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PRIVATE SECTOR INVOLVMENT IN FORESTRY RESEARCH IN INDIA

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ABSTRACT

Forestry Research in India was started with the establishment of the Forest Research Institute, Dehra Dun in 1906. Since mid 70s, several Forest Research Institutes were established both within the public sector and the private sector. The area of research and specialisations have diversified. Some institutions have attracted substantial donor assistance from international sources while some others function as in-house units of forest products companies.

Detailed case studies were carried out in six private sector forestry research organisations. The WIMCO Seedlings, Uttar Pradesh; ITC Bhadrachalam Paper Boards Ltd., Andhra Pradesh; Western India Plywoods Ltd., Kerala; BAIF Development Research Foundation, Maharashtra; Tata Energy Research Institute, Delhi and Indian Plywood Industries Research and Training Institute, Karnataka (in the private sector up to 1990)

The impact of private sector in forestry research in India is not significant in quantitative terms. If quality of output is considered, the contributions of a few are outstanding although that of many is of little significance. The former has not only produced results, but also transferred them to the field, farm or products and demonstrated the feasibility and value of the same. Problems addressed by them are not terminated with R&D. Equal emphasis is given to extension and application. Nevertheless, only a narrow spectrum of forestry research needs are addressed by the private sector.

Among the success factors in private sector organisations, the leadership qualities of the chief functionaries and a mission-oriented dedicated approach have created a culture and climate which drive the organisations to excellence. The absence of a bureaucratic approach enable personnel to take total responsibility and enjoy freedom of action. Among the inadequacies of private sector organisations, the lack of a long term mission, except in in-house units, lack of co-ordination among private sector institutions and dependence on public sector organisations and Universities for basic research is evident.

There should be a networking of institutions doing research in forestry and their interaction should be encouraged. Collaborative research involving Universities, government institutions and private institutions should also be encouraged. A best practice documentation and dissemination scheme may also be set up by FORSPA to link forestry practices in the region and take best advantage of applicable research results generated elsewhere:

INTRODUCTION

1.1 OBJECTIVES

This study on private sector involvement in forestry research in India was undertaken by the Kerala Forest Research Institute for the FAO Forestry Research Support Programme for Asia and the Pacific (FORSPA) with the following specific objectives.

(i) Document successful cases of private sector involvement in forestry research and identify the institutional characteristics which make certain organisations better at responding to the research needs of specific interest groups.

(ii) Assess the factors that have stimulated private sector research and development initiatives including incentives like tax concessions, rules and regulations that safeguard intellectual property rights, etc.

(iii) Identify the linkage between private and public sector research, including the extent of dependence of private sector on basic, strategic and applied research undertaken by the public sector and the measures to strengthen these linkages, and

(iv) Identify measures to strengthen private sector initiatives and to promote more meaningful partnership between governmental and non governmental efforts.

The terms of reference included a case study of four representative institutions to cover background of the institution, structure, resources and activities, important accomplishments, role of research unit in the organisation, factors that have facilitated research, linkage with other research establishments and overall performance of the research establishment/institution. The focus was on research relating to all aspects of conservation and management of trees and forests (natural stands and plantations) and utilization of forest products. Research on plantation and

horticultural crops like rubber, coffee, tea, coconut, pepper, cardamom, etc. were excluded from the purview of this studv.

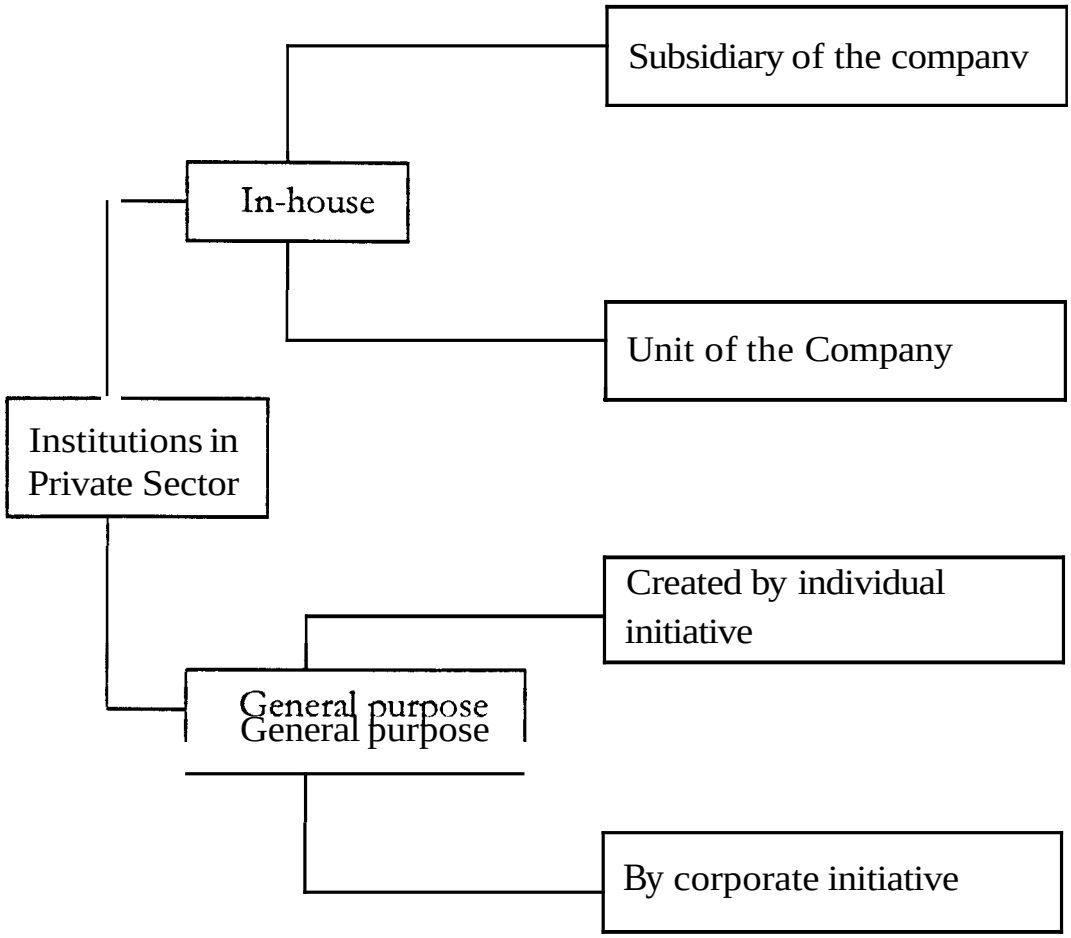
1.2 METHODS OF STUDY

Since private sector involvement in forestry research in India is a recent development, the first task was to prepare a list of institutions engaged in forestry research in India. Names and addresses of institutions known to or said to be connected with forestry research, were gathered from various sources which resulted in a list of 110 organisations. A questionnaire (Appendix 1), consisting of two parts, the first soliciting general information about the organisation and the second, specific information on forestry research carried out, was sent to each of them. It was made clear that response to Part I1 need be sent only if the organisation was in the private sector and engaged in forestry related research. While some of them promptly replied that they did not belong to the target category, *60* organisations responded, fully or partially. Out·of them 15 were found to be either not private organisations or not engaged in forestry research. The remaining 43 organisations (Annexure 2) were subjected to further study.

The information gathered through the questionnaire survey was used to obtain an overview of the involvement of private sector in forestry research in India. In addition, the contribution of the different kinds of organisations in terms of research publications was analysed by a literature search made using the TREE-CD database produced by CAB International. An overview of public sector activities in forestry research was obtained from data gathered from Ministry of Environment and Forests, Department of Science and Technology and other Government sources.

Six institutions were selected for detailed case study based on the following considerations. Private sector forestry research institutions in India fall under two major categories - in-house R & D establishments which largely cater to the specific needs of the sponsoring institutions, and general purpose research organisations which meet social and client needs. They can be further classified in several ways, based on the organisational set up (proprietary, corporate, etc.) or the area of research (plantation forestry, forest products, wildlife, etc.). For this study, the in-house R & D institutions are

classified further into (1) subsidiary companies of the parent company and (2) Units of the parent company. The general purpose organisations are classified further into (1) those established under individual initiative and (2) those established under corporate initiative. This broad classification is shown below schematically.



Although the terms of reference required case study of only four institutions, six institutions, representing the above four types were selected for case studies, in order to cover different areas of research (forestry and forest products), and different regions of India. Wildlife research, often included under forestry research in Indian context, was outside the scope of this study. The selected institutions are listed below showing the type and area of activity. Their geographical distribution is shown in Figure 1.

WIMCO Seedlings Ltd. (WSL)
In-house R & D
Subsidiary company of parent company
Plantation forestry

ITC Bhadrachalam Paper Boards Ltd. (ITCBPL)
In-house R & D
Unit of the company
Plantation forestry

Western India Plywoods Boards Ltd. (WIPL)
In-house R & D
Unit of the company
Forest products

BAIF Development Research Foundation (BAIF)
General purpose
Established by individual initiative.
Multidisciplinary, including forestry.

Tata Energy Research Institute (TERI)
General purpose
Established by corporate initiative.
Multidisciplinary, including forestry.

Indian Plywood Industries Research & Training Institute. (IPIRTI)
General purpose
Special case
Forest products

The last institution, Viz., IPIRTI, represents a special case. It was set up jointly by a large number of plywood industries and the Council of Scientific and Industrial Research (CSIR) of the Government of India. Initially, the expenditure for its running and maintenance was shared by the plywood industries on voluntary basis and the Government. As voluntary contribution from industry gradually declined and ultimately ceased, Government took over its management. IPIRTI was included in order to study the outcome and

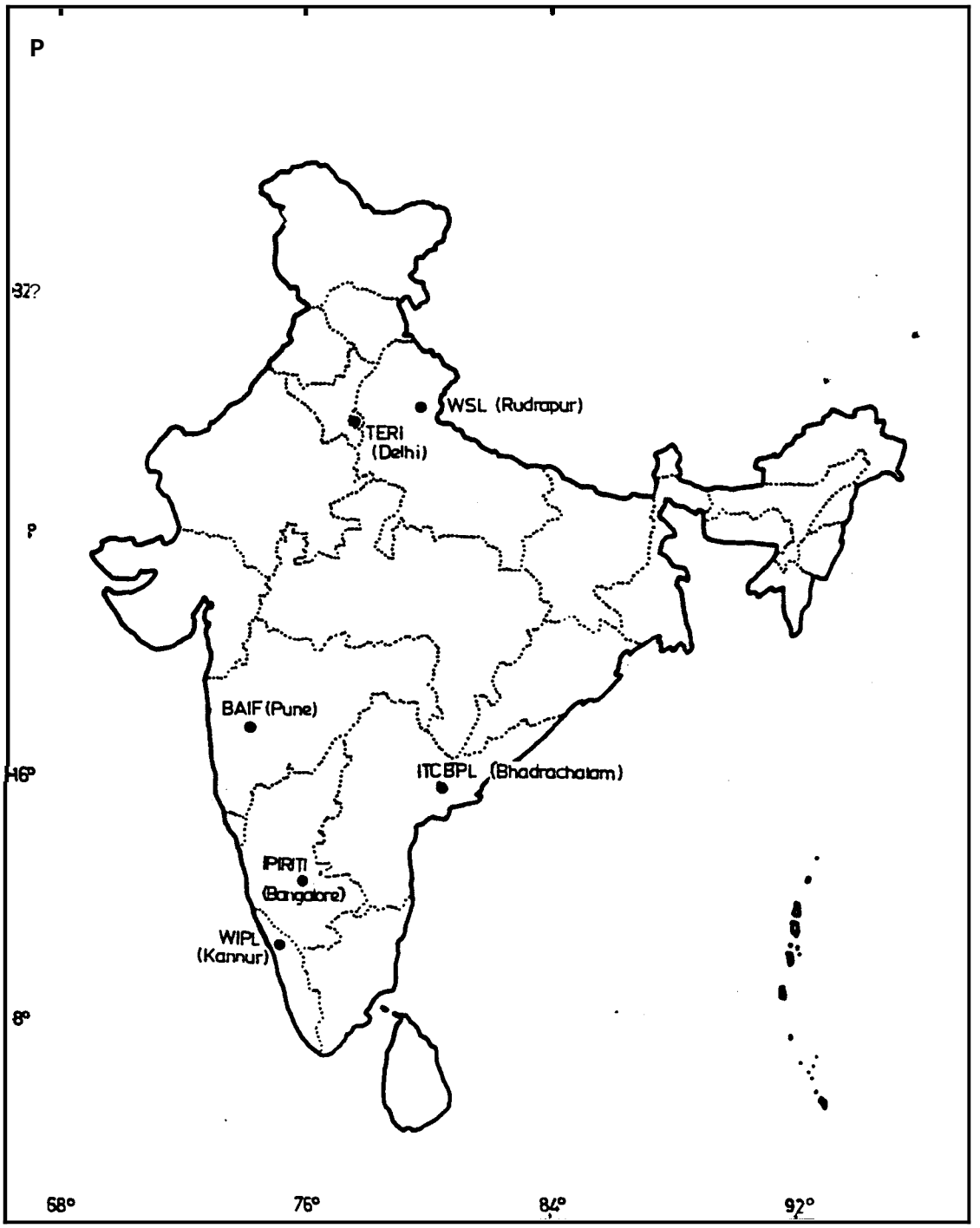


Fig.1 Location of case study units

implications of public and private sector co-operation in research. For each case study, one or more members of the study team visited the institution, held discussions with key personnel and examined the facilities.

1.3 AN OVERVIEW OF FORESTRY RESEARCH IN INDIA

Historical Setting

The development of forestry research in India should be viewed against the following background.

- The forests are almost entirely Government owned, only about 1.23% of the 64 million ha. of forests is under private ownership.

- Till recently, forest was treated as a resource to be managed by Government for timber - for export in the pre-Second World War period and for defence supplies during the war. Even after the war, Government continued to take the responsibility of timber supplies to indigenous wood based industries.

- Forestry has been a State subject till 1976, when, by a Constitution amendment, it was placed in the concurrent list to enable the Central Government also to legislate on forest related matters. Historically, forestry research and education remained the exclusive responsibility of the Central Government.

Because of the above reasons, the involvement of private sector in forestry research could not be anything but marginal. Even the role of State Governments was minimal and confined to site related silvicultural studies.

The Major Players

the present National Forestry Research System, the following major sectors can be distinguished - Government, Universities and Private Sector.

