Trouble shooting training is provided to the instrumentation team. Hiring from a central pool of talented people is useful. A national instrumentation facility has been created where instruments have a user committee that include in-house scientists, technical staff and operators from

	company's side and all the issues of the scientists are addressed there. The pay scales of the instrumentation team are higher than industry scales, so attrition is not a problem. Even for the services of the outsourced company, the people are selected by CDFD, so that the training is fruitful.
Sharing	Usage charge=consumables + notional value of operators salary component + little depreciation value + electricity etc for CDFD users. Other academic users have to pay a little more. For CDFD it is notional, but outsiders have to pay. Priority is given to CDFD users and during idle time it is given to other academic institutes and private companies. That way money is generated and machines are not idle. This policy is in place since 2009. This has led to 100% utilization of equipment. If a scientist buys equipment, he has his own problems. If another person wants to use it, time is not available. Sharing of authorship will also not be agreeable. So the outsourcing model eliminates this completely. The maintenance is done by the instrumentation team, but regular and operational maintenance work is done by the outsourced company. The Scientist procures equipment and once the project is over, he may use it for other projects. However, another scientist who needs to use this equipment is unable to use it as the initial scientist who is trained on using this equipment is busy with his new project so he may not be able to spare time for either operating it or training on it. So CDFD has evolved a new model, the outsourcing model, that has proved to be extremely successful. A company that has been identified through ad and tender etc. and 14-15 high-value instruments have been entrusted to them, which are operator based, where sample preparation is required and an analysis is involved. In some case, it takes times to do the experiment. A scientist, junior scientist and technical assistants comprise the team that operates the equipment. For the last 8 years, CDFD earned 6.4 crores in user charges.
Disposal	Disposal through MSTC was tried but was not successful as the amount was less than expectation and tender did not allow that. So that equipment needs to be re tendered. Some instruments have been in use since 1996 which are beyond repair need to be disposed. Number of years served, cost of repair the instrument, possibility of recurrence of problem, spare parts become obsolete are taken into consideration before disposal. One of the clauses in purchase of the equipment is that the spare parts should be available for 7 years from the year of discontinuing the manufacture of the equipment. It is a standard international norm. When it is known that the instrument is no longer manufactured, more spares are procured. After those are used up, the equipment may need to be disposed. In some cases the spare parts are becoming more expensive the equipment itself

thereby making it unjustifiable to repair. Instead procuring new equipment and getting warranty would help.

Ageing is a typical reason for failure or usage. Some of the parts are like consumables because they have a fixed life after which they fail, so they will need to be replaced but they account for 90% of the cost of the machine. Yet, they are replaced because once replaced the machine works as good as new.

If the cost of repair is less than 50% they are replaced and used for few more years.

Name of the Institute: Central Manufacturing Technology Institute (CMTI)	
Location: Bangalore	**Year of establishment: 1960**
Contact Person(s):	Dr. N. Balashanmugam, Joint Director
Nature of Institute	Autonomous institute, registered as a society under the aegis of Department of Industrial Policy and Promotion (DIPP).
Domain	Nanotechnology, Precision engineering, Metrology (Micro and Nano), Additive Manufacturing, Mechatronics, Vision and Image processing, Digital Design, Product Lifecycle Management (PLM) and Human Resource Development (creating industry ready engineers)
Procurement	• General Financial Rules (GFR), 2005 are followed for procuring scientific equipment. • High value and high end equipment are procured using planned funds of the yearly budget. The requirement is generated by the user group i.e. the researcher/ inventor. • "Capital Goods Committee" prepares the specification of the scientific equipment and initiates the procurement process. Listing the specifications of required equipment is considered as one of the most important and integral part of the procurement system for scientific equipments. • Most of the high-tech equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted by the "Third Party Expert Committee". "Third Party Expert Committee" which evaluates the technical bids, includes external experts to maintain transparency in the evaluation process. CMTI obtains the bids through tendering process like Advertised tender enquiry, Limited tender enquiry or Single tender enquiry etc. • "Purchase Committee" finalizes the deal after due commercial negotiation. Purchase Committee negotiates for discounts, finalizes the terms and conditions and ensures a smooth procurement and installation of the equipment. • Bid Security is obtained from the bidder to safeguard against unwanted withdrawal of the bidders and Performance Security is collected from the successful bidder to ensure due performance as per the contract. • Transparency is ensured in the procurement using the e-tendering facility.

Working mechanism of each facility	• CMTI arranges several training programs for students, academics, MSMEs and private sectors through Academy of Excellence for Advanced Manufacturing Technology (AEAMT). AEMAT aims to meet the needs of "Industry-Ready" engineers in manufacturing sector through their training activity. • Some scheduled training programs are conducted on CNC Technology, CAD/ CAM/ CAE, Quality System Standards, Rapid Prototyping, Lean / Green Manufacturing, Mechatronics & Manufacturing Automation, Metrology & Calibration, Geometric Dimensioning & Tolerancing, Precision Engineering, Nano Technology etc. These programs are scheduled round the year. • AEMAT conducts tailor made training programs for industries. These programs are well accepted and attended by companies like BEL (Bharat Electronics Limited), Bosch, TCS (Tata Consultancy Services) etc. • Apart from these, CMTI arranges training program for their operators and maintenance team. Generally, these trainings are conducted by the manufacturer/ supplier of the equipment.
Maintenance	Most of the equipments are maintained using a 3-tier maintenance architecture. Most of the CMTI equipment is operator driven. These operators are skilled and trained personnel who possess a good knowledge and understanding about the equipment. High value and advanced technology equipments are sensitive in nature. Scientific equipments are maintained through AMC from the manufacturer or supplier. Typically in the very beginning CMTI adopts "Full Contract AMC" for 2 (1+1) or 3 (1+2) years. Most of the scientific equipment needs near about 1 year for installation and test run. After completion of 2 to 3 years, CMTI goes for "Service Contract AMC". In such cases, external failure (like power failure) is taken care of by the internal maintenance team; basic internal failure is taken care by the local vendors and in case of serious failure or need to change spares, CMTI calls for AMC agency. CMTI feels that, this process is the most beneficial and cost effective way for maintenance of high value scientific equipments. Generally, high-tech equipments have life of 15-20 years. Nowadays, technology is changing rapidly and most of the manufacturers/ suppliers withdraw AMC facility after 5-8 years. For this reason, to maintain the facility and equipment beyond AMC period, CMTI maintains an internal maintenance team and has created a pool of local vendors who are experienced in maintenance and repair of high-tech equipments.

Sharing	• The shared facility is open to all. The visibility of the facility is fair. In fact the demand is much higher than the capacity of the facility. Participation is higher in niche facilities. The user of the shared facilities can be categorized in five segments like In-house scientists, students, faculty/ scientist of government organizations, MSME and private organization. Online booking system of shared facility is not available till date, but CMTI is trying to establish it and a MIS reporting system by the end of March, 2017. • The cost of sharing includes capital and operational cost. The cost is calculated on a per hour basis (man-hour or machine-hour). Taxation is accounted as per the existing government norms. The main focus of CMTI is invention through R&D. To attract scholars and private players in R&D, CMTI offers generous discounts in cost of sharing. For the in-house candidates, the sharing of facility is free of cost. For the students and researcher, CMTI recovers only 25% of the accounted cost. For the faculty/ scientists of government organizations/ research laboratories, CMTI recovers 50% of the cost. Usually no discount is granted in favour of MSMEs or private organizations. In some special cases, CMTI offers discounts to the MSMEs and private organizations to support path breaking inventions. • CMTI uses various channel of marketing to enhance the visibility of their shared equipment. CMTI's e-brochure for training and shared equipment and test facility is sent to several organizations across the country and abroad. CMTI organizes several seminars and workshops to market their facilities and equipments.
Disposal	• For disposal of equipment, CMTI strictly follows GFR 2005 regulations. • CMTI ensures safe and secure disposal of equipment through the Disposal Committee. The committee prepares the list of equipment to be disposed, collects recommendations from the inspection team (consisting of internal and external experts) and send the disposal proposal to Ministry. Generally, the equipments are disposed through public auction after advertising in local and national dailies (newspaper). • Only functional equipment is gifted (mainly PCs) to schools or other academic/ research organizations. CMTI uses the high value scientific equipment to the fullest unless the equipment or technology is unserviceable or obsolete. At the time of disposal, most of the equipment is either obsolete or reached end of life. In such condition, no organization/ institution are ready to accept such equipment as gift.

	• Strictly follows the guidelines and regulations of PCB to dispose environmentally hazardous equipment and consumables.
Issues and Recommendations	• As per government rules, Service tax is levied @ 14.5% on bill amount for providing services. CMTI and some other government institutions and research organizations are dedicating their training facility for meeting the shortage of trained and skilled resources. Central government is also taking several initiatives to train people to meet the gap. In such scenario, enforcing as high as 14.5% of service tax on training bills does not align well with the mission and vision of the Government and highly rated government institutes like CMTI. Training facilities should be exempted of service tax. • One of the major issues is maintaining equipment after the completion of project. Most of the equipment of CMTI is funded by DIPP. After completion of the project, the equipment are retained by CMTI and in most of the cases, the equipment are in good and working condition. Some of the equipment can be used for testing and analysis purpose. The equipment of this kind has certain demand in market and can be maintained by sharing with other laboratories or private organizations. On the other hand, some equipment is meant for academic research and hardly gets any commercial attention after completion of project. This equipment is further used to support research activities of in-house or other researcher/ scientist/ student. As the equipment are funded by Government, it would be a national loss if the equipment develops snags due to lack of maintenance. The equipment, which attracts research interest, should get maintenance cost for the entire life cycle. • An MIS reporting tool for the research organizations to get a clear picture of Government spending and usage at any instance of time would be beneficial. Moreover, it can be used to evaluate the utilization of the Government funded equipment.

Name of the Institute: C. U. SHAH Pharmacy College, SNDT Women's University	
Location: Mumbai	**Year of establishment: 1980**
Contact Person(s):	Dr. Pratima Tatke, Professor of Pharmaceutical Chemistry, C. U. Shah College of Pharmacy
Nature of Institute	College under SNDT University
Domain	Research in pharmaceutical chemistry
Nature and Source for equipment funding	Approximately 80% funded by Central Government Grants

Procurement	• Equipments which are valued less than 10K are procured at college level. These instruments are basically low valued which don't need sanction from university authority. Individual PIs may take their proposals to the Principal. Principal has the authority to sanction the amount. PI has to call for three quotations among which usually lowest quotation is considered if it matches requirements laid down in the proposal. All the procurement related decisions are taken at Principal level.
	• Equipments ranging 10K to 1 Lac have separate policy for procurement. It needs approval from the university authority and procurement decision is taken at vice-chancellor level. The process is as follows –
	  • PI needs to raise the request for purchase.
	  • It is then approved by the Principal.
	  • Then the request is sent to University purchase committee, comprising of 7-8 members team, including Vice-Chancellor, PI, Principal, external expert (outside college but within the University) etc. This committee is responsible to decide about procurement as per university guidelines.
	  • Usually PI or the Principal gives presentation about the features of equipment in front of the committee.
	  • If recommended by purchase committee, the proposal is sent for administrative approval and subsequently for financial approval.
	  • Lastly, written order form Vice-chancellor is notified mentioning approval of procurement.
	  • Open tender is invited next. At least three tenders are accepted.
	  • In front of the purchase committee, technical bid is open first. A technical committee comprising technical members examines the technical bids.
	  • Those who have successfully met technical specifications are considered for financial bidding.
	  • Comparative statements are prepared for each of the proposals. Usually L1 is selected, barring few cases which require more technical specifications.

	• Usually total time of procurement is 3-6 months. The same process is followed for equipments which cost more than 1 Lac. Only difference is, e-tendering is must for these equipments. However the process is slightly different in case of imported equipments. One needs to take care of credit transfer and other related activities. Along with the purchase committee, stores manager is also responsible for purchasing consumables. Procurement process of consumables is same as purchasing of equipments. List of requirement is identified and placed on the website at the beginning of the year. Open quotation is invited. After purchase committee reviews different technical specifications and financial bids, 3-4 vendors are shortlisted. Again comparative statement is prepared and upon approval of university authority consumables are purchased.
Working mechanism of each facility	Equipments are being used by the students of mainly three disciplines – B. Pharm, M. Pharm & PhD. • Both students and teachers are trained. • Instruments are bought under projects where usually a PhD student is appointed as Research Assistant under the supervision of PI for 3 years. • These PhD students operate and handle the sophisticated equipments. This is a continuous process; i.e. a new PhD student is replaced by the older one after her thesis submission and the former trains the later. • The process of training passes on like this from one set of trained person to another set of students. • For new equipment, at first, vendor provides training to the PhD students. Several demo sessions are arranged which deal with various operating procedures of new equipments. • These vendors are often consulted on call also.
Maintenance	There is no such dedicated maintenance policy in the institution. The institute is facing serious problems in maintenance of high-end equipments. Maintenance related problems are quite prevalent in academic colleges who have lesser access to high value government funds. However the institute is currently carrying out its own guideline to maintain their equipments- • From the project value, a certain percentage is kept as contingency fund for maintenance. • Sometimes the PI negotiates with the vendors to increase the limit of warranty periods. In case of low amount maintenance college PhD grant is used. However there is no concrete policy for maintenance. The college doesn't have any financial backup to give their instruments under AMC.
Disposal	A scrap committee exists within the university which is responsible to write off the equipment. This committee decides –

	• How long existing equipment would be used. • When it is ideal for replacement. Sometimes equipments are upgraded with the latest versions.
Recommendations	• Separate grant for maintenance needed. • Only 5% equipments are shared. The college has around 40% vacancy for staffs. Lack of skilled manpower has become an issue to share the equipments with outsiders.

Name of the Institute: D. Y. Patil University (DPU)		
Location: Pune	**Year of Establishment: 2002**	
Contact Person(s):	Dr. P N Razdan, ViceChancellor Dr. Ramesh Bhonde, Director (Research)	
Nature of Institute	Deemed University	
Domain	The university's prime focus is healthcare. The university has several schools like Medicine, Nursing, Biotechnology, Dentistry, Ayurveda etc.	
Nature and sources of funding	Major part of the fund comes from University's own source. It also gets funding from DST.	
Procurement	• DPU has dedicated team for procurement of research equipment. • Indenter (PI) raises indent to purchase specific research equipment. • Stores department receives the indent and make entries in inward register. • Copy of the indent goes to team leader, where team leader scrutinizes the indent thoroughly. • Stores department obtains quotations from suppliers. • After obtaining the quotation, stores department prepares a comparison statement depending upon the technical specifications and price quote. • With reference to comparison statement, team leader takes a call on selection of vendor. The process of selection focuses on all the technical specifications and lowest possible price to purchase. Vendor selection takes place in coordination with top management representative and Head of the Department (HOD). • After vendor selection, team leader recommends execution of contracts through purchase order followed by preparation of final comparison statement. • Top management representative approves the procurement and the purchase order goes to team leader. • After team leader's verification the purchase orders goes for updating into the database. Meanwhile, stores department takes care of procurement of the specified equipment.	
Maintenance	• DPU maintains its sophisticated research equipments through Annual Maintenance Contract (AMC). • Period of warranty & extended warranty are taken care of during procurement of the equipment. • After completion of warranty PI opts for AMC. • DPU houses a Biomedical Engineering department for maintenance. • It also maintains required level of spares for the equipments. • For any breakdown biomedical engineer decides whether to repair in-house or to call the manufacturer.	
Sharing	DPU has research wing and hospital. It purchases research equipments for both of these wings. Due to high demand hospital equipments can't be shared but research wing equipments are shared substantially. Inter-department sharing is prevalent in this university. It also receives sample from outside for testing. The rates are different for academics, Government labs and private research organizations.	