The Government Sector

Forestry research in India, promoted and largely undertaken by the Central Government, has a long history, starting from late nineteenth century. The Imperial Forest Research Institute was established in 1906 and moved to its present magnificent premises in Dehra Dun in 1929. Since Independence, it is known as the Forest Research Institute (FRI), Dehra Dun. Till the early eighties, FRI, Dehra Dun, with its outreach Centres located in Bangalore and Coimbatore, was almost the only organisation engaged in forestry research in India. Apart from this, the Central Arid Zone Research Institute, Jodhpur, under the Indian Council of Agricultural Research was involved with research related to afforestation of arid zones. With increasing realisation of the multidimensional role of forests, the consequences of their degradation and shrinkage, and the key role of research in their management and sustainable development, the Government of India, in 1986, established the Indian Council of Forestry Research and Education (ICFRE) by reorganising the existing FRI Centres. The ICFRE was granted full autonomy in 1991. At present, the Council has under its umbrella, 10 Institutes and 1 Centre as listed below. The year of establishment is shown in parentheses; however, the year of establishment is important only in the case of a few new institutes, as the others were formed by reorganising existing Centres.

i) Forest Research Institute, Dehra Dun (1906)
ii) Institute of Forest Genetics and Tree Breeding, Coimbatore (1988)
iii) Institute of Wood Science and Technology, Bangalore (1938)
iv) Tropical Forest Research Institute, Jabalpur (1973)
v) Institute of Rain and Moist Deciduous Forest Research, Jorhat (1988)
vi) Arid Forest Research Institute, Jodhpur (1988)
vii) Institute of Forest Productivity, Ranchi (1987)
viii) Institute of Social Forestry and Eco-rehabilitation, Allahabad (1992)
ix) Temperate Forest Research Institute, Shimla (1977)
x) Institute for Forestry Research and Human Resource Development, Chindwara (1995)
xi) Advanced Centre for Biotechnology and Mangrove Forests, Hyderabad (1995)

Apart from the institutions under ICFRE, forestry related research is carried in the following organisations established by the Central Government .

- Forest Survey of India, Dehra Dun (1981)
- G.B. Pant Institute of Himalayan Environment & Development, Almora (1987)
- Wildlife Institute of India Dehra Dun (1982)
- Indian Institute of Forest Management, Bhopal (1982)
- Indian Plywood Industries Research and Training Institute, Bangalore (1990) (in the private sector from 1962 to 1990, details in Case Study No.6).
- Salim Ali Centre for Ornithology and Natural History, Coimbatore

In the States, research has largely been confined to location-specific silvicultural studies carried out by the State Forest Departments. The sole exception is Kerala, where a ful-fledged Institute was established by the State Government in 1975 as an autonomous body to undertake research on all important aspects of forestry, forest products and wildlife. At present it functions as an autonomous body under the umbrella of the State Science, Technology and Environment Department and receives grant-in-aid from the State Government. Another State to set up a separate organisation for research - although as a wing of the Forest Department - is Madhya Pradesh. Maharashtra has a separate research set-up called Van Anusandhan. Arunachal Pradesh, West Bengal and Karnataka have initiated steps to establish independent research institutes.

Universities

The recommendations of the National Commission on Agriculture (NCA) in 1987 is a landmark, as far as opening up forestry research to organisations other than Central Government institutions. Based on Government decision on these recommendations, 14 Agricultural and 5 general Universities set up forestry faculties. While many of them are engaged in conducting graduate and post graduate courses in Forestry, a few are involved in research, particularly in Agroforestry.

Private Sector

As neither management of forests nor production of wood raw material was the concern of private sector, its involvement in forestry research, as already stated, has been limited. Two wood-based industries viz., Western India Plywoods Ltd. (see Case Study No.3) and Indian Plywood Manufacturing Company Ltd., set up in-house R & D facilities mainly to develop economical adhesives, as the major components of glue, based on petroleum, were very expensive. An important initiative in this sector was the establishment of Indian Plywood Industries Research Association in 1962, later named as Indian Plywood Industries Research and Training Institute (IPIRTI) jointly by the plywood industries and the Council for Scientific and Industrial Research (CSIR). This was in response to the Co-operative Research Scheme (CRS) enunciated by the Central Government in 1960. IPIRTI was one among 7 institutions established under this scheme which covered different commodities like cement, jute, silk, etc. The involvement of private sector as voluntary co-operating agency in running these institutions, as envisaged in CRS, failed in subsequent years and this experiment has, to a large extent, been given up.

With massive multilateral and bilateral funding of forestry projects, from mid-seventies onwards, particularly in the social forestry sector, in which research components were in-built, a number of organisations in the private sector like Bharathiya Agro Industries Foundation (BAIF), and Tata Energy Research Institute (TERI) (details in Case Studies No.4 and 5) which were already in existence augmented their facilities to undertake forestry research and others like Asian Institute of Rural Development established new facilities. In addition, a large number of NGOs came into being predominantly for action programmes related to environmental protection, including afforestation and protection of natural forests, some of which also undertook forestry related research and transfer of technology. They mostly depend on projects sponsored by Central/State Governments or external donors for their sustenance.

The new Forest Policy in 1988 enunciated by the Government of India explicitly stated that forest-based industries should raise wood raw material required by them, preferably by establishing direct relationship between

them and farmers, and that the practice of supply of wood produce to industry by Government should cease. A few industries in the private sector augmented the rudimentary R & D facilities with them or set up new in-house facilities with emphasis on research related to raising plantations of fast growing species. ITC Bhadrachalam is an example of this initiative (details in Case Study No.2).

Budget and Personnel

In the overall perspective of national development, forestry, and especially forestry research, received little priority as may be seen from the budget outlay (Table 1).

Table 1. Budget Outlay for Forestry Research in the 5-year Plans (Rs. in million)

Plan Period	Total Public Sector outlay	Forestry Sector Outlay	Outlay for forestry research	% outlay for forestry out of total public sector Outlay	% outlay for research out of outlav for forestry sector
1951-56	19,600	76.4	-	0.39	-
56-61	46,000	222.1	-	0.46	-
61-64	85,700	458.5	-	0.53	-
69-74	1,57,700	844.2	-	0.59	-
74-79	4,06,500	2,088.4	-	0.51	-
80-85	9,75,000	6,294.9	41.0	0.71	0.6
85-90	18,00,000	18,591.0	159.0	1.03	0.9
92-97	43,41,000	40,818.7	-	0.94	-

Since 1992, however, forestry research is receiving substantial funding, thanks primarily to a UNDP project (1992-1997) worth US $2.56 million and a World Bank project (1994-1999) worth US $58.48 million, implemented by ICFRE. While the emphasis of these projects is on strengthening the ICFRE institutes, through a research grant fund, project-specific funding is also extended to other organisations, including Universities and private sector organisations.

The annual budget of ICFRE Institutes for 1995-96 was Rs.250 million. In the Ninth Five Year Plan, now under finalisation, an annual outlay of Rs.300 million is envisaged.

The allocation for forestry research in State Government budgets has also followed a similar historical pattern. In some States substantial funding have been made available through externally aided projects for social forestry, but very little support bas been extended for forestry research, *per se.*

With respect to research manpower, the ICFRE institutes have a total of 729 scientists among the 11 Centres, and other Central Government institutions have 196. However, the above statistics are only of indicative value, as classification into scientific, technical and administrative cadres is not clear cut. In the States, the Kerala Forest Research Institute has 48 scientists, and about half a dozen professionals in the Silviculture Wing of the Forest Department. In other States, professionals engaged in forestry research vary from 6 to 20 in each.

In the Universities, forestry research has mainly been supported by grants from the Indian Council for Agricultural Research (ICAR), National Wasteland Development Board (NWDB) and ICFRE, especially for agroforestry research. The annual outlay of ICAR for funding agroforestry research in Universities is Rs.20 million. To this, another Rs.10 million can be added which is obtained out of general ICAR grants and internal resources. As the main activity of the Universities is teaching, most of the expenditure is for this purpose and allocation for research is relatively low. About 70 professionals are engaged in forestry research in the Universities, mostly on part-time basis, as teaching is their main duty .

According to information gathered in this study, 43 organisations in the private sector are engaged in forestry-related research. Out of them about 20 have either forestry as one of the principal areas of research or are entirely devoted to forestry/forest products/wildlife research. Others deal with extension or occasional studies on community participation, analyses of public opinion on forestry related issues, etc. Of the 43 organisations, 20 are registered societies, 11 trusts, 9 units of companies and 5 voluntary agencies.

While one of them (Bombay Natural History Society) was established as far back as 1883, most came into existence and ventured into forestry research after the mid- seventies (Table 2).

Table 2. Development of private forestry research initiative over the years

Period	No. of institutions initiating forestry research'
Prior to 1971	1
71 - 80	5
81 - 90	14
91 - 96	10
Total	*30*

[1], Out of the 43 institutions which responded to the questionnaire (Appendix 2), relevant data were available only for 30.

From available, data, the current total annual budgetary allocation of private sector institutions for forestry related research is estimated at Rs.50 million. The major inflow of research funds is from sponsors of projects, viz., Central and State Governments, multilateral/bilateral donor agencies and in a few cases, donations from individuals and companies. The Institutes which have received substantial donor assistance for forestry related research are Tata Energy Research Institute (TERI), BAIF Development Research Foundation and M.S. Swaminathan Research Foundation (MSSRF). The in-house units of companies like ITC Bhadrachalam Paperboard Ltd., Western India Plywoods Ltd. (WIPL), WIMCO Seedlings Ltd. (WSL), etc., however, received support exclusively from the respective parent companies.

Key Research Areas

Traditionally, the key research areas of Government sponsored forestry research were natural forest management, standardisation of Silvicultural

production systems, determination of the properties of various timbers and methods for their processing, preservation and utilization. A large volume of basic scientific data on flora, fauna, wildlife ecology/management , and non-timber forest products were also gathered. Since the enunciation of the new forest policy in 1988, more attention has been focused on revegetation of degraded forest lands, biodiversity conservation, tribal welfare and forestry for social welfare.

The private sector institutes have focused more on development of technologies and problem-solving research - either for improving the productivity of plantations for production of pulpwood, matchwood, etc. or to improve the quality of wood based products and reduce production cost Another stream of private sector organisations like the Bombay Natural History Society have focused their attention on ecological and environmental studies, and some like Tata Energy Research Institute and MS Swaminathan Foundation on forestry-related policy issues.

The Universities which are still in the process of developing forestry research capability, having entered the scene only since 1986, have focused more attention on agroforestry. However, over the years most universities have contributed substantially to fundamental knowledge on flora and fauna.

A more detailed analysis of the contribution and potential of each sector will be made in Section 3, after the case study presentations.

CASE STUDIES

1. WIMCO SEEDLINGS LTD.

(WSL)

1. Background

WIMCO Ltd, Bareilly which claims to be the largest producer of matches in the world with an annual production of 4200 million match boxes faced severe wood shortage in 1970's as the availability of wood from the public forests was insufficient to meet the demand. Wimco Agroforestry division was already encouraging the farmers to plant poplar in farm lands to augment its raw material supply. Wimco seedlings was established in 1984 at Rudrapur near Nainital, Uttar Pradesh, as a joint venture of Wimco Ltd with foreign technical collaboration and equity participation. WSL focuses on selection of improved varieties of trees suitable for match-sticks and boxes, supply of seedlings to farmers, management assistance and buy-back arrangement

In 1984, Wimco tied up with National Bank for Agriculture and Rural Development(NABARD), the agricultural wing of Reserve Bank of India and offered refinancing to Bank, for supporting farmers to take up poplar plantation. This proved successful, and between 1984 and 1991, 11.3 million trees were planted in UP, Haryana and Punjab covering over 22.5 thousand hectares.

The company's mission is to produce enough raw material to sustain their matchwood industries. The objectives were, research and development work on fast-growing tree species of industrial importance, and multiplication and sale of healthy planting material of commercial as well as newly developed poplar *(Populus* spp.) clones to the fanners.

The main client is their parent company, Wimco Ltd., which benefits by the supply of matchwood. However, the products and services of Wimco seedlings are targeted at farmers who buy seedlings and plant them in their own farm land.

2. Structure of the institution

The Executive Director is in overall charge (see organogram, Figure ***2)***. There is a Chief Manager (Operations) under whom there are three Area Managers for West UP, East UP and Punjab & Haryana, Nursery Production Manager, and a Commercial Manager. Under the Executive Director there are six other managers handling Research and Development, Commercial, Consultancy, Accounts, Personnel and Farm. Under each manager there are two to four Assistant Managers/District Managers and Supervisors. The Assistant Managers and Supervisors are agricultural graduates.

Research is a key element in the organisation's activity and it is integrated with its commercial activities. The Executive Director has been directly involved in the research earlier and continues to be the prime mover in current research activities.

A Manager R&D with a doctoral degree in plant pathology is in charge of the research activities. Clone1 selection and multiplication are directed by him. Since the infrastructure and research facility were set up earlier, not much amount is spent on them at present. *All* decisions concerning research and consultancies are made by the Executive Director.

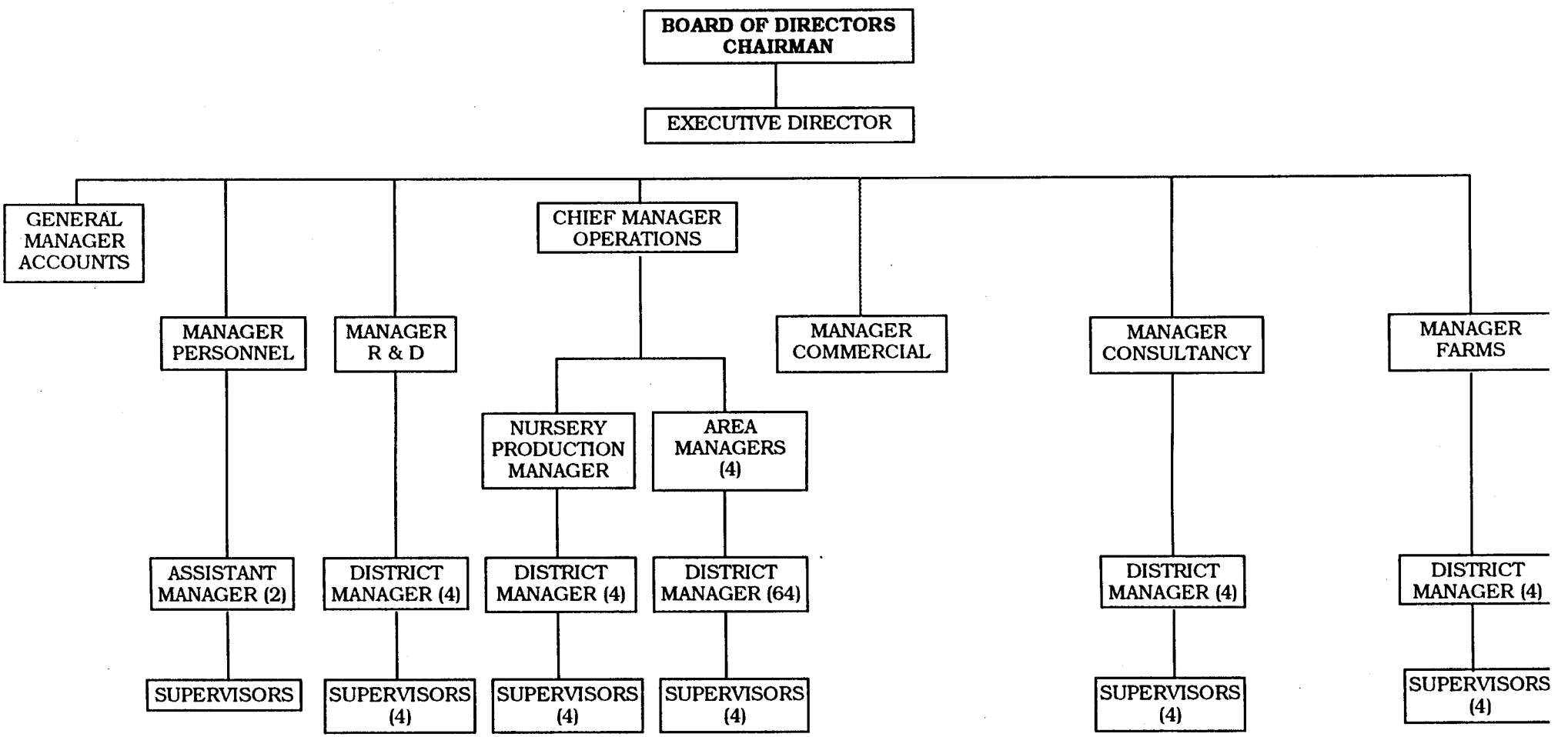
3. Resources and activities

Within the research establishment, there are 12 permanent staff. Of them, two have Ph.D. degrees, three have Post graduate degrees and five graduates.

At their main office at Rudrapur, WSL has 66 ha of land with about 6000 Sq. m of buildings which includes a guest house and a few residential apartments. Besides this, they have a number of mist chambers and laboratory facilities which include a seed processing plant, gravity separator, and seed pelletisation plant.

The total budget for research was Rs. 2.86 million in 1994-95 and Rs. 2.28 million in 1995-96. The parent company Wimco Ltd met all expenses and provided an additional grant of 30 percent as overheads for the first 6 years

Fig. 2. WIMCO SEEDLINGS LTD



and 15 percent thereafter. The sale of seedlings which is their main commercial activity brings in revenue. Poplar *(Populus* spp.) seedlings are currently sold at Rs.18 each. About 2 million poplar and 50,000 Kadam *(Anthocephalus cadamba)* seedlings were sold during 1995. Of late, income from consultancies is also flowing in.

Clonal selection and multiplication of poplar *(Populus* spp.) is the key activity. The germplasm collection at Forest Research Institute, Dehra Dun mas utilised for screening of clones. Limited number of clones of Poplars were also purchased from abroad. Apart from this, extension support in farmer's fields is also provided. The technically qualified graduates help farmers match clones with sites based primarily on experience.

4. Important accomplishments

Fifteen publications on tree breeding, vegetative propagation, plant protection, afforestation and agroforestry are reported since 1990 of which seven were published in Indian Journals, three in proceedings of Seminars and two were articles in edited volumes.

WSL has released three new clones of poplar (Udai, Kranti, and Bahar). They have standardised the techniques of root trainer seedlings for which they have been appointed as consultants of Maharashtra Forest Development Corporation and Indian Council for Forestry Research and Education (ICFRE). They have also standardised the techniques of vegetative propagation of *Eucalyptus, Anthocephalus, Gmelina* and *Paulonia* by stem cutting. They have also provided extension support for the large scale expansion of poplar cultivation in agroforestry. The growing acceptance of the seedlings produced by WSL by the farmers is seen by the management as a testimony to the success of their R&D efforts.

5. Role of research unit in the organisation

To develop new clones and to maintain a continuous supply of healthy seedlings on a continuing basis, research is essential. This is recognised by the organisation and it is given pride of place.

During 1995-96 the budget was Rs.2.28 million. Of this, about 16% went to research and the rest for commercial seedling production. The share for research during the initial years was much higher due to infrastructural development.

No internal cost benefit studies of the returns from research was available. Market response or feed back determines the priority for different species. For example, eucalyptus seedling production is negligible due to the low prices realisable as pulp industries still prefer subsidised supplies from government plantations, or import of pulp.

6. Factors that have facilitated research by the organisation

The Executive Director, who is the most powerful person in the organisation, has long association with the research being carried out at WSL. Therefore research activities have his personal support and it is monitored continuously.

WSL is a company and its activities are commercially oriented. The manager (R&D) and manager (consultancy) reports to the Executive Director which facilitates communication and ensures support for research activities.

The immediate clients of the WSL are the farmers who buy planting materials. The Area Managers and their team assess the market for planting material and the production and research respond to the market signals. A whole package of external services offered include liaison with banks for financing, advice on planting, pruning, crop protection and buy back guarantee at attractive prices. Although poplars are the primary species, several other species are available. Currently plans for diversification into horticultural crops, vegetables and aromatic plants are envisaged. Production and marketing of bio fertilisers and de-oiled neem cake are also planned.

The ultimate client of matchwood produced is Wimco Ltd the parent company. WSL by its research and marketing activities supports Wimco Ltd. Research in WSL is for increasing the productivity to enable early harvest. Shorter rotations make the crops acceptable to the farmers also. Guaranteed buy back arrangement at attractive prices offered in advance with the concurrence of Wimco Ltd is an important factor of success.

WSL has competition in product markets from small scale local nurseries which charge less than half the price charged by WSL for planting materials. However the reputation built up over the years for quality enables WSL to overcome the competition. WSL maintains 219 clones of poplars of which 8 to 10 are commercially grown and marketed for specific sites. The current purchase price of WSL for poplar wood of above 45 cm girth is Rs.4000 per m^3 which is an additional attraction for farmers.

The specific nature of activities of WSL makes it fairly immune from the problem with the changing costs of inputs as land, clone bank, laboratory facilities and manpower have already been organised and the incremental cost of inputs is very small.

The clones available at the Forest Research Institute, Dehradun (now ICRFE) were also made available to WSL free of cost. Except these, no other direct support from the government is reported. WSL does not pay income tax as agriculture is tax-free in India.

WSL is linked to the parent company WIMCO Ltd. While WSL strives to increase the production and productivity of matchwood, WIMCO buys matchwood at market prices and this is a crucial factor in sustaining demand for their seedlings even at a higher price. Their bad experience with production of eucalypt seedling is a good pointer to the fate of production ventures without the buy back guarantee. Irrespective of the quality of seedlings and the productivity, if there are no buyers in the market, the programme collapses and this happened in the case of pulp wood. The pulp industry was not willing to buy pulpwood at competitive market rates or at least at the alternative firewood price as they preferred to obtain supplies from public forests at subsidised prices, or import pulp.

7. Linkages with other research establishments

In the initial years, Norman Jones, an European silviculturist with substantial experience in Africa, had come on deputation from Swedish Match and started the work along with Piare Lal (Now Vice President ITC Bhadrachalam) and J P Chandra. The first annual report of WSL for the year

1986 states "Progress has been rapid because, tried and tested methods from other countries are being adapted to the Indian scene"

As mentioned earlier, selection of clones based on suitability in particular agroforestry zones was the primary requirements. The clones for multiplication had to be acquired or purchased. And to build up a stock for multiplication, tissue culture of two poplar clones were contracted to TERI which built up the infrastructure by grant from the Government of India, Ministry of Bio-technology.

Research fundings are not freely disseminated. However, the company undertakes projects for establishment of the nurseries on turn-key basis, in which their expertise is encashed. Instances of senior research personnel leaving the organisation for better prospects have occurred. Such situations, however, does not affect the business prospects of WSL.

WSL's activities and priorities are linked to the production targets of WIMCO Ltd. Other than that, there is no collaboration with other organisations. With field experience of more than a decade, now WSL has taken up several consultancy projects for establishment of nurseries, mist chambers, evaluation of suitable inter-crops for poplar, etc. Some consultancies such as that with National Dairy Development Board, Anand, Indian Council for Forest Research and Education, Dehra Dun, Maharashtra Forest Development Corporation, Pune, etc are quite prestigious and has enhanced the image of the company.

8. Overall Performance of the Research Establishment

On the whole, WSL has been a successful and timely venture and instrumental in generating wood raw material for the match industry which was facing acute wood shortage. Now WSL plans to diversify into the production of horticultural and vegetables planting material and for the marketing of bio-fertilizers which again is an indication of their soundness and sensitivity to market signals.

2.ITC BHADRACHALAM PAPERBOARDS LTD. (ITCBPL)

1. Background

ITC Bhadrachalam Paperboard Ltd., established in 1975 is promoted by the Indian Tobacco Company (ITC). With its corporate office at Secunderabad and the mill located at Sarapaka in Khammam District of Andhra Pradesh. The mill produces various grades of paperboards including cast coated paperboard for packaging apart from writing, printing, art and kraft paper. With the commissioning of the fourth paper machine presently under installation, the mill is expected to be a major international player in superior quality coated paperboards.

The mill requires annually about 60000 t bamboos and 90000 t of wood as raw material. Although the Andhra Pradesh Forest Department had committed to supplv 70000 t of wood annually, this has not been met at all. This situation led to a total dependence on farm forestry sector.

In the early 1780s the company produced eucalypt seedlings and distributed to farmers free of cost. In 1987, it submitted a project to the National Agriculture and Rural Development Bank (NABARD) which envisaged an annual planting of 1500 ha of marginal agricultural lands in Andhra Pradesh. The project was sanctioned in 1990. Under this scheme, seedlings were distributed free of cost to the farmers with buy-back guarantee for wood at minimum support price or prevalent market price whichever was higher.

During 1787-1995, 7500 ha of marginal lands were planted with eucalyptus following the seed route. However, the programme met with two main drawbacks. First of all, that the plantations raised through the seed route exhibited wide variation in quality and yield. Secondly, non-adoption of proper package of practices by the farmers led to poor field establishment and growth of the plants. Thus a need for research was felt and a research unit was established in July 1989.

The vision of the company is to make the company self-reliant in their raw material. Setting the mission to increase pulpwood production with two

specific objectives, viz. Development of fast growing disease resistant eucalyptus and improvement of the package of practices for establishment and maintenance of plantations.

Although the company has no intention to transfer its research finding to anyone outside the company., the clonal plants developed through their in-house R & D are sold to farmers and other agencies. The main clients for their clonal plants are farmers in eight District of Andhra Pradesh. ITC is the second industrial house to take up farm forestry in a big way after WIMCO. They have been promoting farm forestry with NABARD refinance arrangement since 1982. Upto 1995, 6186 farmers were involved and 7441 ha covered in the district. A many as 450 clones of *Eucalyptus camaldulensis* and *E. tereticornis* were screened and planting material produced from 42 clones. In rainfed areas, productivity has been achieved between 23-39$m^3 ha^{-1} yr^{-1}$ as compared to 6-10$m^3 ha^{-1} yr^{-1}$ obtained in forest department plantations via seed route.

Distribution of seedlings is not restricted to those who enter into buyback agreement. It is supplied to others also as buy back arrangement has not been successful.

2. Structure of the institution

The organisation structure of the company is presented in Figure 3. The ITCBPL has a Chairman and Vice Chairman at Calcutta, a Managing Director, a Finance Director, a Resident Director, a Senior Vice President and Vice Presidents at the corporate office at Secunderabad. At middle management cadre there are General Managers, Deputy General Managers, Chief Managers, Deputy Chief Managers and Managers. At the junior management cadre there are Assistant Managers and Junior Managers. In all there are about 750 persons in the Management Cadre, 1440 people in the employees category and about 500 people employed on daily wage basis.

The Vice President (Plantations) who is a forester with vast experience in farm forestry finalises the research agenda in consultation with Deputy Chief Manager(P1antation Research). These consultations are informal and frequent. The agenda finalised by him is discussed with the Managing Director who is the authority to accord approval.

Forestry Research is implemented by the Plantation Research Wing headed by a Deputy Chief Manager (Plantation Research) who is a qualified genetist with experience in forest genetics with the Forest Research Institute (FRI). The Deputy Chief Manager does all activities at advice of the Vice President (Plantation) whose office is housed in the corporate office at Secunderabad. The Plantation Research Wing has two subunits, one for R & D and the other for Clonal Production. The Deputy Chief Manager is assisted by one Research Officer and four Junior Managers for R & D; and one Deputy Manager and three Junior Managers for Clonal Production. The staff are either postgraduates and graduates in agriculture or other science subjects. Over the last seven years the staff strength has doubled from the initial number of five, with a few joining and a few leaving in between.

Funds for research come from the parent company and therefore there is accountability in terms of cash accounts and progress made.