Disposal	The university follows disposal procedure as per GFR 2005. Most of equipments are disposed either by public auction or through buyback offer. Small research equipments are sold as scrap.
Training	• DPU follows different training methods i.e. training through in-house experts, collaborative training and through external experts. • It brings engineers form Original Equipment Manufacturer (OEM) to train the technical operators and students.
Issues	• Being a deemed university, DPU receives nominal research grant from DST. UGC doesn't provide research grant to private universities. • Lengthy customs clearance process delays the arrival of equipment and/or consumables. Many times the consumables get expired due to this delay. • Absence of Government warehouses and cold storage for biological research is a major issue.
Recommendations	• Online slot booking facility for sample testing should be mandated to every research organization. This will help to grow the culture of sharing. • Special task force for health science research could address the lacunas in Indian research environment • Region wise centralized facility is the need of the hour. This should also cover remote rural areas. • Customs department should have the domain knowledge to maintain the biological consumables. • Government should introduce national level repository for research equipments, consumables, skilled operators and domestic vendors. • Sharing of research equipments should be duly acknowledged on research papers.

Name of the Institute: Fergusson College	
Location: Pune	**Year of establishment: 1895**
Contact Person(s):	1. Dr.Ravindrasinh Pardeshi, Principal 2. Dr.Nitin M.Kulkarni, Vice Principal & HOD Electronic Science 3. Dr. Sameer Terdalkar, Coordinator,Internal Quality Assurance Cell (IQAC)
Nature of Institute	Academic Institution
Nature of work	Major focus areas of the institution are science and arts.
Nature and Source for equipment funding	The institute is mostly dependent on DST and UGC grant for buying scientific equipments. 90% of the funding is from the government whereas rest is borne by parent body.
Procurement	Usually it follows standard procedure like GFR 2005 for procurement, maintenance and other related activities. A dedicated committee has been set up for procurement of equipments. This is known as purchase committee. This committee is responsible for procurement of equipments. Mostly project specific equipments are purchased through DST or UGC grants. The committee generally follows GFR 2005 rules for procurement. Principal is the head of this committee. Average procurement lead time is 1 month. It is more for imported equipments.
Maintenance	The institution has formed a dedicated unit which is responsible for all equipment related activities. The unit comprises of five members and coordinates with 13 departments of the institute. Principal is the supervisor of the unit. The college has its own set of guidelines for laboratory services. Though maintenance checks are done regular basis and logs are kept updated regularly, the institution doesn't have any maintenance policy. The major impediment to maintenance is crunch of funds. Sophisticated high end equipments call for considerable amount for maintenance. The institute does not have sufficient capacity to bear high maintenance cost of high-end equipments.
Sharing	The institute has a long heritage of sharing equipments with other institutions. 20% of these equipments are shared with scientists and students of other organizations as per the requirement. All these sharing are based on mutual understanding, no finance is involved in sharing.
Disposal	Most of the equipments have been purchased in last three or four years. Institute hasn't disposed off any equipment till now. However institute has constituted a committee to monitor the performance of equipments on regular basis. In case any minor parts are damaged and can't be repaired the equipment is written off from the stock.

Recommendations	• Paucity of fund is a major impediment to maintenance of high end equipment. So it is suggested that whenever any government agency is funding instruments, additional 10-15% should be given to the institution as a contingency fund for maintenance. • Equipment sharing should be mandated at all level. Initially it is hard to make this operational at national level, starting at a zonal level could be a solution. • Cluster of academic institutions should be established and equipment sharing should be mandated among them. • The procedures from developed countries (e.g. N8) may be replicated. • Fergusson is open to house national facilities and to take responsibility of managing the academic clusters set up in Pune.

Name of the Institute: Fourth Paradigm Institute (CSIR-4PI)	
Location: Bangalore	**Year of establishment: 1988**
Contact Person(s):	Dr. Vidyadhar Mudkavi, The Head
Nature of Institute	CSIR Laboratory
Domain	Computing system: Supercomputing facility
Nature and sources of funding	Government of India, Central budget of CSIR, Project grant
Procurement	• Scientific equipment is procured after analyzing the requirement (criticality), budget and financial viability • "Stores and Purchase" department is responsible for procuring equipment and handling the import issues • CSIR Procurement Manual: 2008 is followed • "e-procurement" may be launched soon.
Maintenance	The supercomputers and associated facilities are maintained by suppliers and local maintenance team. The local maintenance team consists of trained personnel. The facility can be used by logging in to the system using username and password from any remote location. The jobs submitted by the users are maintained in a queue and processed accordingly. A strong monitoring team is required to maintain this facility. A 24*7 monitoring team is there to monitor the health of the equipment and maintain it locally. On the other hand several utilities that are in-built help to monitor the health of the equipment. The suppliers supply the spare parts whenever it is needed. Once in 1997, the lab had faced a major breakdown in the system and a severe interruption in the working facility. In those days, there was no local help and maintenance was done by a company of Singapore. After 2000, no such disaster happened as the Institute itself develops the expertise through internal training programs and gained a huge experience over the years. Moreover, spares are available locally nowadays. Normally, the central budget or the lab bears the operational and maintenance cost. In some cases, central budget does not consider the maintenance cost of the equipments.
Sharing	The supercomputing facilities are shared and open to all. The facility is open to all and is shared among other CSIR labs, research organizations and private players. 4PI takes need based approach in sharing the facility. The visibility of the facility is fair and it is utilized to the full extent. In fact the demand is much higher than the capacity of the facility. More than 85% of the usage of the equipment is accounted by the different labs of CSIR only. Other than the CSIR labs the facility is shared on

	the basis of Memorandum of Understanding (MoU) signed between 4PI and the hiring organization. For the CSIR labs, 4PI charges only electricity and maintenance charges. For other organizations, the cost of accessing covers the capital expenditures and the operational expenditures. The capital expenditure component is calculated on the basis of the life and cost of the equipment. The operational cost consists of several components like electric bill, cost of manpower, maintenance charge, administrative cost etc. Tax is accounted as per the existing government norms. In most of the cases, the researcher expects to access it in free of cost and they do not account usage of equipment cost while submitting their proposal to government or funding agencies. The cost of usage of the equipment must be made mandatory while submitting any project proposal to the government or other funding agencies.
Disposal	• Disposal as scrap • Only functional equipment are gifted (mainly PCs) to schools or other academic/ research organizations. • The guidelines and regulations of PCB are strictly followed for disposal of environmentally hazardous equipment • CSIR Disposal Guideline is followed.
Recommendations	In India, the high end scientific equipments used for R&D are not fully automatic like in USA or UK. For this reason a pool of skilled manpower is needed to operate and maintain the scientific equipments. Basically 3-tiers of people are engaged with this high end equipment. Tier-1 consists of scientists and researchers; tier-2 represents skilled and trained scientific personnel to operate and maintain equipments and tier-3 means physical personnel. For this tier-2 people, a rigorous training facility is needed. Trained and skilful handling of equipment ensures long life and smooth running of the equipment

Name of the Institute: Indian Institute of Chemical Biology (IICB)	
Location: Kolkata	**Year of establishment: 1935**
Contact Person(s):	Mr. Anjani Kumar Pandey, Stores & Purchase Officer
Nature of Institute	CSIR unit
Nature of work	IICB is dedicated to make an impact on the health scenario of the nation through conducting scientific research on the fields of Cancer Biology & Inflammatory Disorder, Cell Biology & Physiology, Organic & Medicinal Chemistry, Infectious Diseases and Immunology, Molecular Genetics and Structural Biology & Bioinformatics
Nature and source for equipment funding	Government of India, Central budget of CSIR, Project grant
Working mechanism & collaboration	• IICB is engaged in scientific research on health issues (diseases) of national importance and certain problems of global interest. • IICB is emphasizing on quality basic research that have certain applied potential. It is always looking forward to establish a successful Industry-Institute liaison to achieve meaningful public-private partnership. • IICB has a wide range of collaboration with national and international research laboratories, private organizations and academic institutes. Some of the organizations are Albert David Ltd., Kolkata, Angiogen Pharmaceuticals, Australia, Biotech Consortium (I) Ltd., New Delhi, Chatterjee Management Services (P) Ltd., Kolkata, Coir Board, Kochi, Chembiotech Research Int. pvt. Ltd., Kolkata, DNDI, France, Merial SAS, Lyn, France, Mologen AG, Germany, Piramal Life Sciences Ltd., Mumbai, Qualpro Diagnostics, Goa, Santha Biotechnics, Hyderabad, Zyphyr Biomedical, Goa. • IICB has established several wings to access market and commercialize their product like PME (Project Monitoring & Evaluation Division), Patent Cell (Intellectual Property Management Cell) and BD (Business Development)
Procurement	• IICB strictly follows CSIR procurement manual: 2008. • The requirement is generated by the user group i.e. the researcher/ inventor. Once the proposal of buying new equipment is granted by the appropriate authority, the required specification for the equipment is finalized by the user group. • Most of the high-tech equipment is purchased through two-bid system by advertising tender. Tender committee consists of scientists, management experts. To maintain transparency in the procurement, IICB engages external expert and representatives of funding agency in the tendering process.

	• Scientific equipments are procured through that comprises of technical bid and commercial bid which are to be made separately. The technical bid is evaluated by technical expert committee and the commercial bid is only opened if the technical bid is accepted. The Tendering Committee negotiates with L1 (lowest bidder) before placing the final order.
Maintenance	• Most of the high end scientific equipments are imported across the globe. These equipments are maintained through AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract) by the OEM itself or by their registered vendors/ agents. IICB prefers preventive maintenance of high end scientific equipment. • Some of the not so critical equipments are maintained by in-house engineers and scientists. OEMs are communicated on call basis for huge fault or spares only. This reduces cost of maintenance.
Sharing	• Sharing facility of IICB is open to all. IICB maintains central facility to facilitate external researchers and academicians. • For the CSIR laboratories and other academic institutes, the facility is hugely subsidized. For external private organizations they use to charge on cost-to-cost basis.
Disposal	• Generally, the equipments are disposed through public auction. • There is a provision in disposal policy to gift old equipment to other organization(s) but is not much practiced by the research laboratories.
Issues and Recommendations	• Procuring spares from the OEM is costly and time consuming. Indian or local agents having capabilities to supply that spare may not be authorized agent to the OEM and not registered to DGS&D. Spares of equipment may be allowed to buy from non- DGS&D Indian agent or some relaxation should be there. • Several common equipments like confocal microscopes, HLFCs are shared by different universities, research laboratories and other organizations. Most of the universities and research laboratories are funded by different government departments and equipments are funded through different government projects. Since the objectives of different organizations are different, it is reflected in the pricing of equipment sharing. All the equipments, funded by any government agency should bear same set of rules of pricing and must be honoured by all the organizations. Same equipment must be priced uniformly across the organizations if that is funded by any government organization/ department. • In some cases scientists have their own brand preference. In such cases, scientists prepare technical specification in accordance with the specification

	of their desired brand which leads to single bidder situation and takes more time to procure. It is recommended to allow the preference of scientist's brand up to certain limit like 50 L or 1 crore. Checks can be invoked like performance of the equipment (past cases/ reference of other organizations), reference of publication indicating usage of the brand/ make, undertaking of the scientist about the experience of using that brand.

Name of the institute: Indian Institute of Chemical Technology(IICT)	
Location: Hyderabad	**Year of establishment: 1942**
Contact Person(s):	Dr. N V Satyanarayana, Chief Scientist & Head, Business Development & Technology Outreach
Nature of Institute	CSIR
Nature of work	Chemical Technology
Nature and Source for equipment funding	
Procurement	• Procure only critical equipment after analyzing the requirement (critical), budget, financial viability and availability in other CSIR labs • " Stores and Purchase" department of IICT is responsible for procurement and disposal and handle the import issues • Follows CSIR Procurement Manual: 2008 • IICT is planning to launch "e-procurement" facility
Maintenance	• Annual Maintenance and Breakdown service through AMC of high-end equipment is ensured at the time of buying • Downtime is strictly maintained as 24-48 hours
Disposal	• Sell as scrap. • Gift only that equipment which are in running condition (mainly PCs) to schools or other academic/ research organizations. • Strictly follows the guidelines and regulations of PCB to dispose environmentally hazardous equipment • Follow CSIR Disposal Guideline (2004)
Recommendations	• Centralized database of equipment (funded by DST) is needed with online booking facility • A core team of experts and performance monitoring system is required to monitor the utilization of the equipment • Database must reflect the underutilized and idle equipment • Before buying any equipment, DST should check whether that equipment is already available (exist and idle/ can be shared) at other center/ location

Name of the Institute: Indian Institute of Science (IISc)	
Location: Bangalore	**Year of establishment: 1909**
Contact Person(s):	1. Prof. Siva Umapathy 2. Prof. Jaydeep Kumar Basu
Nature of Institute	Academic and Research organization
Nature of work	Science & Technology
Procurement	• For procurement of high end analytical and research equipment, IISc follows their procurement rule which is largely based on GFR procurement policy 2005. • The approval of procuring scientific equipment is generated by appropriate authority based on the value of equipment under consideration. o Up to Rs. 1Lakh: Chairman of Departments o Rs. 1Lakh -25Lakh: Divisional Chairman o Beyond 25Lakh: Director • Most of the high-tech equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted by the "Technical Committee" which evaluates the technical bids. IISc obtains the bids through tendering process like Open tender, Limited tender enquiry with proper justification. • Tender committee consists of Technical committee and finance personnel. Technical committee specifies the technical specification of the equipment. • Representation of funding agency and external expert in Tender Committee ensures transparency in the procurement and tendering system.
Working mechanism of each facility	• IISc provides training facility through CCE (Center for Continuing Education). CCE- Proficience was started on an experimental basis in 1980 and till date it offered 1571 short-term training to more than 80,000 applicants. The training programs conducted by CCE are generally subject of topical interest to scientists and engineers. • IISc offers training to the fresh graduates and researchers to operate high-end equipments to attain the requisite skills to operate the equipment. • IISc conducts several other training programs like Bioengineering Summer Training (BEST) Programme, High School Science Teachers Training Program

	through Talent Development Center etc.
Maintenance	• Maintenance of equipment is done through AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract). • It takes on an average 6 months to 1 year to install and conduct test run for any new scientific high-end equipment. In most of the cases, the maintenance cost of equipment is borne by the institute. In some cases, funding agencies bear the cost of maintenance till the completion of project. • Generally, the financial bid for procuring high-end equipment covers AMC of 2-3 years.
Sharing	• Most of the shared equipment is available in the central facility. Some of the equipment belongs to principal investigator of the project. All the equipment can be viewed and booked online. • The sharing facility is open to all. For the academic researcher and students of IISc, the facility is completely free. For outside researchers, hugely subsidized user fee is charged for using the shared equipment. • Most of the high-end equipment is academic in nature. Generally private organizations need facilities for some routine analysis and testing. Very few private organizations are interested in accessing the sharing facility of IISc. Without the participation of private organizations, it is difficult to accumulate user fee from the researcher and students to bear the maintenance cost of the facility.
Disposal	• Generally, the equipments are disposed through public auction. • There is provision in the disposal policy to gift old equipment to other organizations but has not been done so far.
Issues and Recommendations	• Maintaining equipment beyond the completion of project is a major concern. The equipment, which attracts higher demand, should be upgraded regularly. • To enforce health and security of high end and high value equipment, the equipment must be operated by skilled and trained human resource. Some uniform certification training program should be designed to train undergraduate and post graduate students on operating and maintaining high value equipment. This may lead to creating a pool of trained operators and maintenance engineers for high value equipment that may increase the

life of equipments and reduce maintenance cost. This can be linked with national skills registry to create a centralized database of skilled and trained human resources.

- The number of technical support staff is not enough in most of the academic and research organizations. UGC and other parent bodies can play a key role in maintaining the ratio of faculty/ scientist and number and technical support staff to properly maintain the facilities. Life of equipment largely depends on the proper operating and maintaining. This can be achieved by hiring trained and skilled personnel. IISc arranges training for their students and JRFs but this is not a sustainable process as students graduate and leave.
- Several common equipments like confocal microscopes, HLFC are shared by different universities, research laboratories and other organizations. Most of the universities and research laboratories are funded by different government departments and equipments are funded through different government projects. Since the objectives of different organizations are different, it is reflected in the pricing of equipment sharing. Adoption of uniform pricing can be a welcome step.

Name of the Institute: Indian Institute of Science Education and Research (IISER)	
Location: Pune	**Year of establishment: 2006**
Contact Person(s):	Dr. Girish Rathnaparkhi, Associate Professor & Co-Chair, Biology
Nature of Institute	Ministry of Human Resource Development (MHRD) funded central university for science education & research.
Domain	Science education and research
Nature and sources of funding	Grants from MHRD, Department of Science & Technology (DST), Department of Biotechnology (DBT) and other government organisations. Research grants are either applied at individual level or institutional level.
Procurement	• The PI applies for grant. • Grant amount varies between Rs. 50 and 80 Lakhs. • Scientist cannot buy equipment beyond a certain limit from the research grant. Limit is set by the university. For example, high-end research equipments, worth more than Rs. 1 Cr, cannot be bought through research grant. • A high-level committee that involves director and/or experts from the specific field decides the need of the equipment and is responsible for sanctioning amounts for such capital expenditure in following year budget. High-end equipments are purchased under the head of institutional requirements. • The institution has a national research facility within the campus. The facility has been built based on the concept of Pune Bio-cluster, promoted by DBT. IISER is actively taking part into it. Under this initiative, different directors of institutions meet and list out sophisticated high-end equipments that can be procured and installed at the national facility. Funding for this national facility mostly comes from DBT. Under this initiative, a number of sophisticated equipments have been purchased and installed as national facility in IISER.
Maintenance	IISER maintains its equipments through Annual Maintenance Contract (AMC). Warranty & extended warranty period is decided at the time of procurement. After completion of warranty period, it goes for AMC. The research labs do not have any dedicated team for maintenance. Trained operators & scientists carry out daily maintenance of the equipments.
Training	Vendors provide training to the technical officers and scientists during installation of the equipments. Students and researchers are trained through internal technical officers.

Sharing	• Sharing is a common culture in IISER especially in the Biology department. The equipments are accessible to any academic or commercial users against fixed charges. The research facilities are available for 24 hours to the internal users. 10-20% of run time of the equipment is allocated for academic institutions outside of the university. External users can avail the research facilities between 9 a.m. and 7 p.m. University does not allow duplicate purchase of research equipment. • IISER follows another sharing model through collaboration. The university has established collaboration with the research equipment manufacturer named Leica. Leica supplies research equipments to IISER at half price. In exchange, Leica utilizes 30% of run time of the equipment for its clients' research. Some instances were stated where outsiders came and tested their samples using Leica machines and post satisfactory testing they bought the equipment for their companies. This collaboration has created a win-win situation for both IISER and Leica. IISER is purchasing research equipment at half price whereas Leica is getting opportunity to showcase their equipments to the outsiders. Most well known facility of IISER is microscopic imaging facility. The facility has created a very high demand among the academic and commercial organisations of western India.
Disposal	Established in 2006, the university is relatively new. Most of its sophisticated equipments are working properly. Therefore, question of disposal has not arised yet.
Issues	Customs clearance is a serious issue during import of research equipments. Slow movement of papers in clearing delays the whole procurement process.
Recommendations	• Government should focus on openness of the research laboratories to facilitate sharing of the equipments. • End user should become more responsible while using a shared facility. This would minimize equipment damage. • Individual laboratory system should be abolished and each Government funded lab should become open lab. Most of the time individual proprietorship of research laboratories goes against the culture of sharing. Government should address this issue. • A nodal agency can be formed to monitor the usage details & sharing information of government funded equipments. Online logbook tracking system could help to find out actual usage of the equipments. This usage statistics can encourage the institute to share equipments with others. This can also be termed as 'fair use document' for research equipments.

Name of the institute: Indian Institute of Technology- Delhi (IIT- Delhi)	
Location: Delhi	**Year of establishment: 1961**
Contact Person(s):	Dr. Sandeep Chatterjee, Registrar
Nature of Institute	IIT
Nature of work	Academics & Research
Domain	Technology, Science & Management
Nature and sources of funding	Government of India, Project grant, Sponsored research
Procurement	• IIT- Delhi follows GFR 2005 for procuring of scientific equipments • The requirement is generated by faculty or researchers. Most of the sophisticated scientific equipments are financed by some project/ research grant or sponsored research. • Normally high-tech equipment is purchased through two-bid system by advertising tender. In the two-bid system comprising of technical bid and commercial bid, the technical bid is evaluated by Technical committee and the commercial bid is only opened if the technical bid is accepted. The Tendering Committee negotiates with L1 (lowest bidder) before placing the final order.
Maintenance	• The high value scientific equipments are procured with extended warranty features and AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract). • Normally, the high end scientific equipments of central facilities are operator driven. In some cases, faculty and research scholars also operate the equipments. Basic maintenance of the high end sophisticated scientific equipments is taken care of by operators or by the trained students/ research scholars. • The operators and students are rigorously trained by the OEM/ authorized agent of OEM or existing operators before operating such high value scientific equipments. • In the sharing model, a user fee is collected from the external users. User fee is used to fulfil the financial need of maintenance of the high value-sophisticated scientific equipments.

Sharing	• IIT-Delhi puts a strong emphasis on industry interaction and sponsored research. The IRD (Industrial Research & Development) Unit was set up to support academic-industry collaborative R&D. • The research facility of IIT-Delhi is open to all the academic institutes and research laboratories and industry. The sharing model promotes sharing of knowledge and facility among the collaborative partners. • FITT (Foundation for Innovation and Technology Transfer) acts as an industry interface of IIT-Delhi. FITT was established to promote entrepreneurship and foster the pace of commercialization of science and technology innovation. • A large number of collaborative Research Projects are under operation with Institutes/Organizations of Austria, Australia, Brazil, Canada, Denmark, Ethiopia, European Commission, France, Finland, Germany, Holland, Hungary, Ireland, Israel, Italy, Japan, Korea, Kuwait, Netherland, Nepal, Portugal, Russia, Slovenia, Sweden, Switzerland, Taiwan, UK, USA, etc. Major research activities have also been undertaken in the areas of national importance.
Disposal	• Most of the sophisticated scientific equipments are disposed through public auction. • The guidelines and regulations of PCB are strictly followed to dispose off the environmentally hazardous equipment
Issues and Recommendations	• Training course and workshops should be arranged for the scientists to disseminate knowledge about the advantage and scope of sharing facility in India. Regular workshops on sharing are needed to change the mindsets. • Poor maintenance of facilities is one of the biggest issues in India leading to shorter life span of high value equipment. Shorter life span of high value equipment and under utilization of equipment account for huge financial loss. Government could provide a component of the fund as maintenance cost of the equipment and conduct strict internal audit (utilization of equipment, sharing of equipment, maintenance of consumables, maintenance of log book etc.) of the equipment.

Name of the Institute: Indian Institute of Technology- Kharagpur (IIT- Kharagpur)	
Location: Kharagpur	**Year of establishment: 1951**
Contact Person(s):	Dr. Tapas Laha, Professor-In-Charge, Nanoindentation and Nanotribology Facility, Central Research Facility
Nature of Institute	IIT
Nature of work	Centre of excellence in education and research, in science, technology and management
Nature and source for equipment funding	Government of India, Project grants
Procurement	• GFR 2005 is followed for procurement. • The requirement of an equipment is flagged by a user group i.e. the researcher/ professors. The proposal for buying new equipment is then evaluated by the department heads/ divisional heads before finalization • Any equipment, costing more than Rs. 10 Lakhs, is procured through e-publishing of tender thereby ensuring transparency in the procurement process. E-tendering facility is available along with a full-fledged e-procurement system very shortly. • Most of the high-tech equipment is purchased through two-bid system by advertising the tender. A Tender committee and Technical committee in conjunction with the Purchase department conduct the procurement. External experts and representatives of funding agency in the tendering process are involved to ensure transparency in the whole system. • Scientific equipments are procured through two-bid system where the technical bid is evaluated by Technical committee and the commercial bid is only opened if the technical bid is accepted. The Tendering Committee negotiates with L1 (lowest bidder) before placing the final order.
Working mechanism of each facility	• High end scientific equipments are commonly procured using project funds from various schemes of the Government. Additionally, IIT has its own fund to procure equipments for education and research. • During the project, the equipments are kept under the supervision of the Principal Investigator (PI) of the project. Most of the equipments are handed over to the central facility after completion of the project. • The Institute has active collaborations with national and international R&D

	organizations through their in-house R&D unit, SRIC (Sponsored Research and Industrial Consultancy).
Maintenance	• Normally the equipments are covered with extended warranty features and AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract). • Most of the high end scientific equipments of central facilities are operator driven. Basic maintenance of the high end scientific equipments are taken care of by the operators. • The operators and students are rigorously trained by the OEM or existing operator before actual handling.
Sharing	• The equipments of central facility are fully shared among the students, faculty, researchers of IITs and other external institutes. This facility is also open to the public and private organizations for testing and research purpose. All the equipment can be viewed and booked online. • For the researchers and students of IITs, the facility is completely free. It is available at a hugely subsidized rate to the external researchers. • Scientific equipments of central facility are shared with industries and private research organizations through SRIC.
Disposal	• Generally, the equipments are disposed through public auction following the rules of GFR. • Only functional equipment (mainly PCs) to schools or other academic organizations. • Normally equipments are disposed through the Central Store under the supervision of Disposal Committee and Write off Committee.
Issues and Recommendations	• The Institute depends on the funding agencies for procurement of high end scientific equipments. In government funded projects, the sanction of the of the project may take upto 1.5 to 2 years, by which time, the value of the equipment may have increased. In such cases, revaluation and sanction at existing price may prove beneficial. • In government funded projects, in most of the cases government only provides the cost of the equipment and they may be useful only for academic research making it difficult to bear the cost of maintenance, AMC, manpower and other associated costs.

- Procuring spares from the OEM is costly and time consuming. While Indian or local agents have capabilities to supply that spare, they are not authorized agents of the OEM and may not registered with DGS&D. Provision to purchase spares of equipment from such agents may help in saving time and money.
- In case of shipping of imported high end equipment, relying on OEM/ Supplier of equipment for shipping and handling can save time and greater possibility of resolving any issues in transit by the OEM/ Suppliers is there.
- In case of fabrication equipments, L1 can lead to a crisis if one company of Chennai is L1 and another company of Kolkata is L2 and inspection and travel cost are lesser for the L2 company. However, there is no component for travel cost in GFR.
- Research in niche areas demands specific items and the requirement to invite at least three quotations can lead to unnecessary time delays. Moreover in some cases, projects are sanctioned by specifically mentioning the brand and make of the equipment to be used in that project. But the finance department and purchase section do not ready to allow directly procuring a brand without tendering (in case of high value equipment), as they have to face CAG in audit. This leads to bottlenecks.
- In most of the organizations, scientists are managing the sharing facility which is a clear indication of the wastage of manpower or human resource. To maintain sharing facility dedicated management people is needed. A proper management system to allocate time slots and marketing the facility is needed for improving visibility of facility and ensuring that researchers can focus on science.
- A push by the Central government for the OEMs to set up their inventory of spares in India will bring down the down time and cost of the maintenance in a country that routinely orders imported equipment.

Name of the Institute: Indian Institute of Technology-Madras	
Location: Chennai	**Year of establishment: 1959**
Contact Person(s):	Mr. R Sundaram, Chief Techno Economic Officer
Nature of Institute	Indian Institute of Technology
Nature of work	Technology
Procurement	• Sophisticated Analytical Instrument Facility (SAIF) is hosted by IIT- Madras since the late 1970s. This program is solely funded by Department of Science & Technology (DST). IIT- Madras strictly follows GFR 2005 regulation for procuring equipment. • High value and sophisticated equipments are procured mainly through Planned Fund of the budget. The researcher and PIs raise their requirement of equipment and the requirement is evaluated by the department heads. • Any equipment, costing more than Rs. 10 Lakhs, is procured through e-publishing of tender, in order to maintain transparency in the procurement process. • E-procurement will be invoked shortly (may be next financial year, 2017-18). • High-end sophisticated equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted by the Expert Committee. To ensure long life and low maintenance of the sophisticated equipment, they prefer to procure quality products from reputed manufacturers/ suppliers.
Safety and insurance	• IIT Madras holds a safety committee at institution level consisting of department heads and external experts. One Safety Consultant is dedicated to deal with safety issues. Safety measures are maintained by concerned department heads. Periodical reviews take place to enforce safety. The Safety Consultant is an independent post and directly reports the Director of the Institute. • Comprehensive insurance is undertaken by IIT- Madras for facilities and high end equipment. Approximately Rs. 300 crores of assets, including facility and equipment, have been insured till date. End user generates the requirement of insurance through concerned department heads every year. One expert committee evaluates the requirement. Every year, periodic review is done to add or alter the facility for insurance.

Maintenance	Most of the high-end and sophisticated equipment are maintained through AMC. In case of sponsored research, the maintenance and AMC charges are considered while framing the costing of the project. To ensure proper maintenance of high-end sophisticated equipment beyond the completion of the project, SAIF accumulates a fund, known as "Research Maintenance Fund" (RMF). RMF is generated by keeping aside 2% of the project value for each project. This fund is used to maintain equipment beyond the project life cycle. In case of government funded projects, Government provides high value equipment for research. The ancillary instruments and consumables are funded by accumulated user fees. In addition to AMC of the equipment, a small maintenance team is retained for maintaining the facility and equipment. The equipment is retained by the institute after the completion of project. The institute continues to quote projects using the used but well maintained equipment. It results in lower project cost and also ensuring the utilization of equipment. This is a win-win situation for both the parties i.e. institute and sponsor.
Sharing	The shared facility is open to all and can be categorized in several segments like: • In-house scientists, students, faculty/ scientist of government organizations, faculty/ scientist of other institutes/ universities, MSME and private organizations. The visibility of the facility is fair and online booking facility of shared equipment is available. IIT- Madras promotes research and invention. Generally, the institute shares the equipment and facilities that are not commercially available for researcher or other institutes/ organizations. The cost of sharing usually includes maintenance and usage cost. Taxation is charged as per the existing government norms. IIT- Madras usually follows differentiate rate chart for different categories of users. For the in-house researcher (faculty, student and researcher) the usage is free and for external students and researchers IIT- Madras offers generous discounts. • The Sophisticated Analytical Instruments Facility (SAIF) was established by Department of Science and Technology (DST) is one of the oldest models of sharing scientific resources in India. SAIF provides the platform to collect data collection by using sophisticated analytical equipments with nominal charges. SAIF has grown into a major facility for the researchers and students to work in the field of spectral measurements, molecular and crystal structure determination and materials characterization. • Society for Applied Microwave Electronic Engineering and Research (SAMEER) is an institution set-up by Ministry of Communications and Information

	Technology has been working in the field of Electromagnetic Interference and Compatibility since 1983. The centre has served Indian and global industries in applied research & development, testing & training and design consultancy. State-of-the-art infrastructure and experienced and qualified engineers and technicians are the backbone of the facility. The facility is NABL accredited and recognised by various international bodies.
Disposal	• Disposal Committee shares the responsibility of disposing high-end equipment with the concern department. The department prepares the list of equipment to be disposed and send it to disposal committee. After have a thorough checking, the committee has the authority to recommend the disposal process. Generally, the equipments are disposed through public auction. • Some of the equipment are gifted to schools within IIT campus or to the sister concerns of IIT like NITs. Only equipments in running condition are gifted to other institutes. • Strictly follows the guidelines and regulations of PCB to dispose environmentally hazardous equipment and consumables.
Issues & recommendations	• Service tax: As per government rule, service tax is levied @ 14.5% on bill amount for providing services. Sharing of equipment facilities used by the research institutes and universities for the use of research and training could be provided tax exemption. • Maintenance of equipment: The equipment, which attracts research interest, could be provided with a maintenance cost for the entire life cycle of the equipment.