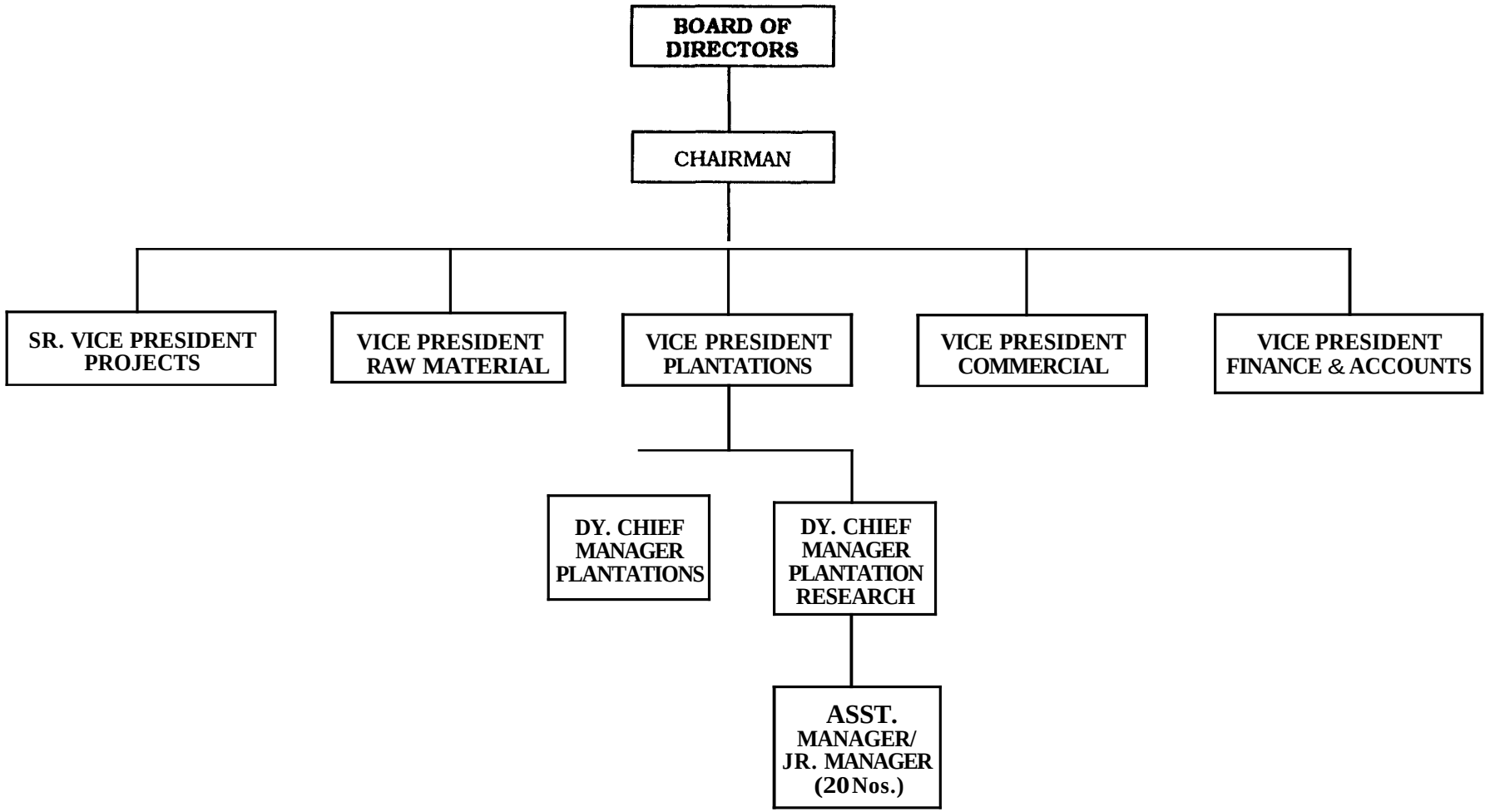
3. Resources and activities

The human resources are the qualified research staff (scientists) recruited and deployed. Consultants are also employed for specific jobs. The central laboratory and clonal research laboratorv have infrastructure and facilities for pulpwood testing and other biological research. Pulpwood is done at central laboratory of the company which has qualified staff on paper technology.

The R & D (unit) has a land area of 2 ha, consisting mainly of buildings of 300m^2, green house of 940m^2, and shade house of 200m^2. The open nursery area occupies of 3000m2 including roads. In addition, an area of 18 ha is utilised as Clonal Multiplication Area (CMA) and 8 ha as Clonal Testing Area (CTA).

The equipments include an inoculation chamber, a microscope and a few instruments. The company does not encourage procurement of expensive. Sophisticated equipments which are generally once in a while. The infrastructural set up is maintained to the level necessary for just meeting immediate needs.

Fig. 3. ITC BPL BHADRACHALAM



The company's library on forestry is small. Most of the books are personal collections belonging to senior personnel and it numbers about 250. The company subscribes to 11 journals of which four are free subscriptions. There has not been any increase in the number of journals ever since the plantation research unit was established.

The R & D expenditure reported by the company includes both Capital and Revenue expenditure incurred for both research and production of clonal plant for sale. In 1989-1990 the amount was Rs. 32 lakhs which gradually decreased to 10.52 in 1793-1774 and then increased to 33.32 in 1994-1995 and then to 32.19 in 1995-1996. In 1996-1997 the budgeted amount is Rs. 50 lakhs. The large fluctuation in budget is mainly due to the variation in capital costs. The amount spent for research and commercial production of clonal plants are not accounted separately and therefore it is difficult to separate the amount spent exclusively for R & D. The R & D wing receives its entire funding from the company and so far has not sought external financial support for research.

Most of the research programmes are need based and result oriented. The main thrust is on selection of superior trees for production of superior clones of *Eucalyptus*. To achieve this, several experiments were carried out to standardise rooting hormones, rooting media, coppicing of trees, fungal pathology and rejuvenation. Although the stress was on *Eucalyptus,* a few trials were also carried out on rooting of *Casuarina* cladodes. In all 21 experiments were carried out during 1989-1996. Of this 12 were in 1995-1996 alone and the rest were carried out during previous six years with a maximum of three experiments in an year. The company designates both the experiments and the results as 'classified' which means that they are not revealed to outside world. Therefore, the scientists are not encouraged to publish the results. However, since the clonal multiplication technology is becoming popular in forestry, the company considers it only appropriate to sell its technology through consultancies or transfer of technology. The research wing also extends technical backstopping to the farmers in pests and disease control and fertilisation, based on field tests conducted by the research staff.

4. Important accomplishments

The R & D wing has been able to produce good result in terms of selection of fast growing *Eucalyptus* clones, propagate them though vegetative means and field test. Of the several clones tested, a number of them are promising. The selection programme is in progress. The reasons for the good performance can be attributed to

Clear cut R & D objectives and well defmed goals,
strong commitment and fmancial support,
continuity of staff especially at the senior level, and
Delegation of powers and freedom.

The research results produced by the R & D Wing are made use by Clonal Production Centre for commercial clonal multiplication of *Eucalyptus*. The clonal plants are supplied to farmers and other Government agencies on cost.

The growth of the clonally propagated trees is compared with those raised through seed route. Also thev consider the demand for such clonal plants from farmers as well as other Government agencies as an indication of their success.

5. Role of research unit in the organisation

Wood and bamboo are the raw materials for ITCBPL. Therefore, attempts made to increase the yield of raw material is a need of the company. The company has not made an attempt to quantify the returns from research.

6. Factors that have facilitated research by the organisation

The mission is well defined in terms of improvement of productivity of pulpwood (mainly eucalyptus) plantations and there is a definite commitment in achieving the objective.

In the past, the R & D unit did not have any freedom to respond to the needs of others who approach them for technical help as they were interested in their specific objective. Of late, there is a feeling for the need of flexibility in thinking in this regard.

A well-knit team, commitment of funds, freedom and in-house training for conducting the job are some of the factors favouring early achievement of the intended results.

Although they consider clonal propagation of eucalyptus as their monopoly, competition is likely to build up with other agencies acquiring and developing the technology.

Although there is an annual escalation of about 10 per cent in the costs of various inputs, it is not likely to adversely affect the functioning of the R&D units, considering the demand for good quality plants.

So far there has not been any direct, support from the Government. They company is seeking recognition from the Ministry of Commerce and Industry so that it can establish a small institute for pulpwood research. Although income tax rebate, as per Government rules, is availed, it is not substantial. In accounting, all costs are charged. The incentives provided by Government have been taken advantage of.

Non-availability of land for field trials and pilot planting is the primary constraint. The land with farmers for tree planting is not much. The average holding is one ha. and is limited to marginal lands. Secondly, lack of access to large breeding population for selection of clones is a serious technical constraint. Thirdly, the number of personnel and facilities available for research is limited as the company is not interested in expanding the R & D into a full fledged and well equipped setup as they fear it would become a liability once the priorities charge.

7. Linkage with other research establishments

In the initial five years ITCBPL collaborated with Tata Energy Research Institute (TERI, Delhi) on clonal propagation and that was a great experience of mutual benefit for both' the agencies. The R & D wing of ITCBPL is a member of the Association of the Asia-Pacific Forest Research Institutes. However, it is yet to benefit from this membership.

The R & D unit depends on Universities and other laboratories for soil testing. For in-house training of staff, external resource persons are drawn from forestry and agriculture. The research personnel also undertake visits to other research institutions for updating their knowledge.

Although there are 21 research papers published by the senior personnel of the company, most of them are general papers and specific details on rooting and root trainers technique are not revealed in them.

The company does not collaborate with other organisations except with the Andhra Pradesh Forest Department (APFD) for screening the Forest Department plantations for candidate plus (superior) trees. The plus trees were selected in consultation with the APFD. The APFD also made use of them. The clones assembled at the Eucalyptus Research Centre of FRI (now c1osed)at Hyderabad were also made use of. The company has not maintained any germplasm bank of its own.

8. Overall performance of the research establishment

The company has done a good job towards enhancing productivity of eucalyptus plantations in Andhra Pradesh. To achieve this, it mainly adapted the methodologies and technologies developed elsewhere and modified them to suit the local conditions.

The company has received the FAPCII Award for Best Technology Development, the Indian Confederation of Industries Award in 1995, and the Rajiv Gandhi Parti Bhoomi Mitra Award 1995-1996 (sponsored by the Government of India - for developing non-forest wastelands) as recognition of their programmes.

3. WESTERN INDIA PLYWOODS LTD. (WIPL)

1. Background

Western India Plywood Ltd. was started in 1945 as a private limited company at Baliapattam, Kannur, in Kerala State. They manufacture plywood, blackboard, hardboard, prefmished hardboard furniture, and decorative items. During 1994-95, the company produced 0.75 million m^2 (3 ply 4mm basis) of plywood and 26,343 tones hardboard. It had a turnover of Rs. 464 million and the dividend declared was 24%. Although registered as a limited company, it is mostly a family concern. The founder MD continue to take a leading role in decision making in all matters of the company including research. Although he has formally stepped down recently in favour of his son, the present MD.

The manufacture of plywood for tea chest started in India in the beginning of the twentieth century. However, the versatility of plywood for application in construction, panelling and transport (especially in railways) came to be appreciated only in the fifties. In order to cater to the research needs of the plywood industry the manufacturers took the initiative to establish Indian Plywood Industries Research Association (IPIRA), (later renamed Indian Plywood Industries Research and Training Institute) with the involvement of the Council for Scientific and Industrial Research (CSIR). With demand in construction and transport sector rising phenomenally, some manufacturers felt the need to establish in-house R & D facilities to meet their specific needs. Thus an in-house R & D unit was established in WIPL. The objectives include,

- Testing product quality to maintain conformity to relevant standards,
- Development of cheaper adhesives to achieve cost reduction and
- Adaption of technologies developed elsewhere.

The mission of the R & D units of WIPL is to make the factory leaders their line of production. The research unit within WIPL was established to support production activities and to provide in-house testing and quality control.

The priorities in research hare been to support the production of quality plywood and hardboard, trouble shooting in production, developing in-house competence and research on innovative products and procedures. The R & D unit is functioning solely for the company.

2. Structure of the institution

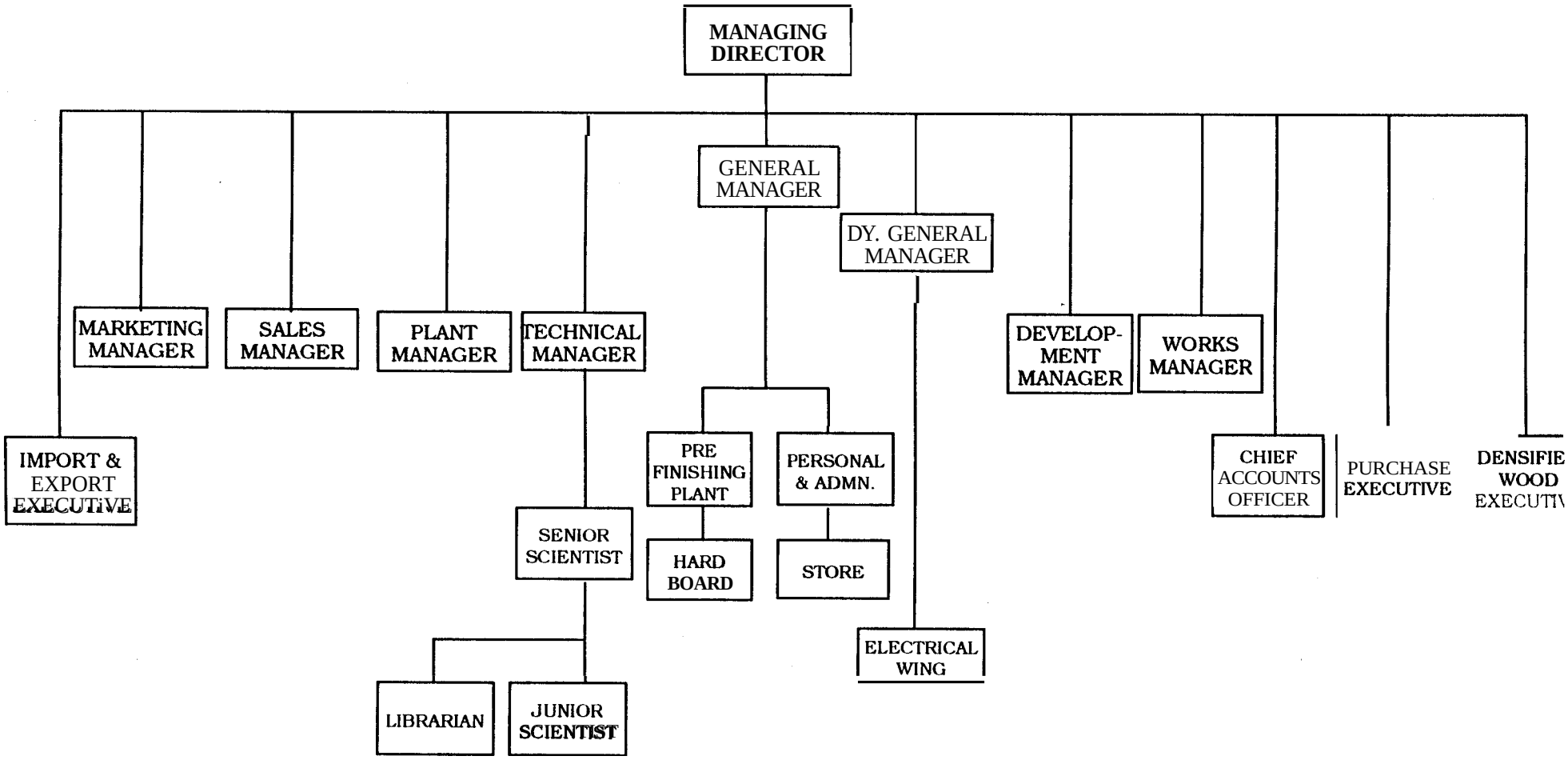
The R & D unit is headed by the Technical Manager (Research & Development). He is assisted by three senior scientists, seven junior scientists and one librarian. Of the scientists, 3 hold Ph.D. degree in Polymer Science and 4 hold postgraduate degree in Material Science, Mycology, Polymer Technology and Chemistry. The Technical Manager reports to the Managing Director of the company. The organogram is given in Figure 4.

The R & D unit is an integral part of the company. In addition to specific research programmes, regular testing of products is also carried out.

The R & D unit is largely responsible for maintaining consistency in quality of products of the company. It's location in the factory premises has been a great asset to the production and marketing units while holding trade negotiations with quality conscious consumers. Hence its standing within the organisation is high.

The Technical Manager assembles relevant information under the guidance of the present and former Managing Directors, discusses the same with him and takes further action based on the decision made by the present and former Managing Directors. All decisions are taken by the Managing Director - either based on suggestions of the Technical Manager and other research staff or on his own perception. Being an expert in the field, the Managing Director's perceptions

Fig. 4. WESTERN INDIA PLYWOODS LTD.



3. Resources and activities

The R & D unit has 12 research personnel of whom11 scientific staff and one Librarian. The senior persons have been with the company for the last 20 years and they are paid Rs. 50 to 60 thousand per year as salary. A few have been provided with subsidised company accommodation in the nearby town. The research staff also receive the usual bonus paid to the production staff.

The R & D unit is housed in a building of 622m^2 plinth area. Important facilities include wood testing, physical, chemical and microbiology laboratories. A gamma ray unit is also available. The major equipments include a weatherometer, rheometer, optical microscope, mechanical and electrical testing equipments. The library in the R & D unit has a collection of 2284 books and current subscription to 23 journals..

Due to shortage of electrical energy from the State Electricity Board, continuous power supply is ensured by WIPL's own diesel generator. As the R & D unit is situated within the WIPL complex, the production facilities and workers are utilised for pilot production of any new product developed. Full fledged testing facilities available in the factory enables the R & D unit to test and provide quick feed back on the quality of the new product.

The research budget during 1995-96 was Rs. 4.08 million which included purchase of a rheometer costing Rs. 2 million. Budget for the previous year (1994-95) was Rs. 0.68 million. The budget for the year 1996-97 is Rs. 3.08 million. Project-wise accounts are not available. The entire research funding is obtained from WIPL's own sources.

The initial focus of research was on development of economical adhesives to bond plywood. Subsequent activities included top coat printing, imparting fire retardancy to plywood, development or new wood preservatives, modified rubber wood, bitamenised hardboard, weather proof hardboard, pollution control dye absorption, etc.

4. Important accomplishments

Technology for imparting attractive grain pattern of superior hardwoods on panels manufactured from less expensive wood was purchased from Trefert, a German firm, and adapted to local conditions, by adaptive research carried out in the R & D unit. In addition, the technology was upgraded to improve water and scratch resistance. A cost effective process was developed to produce hardboard with an asphaltic surface coating. A new process was developed to improve weather resistance of hardboard for outdoor use.

The R & D unit claims to have developed several products and processes which have reduced cost and improved the quality of adhesives.

The R & D unit also claims to have developed a method of preservative chemical treatment for outdoor stored timber including rubber wood to prevent fungal and insect damage. This is being projected as a replacement for the leachable boron treatment, but the details are not available ascertain to judge its suitability.

Only research which is needed to support their production activities and help introduce new products in the market is undertaken. The research results, if found economically viable, are put to use directly in their own production process.

There is no formal mechanism by which the success of the R & D efforts are measured. However, their contribution to cost reduction and quality improvement are well appreciated by the company.

5. Role of research unit in the organisation

The company depends on the R & D unit for trouble shooting in production activities. Also their involvement is essential in adapting new technologies in production process.

The proportion of funding for R & D as compared to WIPL's annual budget has been in the range of 0.15 to 1 percent.

6. Factors that have facilitated research by the Organisation

An important factor that has contributed to the success in R & D effort in WIPL has been the vision of the former Managing Director Mr. A.K. Kaderkutty and his close interaction with the R & D personnel. Mr. Kaderkutty is an engineer by training and has very wide experience and contacts across the globe in the manufacture of wood based panels. The former MD, has built up a reputation of meeting requests for supply of special purpose plywoods. The R & D unit has helped produce special products for Indian Space Research Organisation, Hindustan Aeronautics Ltd. and Indian Railways.

The R & D unit of WIPL has the advantage of being situated within the production complex. Thus any product developed by R & D can be immediately tried and a trial run arranged for newly developed or process. The time lag from the laboratory to factory is minimised. The new product can be tested in house and the feedback from the production staff can be used to evaluate the quality. Thus the delay in transfer of technology common in research organisations is minimised. Further, as the R & D unit is working on the priority areas identified by the management most of the time, there is commitment by the top management to provide facilities.

Plywoodhas a highly competitive market in India. The survival of the R&D unit will depend on competitive price and quality. The management perceives that the investment in research has enhanced its competitiveness. As a result of this, the company produces a diversified range of high quality products.

There are a few constraints too. The first is that the entire wood for plywood production is now imported, and this increases transportation costs. If restrictions to the present liberal import policy of the Government is made or tariffs increased, it could affect the production and profitability of the unit. While the plywood plant has an installed capacity of 2.5 million m^2 the production during 1994-95 was only 0.75 million m^2. The second constraint is that many competitors quote low prices for products which do not have the quality standards of WIPL. Many Government agencies go by the lowest price criteria and therefore WIPL loses out.

The entire research funding is by the company. Probably the only instance of an external support is a gamma radiation unit provided by the Bhaba Atomic Research Centre (BARC), Bombay, installed in the factory for experimental production of irradiated wood. Other than the above there is no direct support from the Government.

Section 1 provides details of the tax and other incentives offered for research by the Government. The supply of timber at subsidised rates which existed about a decade back, is no longer available. However, liberalisation of imports have enabled the company to procure raw-material from Myanmar, Malaysia and several African countries.

7. Linkage with other research establishments

The WIPL does not have any collaboration with other R & D units except for an on-going research project being funded at the Sri Ram Institute for Industrial Research, Delhi, on some polymer product. The thrust in WIPL has always been to develop in-house competence. Collaboration with others in research is therefore not encouraged. The company's earlier bad experiences with suppliers of adhesives (not supplying quality material in time) have forced WIPL to give greater consideration to self reliance.

The Management is on the lookout for new developments in their line of production and tries to utilise available technologies to their benefit, after carrying out adaptive research where necessary. The research findings of the R & D unit are not normally published and therefore not available to others.

8. Overall performance of the research establishment

As the research is integrated with the production programme, the research unit has helped in introduction of innovative technologies and diversification of its product range. Since the research results are only available to the company its contribution to science is not assessable.

4. BAIF DEVELOPMENT RESEARCH FOUNDATION (BAIF)

1. Background

BAIF Research Foundation is a non-profit development research organisation registered as a Trust in 1767. Though originally named Bharathiya Agro Industries Foundation, the organisation was subsequently renamed 'BAIF Research Foundation', and is popularly known as BAIF. The organisation has its origin in the Nature Cure Ashram established in 1746 by Gandhiji and subsequently looked after and developed into its present shape by Dr. Manibhai Desai. Dr. Desai passed away in 1973.

BAIF's mission is to create opportunities of gainful self-employment for rural families, especially disadvantaged sections, ensuring sustainable livelihood, enriched environment, improved quality of life and good human values.

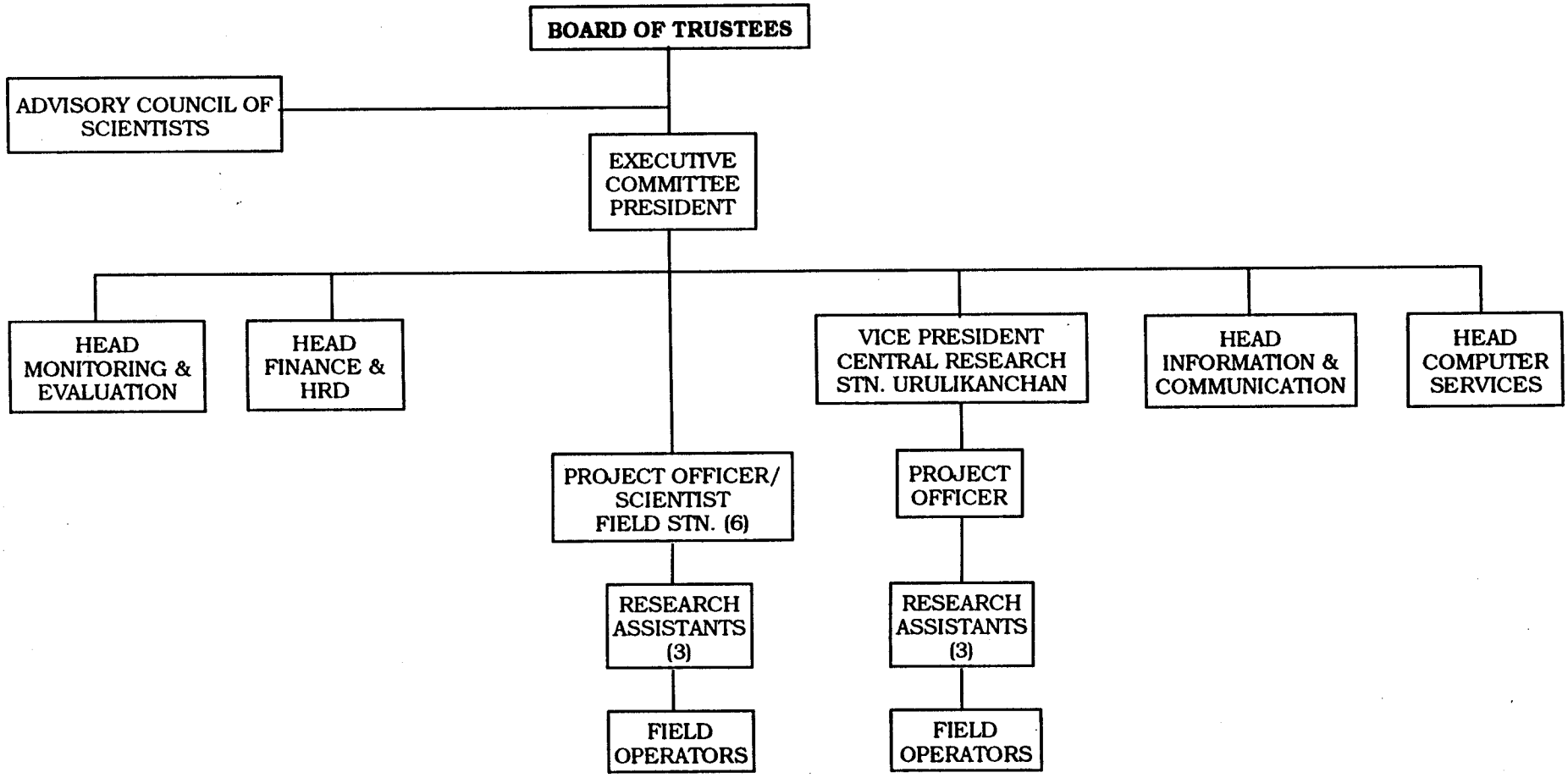
Though started originally as an institution to promote the technology of cross-breeding of cow for increasing its productivity, and though even today this area of activity is one of the mainstays of the organisation, BAIF has moved into several activities with a multi-disciplinary approach. BAIF's avowed aim is to improve the quality of rural life through sustainable development of the degraded natural resources - land, livestock, water and vegetation using idle human time, through multidisciplinarv programmes.

2. Structure of the institution

BAIF is a Trust. It is managed by an Executive Committee and a central Management Council. The activities of BAIF are spread over five States, namely, Maharashtra, Karnataka, Gujarat, Rajasthan and Orissa.

Organogram of BAIF is presented in Figure 5.

Fig. 5. BAIF DEVELOPMENT RESEARCH FOUNDATION



Field Stations are located in Maharashtra, Gujarat, Karnataka, Rajasthan and Utter Pradesh

BAIF operates through five of its subsidiary institutions, namely, the Central Research Station at Urulikanchan, Poona, Maharashtra; Maharashtra Institute for Technology Transfer for Rural Areas; Gujarat Rural Institute for Socio-economic Reconstruction, Vadodara, BAIF Institute for Rural Development, Lakihalli, Karnataka; Rajasthan Rural Institute of Development, Udaipur; and BAIF Institute for Rural Development, Uttar Pradesh. The main office of BAIF is situated in BAIF Bhavan at Dr. Manibhai Desai Nagar on the, Bombay-Bangalore Bye-pass Highway.

The experience and research findings of BAIF are published in the form of annual reports, seminar proceedings, workshop proceedings, training material, pamphlets and brochures. The BAIF also has a quarterly journal and a monthly Newsletter on Multipurpose Tree Species. In addition to publications, BAIF has also prepared video films on their activities.

BAIF is not a mere research organisation. As already stated, its mission is to create opportunities for the rural families, especially disadvantaged sections. Hence the activities of BAIF are development oriented with research and development supporting such activities.

The Trustees of BAIF include eminent personalities from industries and renowned scientists like Dr. M.S. Swaminathan. The BAIF has an Executive Committee which takes major decisions for the organisation. BAIF also has a Central Management Council which includes most of the programme and research unit heads. This Council takes decisions relating to technical aspects and management of implementation programmes.

BAIF has a large contingent of research staff, programme co-ordinators, farm management officers etc., distributed in its different units. Not all of them are connected with Agroforestry and forestry research. In each unit there are personnel exclusively devoted to Live Stock Department which is one of the key activities of BAIF. Other staff have general responsibilities in agroforestry, farm management, laboratory unit, seedling production, training, etc.

At the Head Quarters in Pune, a Ph.D in agriculture is in charge of all forestry related matters. In the other units there are scientists/project officers

charge of all the activities assisted by research assistants. For agroforestry and connected research agricultural graduates and postgraduates are taken as research assistants/research officers. Among the scientific staff there are 4 Ph.Ds, 6 Postgraduates and 49 graduates. Among the technical and administrative staff there are 19 postgraduates and 38 graduates.

Since most of the top and senior people have overall responsibilities relating to all activities of the units, it cannot be said that all the above personnel are devoted to forestry research. A rough assessment would be that one-third of the above personnel would be engaged mostly in forestry related activities.

Activities related to the forestry research cover the following.