Name of the Institute: Indian Institute of Technology-Bombay, Sophisticated Analytical Instrument Facility (SAIF)	
Location: Mumbai	**Year of establishment: 1976**
Contact Person(s):	Dr. Anindya Datta, Head, SAIF
Nature of Institute	formerly known as the Regional Sophisticated Instrumentation Centre (RSIC), was established at the Indian Institute of Technology, Bombay, in the year 1976, with the support of the Department of Science & Technology, Government of India, New Delhi
Domain	•To provide for guidance and acquisition of data using Sophisticated Instruments. •To organize workshops on the use and application of various spectroscopic and analytical techniques for students, teachers and personnel from other Laboratories, Universities and Industries. •To provide facilities of sophisticated analytical instruments to scientists and other users from academic institutes, R&D laboratories and industries to enable them to carry out measurements for R&D work. • Efforts are made by SAIF to develop new techniques/ methods of analysis to put the instruments to their full use and offer them to scientists for exploring newer dimensions.
Procurement	• Procurement follows standard procedure of DST. • Proposals are submitted along with technical specification, potential utilization and support to be provided for such equipment. • The feedbacks of users are also taken into consideration to understand whether such kinds of equipments are really needed. • In the proposal the feedbacks of users are also attached. • Upon accepting the proposal by the DST review committee, fund is allocated for the equipment.
Maintenance	AMC – external vendor takes care of all maintenance related activities.
Sharing	Outside users have to register themselves for using the instrument of SAIF. The registration provides the user a priority number and IIT Bombay a reference to the user's sample. Policy for External Users : University/ Colleges: University/ Colleges can come personally or send their samples along with a letter from the Head / Guide on their College/Institute original letterhead duly signed and sealed for registration stating that the analysis is for research purpose to qualify for academic concession. The letter should be addressed to The Head, SAIF, IIT, Mumbai. National Lab: National Labs can come in-person or send their samples along with a letter from

the institute's original letterhead duly signed and sealed for registration stating that the analysis is for research purpose. The letter should be addressed to The Head, SAIF, IIT, Mumbai.

Industry:
Industry can send their samples along with a letter for registration. Covering letter should be on the company's original letterhead duly signed and sealed and should also state that the content of report/bill is meant for their information only and will not be used for advertisement, evidence or litigation.". The letter should be addressed to The Head, SAIF, IIT, Mumbai.

In the letter industry has to clearly mention that SAIF, IIT Bombay, will be appropriately acknowledged in their publications where SAIF Instrument results are incorporated /used. As per the guidelines of the Department of Science and Technology (DST), in all publications of research work, wherein the analytical services of the SAIF have been made use of, the DST and the SAIF shall be duly acknowledged.

Sophisticated equipments call for skilled technical operator. IIT-Mumbai's SAIF working as a cell of Centre for Research in Nanotechnology & Science (CRNTS) ensures availability of skilled technicians to handle the SAIF equipments. Merger with CRNTS in 2008 has proved to be very effective for SAIF, which allowed them recruiting PhD students from CRNTS. It provided a platform for collaborative research in the area of Nano technology and science. Each equipment is assigned to a scientist and one or more operators. These operators are called Technical Assistant (TA) and recruited from the pool of students who are pursuing their PhD under IIT-B. Usually, these TAs are appointed on a contract basis for two years. They are trained by professors & senior PhD students as well as external experts and manufactures. The TAs have to spend minimum 8 hours in a week in the laboratory against which they get incentives. Recently IIT is considering a policy where these students could avail the instruments of SAIF freely for two hours for their PhD work against the service of four hours in a week. Performances of these TAs are strictly evaluated by SAIF committee. On every Friday, the committee evaluates the utilization percentage of each equipment with respect to each TA. Apart from these, several workshops are conducted to train these bright students. All kind of samples come for testing, internal or external, are chargeable. Users can book their slot through online portal designed by IIT-B for testing their samples. Usually requests are accepted at first come first serve basis. However, in some special cases queues are reshuffled. In some special cases, industries are allowed to test their samples instantly with higher charges. For jumping the queue, they have to pay 3 times of the usual charges. Queues are also tweaked in case a PhD student has to test her samples on a priority basis for submission of her thesis. These exceptions are only allowed subject to strict evaluation and recommendation of the SAIF committee. In 2015-16, 14106 such internal samples have been tested in SAIF. These numbers are 6688, 219 and 1081 for university

	sample, national laboratory sample and industry sample respectively. In 2015-16 the numbers of internal users were 1148 whereas 1081 external users used the equipments of SAIF. Revenue earned through internal source Rs. 1,72,05,385 whereas income from external sources is Rs. 87,93,233. Waiting time on an average is 2-6 months. However for high-end equipment waiting time is more.
Disposal	• Usually after 10 years of the purchase of the equipment, write off committee decides whether the equipment should be written off from the stock and disposed off. • Upon recommendation of the write off committee, internally it is checked whether any department is interested to use the equipment. External academic institutes are also consulted. • Equipments are gifted in case any interested party is found else sold as scrap at a very lower price.
Recommendations	• Recruitment of TAs from PhD students. This will allow inflow of skilled technical operators. • Weekly evaluation of these TAs. • Maintenance fund should be arranged which is the biggest challenge in managing equipments • There should be guidelines stating that if certain labs earn X rupees as revenue, government should provide certain percentage for maintenance. • There must be a clear career path for TAs, which will attract bright students in the laboratories as operator.

Name of the institute: Inter-University Accelerator Centre (IUAC)	
Location: Delhi	**Year of establishment: 1990**
Contact Person(s):	Dr. Dinakar Kanjilal, Director Dr. P Sugathan, Scientist 'H' & Research Coordinator
Nature of Institute	DAE funded autonomous research laboratory
Nature of work	Playing pivotal role in accelerator based research in the context of Indian Universities as coordinator cum facilitator for more than three decades. It started in 1984 and originally known as Nuclear Science Centre. In 2005, it was renamed as Inter-University Accelerator Centre (IUAC).
Domain	Nuclear Physics, Materials Science, Atomic Physics and Radiation Biology. This IUC has the dual role i.e. to establish state-of-art accelerator system along with the experimental facilities and to create adequate infrastructure for enabling the university community to undertake internationally competitive research.
Nature and sources of funding	IUAC is funded through UGC grants and MHRD (Ministry of Human Resource Development). Several other Government departments like DST (Department of Science & Technology), MoES (Ministry of Earth Sciences), DAE (through Board of Research in Nuclear Sciences, BRNS) fund several projects and high value equipment. IUAC attracts funds from several leading Governments laboratories like CSIR laboratories in the form of extramural projects.
Procurement	• IUAC follows GFR rules for procurement and ensuring transparency in financial transactions is a priority. • Procurement of high value equipment is done as per planned budget. Budget In-charge of every department provides the yearly budget for procurement according to their requirement and that is to be approved by Director after due consultation with corresponding department. A Purchase committee consists of scientists and financial experts take care of the procurement process. IUAC invites external experts to take part in procurement process to ensure transparency. Purchase committee meets every week to review the procurement scenario of the organization. • Most of the high-tech equipment is purchased through two-bid system where the commercial bid is only opened if the technical bid is accepted by the Expert Committee. Expert Committee comprising of external experts, among others, evaluates the technical bids. • Once the technical bids are evaluated, purchase committee starts negotiation with the lowest bidder (L1). • IUAC has implemented e-tendering and ERP system for procuring of equipment.

Maintenance	• The facility of IUAC is open to all the universities of India and several government research laboratories. All the facilities (laboratory, library, office etc.) are open 24X7 throughout the year. IUAC has strong international collaborations with several institutes of first world countries like Japan, USA, and Germany etc. • Dedicated in-house maintenance support system comprises of scientists and engineers. The scientists and engineers are properly and regularly trained by OEM (original equipment manufacturer) and suppliers. At the time of procurement, the in-house maintenance team is assigned to the equipment during the installation of any new equipment and they are engaged with the installation process right from the very beginning. • Some of the hi-tech high value equipments are maintained through AMC. In most of the cases, the in-house maintenance team maintains the facility. Comprehensive in-house maintenance support results in huge cost benefits and creates a skilled work force as well. • Several maintenance and monitoring tools are designed by the scientists of the IUAC itself. Engineering team is also encouraged to develop their own instruments and funds are provided to support their development activity. The maintenance engineering team of IUAC has already designed high voltage power supply instruments and UPS (uninterrupted power supply) that are used in different projects of IUAC.
Sharing	The facilities of IUAC are typically created to encourage research activity in education system in India. IUAC dedicates its support to all the universities of India and is open to all government research laboratories. The accelerator facility of IUAC is in high demand and is completely utilized. The whole facility is shared with universities and government research laboratories. The visibility of IUAC is achieved through Acquaintance Programme which is conducted in different parts of the country to make the local scientific community aware of the IUAC facilities. Participants comprising of faculty members, research scholars and students from the neighbouring colleges and institutions attend the programme. The cost of sharing is absolutely free. For the individual researcher and students in some cases financial assistance is also available for travel and accommodation. Normally in sponsored projects, the cost of sharing is free but IUAC does not take the financial burden of accommodation and travel of the involved scientists and researchers IUAC has initiated some activities to help improve the Physics laboratory facilities in the universities like designing and providing table top equipments that are used at M.Sc level. For example, a low cost Radiation detection and Analysis System has been developed which is useful to carry out some of the Nuclear Physics experiments at M.Sc level. This has been distributed to thirty universities after proper training on the instrument usage.
Disposal	• IUAC strictly follows GFR guidelines for disposing equipment. • Majority of the equipment is in running condition and used by IUAC. The equipments are disposed through write off committee that consists of

	external and internal experts and finance personnel. • Most of the scraps are sold through public auction. • Major high-end equipment are used till their end of life and utilized in different ways. Old equipment that are obsolete or having less capacity is used for training purpose. IUAC gifts their old equipment to other research organizations if the equipment is in running condition and any organization shows interest in taking the equipment. For instance, once IUAC had to buy one large nitrogen liquid plant despite of having a smaller one to increase the capacity to meet the increasing demand of the equipment. After buying the new and large facility, IUAC gifted the old and small fully functional nitrogen liquid plant to UGC-DAE Consortium For Scientific Research, Indore. • Strictly follows the guidelines and regulations of PCB to dispose environmentally hazardous equipment
Training	• M. Sc. Orientation programme is conducted by IUAC to encourage interested students to continue their career in science by supplementing their knowledge and research mind. The two-week M. Sc. orientation programme provides hands-on training associated with accelerator based research. • IUAC conducts two semesters of Ph.D programme (partner with Jawaharlal Nehru University) for research students of different universities and research centers (JRF candidates) and new scientist trainees of the Centre. The programme consists of two semesters- first on Experimental Physics and Accelerator Physics and the second one is on Computers in instrumentation, data acquisition and advanced course on Material Sciences and Nuclear Physics etc.

Name of the institute: Jadavpur University (JU)	
Location: Kolkata	**Year of establishment: 1955**
Contact Person(s):	Prof. Subratanath Koner, Dean - Faculty of Science
Nature of Institute	University
Nature of work	Education and research, in science, arts, technology and management
Nature and source for equipment funding	UGC, State Government, Government of India, Project grant
Procurement	• Procurement follows GFR 2005 guidelines. • Project grants of several departments and agencies of Government of India and UGC are procured by most of the high value scientific equipments. • Normally high-tech scientific equipments are procured using the two-bid system by advertising tender. Several committees play a key role in various aspects of procurement like design of technical specification of the equipment, conducting tendering process and evaluation of technical bids with the help and support of the Purchase department and support of external experts. • The two-bid system comprises of technical bid and commercial bid where the technical bids are evaluated by the experts and the commercial bids are only opened if the technical bid is accepted by the experts. The Purchase Department negotiates with L1 (lowest bidder) before placing the final order.
Maintenance	Normally scientific equipments are covered with extended warranty features and AMC (Annual Maintenance Contract) or CMC (Comprehensive Maintenance Contract).
Sharing	• The equipments are shared among students, faculties, researchers of JU and other external collaborative institutes. Those equipments which are available for sharing can be viewed online. • For the researchers and students of JUs, the cost of sharing is completely free. JU charges a subsidized rate for external researchers and scientists also.

Disposal	Generally, the equipments are disposed through public auction following the rules of GFR.
Issues and Recommendations	• Fund is the major constraint to maintain equipments after completion of the project. State universities do not have enough funds and are mainly sponsored by state governments and UGC. State government provides the fund for maintenance of the infrastructure and creation of infrastructure. Funding agency should come up with comprehensive procurement including extended warranty, AMC/ CMC of the scientific equipment. • Funding agencies only provide for cost of the equipment. Receiving organizations request OEM to raise a bill of equipment in such a way so that it includes Warranty and AMC for 2-3 years to cover maintenance for at least the project duration. But in several cases, OEM does not provide maintenance and it rests with a third party maintenance team. In such a scenario, the organization has to bear the maintenance cost after the warranty period. • In case of breakdown of any equipment, Principal Investigator of the project has to apply for the cost of repairing from the funding agency and has to face several questions. Moreover it takes lot of time to get the funds for repair from the funding agency. Under this kind of circumstances, project leads/ principal investigators are not motivated to share the equipment with others. • After completion of any project, the equipments are kept with principal investigator or department of university. University has to bear the maintenance cost of the equipment. In most of the cases, lack of funds leads to non-maintenance of scientific equipment. Funding agencies of central government and/or UGC can consider to mandate a central facility (common place) in state run universities to ensure extended and shared use of high end scientific equipment after the completion of project.

Name of the institute: National Aerospace Laboratories (NAL)	
Location: Bangalore	**Year of establishment: 1960**
Contact Person(s):	Dr. Jitendra J Jadhav, Director
Nature of Institute	CSIR Laboratory
Nature of work	ISO certified organization (ISO 9001-2008 QMS Standard) NAL has the mandate "to develop aerospace technologies with strong science content, design and build small and medium sized civil aircraft, and support all national aerospace programmes". The organization has huge experience of conducting collaborative research and sponsored projects with big organizations like Boeing, USA, BELL Helicopters etc. NAL is the member of several prestigious associations like Supersonic Tunnel Association International, International Forum for Aviation Research and Asian Passenger Plane Forum, Japan. NAL has huge contribution to several national defence programs as well.
Domain	Aerospace technologies and research
Nature and sources of funding	Government of India, Central budget of CSIR, Project grant
Procurement	• For high value and high end scientific equipments NAL strictly follows CSIR Procurement Manual: 2008. • Any equipment, costing more than Rs. 10Lakhs, is processed through e-publishing of tender and orders. E-tendering facility is available to invoke transparency in the tendering and bidding process. E-procurement is expected to be invoked very shortly. • The requirement is generated by the user group i.e. the researcher/ inventor. Once the proposal of buying new equipment is granted by the appropriate authority, the required specification for the equipment is finalized by the user group. Most of the high-tech equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted. • "Purchase Committee" comes into picture to finalize the deal in terms of commercial negotiation. Purchase Committee negotiates for discounts, finalizes the terms and conditions and ensures a smooth procurement and installation of the equipment.