- Agroforestry and afforestation..
- Evaluation of multipurpose tree species.
- International trial on dry zone tree species.
- Selection of Australian hardwood species for drought prone areas.
- Cultivation of medicinal plants.
- Agroforestry project in Kamataka.
- Development of biofertiliser technology for field application.
- Tribal rehabilitation.
- Comprehensive tribal development programme in Gujarat.
- Greening projects for industries on turn key basis.
- Advisory services

3. Resources and activities

BAIF is in possession of large tracts of land for forestry research. At Urulikanchan, BAIF has about 700 ha. in the Central Research Station and another 20 ha. near the BAIF Community Research Centre. Both these areas abound in different agroforestry species, bamboo, fruit trees and intercropping of grass, medicinal plants, etc. At Wagoli also BAIF has about 300 ha of land, where several agroforestry species are grown. The main Semen storage factory and a factory for production of Biofertilisers from the biomass of the forest plantations are also located in this campus. The Lakihalli campus in Karnataka is also about 120 ha. in extent and several agroforestry species are grown here.

The agroforestry plantation and connected research of BAIF has a standing of nearly fifteen years. The campuses have adequate buildings, laboratory facilities for testing soil, etc. and mist chambers and green houses for seedling development. BAIF has qualified and experienced personnel for forestry as well as cattle development and other areas of rural development. In addition their own staff BAIF utilises the services of professors in statistics from agricultural colleges consultancy basis for design and analysis of field experiments.

Annual budget for research doing 1994-95 and 1995-96 were Rs. 2 millions and Rs. 2.5 millions respectively. The estimate for 1996-97 is Rs. 3 million. The reputation acquired by BAIF as an institution concerned with rural development and its continued activities in cattle development have enabled BAIF to carry on forestry research funded regularly by international agencies, national agencies and industrial clients in a sustainable manner.

BAIF has several joint research programme with other organisations. For example, a silvi-pasture study with Senegalese A.R.I., Government of Senegal and Agriculture and Food Development Authority of Ireland in Sahelian Senegal. This project is funded by the Commission of European Community to initiate research for enhancing the productivity of Sahelian pastures.

BAIF also undertakes research in collaboration with institutes like Oxford Forestry Institute, Australian High Commission, Danish International Agency etc. BAIF has an information resources centre equipped with computers and communication softwares.

BAIF has a very effective publication system. It has published books, pamphlets, video films etc. These are agroforestry, wasteland development, nursery techniques, nitrogen fixing, social forestry, non-wood forests, multipurpose tree species etc.. BAIF organises periodically seminars at national and international levels to share its experience and research findings.

4. Important accomplishments

During the last five years BAIF has published over 50 papers on forestry research including those in BAIF journal. As already stated, BAIF's activities

are community development oriented and the research undertaken is for supporting development programmes. The results of research which they undertake on different forest species are translated into field in such projects as agroforestry projects in different states, industrial greening projects (for companies like Gokak Mills, Kakrapai Atomic Power Plant, Tarapur Atomic Power Plant, IPCL, Nagothane, NOCIL, Thane, Float Glass India Ltd., Taloga, etc.) and in tribal development activities in different States.

There is no specific attempt to measure success although it is evident from the fact that their research is feeding into the developmental programmes, which is the main objective of the organisation.

5. Role of research unit in the organisation

In as much as tree growing is advocated by BAIF as an economic component of rural development, the scientists feel that forestry research is vital to their developmental projects.

The returns from the research carried out by BAIF are in the nature of matching species of forest trees to different agroclimatic area and thereby making forest tree growing as an economic proposition in the rural areas.

6. Factors that have facilitated research by the organisation

Not only the leadership, but also the scientists and operating personnel seemed to be highly committed. Mr. Manibhai Shah, the founder of the organisation (who is no more) provides a model of service to community, especially to disadvantaged group. Discussions with top management revealed that they are quite concerned with rural development issues and solution to problems.

The organisation has a relativelv flat structure. Hierarchy does not stand in the way of interaction. Decision making is often through discussions. Access to top functionaries is quite easy. Informal relationships prevail. Even operator level persons are given full freedom to take decision. They are given often total responsibilitv with freedom of action.

BAIF has close links with the State governments. The farmlands have been given to BAIF by the State governments. BAIF is also actively engaged in rural development, forestry and tribal development programmes of the State governments. BAIF has undertaken a large number of projects for national and international bodies like ICAR, Ministry of Science and Technology, CAPART, Department of Bio-technology (GOI), Ministry of Welfare (GOI), National Wastelands Development Board, Ministry of Environment and Forests, Ministry of HRD, Social Welfare and Tribal Department, Ministry of Non-conventional Energy Sources, Department of Electronics, Canadian International Development Agency, International Development Research Centre, Danish International Development Agency, Kreditanstalt Fur Weideraufbau, Commission for European Communities, German Agro Action, FAO, Embassy of France, Government of Netherlands, Wagenigen University, Australian High Commission, British High Commission, Swedish International Development Authority, Swiss Development Corporation, Norwegian Agency for Development Co-operation, World Food Programme, International Health Policy Programme, Ford Foundation, Watumull Foundation, Hawai, Aghakhan Foundation, Winrock International, Industries like IPCC, NOCIL, Mafatlal Industries, etc.

About half of the funding for forestry research by BAIF comes from International Agencies, 25% from National agencies, 20% from clients like industries and the balance 5% from own funds. BAIF tries to integrate their agroforestry projects with the living styles and environment of the beneficiaries, in order to encourage people to accept and maintain the programmes in a sustainable manner.

Contributions made to BAIF for research and development are exempt from income tax under Section 35(i) (ii) of the Income Tax Act.

7. Linkage with other research establishments

BAIF is recognised as a Research Institution by the Indian Council for Agricultural Research (ICAR), Ministry of Agriculture and Ministry of Science and Technology. The University of Poona, South Gujarat, Surat and YC Open University, Nasik, have recognised BAIF for conducting research and training. BAIF is also recognised as a Regional Resource Agency by the

Ministry of Environment and Forests for organising the Environment Awareness Campaign.

As already indicated BAIF has collaboration with many national and international agencies in many of its research projects. The scientists are proud of this. They also get opportunities for travel to different places and present their findings.

8. Overall performance of the research establishment

BAIF has several recognitions and awards to its credit. BAIF received ICCI award for Rural Development in 1978, Indira Priyadarsini Vrikshamitra Award in 1986, NCERT-Best Children's Literature Award for 'Mother Nature' in 1991, Rajat Kamal Award for "Golden Earth" film in 1991, Green ilm Award, Berlin Festival for "Golden Earth" fdm in 1991 and Rajat Kamal Award for 'Building from below' film in 1994. The founder President of BAIF Mr. Manibhai Desai was the recipient of Padmashree (1968), D.Sc. (Honoris Causa) by MPKV, Rahuri (1977), Ramon Magsaysay Award (1992), G.J. Watumull Memorial Award (1982), Jamanlal Bajaj Award (1983), D.Litt (Honoris Causa) by the University of South Gujarat, 1984, BESI Men of the Year Award (1986), asantrao Naik Award (1988), and Vishwa Grjari National Award (1989), National Citizen Award (1991). Gopal Ratna was awarded to Ashram Goshala at Urulikanchan in 1962.

The infrastructural facilities, qualified and experienced personnel, and the initiatives in forestry research makes the organisation ideally suited for being used as a national centre for agroforestry research.

Documentation is inadequate in certain areas. Although BAIF is a consultant to many industrial organisations for greening programmes, the technical documentation of the experience is poor. Networking with organisations engaged in agroforestry has not received proper attention.

5. TATA ENERGY RESEARCH INSTITUTE. (TERI)

1. Background

Tata Energy Research Institute (TERI), New Delhi, established primarily to examine the energy problem in all its aspects, has wide ranging and significant involvement in forestry research in India. It was established in 1974 at the initiative of Tata companies, a major group of private enterprise in India, as a response to the oil crisis of the early seventies. It was registered as a Society on 18 June 1974, and during the two decades of existence, it has grown steadily to become an organisation of international repute in the energy - environment field. It has regional centres at Bangalore and Guwahati in India, an affiliate in Washington, DC, (USA) and representative Offices in Bangkok, (Thailand) and Julich (Germany).

The activities of the Institute are varied, ranging from biotechnology research dealing with tissue and protoplast cultures at the micro-level to the development of mathematical energy-economy models for the country, at the macro-level. Forestry related research is a major activity of the Institute and covers a wide spectrum from tree tissue culture to energy - forestry interface.

The Institute studies and seeks solutions to the immense problems arising due to the rapid depletion of natural resources and the consequent environmental hazards. Every stage of the energy cycle is examined - extraction, generation, transmission, distribution and usage -with focus on the environmental impacts at each stage. The ultimate objectives are to reduce adverse impacts and assist in the conservation of natural resources by improving operational techniques, and wherever possible, by development and substitution by renewable energy technologies.

TERI is currently active in the following broad fields of research.

- Energy environment policy analyses
- Energy engineering and technology including renewable energy
- Forestry and rural energy systems
- Biosciences, including tissue culture propagation of tree species.

Forestry research is mainly focused on energy implications and addresses issues of contemporary interest in several areas like man made forests, afforestation of problem sites, policy issues, etc.

To complement its research activities, the Institute conducts training courses and publishes literature, which range from newsletters and abstracts to comprehensive scientific reports, conference proceedings and books, in addition to journal papers. It also telecasts short films on environmental issues in the national television network.

TERI is not an in-house research centre as the clientele is not limited to Tata Companies, and the research is not designed to address their needs. As borne out in the Mission Statement, the aim is more global and fundamental. The Tata companies do not influence the direction of research of the Institute. This is reflected in the composition of the Governing Council, in which representation of Tata industries is limited to about one fifth. With research sponsored and funded by governments, bilateral and multilateral donor agencies, national and international institutions, the stakeholders are many varied and clients range from village communities, to national governments and international bodies. Currently forestry related research is sponsored by organisations such as the Government of India (Ministries of Non-conventional, Energy Sources and Environment and forests), Indian Council of Forestry Research and Education, National Tree Growers Co-Operative Federation, Ford Foundation, Food and Agriculture Organisation of the UN, University of Massachusetts, USA, MacArthur Foundation, USA, Overseas Development Administration, UK, UNDP, World Bank, International Tropical Timber Organisation, USAID, WWF & WRI, Washington and Biodiversity Conservation Network. (TERI has BCN Project like KFRI)

2. Structure of the institution

The Institute has an independent identity in the Tata group and is a Society registered under the Societies Act. Its administration is vested in a Governing Council consisting of 10 members (including the Chairman and Director of the Institute) who are internationally known, enjoying considerable clout in the Government of India and international organisations engaged in scientific, social and policy research.

Until recently the Institute was functioning in different rented building in New Delhi. During 1994-95, its physical infrastructure underwent a major change, with the majority of TERI personnel moving from dispersed rented premises to their own modern building at Habitat Place located in Lodhi Road, New Delhi.

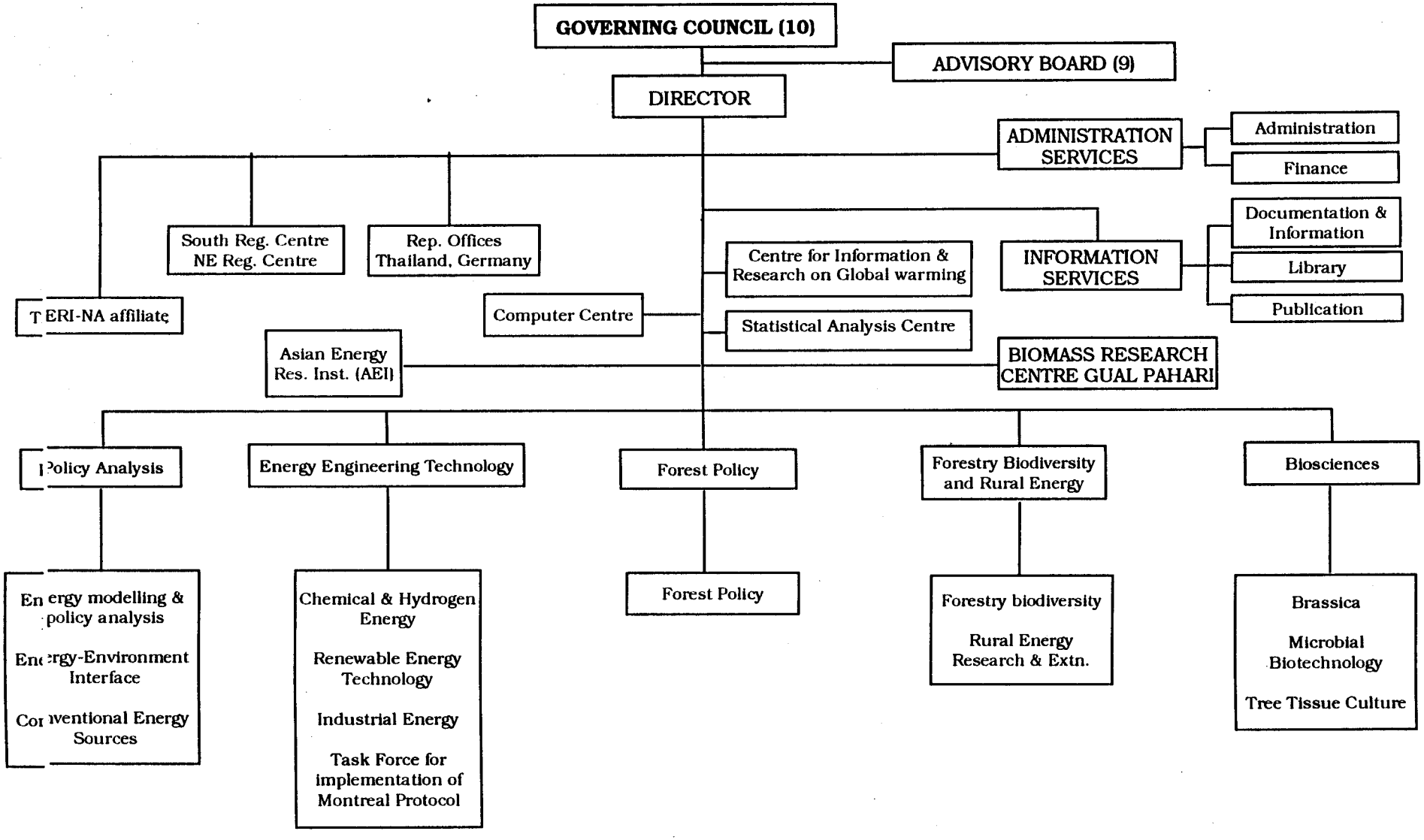
The organisational structure of the Institute is flexible, and depends on expertise available and thrust areas of research identified from time to time. TERI is currently organised into seven research and support divisions viz., Policy Analyses, Energy Engineering Technology, Forestry Policy, Forestry Biodiversity and Rural Energy, Biosciences, Information Services, and Administration. The organogram of TERI is presented in Figure 6.

Forestry research is carried out mainly in the Divisions of Forestry Policy; Forestry, Biodiversity and Rural Energy; and Biosciences Divisions. The Scientists in these Divisions link with other Divisions to form interdisciplinary and multidisciplinary research groups.

The scientific Divisions are generallv under the charge of Deans and divided into Areas or Centres, each being looked after bv a Convenor. A Scientist is designated as Principal Investigator for the research projects in the Areas or Centres and other scientists involved in the particular project are generally designated as Team Members. Secretarial assistance is provided depending on the size of the project . Apart from the above, there is the Administration Division, under the charge of the Chief, Administrative Services.

There are two regional centres viz., South Regional Centre at Bangalore, engaged in creating awareness and demonstrating the benefits of improving energy efficiency to industrial sector and North-eastern Centre at Guwahati devoted to develop area based energy intervention plans for the region and identify energy requirements for various end uses in the area.

Fig. 6. TATA ENERGY RESEARCH INSTITUTE



The Tata Energy and Resources Institute - North America (TERI - NA) is an affdiate which is a publicly supported non profit research organisation incorporated in Washington, DC. Its genesis is rooted in the realisation that emerging global concerns on the environment must bring together new partnerships between the developing and the developed countries recognising the socio-cultural-economic realities influencing the current patterns of development. This affdiate organisation is attempting to bridge the communication gap and overcome the barriers of understanding between the developing and developed world. It has developed various innovative programmes and strategies for promoting energy efficiency and the use of renewable energy in India.

The representative offices in Thailand and Germany are engaged in interaction with institutions in Europe and South East Asia respectively regarding energy-environment interface and related issues.

TERI is facilitating a network of energy institutions in Asia, which is known as Asian Energy Institute (AEI). The network includes representatives from Bangladesh, China, India, Indonesia, Iran, Japan, Jordan, Korea, Malaysia, Philippines, Sri Lanka and Thailand. Some international organisations and national institutions outside Asia are associate members. The AEI, in addition to facilitating information transfer, is examining the complementarities and potential conflicts between national energy policies and global environmental concerns.

Although TERI was initially sponsored by the Tata group of companies it is free of any admmistrative control from the sponsors. As such in research policy and working it is not bound by the policies of the Tata group. In view of its international repute and association with persons of erudition, TERI enjoys a highly respected status within the Tata

The Governing Council is the supreme body which provides guidance and facilitates interaction with Government of India, other national governments, government agencies, international organisations etc., either through its members or other contacts. In matters of research, it does not interfere either in the selection of programmes or projects or in their implementation. It is left to the Advisory Board, which consists of 9 members, mostly drawn from

the senior staff of the Institute. This Board, approves projects, keeping flexibility in areas of research and *modus operandi* of implementation, as prime considerations. Thus, there is no rigidity both in selection of projects and in the course of investigation, which are left to the research teams, subject, however to availability of funds and terms laid down by sponsors.

In-house interactions, monitoring and evaluation are emphasized and ensured by weekly meetings, retreats, seminars etc. Thus inputs from diverse disciplines and backgrounds within the Institute are liberally made available in formulation and implementation of projects.

3. Resources and activities

The key activity areas and research are summarised below

Forestry

- Develop methods and models for regenerating degraded and difficult/ problem sites
- Identify. methodologies for biomass assessment and technologies to improve tree species to achieve sustainable levels of productivity, conservation of biodiversity and environmental security
- Evolve mechanisms for community participation in sustainable forest management
- Assess environmental impact
- Study forestry and global warming/climate change interface

Rural Energy Research and Extension

- Examine the implications of supply and use of biomass and other energy resources and to suggest policy options in rural energy sector.
- Develop and strengthen methodologies for rural energy planning and management in the context of sustainable development.

Forest Policy

- Formulate and suggest policy options for sustainable management of public forests
- Work out approaches and demonstrate implementation of Joint Forest Management

Tree Tissue Culture

- Promote the proven advantages of tissue culture method of propagation to ensure its full acceptance in developing countries
- Develop laboratory and commercial protocols for mass multiplication of superior trees species
- Develop the facility, at Gual Pahari which is totally indigenous to the level of best in the world exclusively devoted to tree species

TERI recognises that the most dynamic asset available to any organisation is its people, cadre motivation, team spirit and personnel skills. Hence Human Resource Development (HRD) programmes have been given high priority in the activities of the Institute. To cater to the diverse demands of TERI professionals, the HRD cell conducts in house training and development programmes on a regular basis. Courses on team work, interpersonal effectiveness, scientific project management skills, management role effectiveness etc. are conducted on a regular basis. Other programmes include finance for non finance personnel, leadership skills, communication skills, counselling in performance appraisal, strategic management and conflict management.

A very flexible approach is followed for recruitment of professional staff. Instead of the normal route of notification/advertisement and selection, recruitment by contact is preferred. Persons who have achieved excellence are contacted and if found mutually compatible, appointed, mostly on contract basis. The contract is extended based on performance. The salary offered is about three times higher than in the public sector. Salary increment is given based essentially on evaluation by self assessment of performance and the amount of salary increment is not fixed, as in the public sector. Periodic assessments are made by peer groups to consider promotion to higher positions. Other incentives given are training abroad in frontier areas, participation in national and international conferences and facilities for higher studies.

The professional staff deployment is also highly flexible. It is largely project based ; individuals with specific skills are quickly put together to match the requirement of a given project. Grouping of staff into areas and broad based

Divisions is the TERI way of encouraging exchange of ideas and information across subject boundaries. In this system, one person may find placement in more than one Area and even Division, at a given time. Area Convenors and Deans are selected from the professional staff on two years rotations.

The staff strength, as on 31 March 1996 is 550, distributed in Delhi, regional units and overseas outfits. About 66% of staff are drawn on contract basis from public sector, private sector and universities; only 34% are recruited from the open market.

The Tata companies provided core funding to the extent of Rs.100 million at the time of establishment of the Institute. A few international agencies also extended core fund support since then. The interest earned out of this corpus is utilized for infrastructure maintenance, administration and support services. In addition, amount charged as overheads in project budgets (wherever the donors have provision for this) is also utilized for the purpose. For research, the principal source is projects sponsored by international agency contributes 75% and national agencies contributes 25% of the total funding.

The expenditure on forestry related research and the income through donor support to forestry projects are not available. It was, however, borne out during discussions that forestry related research accounts for about 10% of the budget allocation on an average. It was Rs.8 million in 1994-95 and Rs.9.67 million in 1995-96.

The Institute has facilities required for the kind of research normally undertaken. For forestry research about 28 ha of land is available in Gwal Pahari, which is about 30 km from the Institute head quarters at Delhi. Well equipped laboratory for biotechnological research, mist chambers, etc, are also available at this place. Drip irrigation and sprinkler systems provide irrigation facilities. A specialised library, access through Internet and offices in USA, Germany and Thailand enable the researchers to source information speedily and efficiently.

4. Important accomplishments

Significant Outputs in the past 5 years include production of National Forestry Action Plan (NFAP) for India in collaboration with the Ministry of Environment and Forests and FAO, Development of policy suggestions for management of public forests, Formulation of policy guidelines for Joint Forest Management; clonal propagation of *Eucalyptus tenticomis* for increased productivity and income to farmers; Reclamation of waterlogged sites by planting appropriate grass and tree species; and development of viable protocols and commercial scale production of seedlings of route in *Anogeissus pendula, A. latifolia, Eucalyptus tenticomis, Populus deltoides* and *Dendrocalamus strictus*.

5. Role of research unit in the organisation

An important feature in which TERI is different from other institutions, both in public and private sectors, is the special efforts taken to transfer technologies for field application, often resulting in commercialisation of technologies developed. Examples can be seen in clonal propagation of *Eucalyptus tereticornis* and in vitro propagation of tree species. In Policy research, under Joint Forest Management (JFM), the procedures developed have been field tested and adopted by TERI in the management of forests in Haryana with the participation of people.

Although the Institute has not laid down definite yardsticks to measure the success of its R & D efforts, the self sustainability factor has been quoted as the touchstone of success. Enhanced donor support for follow up, cash inflow generated by research outputs (as in the case of income obtained by scale of seedlings produced by employing *in vitro* techniques developed in the Institute) are articulated by TERI as examples of success. Similarly its nomination by DBT as centre for mass propagation of some tree species and bamboo and providing liberal financial support for the purpose, is mentioned as proof of success.

6. Factors that have facilitated research by the organisation

The professional vitality of its staff and a stimulating work culture together with a sense of self imposed discipline have been claimed by the Institute (and endorsed by some donors and beneficiaries, examined during the case study) as factors responsible for success. A very flexible approach in identification and implementation of project, teaming of personnel for investigation are internal factors, worthy of specific mention. And the quality of leadership (drawn from the most influential sections of scientific community) has played a key role in its success. For example, in the Governing Council, persons, who have combined erudition with clout have been nominated and expenditure incurred to get them together for meetings etc. although heavy, is considered as a necessary investment. A flexible and liberal approach in recruitment of professional staff, expenditure incurred for their training in India and abroad, opportunities provided to them for participation in national and international conferences etc. are also important internal factors, which have contributed to the success.

The common external factors which contribute to the success of private sector involvement in research like direct government support, tax exemptions, government patronage for testing, monitoring etc. have made little contribution to the success of TERI. The timing of its establishment (ie. as a response to oil crisis), the initiatives its leadership took to involve highly influential individuals at its helm and efforts made at the beginning itself to link national and international agencies, are some of the external factors that contributed to its success at the initial phase of its life itself.

7. Linkage with other research establishments

Formal or informal linkages have been forged with other organisations for various purposes as shown below.

United Nations Univesity .
Development of a database and information exchange arrangements between the countries of former Soviet Union and rest of Asia.

University of Delaware
Training programme titled STEER (Sustainable Tenets, Energy, Environment and Resources) for carefully selected senior bureaucrats, personnel from the corporate sectors, media, research and academic institutions and NGOs.

World Resources Institute
Second India series - studies on natural resources and sustainable development.

University of Florida
Studies on India's Forest Management and Ecological Revival

With specific reference to forestry research, however, there are no strong links. The following linkages though not in forestry research, have indirectly helped forestry research also.

An important initiative of TERI in linking informally 12 energy - environment research institutions in Asia and those in the forefrontin North America, has resulted in a very useful networking. Other informal linkages (mostly project specific) are with ICFRE, University of Massachusetts, National Dairy Development Board, etc.

8. Overall performance of the research establishments

Confming the analysis to forestry research only, the performance can be rated as positive and high. The enlistment of the Institute to prepare the National Forestry Action Programme (NFAP) under a FAO/UNDP Project, the selection of TERI (along with ANZDEC, New Zealand) by the World Bank to prepare the Kerala Forestry Project, for World Bank support retention of the Institute by the public sector Hindustan Paper Corporation to provide technical support to raise captive plantations of pulpwood species are some recent testimonies of the performance of TERI. The production of thousands of tissue culture raised seedlings of tree species of forestry importance, which have survived to a very large extent, raising of clonal plantations and demonstration of JFM at the field level are some of the contributions of the Institute.

Notwithstanding the success achieved by TERI, it is difficult to offer it as a role model for forestry research initiatives in the private sector because of two factors. Firstly long term vision for sustained research is lacking. It appears that most of the research is donor-driven and objectives are changed based on donor perceptions at a given time. Thus, except in tree tissue culture studies, where an IDRC sponsored research was followed by DBT assistance, sustained research is wanting. In the long run, this is a serious drawback, as sustained effort with reasonably ensured continuity is very important in forestry research. Secondly, flexibility taken to the extreme limit, is more of a weakness, than strength. A sense of *ad hocism* is evident everywhere - the choice of projects, teaming of professional staff and implementation. In such an atmosphere, opportunities for specialisation are limited. In view of this, professional staff turnover, at the middle and lower level is high.

6. INDIAN PLYWOOD INDUSTRIES RESEARCH & TRAINING INSTITUTE (IPIRTI)

1. Background

In 1962, as a joint venture of the Council for Scientific and Industrial Research (CSIR, Govt. of India) and several plywood manufacturing companies, under the Co-operative Research Scheme of the Central Government, IPIRTI, then known as Indian Plywood Industries Research Association (IPIRA) was established. Its aim was to support the research needs of the Plywood industry. Voluntary contribution from the plywood industry (to the extent of two-thirds of capital and half of recurring expenditure) and grants-in-aid from CSIR were the main source of finance.

IPIRA was renamed as Indian P1ywood Industries Research Institute (IPIRI) in 1970. Its administrative control was transferred to the Ministry of Industry in 1978, but the pattern of financing continued as before. until contribution from the industry ceased. In 1990, it was taken over by the Ministry of Environment and Forests as an autonomous body. To reflect the training activity in the Training Centre for Mechanical Wood Industries established in the Institute with the assistance of Food and Agriculture Organisation (FAO) and United Nations Development Programme (UNDP), name of the Institute was changed in 1992 as Indian Plywood Industries Research and Training Institute (IPIRTI). IPIRTI continues as an autonomous body, supported by the Ministry of Environment Forests, Government of India.

The objectives of IPIRTI include research to prolong service life of wood and products, economic wood volume in end use and reduce wastage in conversion as well as application; the focus of research efforts being reduction of pressure on natural forests, training to improve skills, upgrade product quality and optimise production cost and advice on standardisation of products and policy issues relating to mechanical wood industries development.

Membership of the Institute (other than nominees) is open to forest based enterprises, individuals and association on payment of an initial and annual fees.

The members are entitled to participate and vote in meetings of the Society, be nominated to the Board of Governors and various Committees the Institute, receive all scientific publications, technical information on request and concessional charges for services.