Maintenance	• The high technology and high value equipment is maintained through AMC (Annual Maintenance Contract). NAL prefers to provide the responsibility of AMC to OEM (Original Equipment Manufacturer) or Authorised service providers of the manufacturer. • In some cases, for critical equipment, NAL goes for CMC (Comprehensive Maintenance Contract). • NAL does not maintain any formal maintenance team. The operators of highly critical equipments are trained in-house and they are capable of performing some basic and regular maintenance job of their respective equipments. • Simulators developed by NAL are maintained by their engineers.
Sharing	The facilities of NAL are shared and open to all. The facility is open to all and is shared among other CSIR labs, research organizations and private players. Manufacturing and testing facilities are utilized to their fullest and inspection types of equipment are utilized to about 80% of their strength. Acoustic facility is one of the most popular facilities of NAL. Several research organization and private players use this facility. The facilities that are not available in the market (niche facilities) have high demand. A 3-tier costing model is adopted by NAL. Within CSIR laboratories, for academic organizations and individual researcher, the cost to access the equipment is lowest. NAL provides generous discounts for the publicly funded research institutes or organizations. Private research organizations do not get any discount and NAL charges them on a cost-to-cost basis. Taxation is accounted as per the existing government norms.
Disposal	• Disposal as scrap by write off committee through public auction. • Only functional equipment is gifted (mainly PCs) to schools or other academic/ research organizations. Capital or high-value equipment are generally not gifted to other organizations. • Strictly follows the guidelines and regulations of PCB to dispose off environmentally hazardous equipment • Follows CSIR Disposal Guideline.

Training	One-year training programmes at the Diploma, Graduate (BE/BTech/MSc/MCA etc) and post graduate (ME/MTech/MPhil only) levels are designed to supplement the knowledge and research mind of fresh Diplomas, Graduates and Post-Graduates in different disciplines, to get an exposure to the various facilities and S & T developments and to take part in the ongoing R & D programmes of NAL. The duration of the training programme is for one year. Among the programmes designed for them is the Dr. Ambedkar Trade Training Programme, exclusively for SC/ST candidates with ITI qualification in different disciplines. More than 3500 people have been trained so far.
Issues and Recommendations	• A marketing team is needed to manage and market the facility • CSIR man-hour rate is higher, as a result, only unique facilities are hired by the external users. • A waiver on Custom duty for R&D equipment would be a welcome move for government research organizations. • NAL does not gift capital (high value and hi-tech) equipment to other organizations as those equipment have significant scrap value. A strict and transparent disposal policy is needed to gift high-end equipment to other organization.

Name of the institute: National Centre for Biological Sciences(NCBS)	
Location: Bangalore	**Year of establishment: 1992**
Contact Person(s):	Dr. S Krishna, Associate Professor
Nature of Institute	Autonomous unit under the aegis of Tata Institute of Fundamental Research (TIFR)
Domain	Premier biological research and training institute in India. It is a part of Bangalore Life Science Cluster (**BLiSc**). BLiSc is a hub of cutting edge research excellence, housing three premier institutes namely NCBS, Institute for Stem Cell Biology and Regenerative Medicine (**inStem**) and Centre for Cellular and Molecular Platforms (**C-CAMP**)
Nature and sources of funding	Extramural and intramural grants through different Government agencies and private organizations. Several government agencies like Department of Atomic Energy (DAE), Department of Biotechnology (DBT), and Department of Science & Technology (DST) are the main source of intramural and extramural funding support. Research excellence of NCBS attracts funding from different private foundations and trusts of India and abroad like Wellcome Trust, Bill and Melinda Gates Foundation (BMGF), Simons Foundation, Fragile X Association (FRAXA), Tata Trusts, Wildlife Conservation Trust (WCT), Medicines for Malaria Venture (MMV) etc. NCBS has a great rapport with renowned corporate houses like L'Oreal, Unilever, and WIPRO etc.
Procurement	• NCBS rigorously follows their own institutional procurement guideline which is largely derived from GFR (General Financial Rules), 2005 and different best practice models of procurement adopted by huge corporate and public organizations. • The requirement is generated by the user group i.e. the researcher/ inventor. Procurement is through public tender. Most of the high-tech equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted by the "Third Party Expert Committee". "Third Party Expert Committee", evaluates the technical bids, consists of external experts to maintain transparency in the evaluation process. NCBS obtains the bids through tendering process like Advertised tender enquiry, Limited tender enquiry or Single tender enquiry etc. The Instrumentation Engineers are made available and involved while installation of any scientific equipments. One copy of the "Manual and Installation report" is kept in laboratory and another one copy is given to the Instrumentation Team. • E-tendering facility is available to invoke transparency in the tendering and

	bidding process. E-procurement has started recently.
Maintenance	• NCBS maintains the equipment facility through AMC (Annual Maintenance Contract) and dedicated maintenance workforce known as Instrument Team. Day to day maintenance is governed by the Instrument team and in case of need of spare and major problem NCBS calls the AMC team. The in-house instrumentation team of NCBS is operative 24*7. While buying the high value equipments from the manufacturer/ supplier, NCBS usually fixes the maintenance terms in AMC agreement and normally NCBS maintains the turnaround time as 24-48 hours. • The scientific equipments of NCBS are classified in three broad categories based on the maintenance requirements and criticality of the equipment. These are high, medium and low-priority equipments. High-priority equipments are usually taken up for preventive maintenance once in a month. While medium-priority equipments and low-priority equipments are take up for maintenance once in two and three months respectively. • Nowadays, technology is changing rapidly and most of the manufacturers/ suppliers withdraw AMC facility after 5-8 years. For this reason, to maintain the facility and equipment beyond AMC period, NCBS maintains internal maintenance team and creates a pool of local vendors who are experienced in maintenance and repair of high-tech equipments.
Sharing	• The shared facility is open to all. The visibility of the facility is fair. In fact the demand is much higher than the capacity of the facility. Participation is higher in niche facilities. Most of the equipments are utilized more than 70%. Niche equipments are used more than 100% (8hours per day, 20 days per month). There are 20 different research facilities across the campus. Technical consultants are invited through C-CAMP. • NCBS markets their facility through C-CAMP. C-CAMP is a well known incubation center in the same campus. The marketing team of C-CAMP consists of senior personnel with managerial and marketing skills, so it is convenient for NCBS as the scientists do not have to bother in managerial issues. • Visibility of facility is maintained through C-CAMP. About 200 organizations used facility of NCBS till date. Online portal for searching and booking equipment is available. Among non-academic users, fair share of start-ups and MSMEs has been observed. • While sharing the equipment with outside organization for a long period of time,

	NCBS usually trains the user to make them capable of using the machine of their own. One dedicated scientist and a member of instrument team is attached with every external user to enforce the security of the high end equipment. In the case of short term projects run by external users, NCBS provides skilled operators to operate the equipments. • Cost of sharing is calculated for In house as Running cost (consumable+ maintenance cost); For external academics the cost is calculated as Running cost+ Admin charge+ Manpower cost; For private users it is Cost-to-cost
Disposal	• Often buy back is offered by the OEM or by their authorized agent. • Very little has been disposed till date. NCBS uses the high value scientific equipment to the fullest unless the equipment or technology is obsolete or unserviceable. Generally, the equipments are disposed through public auction after advertising in local and national dailies (newspaper). • Normally, fully functional equipments are gifted (mainly PCs) to schools or other academic/ research organizations. There are some instances of gifting high end equipment as well. The ownership of gifted equipment belongs to NCBS and they track the usage of the equipment. • The guidelines and regulations of PCB are followed strictly to dispose environmentally hazardous equipment and consumables.
Training	• General training is held in the month of April and October for the common instruments. Students have to undergo training before they start using any instrument in the laboratories of NCBS. The training is much required as the instruments are very sophisticated & expensive. The internal training for the students are managed and conducted by the Instrumentation Engineers.
Recommendations	• Service tax in training facilities: As per government rule, service tax is levied @ 14.5% on bill amount for providing services. Exemption from Service Tax can be considered for **R&D testing and training service**. • Maintenance of equipment: **The equipment, which attracts higher demand, should be upgraded regularly.** For this, external expert panel should be involved to check the condition of equipment after the completion of the project and proper and one common MIS reporting system must be there to measure the utilization of high value government sponsored equipment.

Name of the Institute: National Institute of Nutrition (NIN)

Location: Hyderabad	**Year of establishment: 1958**
Contact Person(s):	Dr. Dinesh Kumar Bharadwaj HOD, Drug Toxicology DIvision & Head, Instrumentation
Nature of Institute	Grant-in-aid institute under Indian Council of Medical Research (ICMR)
Domain	National Institute of Nutrition is well-known for its pioneering studies on broad based aspects of nutrition research. It has special focus of Protein Energy Malnutrition (PEM).
Nature and sources of funding	Each PI receives his/her own grant for research from ICMR. Mostly these grants are government funded.
Procurement	• NIN follows ICMR procurement process • Limited tender to procure equipments that cost less than Rs. 2 Lakhs. • The institute has a list of registered vendors who can supply the equipments below Rs. 2 Lakhs. • Only registered vendors are requested to submit tenders in this category. • To procure the equipments more than Rs. 2 Lakhs and up to Rs 5 Lakhs the Institute opts for 2-bid tendering system. • To procure the equipments cost more than Rs. 5 Lac NIN arranges global tender based on e-tendering process. • As per ICMR rules the procurement costing more than Rs. 5 Lakhs is taken care of by ICMR itself. • A science advisory committee is responsible to scrutinize all equipment purchase requests submitted by the individual PIs. • The institute has an instrumentation team headed by the HOD-Instrumentation to manage whole procurement process.
Maintenance	• NIN follows standard Annual Maintenance Contract (AMC) procedure for maintenance of equipments. • The institute does not house any dedicated maintenance team. • Daily maintenance is taken care of by the technical officers. • Due to crunch in maintenance fund NIN is unable to put all the high-end equipments under AMC. Presently only 17 research equipments out of more than 100 equipments are under AMC.
Sharing	NIN doesn't have any specific sharing policy. Sharing takes place on mutual understanding with other institutes. Other ICMR institutes send their sample to NIN for testing against minimum charges. The charges for industry are higher. NIN does not provide any ICMR certification to the industry for the test results.
Disposal	• Disposal of equipments mainly takes place through public auction and scrap selling. • Write off committee in NIN identifies the equipments to be disposed of. • The committee sends a list of equipments to ICMR for condemnation. • Disposal of equipment is possible only after sanction of ICMR condemnation committee. The institute has no right to dispose of equipment on its own.
Training	The institute trains its technical officers and scientists through vendor. The operators get trained during installation of the equipment only. NIN does not provide any

	further periodic training to the operators. ICMR doesn't provide fund for any external training. This creates skill gap .
Issues	• Lead time of procurement is very high in ICMR institutes. ICMR purchase committee meeting takes place only twice a year sometimes once in a year leading to longer delays in procurement. • Duplication of purchase unnecessary wastes public money • Due to selection of L1, low cost imported equipments are selected in procurement process. These equipments have issues with longevity and unavailability of spares. • Unavailability of skilled manpower is a serious issue for maintenance. ICMR doesn't provide fund for training of technical officers & scientists. • ICMR follows the condemnation rule where manufacturer has to certify the non-functionality or obsolescence of the equipment. In cases of older equipments where manufacturer doesn't exist anymore, it becomes difficult to write off the equipment.
Recommendations	• NIN suggested that the Government should provide fund for periodic training of the technical officers and scientists on new equipments. • A certain percentage of the research grant has to be kept aside for maintenance. • A comprehensive sharing policy is required, which will incentivize revenue earned through sharing. Revenue earned through sharing of equipment could be utilized for maintenance of the equipments.

Name of the Institute: National Institute for Research in Reproductive Health(NIRRH)	
Location: Mumbai	**Year of establishment: 1970**
Contact person(s):	Dr. Smita Mahale, Director Dr. Deepak N Modi, Scientist E & Head, Molecular and Cellular Biology laboratory
Nature of Institute	ICMR Institute
Domain	Research in Reproductive Health
Nature and Source for equipment funding	Funding is both intramural and extramural. There is a provision to buy project specific equipments using extramural funding where an individual PI has to take approval from both ICMR and funding agency. Usually most of the funding comes through ICMR.

Procurement	• All equipment purchased has to follow ICMR standard procedure. The procedure is like:
	• An individual PI has to raise the request
	• He has to fill up a simple form internally provided by the organization where he has to provide information about –
	  ○ Why he is to buy this equipment?
	  ○ Does the equipment already exist in the institution? If yes, why PI wants to purchase is again?
	  ○ The number of users – internal and external etc.
	• All these have to be approved by the director. Then it is sent to the ICMR committee.
	• This is the rule followed by 33 ICMR institutes in India. ICMR committee meets once in a year and discuss about all the requests submitted by 33 institutes.
	• Procurement processes are of two types.
	• For equipments less than 25 Lakhs, the entire process is managed at institutional level. Here restriction is less. For below 25 Lakhs there is no need to go for tendering. The institute can have limited quotations and select L1 based on GFR 2005 rules. There are various committees involved in procurement. Two-bid system – technical bid & financial bid – is followed for procurement. There is one technical specification committee comprising of institute's scientists and external experts who are responsible to review the technical specification provided by the vendors. The bids which qualify technical specifications are recommended for financial bid. Again there is a committee comprising internal and external experts to review the financial bid. A comparative statement is made. Then the entire proposal goes to ICMR. ICMR goes through the proposal depending upon fund availability to consider the proposal.
	• The process is different for equipments more than Rs. 25 Lakhs. The institute's responsibility is only to call for tender and collect information about technical and financial bid. In due process they have to publish this call for tender in Indian trade journal, ICMR website as well as institute's website. Then the entire bunch of information is sent to ICMR.

	• ICMR has its own technical committee to take care of all equipment procurement related activities of all the 33 institutes enlisted under it. The committee decides whether the proposal is justified or not. Sometimes instead of buying the committee recommends to use similar equipment placed at other ICMR institutes. In case the same equipment is needed exclusively for a project, the institute has to make a case and provide considerable justification for procurement. An internal committee of ICMR reviews all the requests. This committee comprises of experts form ICMR itself and external experts from AIIMS, IIT etc. after technical and financial review vendor is called where vendor has to provide in writing that they didn't supply the equipment in lesser amount than what they have quoted. • Usually the warranty period is fixed for 5 years. AMC charges are also fixed during negotiation with vendor. The non-comprehensive AMC charge for sixth year onwards is also decided. Vendor has to agree with 15 point check-list. After all these steps equipments are procured. • Depending upon the utility of the equipment, it is either kept in lab or in central facility. For any equipment and/or consumable purchase it has to go through three ethics committee. These are human ethics, animal ethics and bio-safety committee.
Working mechanism of each facility	Training is usually provided by the vendor, sometimes internally and through external experts.
Maintenance	Annual Maintenance Contract
Sharing	Sharing of equipments is a common practice among the 33 ICMR institutes. Any of the ICMR institutions can use the equipment of NIRRH and vice-versa with no charge. Sometimes the institute allows sample from industry where the charges are higher. Equipments are also shared with academic institutions against minimal charges. All the earnings from equipment sharing go to ICMR. NIRRH is a member of Health Consortium set up by IIT Mumbai. This consortium allows NIRRH to use equipments located at central facility of IIT-Mumbai.
Disposal	There is no clear disposal policy in ICMR institutes – • Mostly through public auctions • Buy back by the manufacturer. There is no such gifting policy as the equipment is used until it becomes non-functional. So after its life ends, it is generally sold as scrap. Vendor has to certify that particular equipment is going to be obsolete in next two years. An internal committee reviews the statement and a case is prepared for disposal. Then it goes to ICMR for condemnation. When ICMR approves the request, then equipment goes for public auction.
Recommendations	• Unavailability of skilled technician is main problem of equipment maintenance. • Institute has to involve its own people as in-charge. These scientists take care of

all the admin related activities in central facility. It hampers his/her research. So a dedicated instrument team should be there to handle all the equipment related activities.

- Pool of skilled technicians can be created by linking National Equipment Policy with national skill registry. However, recruitment process should be changed accordingly. Presently all the recruitment process is done through written examination following ICMR recruitment policy. A technician who is very good in operating equipment might face difficulty in clearing written examination which requires lot of academic theoretical knowledge rather than practical knowledge.
- Another issue is lead time for procurement. ICMR meeting takes place once in a year. So the cycle from proposal to procurement takes almost one year which incur huge loss in research perspective.
- A centralized facility can be created for AMC of the equipments.

Name of the Institute: National Physical Laboratory (NPL)	
Location: Delhi	**Year of establishment: 1947**
Contact Person(s):	Dr. O S Panwar, Sc G & Head (Deputy Director) Dr. Suresh Chand, Chief Scientist
Nature of Institute	CSIR Laboratory
Domain	Mandated to be India's "National Measurement Institute" (NMI) by act of Parliament and is the custodian of "National Standards" with a responsibility of the dissemination of measurements to the needs of country.
Nature and sources of funding	Government of India, Central budget of CSIR, Project grant
Procurement	• The procurement of high value and high end scientific equipments in NPL is done by strictly following CSIR Procurement Manual: 2008. • Any equipment, costing more than 10 Lakhs, is processed through e-publishing of tender and orders. E-tendering facility is available to invoke transparency in the tendering and bidding process. E-procurement is scheduled to be launched shortly. • The requirement is generated by a user group i.e. the researcher/ inventor. Once the proposal of buying new equipment is granted by the appropriate authority, the required specification for the equipment is finalized by the user group. Most of the high-tech equipment is purchased through two-bid system. In two-bid system, the commercial bid is only opened if the technical bid is accepted. The lowest bidder (L1) is then offered the tender. • "Purchase Committee" comes into picture to finalize the deal in terms of commercial negotiation with L1. Purchase Committee negotiates for discount, finalizes the terms and conditions and ensures a smooth procurement and installation of the equipment. CSIR organizations involve external experts in the procurement and bidding process to invoke transparency.
Maintenance	• The high technology and high value equipment is maintained through AMC (Annual Maintenance Contract). NPL prefers to provide the responsibility of AMC to OEM (Original Equipment Manufacturer) or Authorised service providers of the manufacturer. • The user fee collected from the users is used to create Laboratory Reserve Fund. This fund is used for maintaining the facility. All the equipments of NPL are operated by the skilled operators. • Safety issues are taken care by the principal investigator (PI) and respective scientists of the project.

Sharing	• Research outreach program is designed to make the facilities of NPL available beyond office hours and on holidays, to other research organizations, institutes and industries that do not have the access to these facilities and thereby ensuring maximum utilization of available resources. The objective of the program is to ensure; i) maximum utilization of NPL facility, ii) create a pool of trained resource in the area of measurement science and technology and iii) developing standardization center for MSMEs. The services are provided through 11 outreach cluster areas namely Mechanical, Thermal, Electrical, Optical, Surface/ interface characterization and spectroscopy, Magnetic, Micro structure, Thin film, Special bulk, Nano fabrication and silicon solar cell fabrication. • The cost of sharing is charged as the standard practice of CSIR laboratories. The user fee has two parts, equipment usage charge and equipment depreciation charge. For research laboratories, academic institutes and government organizations, NPL charges equipment usage charge only. Private organizations are charged for both the components. • NPL provides commercial service to the industry by calibration and testing of equipment through CFCT (Center for Calibration & Testing). NPL has nearly 3200 customers from different government organizations, research laboratories and industries. • Intranet booking system of the shared facility is available for the internal users. For the external users, all the information related to equipment and cost of accessing is furnished in their website. NPL is designing an ERP solution for their organization.
Disposal	• Disposal as scrap is conducted by write off committee through public auction. • Only functional equipment (mainly PCs) are gifted to schools and other academic/ research organizations. Capital or high-value equipment are generally not gifted to other organizations. • Strictly follows the guidelines and regulations of PCB to dispose environmentally hazardous equipment • CSIR Disposal Guidelines are followed.
Training	• NPL is planning to launch a Planned Training Program through their outreach program. The program will be dedicated to create skilled human resource in measurement science and technology. This program is designed to ensure the uttermost utilization of available equipments. The training program will be for both internal and external candidates.
Issues and Recommendations	• Access to the shared facility of NPL for researchers and scientists is absolutely free. In case of individual researcher, universities and other government research laboratories, NPL recovers equipment usage charge only. Most of the researchers are not willing to pay any amount for using the shared facility. Nowadays, the scenario is changing gradually but the problem still remains. • Some government research laboratories and university departments are not ready to share their facility with others. All the government organizations like research laboratories, universities should come up with more workshops and

	seminars to spread awareness on the advantages of sharing facilities all over the country.

Name of the Institute: Professor Jayashankar Telangana State Agricultural University (PJTSAU)	
Location: Hyderabad	**Year of Establishment: 2014**
Contact Person:	Dr. V Praveen Rao, Vice Chancellor Dr. Sreedhar Mulinti, Principal Scientist & Technical Manager Dr. V. Vasudeva Rao, Principal Scientist & Head, AINP on Vertebrate Pest Management
Nature of Institute	State-run agricultural university in Telangana
Domain	The mandate of the institution is divided into two broad categories – education & research. The institution is focused towards training human resources for agricultural and allied sectors. In research domain the institution is constantly striving for new technologies to increase production in the agriculture.
Nature and Source for equipment funding	It gets fund from ICAR and State Government.
Procurement	The university follows procurement rules of the funding agency. A dedicated committee is there to take care of procurement of all the consumables. During the beginning of the year the consumables are procured on rate contract basis. The process of procurement is divided into three parts – • If the equipment to be procured is below Rs. 10000, the University has leverage to purchase it directly from the vendor. • For the equipments costing from Rs. 10000 to 1 Lakh the University asks the vendor to submit quotation along with the technical specifications. Among the quotations, the procurement committee selects the vendor with lowest price and matching specifications. • The equipments which cost more than Rs. 1 Lakh are procured by 2 bid tendering process. This includes technical and financial bids. The technical bid is open first by the committee. The vendors which satisfy technical bids only get call for financial bid opening. The L1 is selected within the vendors called for financial bid. • The whole tendering process follows GFR 2005 guidelines.
Central instrumentation facility	ICAR has recently granted Rs. 1 Cr. to PJTSAU that is being used to form a Central Instrumentation Cell within the University. The instrumentation cell is intended to facilitate access to common equipments within the facility by all departments. They suggest that the external sharing will become possible with dedicated centralised instrument cell. A pool of highly trained manpower can be assigned to take care of the equipments within this cell while sharing with outside institutes.
Working mechanism of each facility	The research equipment within the University are handled by trained research staff and faculty. Research staff are taken on contract basis and trained to handle high-end equipments. The technicians with instrumentation knowledge are trained by experts. Vendors also provide training to the research staff to handle the equipment. Sometimes the University sends staff outside for training on specific equipment. The employees of the organization are enrolled in the Employees State Insurance Scheme which provide a

	safety cover in case of any eventuality.
Maintenance	The committee has decided to keep an amount for maintenance from the current year. This earmarked amount can be used for AMC or other maintenance works for high-end equipments in the University.
Sharing	Sharing of equipments is prevalent within the University. All the research labs within the University premises share equipments among them. This helps to reduce duplication of high cost equipments within the campus. For internal sharing PI has to submit indent to the competent authority to use particular research equipment. The sharing among the labs is on cost basis. However, the University doesn't allow sharing their equipment with outside institutes. Ownership of the equipment becomes an issue while sharing with outside institutes. While the university cannot allow untrained operators to operate high-end equipments, the dedicated manpower to handle the equipments are busy and engaged with their own projects. Under the surveillance of skilled technician the outsider can use the equipment. But, the University doesn't have that much manpower dedicated for high-end equipments. However, they do sample testing and analysis for outsiders. This is done by the scientists and staff dedicated for the job. Since every state has its agricultural university and some have more than 1, so sharing in this sector may not really be required at a national level.
Disposal	A write-off committee decides to identify the equipment which are inadequate to deal with. After write off, the equipment is generally sold as scrap. There is no concrete disposal policy for the University. Most of the equipment are used extensively through their lifetime, so there is no scope of gifting the equipment to smaller institutes, as it would not be useful for them either. Buy back is another option for disposal of equipments.
Issues and Recommendations	• Lack of a component for maintenance in the fund provided by funding agencies creates problem to go for AMC. • The vendors are very much reluctant to continue AMC for old equipments. Due to rapid technological advancement, after few years of purchase, the vendors force the buyer to purchase newer versions of the equipment, while offering to buy back the older equipment at a minimum price. This creates a serious issue with research. If the technology of equipment changes in between the research, it takes time to get accustomed with new technology. Eventually this hampers the research work. • Most of the equipments are imported from Germany. Frequently, the University faces problems with maintenance from overseas companies. The overseas companies tie up with local companies who have experience in maintenance of specialized equipments. During the AMC period, if the tie up breaks down, the user faces the problem with AMC. According to the University, 3rd party maintenance is a big issue for research equipments. 3rd party maintenance doesn't offer quick response to the breakdown of equipment and subsequently increases down time of the equipment. • The University faces serious issues with customs clearance. Any small change in specification delays the whole process of clearance and hampers the research. • Funding agency doesn't allow quoting the name of the preferred manufacturer of the equipments. University can only mention the specifications while quoting. This sometimes leads to procurement of products that are less than ideal. • Insurance of high-end equipment is another issue faced by the University. Very small

numbers of insurers available in the Indian market, to provide insurance for research equipments.

- The audit procedures need to be upgraded alongside the domain can help reduce the burden and time in procurement as the auditors would be able to understand synonymous requests as well as understand that sometimes a small fee can reduce the delay in delivery of the equipment before obsolescence and completion of projects. Also, at times more time and effort is spent in small audit objections which can be written off.
- Presently scientists are required to take care of the whole procurement procedure. This hampers research work. The University suggested creating a procurement agency to purchase equipments from Government sanctioned fund. This agency would take care of all the procurement related activities helping the PIs to focus on their research work.
- Most of the labs should be aligned with existing approved quality management systems. When funding agencies enforce these certifications, the processes will get streamlined. This will foster quality research and standardized output from the research work.
- A centralised training monitoring system is required to get best output from the training programs for equipments. This system will scout new technologies coming into the market and monitor the training needs accordingly. Along with this, the system can further facilitate new training programs to the skilled personnel to create a pool of resources where the personnel would be skilled to handle more than one high-end equipment.
- Decentralised zone based storage and distribution system is the need of the hour. The central government should take onus to build zone based storage of equipments and consumables in collaboration with private organizations. This could be modelled like a grid with dedicated transportation facility to speed up research work.
- Presently different labs (private and government) charge differently for use the same equipment. This creates ambiguity among the users. To facilitate equipment sharing, Government should focus on bringing uniform policy for charging to use the equipment.
- Public-Private discrimination shouldn't be there while sharing the equipments. The private organizations should also take onus in sharing. NABL should bring all the public and private laboratories under one umbrella to foster research. Any lab having equipment worth (say) Rs. 10 Cr, whether public or private should be accredited in national level. The accreditation would compel the labs to maintain standard procedures. A transparent accreditation process can foster the nationwide research.
- PPP model for procurement and sharing of equipments is very effective. Government should collaborate with Private organizations while focusing on equipment sharing.
- A research lab can't commercialize a product or process. It has to sell the product or process to the companies to commercialize into market. The Government should create liaison between research institutes and companies to fast pace the commercialization process.
- Regular approved training schedules for all the staff to ensure updating their skill sets while they are monitored.

- When services are on charge per visit, it is possible that vendors may provide better service.
- Cut throat technologies are being used in instruments. So training alone will not help in developing the skills. By becoming an entrepreneur and with practice of using the skill can the people become experts in handling of this equipment.

Name of the Institute: Sami Labs Ltd	
Location: Bangalore	**Year of establishment: 1988**
Contact Person(s):	Mr. V G Nair, Director & Chief Executive Officer
Nature of Institute	Private company
Domain	Natural product industry producing nutraceuticals, cosmeceuticals, standardized herbal extracts, speciality chemicals etc
Nature and sources of funding	Own fund and partially government. 30-40% of their equipment is sponsored by Government through DSIR. In such cases, Sami Labs is expected to pay royalty to NRDC.
Procurement	The responsibility of entire procurement process is shared between Procurement & Environment department and User department. User department consists of Scientists and researchers of different ongoing projects. The procurement process of Sami Labs is as follows: • User department generates the requirement of equipment. • Once it is decided to procure any equipment, the user department prepares the specifications list of the equipment • The user department contacts the suppliers of the equipment and collects quotations from different suppliers. • The shortlisted suppliers (best 3 or 5 quotations) are asked to give the presentation on their product • The user department passes the quotations to Procurement department with their comments • Procurement department negotiates and finalizes the price with the selected supplier and raises an invoice. • All the commercial aspects like taxation, accounting etc are taken care by Procurement department • For the herbal consumables, User department collects sample from suppliers and analyzes the sample to confirm their quality before passing it to Procurement department.

Working mechanism of each facility	• Sami Labs provides in house training facilities to their employees. Sometimes it is provided by suppliers. In case of high value and hi-tech equipment, suppliers conduct training programmes before handing over the equipment to the company. After undergoing rigorous training, the local operators take over the charge to operate any equipment. For private companies like Sami Labs, training is very important as there is always a need for hiring trained personnel for operating high-tech equipments. • Sami Labs is the owner of all the equipment and IP filed by them. 30-40% of their equipment is sponsored by Government through DSIR. In such cases Sami Labs has to pay royalty to NRDC. All these issues are taken care by IPR department of Sami Labs. • Quality assurance is invoked through monitoring of equipment and process. Being an ISO certified company, Sami Labs has to accurately maintain the monitoring system of the equipment and consumables. Documentations and logs are maintained for each and every process.
Maintenance	All the equipments are maintained by Sami Labs through AMC (Annual Maintenance Contract) agreements with the suppliers of the equipments. The equipments are thoroughly examined and necessary maintenance is done by the AMC Company in a periodic manner. The period of maintenance is typically 3 months or 6 months, depending on the criticality of the equipment. Sami Labs encourages preventive maintenance rather than calling AMC team during a breakdown. Other than this, the User department of Sami Labs maintains the usage log of the equipment. The down time of any equipment is strictly maintained as 24 to 48 hours.
Disposal	• Sami Labs maintains industry standards in disposing off their equipment but they have very little experience as they have hardly disposed any equipment. • In some cases, they have gifted their equipment to educational institutes, for example a piece of equipment was gifted to a college affiliated to University of Mysore. • In the case of disposing hazardous waste and chemical residuals, Sami Labs follows government guidelines as directed by PCB (Pollution Control Board).
Recommendations	• Private companies like Sami Labs have little chance to share their own equipment as their equipment is fully utilized by them. Sami Labs strongly recommends for sharing of equipments, as small companies have a limited capacity to buy high end expensive equipment that is much needed for analytical tests and several other purposes. Availability of equipment must not be a barrier to R&D activities. • The shared equipment must be visible to all and a strong database should be

maintained indicating the availability of the shared equipment.

- In different organizations in Bangalore, the facility of sharing is available and private organizations can access the high end equipments for their R&D purpose. But several times the next available date to access the equipment is 3 months or 6 months after approaching to the organization. Private companies can't wait for that long as they have to finish their job by a stipulated time frame. This scenario can be avoided by developing a centralised database of equipment and invoking a strong MIS (Management Information System) system.
- In most of the cases the company has to hire experienced people which costs higher otherwise hires fresh graduate and train them which again incurs huge cost. If there is a National Skill Directory where skilled personnel trained by agencies of Government of India are registered, it will be a great help for the private organizations.

Name of the Institute: Savitribai Phule Pune University- Central Instrument Facility (CIF)	
Location: Pune	**Year of establishment: 1948**
Contact Person(s):	Dr. V B Gaikwad Director, BCUD
Nature of Institute	NAAC 'A' Accredited University with 46 Departments
Domain	Education and Research
Nature and Source for equipment funding	Total cost of the equipment in Pune University worth around 12-15 Cr. Out of this, 85% was bought by own fund whereas rest 15% was purchased through various government grants.
Procurement	• The Central Instrument Facility follows a two-bid system for procurement. • When a procurement request is raised by any scientist, the committee headed by the director decides its viability, usability and budget. • Next, they call for tenders where both technical specification as well as costing is analyzed. Usually L1 is accepted. • However the procurement process involves lot of hierarchy, as a result average procurement lead time is almost 1 year. Most of the equipments have been purchased within last three years.
Central instrumentation facility	The Central Instrument Facility (CIF) was established with their own fund. The CIF is nationally recognized and anybody can use the instruments with nominal charges. Separate rates are charged for research labs and private companies. Private companies are charged more for sample testing. The organization is the owner of all the equipments in CIF. The CIF procures consumables on demand basis. Internally 10 people have been trained to use equipments in CIF. The University also organizes various workshops to train students, teachers, scientists of other organizations. Roughly 150 people have been trained so far. The trainings are mostly in-house. However in some cases collaboration is established with other research organization. Sometimes external experts are also hired to provide training. Laboratories at all levels maintain a stock of spares, consumables and testing equipments. Stock levels for spares are reviewed in every three months. CIF committee and in-charge of the instruments determine resupply. Stock balances are monitored regularly. Damaged and expired products are also separated and removed from stock records. Apart from storage of day-to-day consumable and testing equipments, the university doesn't store any other sample. Usually, outsiders book a time slot, carry their own sample and test it using laboratory equipments. Most of the equipments of CIF are now within the warranty period. Therefore, question of maintenance has not arised yet. After the warranty period the university is planning to go for AMC. However for day-to-day maintenance and operation of

	equipments, five students of the university have been appointed by the CIF committee on 5 year contract as technicians. They are responsible for day-to-day maintenance, operation and keeping logs of maintenance.
Working mechanism of each facility	Any IP emerging from the research, belongs to the University.
Maintenance	Almost 100% equipments are functional at present. CIF committee is responsible for all equipment related activities like procurement, maintenance, disposal, legal compliances, financing and costing, quality assurance, inventory and sharing of equipments.
Sharing	The University has been always open to sharing of equipment. Anyone can apply to use CIF equipments on first come first serve basis. The committee comprises of seven members who are mostly scientists and heads of different scientific departments. A dedicated team/department of Board of College and University Development (**BCUD**) handles all IP related activities. Charges are lower than other similar facilities. Because of this low charge often a long queue is observed. Testing charges are higher for the corporate. Time slots are allotted on first come first serve basis.
Disposal	As all the equipments are within warranty period, disposal is not applicable at this moment
Recommendations	• If National Equipment Policy has to be implemented properly, is should be streamlined and structured efficiently. • Zone specific central facility has to be created where dedicated team should be appointed for smooth running of the facility. • Pune University is very much interested to take part and lead in this endeavour of national interest. • A uniform equipment policy throughout the country might not work for various reasons. However, zone-wise clustering may increase greater collaboration due to familiarity of work culture and mutual understanding among the institutions of a particular zone. As for example, in Pune, some prominent research labs and universities are present which are carrying out commendable research. It is easier to establish collaboration among these organizations rather than trying it at a national level. • High end equipments are indispensable for biological research, availability of skilled technicians is also important for smooth running of these equipments. Policy should be designed in such a way which will allow sharing of equipments as well as sharing of skilled technicians. Therefore there is a provision to link this policy with national skill registry. A pool of technicians should be created under National Skill Registry who will have the ultimate expertise to handle such sophisticated equipments. This skilled manpower can be shared among the institutes along with the equipments.

Name of the institute: Structural Engineering Research Centre(SERC)	
Location: Chennai	**Year of establishment: 1965**
Contact Person(s):	Dr. G. Raghava, Chief Scientist & Head, Fatigue & Fracture Engineering
Nature of Institute	CSIR
Nature of work	Structural Engineering
Domain	Focus of research & development programmes in the following broad thrust areas: • Structural Concrete Engineering & Technology • Sustainable Materials and Composites & retrofitting/Rehabilitation of Structures • Computational Structural Mechanics for Analysis and Design, Modelling Simulation & Software Development • Transmission line towers, Metal Structure Behaviour and Fatigue and Fracture • Structural Health Monitoring and Evaluation & Forensic Analysis • Wind Engineering and Earthquake Engineering
Nature and sources of funding	Government of India, Central budget of CSIR, Project grant
Procurement	• Strictly follows CSIR Procurement Manual 2008. • Any equipment, costing more than 10 Lakhs, is processed through e-publishing of tender and orders. E-tendering facility is available to invoke transparency in the tendering and bidding process. • The procurement process of SERC is governed by Purchase Committee and Technical Purchase Committee. Purchase Committee is authorized to procure equipment upto 25 Lakhs. Beyond 25 Lakhs, the Technical Purchase Committee comes into the picture. • The requirement is generated by the user group i.e. the researcher/ inventor. Once the proposal of buying new equipment is granted by the appropriate authority, the required specification for the equipment is finalized by the user group. The "Technical Committee" reviews the technical specifications. • Most of the high-tech equipment is purchased through two-bid system. In two-bid system, technical bid and commercial bid are made separately. The commercial bid is only opened if the technical bid is accepted. The lowest bidder

	(L1) is offered the tender. • "Purchase Committee"/ Technical Purchase Committee" comes into picture to finalize the deal in terms of commercial negotiation with L1. The Purchase Committee negotiates for discount, finalizes the terms and conditions and ensures a smooth procurement and installation of the equipment. • CSIR organizations involve external experts in the procurement and bidding process to invoke transparency.
Maintenance	• Maintenance of the equipment facility is through AMC (Annual Maintenance Contract) and dedicated maintenance workforce. • The equipments at SERC are mainly operator driven. These operators are skilled and trained personnel who possess a good knowledge and understanding about the equipment. • High value and advanced technology equipments are sensitive in nature. Critical equipments are maintained through AMC from the OEM (Original Equipment Manufacturer) or authorized supplier. AMC is allotted depending on the criticality of the equipment and availability of fund. • SERC hires a dedicated work force for the maintenance of the equipment. SERC appoints two different groups of engineers for operating and maintaining the facility. Most of the hired people are engineers of varying subject specialization like instrumentation, electronics, electrical, mechanical, civil etc. One set of people having ITI training or diploma in engineering is hired and another set of people are graduate engineers or post graduate degree holders. Fresh candidates are scrupulously trained to handle the high-tech equipments.
Sharing	• SERC has a central facility to share equipment with other research laboratories, academic institutes and industry. The Business Knowledge Management & Development (BKMD) division of SERC oversees the sharing. BKMD is involved in R&D planning, performance monitoring & management and facilitates the project team / leaders in estimating project cost in terms of manpower, material, capital and other items. Apart from these activities, BKMD facilitates the marketing and publicity of sharing facility to attract customers and manage the booking of the equipment. • Eboss, the online booking facility of shared equipments was launched by SERC in August, 2016. This helps to improve the visibility of their sharing facility. All the shared equipments can be booked online.

	• Any organization, government or private, can approach SERC to use their shared service. The service is open to all and the cost of sharing is determined by the Business, Knowledge Management & Development (BKMD) division. The equipments are operated by the dedicated operators and scientists. External users are not allowed to access the equipments physically; rather they submit their sample and collect the test result.
Disposal	• Often disposed through the OEM (Original Equipment Manufacturer) by using the buy-back policy of the manufacturer. • Dispose as scrap by write off committee through public auction. • Gift only that equipment which are in running condition (mainly PCs) to schools or other academic/ research organizations. Capital or high-value equipment are generally not gifted to other organizations. • Strictly follows the guidelines and regulations of PCB to dispose environment hazard equipment • Follows CSIR Disposal Guideline.
Training	• Organizes specialized courses on structural engineering for the benefit of practicing engineers to familiarize them with the latest developments in analysis, design and construction.
Issues and Recommendations	CSIR has a clear disposal policy and a provision to gift equipment to other research laboratories or institutes. But in practice, several hurdles make it difficult to execute. Most of the laboratories gift low end equipment like computers to schools. But in the case of high end equipment it is very rare. Some of the issues related to this are listed below • SERC uses the high-end equipment till the end of its life. After that only the scrap value remains. CSIR has a clear policy that it only gifts any equipment in running condition. A provision can be amended in the disposal policy so that interested institutes or researchers can take the exhausted equipment for reverse engineering or training purpose. Government should encourage under-graduate and post-graduate level college and universities department to take up reverse engineering research • In most of the case, the colleges and university departments are not efficient enough to maintain or run high-end equipment. There is lack of knowledge and expertise to keep such high-tech equipments. In such cases, the donor has to install it, provide training to local mass about the equipment, station one expert at least for couple of months, track the equipment regularly, and ensure that the

institute is taking care of safety and security issues. These have to be done as the equipment belongs to laboratory itself. Most of the laboratories are short of man power and so none of the laboratories are willing to take these responsibilities.

- Another problem is the bureaucratic nature of the government funded organizations. Hi-tech equipments are very expensive in nature and they possess good scrap value also. In such condition, every move in gifting any equipment to any other institute always comes under scanner. The authorized person or committee is questioned about the procedure they follow. There is no stringent procedural guideline for gifting any equipment. For these reasons, the laboratories are not taking initiative or responsibility to gift it to other institutes, else feel comfortable to dispose high-end equipment through buy back scheme of the OEM or public auction.

Name of the Institute: Symbiosis International University	
Location: Pune	**Year of establishment: 2002**
Contact Person(s):	Dr. M.S. Shejul, Registrar
Nature of Institute	private co-educational, multi-institutional university
Domain	Law, Management, Computer Studies, Health & Bio-medical Sciences, Media, Communication & Design, Humanities & Social Sciences and Engineering
Nature and Source for equipment funding	Total cost of the equipments in these laboratories is Rs. 1-1.5 crores. All the equipments purchased through institution's own fund. The institute does not enjoy any other external financial support to purchase equipments.
Procurement	• The departments follow standard central purchase policy for procurement of equipments. The instrument policy covers guidelines for procurement, disposal, legal compliances, financing & costing, health & safety etc. The departments follow standard purchase policy. • A purchase committee is responsible for entire procurement related activities • As and when equipment is required in a department, requisition is sent to the purchase committee for their recommendation. • The committee considers several aspects like cost, usefulness of the equipment before granting any purchase request
Working mechanism of each facility	Only two departments and their sub-departments use equipments. • Engineering Department • Biomedical Department ○ Biotechnology ○ Stem Cell Research Scientific equipments are extensively used by these departments. A Research & Publication Department located in the university handles all IPR related issues.
Maintenance	Departments, using the equipment, are responsible to take care of all the instrument related activities. Both general purpose & hi-tech equipment maintenance are taken care of through third party AMC.
Sharing	All the equipment is shared within the organization on a request basis. Faculty and students of the institutes are the primary users of these equipments.
Disposal	
Recommendations	• Institute/organization should be categorized in three distinct categories. 1. Defence related Org.: These types of organizations deal with research, which have higher degree of confidentiality. So strategic sectors like defense related research organizations should have separate equipment policy. 2. Research labs: A consortium of research labs should be created and a uniform equipment sharing policy should be established. 3. Zone/cluster wise consortium: It can be created involving the academic institutions of the region.

- Along with an equipment sharing policy, a National Library Policy should also be created to foster knowledge sharing in the country.

Name of the Institute: The Energy Research Institute (TERI)	
Location: Delhi	**Year of establishment: 1974**
Contact Person(s):	Dr. P K Bhattacharya, Fellow, Knowledge Management Division
Nature of Institute	Non profit research organization
Nature of work	Leading think tank dedicated to conducting research for sustainable development of India and the Global South
Domain	• Clean energy • Water management • Pollution management • Sustainable agriculture • Climate resilience
Nature and sources of funding	Mostly own funds, partly government funds
Procurement	• TERI has its own procurement policy which is derived from GFR regulations and best practices of the prevalent procurement models of industry. • Procuring high-end equipment is the joint responsibility of "User group" and "Purchase Committee". • The process is initiated by User group by raising the requirement of equipment. • Approval of requirement is evaluated on the basis of: i) sources of fund (can be internal or funded by external agency) and ii) criticality of the requirement. • Once requirement is approved, User group starts listing the specification of the equipment. Once specification is finalized by the user, "Purchase Committee" collects quotations from the vendors. • In most of the cases, at least three quotations are mandatory to start the bidding process. • TERI adopts two phase bidding process for procuring high end equipment and vendor has to conform the quality specification. TERI is not inclined to accept the lowest bid; rather they focus on procuring a good quality product. • TERI does not compromise with the quality and specification of equipment. In some government agencies' funded project, the grant amount is not enough to procure latest model of the required equipment. In such a scenario, TERI puts its own fund to acquire the latest high end model and ensures due maintenance.
Maintenance	• TERI enforces maintenance through AMC of the equipment. The priority is involving OEM (original equipment manufacturer) for the maintenance of the equipment. If that is not available, AMC is done through authorized maintenance team or dealer of the OEM. • In most of the government funded and sponsored project, maintenance cost is not included in the grant. The organization has to bear the maintenance cost of the equipment. TERI allocates dedicated fund for maintenance of the equipment in their annual budget to ensure proper and timely maintenance. • All the usage and maintenance activity is recorded in logbook. TERI carries out rigorous and transparent paper work for NABL accreditation. • The equipment of TERI is researcher driven. The researcher wanting to access

	any equipment is accompanied by the user researcher of that equipment. A short and proper training and guidance is provided on the use of equipment to ensure healthy and sage use of the equipment.
Sharing	• TERI has collaborations with several academic institute and R&D laboratories. The scientific facility created by TERI is shared and accessed by their collaborators. • The research facility in TERI is open to all the academic institutes and research laboratories that have collaboration with TERI. TERI does not collaborate with industry for sharing their equipment. TERI promotes inter-institute collaborative research and accessing their sharing facility is completely free for other collaborative partners. The sharing model is based on achieving research heights by means of sharing knowledge and facility among the partners. According to TERI, they collaborate with research organizations and academic institutes to complement each other in the field of research. • There is no dedicated marketing team of TERI. TERI facilitates technology transfer through the joint ventures with collaborative partners (institutes, research laboratories and companies).
Disposal	• Majority of the equipment is in running condition and used by TERI. Proper maintenance of equipments leads to higher life of the R&D equipment. The equipments are disposed through a write-off committee that consists of internal experts and finance personnel. • Most of the scrap is sold through public auction. • Strictly follow the guidelines and regulations of PCB to dispose environmentally hazardous equipment
Training:	TERI arranges several training programs and workshops to facilitate research on sustainable development of environment and energy. The events are generally 2 days to 3 weeks long. The topics of some of the recent/ upcoming training events and workshops are mentioned below: ○ Integrated approach towards sustainable development ○ Natural Resource Security: Governance, Challenges and Opportunities ○ Renewable Energy and Energy Efficiency ○ Energy and Water-use efficiency ○ Capacity Building Program on 'Carbon Footprint Assessment and Management' ○ Applications of Biotechnology and its Regulation ○ Trade and Sustainable Development: Issues for Developing countries ○ Training Workshop on Understanding and Resolving Water Conflicts in India ○ Climate Change and Sustainability ○ Energy Access and Human Development
Issues and Recommendations	• The research laboratories having high end facilities and equipments in India are government funded or undertaken. The objective of research organizations is more academic and these organizations must dedicate their full efforts to filing of patents. Self-financed sustainable model for the research organizations should be developed and adopted to run these organizations in a more commercially

viable manner.

- Target driven and award based system should be introduced to ensure that the Principal Investigator will be awarded for successful completion of project in due time, generation of intellectual property, designing research application that can be transferred to market, sharing of equipment with other project/ research activity to fully utilize the efficiency of the equipment, proper maintenance of equipment and several other parameters.
- In existing established central facilities, a more commercial approach is needed. Accountability of the in-charge and operators are the primary constraints in central facilities. A training module should be designed to train facility managers of central facilities to develop management skills to make the facility more commercially viable.
- Training course and workshops should be arranged for the scientists to disseminate knowledge about the advantage and scope of sharing facility in India. Regular workshop on sharing is needed to break the psychological barriers of the scientists and researchers.
- Poor maintenance of facilities is one of the biggest issues in India leading to shorter life span of high value equipment. Shorter life span of high value equipment and under utilization of equipment account huge financial loss. Government should fund the maintenance cost of the equipment and conduct strict internal audit (utilization of equipment, sharing of equipment, maintenance of consumables, maintenance of log book etc.).

Name of the Institute: University of Hyderabad – Central Instrument Laboratory (UoH-CIL)	
Location: Hyderabad	**Year of establishment: 1974**
Contact Person(s):	Dr. S M Ahmed, Principal Scientific Officer, Head CIL
Nature of Institute	Central University
Domain	Scanning Electron Microscopy, Confocal Microscope, Spectroscopy (X-Rays, UV-VIS-IR), Spin Resonance studies, Vibrating Magnetometer
Nature and sources of funding	University of Hyderabad receives grant from University Grant Commission (UGC)
Procurement	• Competitive bidding is the standard procurement procedure for research equipments • High-end equipments are purchased through open tendering. • For the equipment worth more than Rs. 5 Lac the indenter takes a call to shortlist the vendors according to the specifications. • After selection he/she prepares a compliance sheet about the criteria met by the vendors. • The technical committee approves the compliance sheet. • A techno-commercial bid meeting is arranged with the selected vendors. • The lowest bidder gets selected in techno-commercial bid meeting. • Period of warranty and extended warranty are decided during the process of procurement. • For the equipments worth less than Rs. 5 Lac price gets priority over brand. Indenter chooses L1 for procurement.
Maintenance	• CIL maintains its sophisticated research equipments through Annual Maintenance Contract (AMC). • The companies provide warranty for on an average of 2 years. After completion of warranty period, the PI opts for AMC. • The AMC goes for another 6-7 years. • Most of the vendors have policy not to provide support through AMC after 10 years of purchase. • Instead of AMC the vendor insists for up-gradation of the equipment with latest technology. • The operators of CIL are trained enough to repair small breakdowns of the equipments. •
Sharing	• Central Instrument laboratory (CIL) is designed to share equipments among different departments within the university. • The university also has a policy for sharing of equipments with outsiders. • Academic institutes get highest priority on the list of sharing. • Government laboratories come at second and private organizations come at the end of priority list. • For academic institutions CIL charges a minimum rate. • For Government research laboratories the rate is 30% higher than the academic institutions.

	• For private research organizations the rate becomes two times higher than the government research laboratories. • The fund generated through sharing goes to the corpus fund of the university.
Disposal	University of Hyderabad has a department called Estate Section to take care of all disposals related activities. This section disposes off junk materials to high-end equipments. The standard procedure is to write off the equipment from CIL and send to Estate Section. After that, the section sells the materials as scrap or calls for public auction. For general equipments like computers, CIL donates these to different schools. Gifting is not much for research equipments though the equipments are gifted to different departments within the university.
Training	CIL has dedicated pool of trained operators to run the research equipments. Training for the operators takes place in-house only. The PhD students with four years of research experience can carry out their own research after working hours. These researchers get training from the operators.
Recommendations	• Bank guarantee principle for procuring high-end equipments should be mandatory for all the research laboratories and universities. • Technical committee should have the power to choose L2 over L1 depending upon the after sales service experiences. • Universities and research laboratories have hands on experience and samples to run the skill development programs. University of Hyderabad suggests that Government could come out with a 1 year certification course under IITs & central universities where freshers with instrumentation background can have the scope to avail this.

Appendix 5: List of the institutes visited under the study

Name of the Institution	Category	Place
Indian Institute of Technology Bombay	IIT	Mumbai
National Institute for Research in Reproductive Health (NIRRH)	ICMR	Mumbai
Advanced Centre for Treatment, Research & Education in Cancer (ACTREC)	DAE	Mumbai
Dr. D. Y. Patil University	NAAC 'A' accredited University	Pune
Savitribai Pule Pune University	State University	Pune
SNDT Women's University	State University	Mumbai
Fergusson College	NAAC 'A' accredited college (DST funded equipments)	Pune
Indian Institute of Science Education & Research (IISER)	Central University	Pune
Centre for Development of Advanced Computing (C-DAC)	Research Institute	Pune
Symbiosis University	NAAC 'A' accredited University	Pune
Institute of Genomics & Integrative Biology (IGIB)	CSIR	Delhi
The Energy & Resources Institute (TERI)	Research Institute	Delhi
Inter-University Accelerator Centre (IUAC)	Research Institute	Delhi
IIT Delhi	IIT	Delhi
Indian Agricultural Research Institute (IARI)	ICAR	Delhi
Institute of Nuclear Medicine & Allied Sciences (INMAS)	DRDO	Delhi
National Physics Laboratory (NPL)	CSIR	Delhi
CSIR Fourth Paradigm Institute	CSIR	Bangalore
Sami Labs Limited	Research Institute	Bangalore
National Aerospace Laboratories (NAL)	CSIR	Bangalore
Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)	Research Institute	Bangalore
Indian Institute of Science (IISc)	Central University	Bangalore
Central Manufacturing Technology Institute (CMTI)	Research Institute	Bangalore
Bharat Electronics Limited (BEL)	PSU, industry	Bangalore
ISRO Satellite Centre (ISAC)	ISRO	Bangalore
Madras Diabetic Research Foundation (MDRF)	Affiliated to University of Madras	Chennai
Structural Engineering Research Centre (SERC)	CSIR	Chennai
Indian Institute of Technology Madras	IIT	Chennai

Indian Institute of Chemical Technology (IICT)	CSIR	Hyderabad
Research Centre Imarat (RCI)	DRDO	Hyderabad
Centre for Cellular & Molecular Biology (CCMB)	CSIR	Hyderabad
PJT State Agriculture University	State University	Hyderabad
Centre for DNA Fingerprinting & Diagnostics (CDFD)	DBT	Hyderabad
National Institute of Nutrition (NIN)	ICMR	Hyderabad
Indian Institute of Chemical Biology(IICB)	CSIR	Kolkata
CGCRI	CSIR	Kolkata
Jadavpur University	State University	Kolkata
University of Calcutta	State University	Kolkata
IIT Kharagpur	IIT	Kharagpur
University of Hyderabad	Central University	Hyderabad

Appendix 6: Questionnaire for National Equipment Policy

A. General Information					
1. General information about the organization					
1.1	Name of the Organization				
1.2	Type of the organization	CSIR_	DRDO_	Academic Institute_	Others(specify)_
1.3	Area of focus				
1.4	Contact Person				
1.5	Designation				
1.6	Department				
1.7	Contact Number				
1.8	Address of the organization				

B. Equipment Policy			
1	Total cost of equipments in the laboratory (in Rs.)		
1.1	What are the sources of existing funding for laboratory services, including infrastructure, supplies and equipment? Indicate the percentage of funding contributed by each source:		
	1.1.1. Government?	_____ % of total funding	
	1.1.2. User's fees/cost recovery?	_____ % of total funding	
	1.1.3. Donors (list by donor)? Donor 1:_____ Donor 2:_____ Donor 3:_____	_____% of total funding _____% of total funding _____% of total funding	
	1.1.4. Other? (*specify*):_____	_____% of total funding	
2	Performance of equipments (specify whether the equipments are functional/ non-functional as on day)	Functional (in %) _	Non- Functional (in %) _ Idle _ Scrap _
2.1	If not functional please indicate the reason (pick the right choice)		
	a) Equipment not available for use due to non-availability of spare parts b) Equipment outdated and in need of replacement c) Consequent to the project completion, equipment not operated due to lack of qualified man power d) Others (please specify):		
3	Is there unit responsible for all equipment related activities?	Yes _	No _
4	Composition of the unit		
4.1	No. of staffs		
4.2	No. of departments engaged		
4.3	Designation of the supervisor of the unit		
5	Is there any policy document for laboratory services:	Yes _	No _

5.1	If yes, what are the areas covered under the policy document			
5.1.1	Procurement	Yes _	No _	NA _
5.1.2	Maintenance	Yes _	No _	NA _
5.1.3	Disposal	Yes _	No _	NA _
5.1.4	Legal compliances	Yes _	No _	NA _
5.1.5	Financing & Costing	Yes _	No _	NA _
5.1.6	Health & Safety	Yes _	No _	NA _
5.1.7	Training	Yes _	No _	NA _
5.1.8	Quality Assurance	Yes _	No _	NA _
5.1.9	Inventory	Yes _	No _	NA _
5.1.10	Storage & Distribution	Yes _	No _	NA _
5.1.11	Logistic and Transport	Yes _	No _	NA _
5.1.12	Sharing of equipment	Yes _	No _	NA _

C. Procurement			
1	Is there any available guideline for procuring consumables?	Yes_	No_
2	Is there any available guideline for procuring equipments?	Yes_	No_
3	Use of online procurement system	Yes_	No_
4	Is there any dedicated unit responsible for procurement related activities?	Yes_	No_
5	Is there any standard bidding system for procuring R&D equipments?	Yes_	No_
6	Average procurement lead time for programs		
7	Who is responsible for procuring equipments?		
8	Who is responsible for Coordinating procurements across programs?		
9	Who bears the cost of procuring the equipment		
	Comment		

D: Maintenance			
1	Follow standard procedure for maintenance	Yes_	No_
2	Dedicated team for maintenance	Yes_	No_
3	Is it possible to utilize the talent pool of National Skills Registry to recruit people for day to day maintenance operation	Yes_	No_
4	Maintenance checks done at a regular basis: Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
5	24X7 Maintenance support is ensured Strongly agree Agree Neither agree nor disagree Disagree		

	Strongly disagree
6	Logs of maintenance are maintained Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree
7	Comment

E: Disposal				
1	Disposal of equipment handled by			
1.1	Auction of spares	Yes_	No_	NA_
1.2	Gift to academic organizations	Yes_	No_	NA_
1.3	Parts recycled	Yes_	No_	NA_
1.4	Sold as scrap	Yes_	No_	NA_
1.5	If others, please specify:			
2	There are standard safety and health procedures for disposal: Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree			
3	Logs properly maintained for equipment disposal Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree			
4	There are written guidelines for disposal or destruction of damaged and/or expired laboratory products Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree			
5	There are disposal guidelines for obsolete laboratory equipment. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree			
6	Written guidelines for disposal or destruction of damaged and/or expired products are available in this laboratory Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree			

F. Legal Compliances					
1	Who owns the equipment?	Principal Investigator	Project	Department	Organization
2	Who owns the IP?	Funding agency	Organization	Individual	Shared
3	Are there any dedicated team/ department to handle IPR issues?			Yes	No

G: Sharing of Equipments			
1	Whether the equipment is shared presently	Yes_	No_
1.1	If yes please provide the % of shared equipments		
2	If shared, what is the equipment sharing policy		

3	If not shared, what is the reason (pick the right choice) a) Lack of dedicated instrument specific technical person to supervise the operation for external usage b) Apprehension toward the safety of sophisticated/ costly equipments c) Because the equipment is purchased exclusively for internal usage d) The instrument requires consumables for analysis/ sample preparation, hence incurs additional cost e) If any other reason please specify:
4	Please describe the process of cost management including the policy for VAT, GST, Excise Duty, different accounting and auditing techniques etc.

H: Health & Safety				
1	Has the proposed activity been discussed and agreed?		Yes_	No_
2	Have any potential ethical issues and approvals that might be associated with the work or the samples involved been considered and agreed?		Yes_	No_
3	Have the risks associated with the operation of the equipment been considered?	Yes_	No_	NA_
4	Have the equipment control measures and training requirements been agreed?	Yes_	No_	NA_
5	Have the data storage and computer access been agreed?	Yes_	No_	NA_
6	Have the necessary access arrangements been put in place?	Yes_	No_	NA_
7	If any samples are to be brought on site by the visitor, have the risks, control measures, and approval requirements associated with these samples	Yes_	No_	NA_

	been agreed?			
8	Have sample and product storage, return and waste disposal been agreed?	Yes_	No_	NA_

I: Training				
1	No. of people trained			
2	Type of people trained			
3	Is there any specific training policy?		Yes_	No_
4	Equipments are used for training during idle time		Yes_	No
5	Is there any provision for linking training with National Skill Registry		Yes_	No_
6	Training is provided through			
6.1	In-house	Yes_	No_	NA_
6.2	Resource Sharing	Yes_	No_	NA_
6.3	Collaboration	Yes_	No_	NA_
6.4	Through external experts	Yes_	No_	NA_
6.5	Any other mode (please specify)			
7	Comments			

J: Quality Assurance			
1	There are written quality assurance policies and procedures available in this laboratory.	Yes_	No_
2	Does the laboratory undertake the following internal quality control procedures (*check all physically*):		
2.1	Daily record refrigerator temperature charts Yes/No		
2.2	Daily record freezer temperature charts: Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
2.3	Include commercially prepared controls whenever a batch of tests is run Yes/No		
3	The laboratory has guidelines for handling cold chain products that have been exposed to higher temperatures? (For example, by sitting outside for a while or after a relatively long power outage.) Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
4	The laboratory prepares in house controls for quality control testing: Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
5	The laboratory participates in any external quality assurance scheme? Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
6	Comment		

K: Inventory	
1	Laboratories at all levels have a set minimum stock level for spares. Yes/No
2	How often is the stock level for spares and supplies reviewed? Less than 1 month 1-3 months 3-6 months More than 6 months Others
3	Who determines resupply quantities to fill orders? Please specify_____
4	Stock balances at all levels monitored regularly so that procurement decisions and actions can be made on time to avoid stockouts or overstocks. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree
5	Damaged/expired products physically separated from inventory and removed from stock records. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

L: Storage & Distribution			
1	There is a central level store for laboratory supplies and equipment.	Yes_	No_
2	The existing storage capacity is adequate to handle the required quantities of laboratory supplies at the national (or intermediate, if no national) level. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
3	The existing cold storage capacity is adequate to handle the current quantities of cold chain reagents at the national (or intermediate, if no national) level Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
4	There are adequately refrigerated vehicles to distribute cold chain reagents to sites. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
5	The existing storage capacity (including cold chain) is adequate to handle the expanded program goals for the next three years? If no, specify what is inadequate and what is done alternatively. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
6	Established distribution system available for laboratory supplies and equipment for all levels. Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
7	Organization has suitable storage/freezer/container capacity during transit Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree		
8	Comment		

M: Logistics and Transport			
1	All of the laboratory supplies come from the same source	Yes_	No_
2	The distribution of laboratory supplies is integrated across all programs.	Yes_	No_
3	The laboratory have access to a vehicle	Yes_	No_

4	24x7 availability of vehicle	Yes_	No_
5	The laboratory uses the vehicle to pick up supplies.	Yes_	No_
6	Comments on issues faced related to transport in recent past (if any)		

NSTMIS Division

Department of Science & Technology

Ministry of Science & Technology

Technology Bhawan, New Mehrauli Road, New Delhi 110016

Phone: 011-26567373

Website: www.nstmis-dst.org/

About NSTMIS:

The National Science and Technology Management Information System (NSTMIS), a division of Department of Science and Technology (DST) has been entrusted with the task of building the information base on a continuous basis on resources devoted to scientific and technological activities for policy planning in the country.

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Disclaimer:

Every care has been taken to provide the authenticated information. However, the onus of authenticity of data rests with the PI of the project.