2. Structure of the organisation

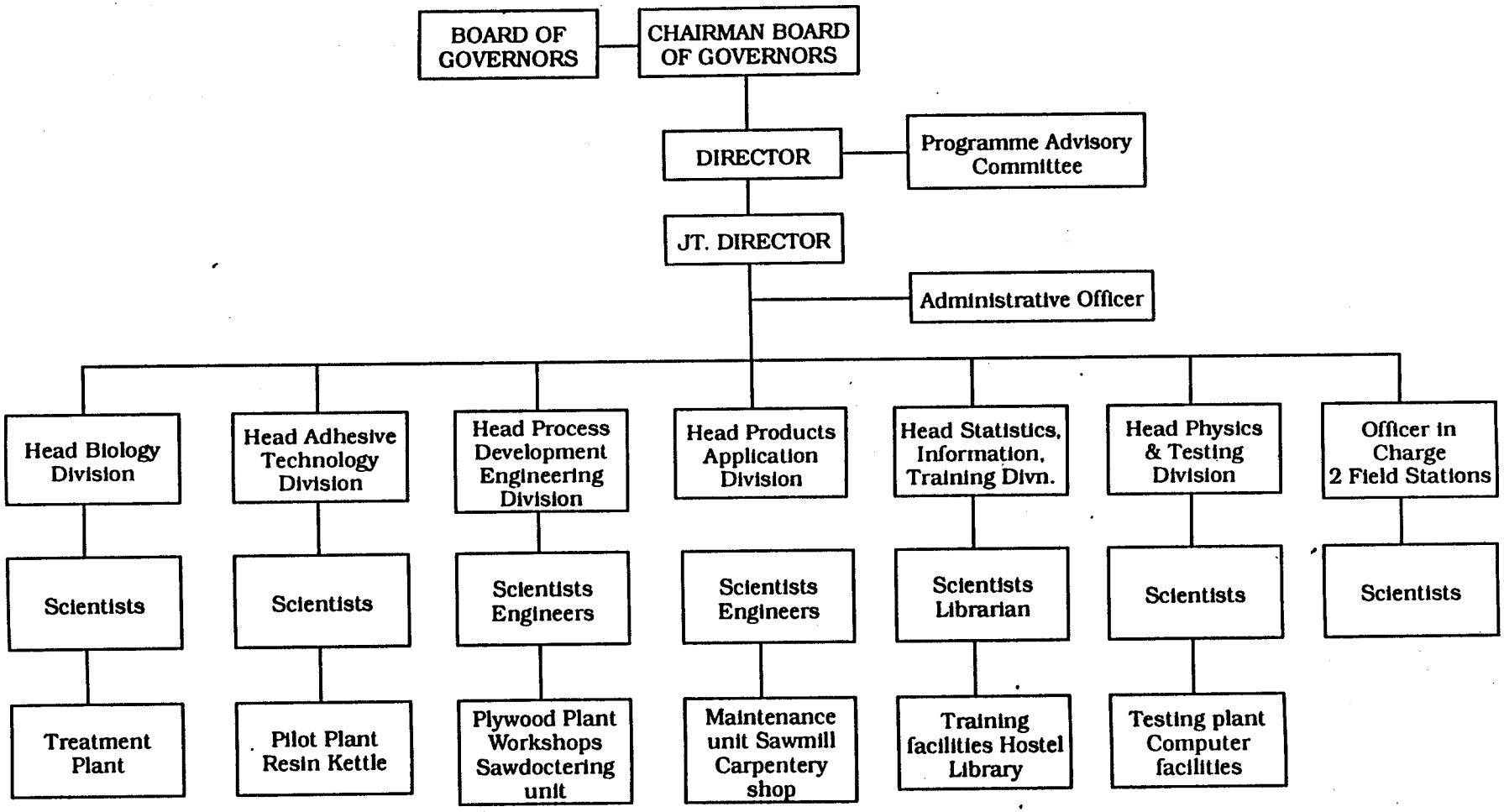
The Institute is an autonomous body of the Ministry of Environment & Forests, Government of India (GOI). It is a registered Society with a Memorandum of Association.

The Minister for Environment & Forests, GOI, is the President of the Society and members include Secretaries of various Departments, Inspector General of Forests and other senior officers of GO1 and the Government of Karnataka, nominees of scientific organisations and representatives of forest based industries in the public and private sectors. The organogram is given in Figure 7.

The general superintendence, direction and control of the affairs of the Institute are vested in the Board of Governors comprising Secretary, Ministry of Environment & Forests (Chairman), Secretaries, Industrial Development; Science & Technology, Chief Secretary, Government of Karnataka, Inspector General of Forests, 2 representatives of Forest Corporations, 3 representatives of large/medium scale forest based industries, 2 representatives of small scale forest based industries, 4 representatives of individuals/NGOs, Director General, ICFRE, Director, Institute of Social and Economic Change, Representatives of BIS and FIPPI, Joint Secretary & Financial Adviser, Ministry of Environment & Forests, 2 Scientists of IPIRTI and the Director, IPIRTI (Member-Secretary).

The Programme Advisory Committee (PAC) constituted by the Board of Governors finalises research and training agenda.

Fig. 7. INDIAN PLYWOOD INDUSTRIES RESEARCH AND TRAINING INSTITUTE



The principal activities are research, training, testing, instrument development, design and fabrication of wood application prototypes and extension. Research is essentially user oriented, multidisciplinary and based on problems identified by scientists of the Institute, industries and other interested groups. Time-bound projects with defined objects and outputs are thereafter prepared and those approved by the PAC are taken up for implementation. The Internal Research Committee (IRC) monitors the progress of research regularly, projects funded by national, bilateral and multilateral donor agencies are taken up for implementation and results disseminated in terms of grant conditions. Research sponsored by individuals are taken up and sponsors given the exclusive right to results, if they so desire. Collaborative research with other institutions/organisations is undertaken when sharing of facilities is required.

3. Resources and activities

The Institute has infrastructural facilities and human resources to undertake in different research areas such as Structure, Properties and Protection of Wood and Wood products, Adhesive Technology, Process Development Engineering and Saw Doctoring, Wood Physics and Testing, Product Application Development and Sawmilling, Statistics and Operations Research, Instrument Development and Design and Fabrication of Wood Application Prototypes. In addition, long and short term training on Sawmilling, Sawdoctoring, Plywood manufacturing, Protection of wood, wood based panels, testing and quality control in wood processing industries are also conducted.

The Institute is run by grants in aid from the Ministry of Environment and Forests. The grant for items in Plan expenditure (mostly infrastructure development and initial operations) is about Rs.5 to 5.5 millions annually. The non-plan (recurring expenses) annual grant is about Rs. 6 million. The institute generates consultancy income to the tune of Rs.l to 1.2 million a year.

4. Important accomplishments

Significant outputs during the last five vears include Production of plywood from small diameter, plantation grown species, Development

commercialisation of improved Bamboo Mat Board to replace this plywood, Formulation and industrial scale application of lignin incorporated PF resin adhesive in which phenol is replaced to the extent of 40% , Evolution and factory scale demonstration of two stage pressing to reduce wood loss on account of shrinkage, Vapour boron treatment of plywood and Glue line preservative treatment of plywood. Most of the research outputs were upscaled to industry level application and demonstrated.

Application of research results are achieved mainly by three ways. Firstly, a good part of the research and development undertaken in the Institute is need based with reference to the wood industry. The mission is evident from its genesis as an initiative of the Indian Plywood Industries with the participation of the Council of Scientific and Industrial Research. Even though the Institute became a Central Govt. sponsored Autonomous body in 1990. The nature of its research activities and the emphasis still remain as a R & D Organisation to support the Wood Industry.

Secondly, The Institute has expertise and facilities for identification of wood and testing wood, wood panels, panels based on other lignocellulosic materials, adhesives, adhesive components, preservative chemicals etc. for conformity to Indian and other standards. Central and State public works departments, Bureau of Indian Standards, Directorate General of Supplies and Disposals, Customs, Central Warehousing Corporation and manufacturers of wood panels regularly avail the testing services.

Thirdly, The Institute takes initiative to hold workshops, brain storming sessions and meetings with industrialists periodically to them updated on latest technologies and findings of the Institute as also to have close interaction with industries and to know their problems and future needs in respect of R & D works.

As most of the Institute's research findings are applied in industry and that the research programmes are drawn up in consultation with the industries the feeling is that their research is mostly successful.

5. Role of research unit in the organisation

The organisation is practically a full fledged research organisation. Training, extension and consultancy activities which form about 20% of the total activities are complementary to the research activities.

About 80 to 90% of the human, material and infrastructural facilities are devoted to research.

Even though cost-benefit studies of research has not been undertaken by the Institute, since the Institute had its origins as an R & D set up of the industrialists themselves and also since as a Central Govt. organisation also it is still doing research in close interaction with industry, the benefits of the research is immediately available to the industry. The papers and technical notes, most of which relate to solution of problems in the wood industry stand testimony to this. The institute is engaged mostly in applied research.

6. Factors that have facilitated research by the organisation

A glance at the composition of the Board of Governors shows that the general superintendence, direction and control of the affairs of the Institute is in the hands of people highly concerned with forest based industries, science and technology, environment and forests and research and development activities. The Director of the Institute at present, is from the Indian Forest Service and is also academically distinguished through a Ph.D.

Discussions with the Scientists revealed that they have been with the organisation for long and would like to continue in the Institute. They all have high regard for an earlier Director who was in office for nearlv a decade and who was responsible for taking initiative to convert the organisation into a Government of India sponsored autonomous body in 1990.

The Institute is divided into six divisions. They are Biology, Chemistry, Product Application & Sawmill Division, Process Development Enpeering & Saw Doctoring, Physics and Testing and Statistics, O.R and Training. In addition they have two field stations. One at Calcutta where the emphasis is

on tea chest plywood and the other at Tinsukia which is essentially an extension centre.

Discussions with the heads of most of the Divisions revealed that they have full freedom of work within their Divisions and are happy about the security of job.

The Scientists also endorse the above views and agree that the research undertaken in the Institute is more or less fully industry oriented and client specific. As such the scientists feel that operational flexibility and ability to respond to the needs of the clients is very high.

Competition in product and raw material markets is not a serious problem with the IPIRTI. Though there are organisations like the Forest Research Institute, Dehra Dun, of the Government of India, the State level institutes like Kerala Forest Research Institute etc. doing research in Forestry. IPIRTI is the only strong player on research in wood panels.

Changing costs of inputs is a problem faced by the Institute, which is compounded by the pressure from the Govt. to earn thirty percent income from consultancy assignments. The current generation of internal resources is about Rs. 1 to 1.2 millions only. Unless this income generation is improved, the Institute will face severe financial crisis by 2000 A.D, as the grants will either remain static or reduced in spite of escalation of prices and salary.

As already indicated, the Institute was initially being funded by industries and the Council of Scientific Research of GOI. After some years, the industries did not keep up the funding and the institute was in difficulties. The GO1 was funding the institution since then. With its changed status as a Central Govt. sponsored Society also the Central Government was funding the organisation almost fully. The only source of internal generation of funds is from testing and consultancy services. Under the new economic policy in the country, the Govt. has placed a 30% norm for internal income generation. This the institute is currently not able to achieve.

The institute is recognised by the Ministry of Science and Technology, under the (DSIR) Scheme. The Institute is permitted by the Ministry of Home Affairs to accept foreign contributions.

Membership of the Institute is open to forest based enterprises, individuals and associations on payment of specified contributions ranging from Rs.1,000 to Rs.30,000 annually.

One critical factor is that there were no recruitments to any vacant posts in the Institute since 1976 which created a big void in the hierarchy with no second line of scientists to take over the higher and important positions. This situation resulted due to the industries not keeping up their commitments to funding. The Director has strongly recommended recruitment to middle levels who can be developed to fill in the void mentioned above.

7. Linkages with other research establishments

As already mentioned, the Director General, ICFRE and the Director, Institute of Social and Economic Change are members of the Board of Governors of the Institute. Also in the workshops and seminars organised by the Institute, other research institutions do take part. Scientists also visit other institutes like Kerala Forest Research Institute, Peechi and scientists from other institute visit IPIRTI.

The Institute has been in existence for about 4 decades now and has been doing client oriented research. Hence no evidence on dependence on research/studies by other institutions could be observed. However, from the list of reference literature which the institute uses, dependence on the findings of other institutions cannot be ruled out.

The Institute follows a documentation system in the form of publication of papers in scientific journals, technical notes and research reports for dissemination of research findings. A monthly Technical Information Service Bulletin is also published. The publications are available on request and on

The Institute maintains itself as a transparent research system. Only in the case of research undertaken for individuals, if the individual so desires, the results are given exclusively to him.

No specific incentives are provided to staff for external collaboration. FAO and UNDP have assisted the Institute in setting up its training centre. The trainees of these trainings are said to be in high demand in the industries for employment.

8. Overall performance of the research establishment

IPIRTI has been playing an effective R & D role for the Wood panel industries. It has extended the research results to factories through industrial scale trials and demonstrations. It provides testing services to plvwood industries and imparts training. With dwindling supply of plywood timber from forests, research efforts must now focus on use of agroforestry timber and small-dimension timber. The Institute can meet this challenge if enough funds are made available and recruitment of scientists are made to fill existing vacancies. The history of IPIRTI also shows that private companies who are expected to support research that will be of public benefit tend to withdraw their support because of the benefit it will provide to their competitors. It points to the inherent weakness of a corporate body of private sector competitors.

ANALYSIS OF CASE STUDIES AND RECOMMENDATIONS

3.1 ANALYSIS OF CASE STUDIES

As stated in the Introduction, the institutions selected for case studies represented different types of organisations. At one end of the spectrum is WIPL, whose R & D efforts are essentially for the company, and the results are generally not published. The parent organisation is thus the main beneficiary and the society benefits only indirectly through the availability of good quality products. At the other end are BAIF and TERI, established under private initiative, but the results are for the benefit of public. In between, are WSL and ITCBPL whose main aim is to benefit their respective sponsors, but the results are made known to the public and while utilising the results, rural communities are benefited by way of increased earning. In addition, due to increased productivity, achieved through their research pressure on forests is reduced. These institutions, therefore cover the main range of private sector initiatives in forestry and forest products research. However, data gathered from other sources are also used to get an overview of private sector involvement in forestry research. These came mainly from the questionnaire survey of 39 other institutions engaged in some degree of forestry research, as indicated in Section 1. Even these do not cover the entire spectrum of private research organisations involved with forestry research as there are others which either did not respond to the questionnaire or could not be reached. Data collected from the Government Sector and Universities are used for comparative analysis.

The main characteristics of private sector forestry research as brought out by the study are examined below.

Objectives of private sector forestry research

The objectives of the case-study institutions in undertaking forestry-related research can be summarised as follows.

i. To increase the supply of wood raw material to meet the requirements of parent organisations without dependence on Government supply (WSL, ITCBPL).

ii. To develop strategies for rural development based on integration of agriculture, forestry and animal husbandry, consistent with environmental and socio-economic concerns (BAIF).

iii. To ameliorate energy crisis through natural resource development, and to suggest policies thereon (TERI).

iv. To provide R & D support to optimise cost of production of plywood and other panel products and improve product quality (WIPL).

v. To develop or adapt technologies to produce wood panels conforming to international standards and to standardise conversion and production processes to reduce wastage of wood (IPIRTI, WIPL).

It may be seen that these objectives vary from specifically meeting the commercial interests of the sponsor (WIPL) to addressing national and global concerns, especially socio-economic security of rural people and environmental stability (BAIF, TERI). Even when the prime objective is commercial interest of the sponsor, the society benefits indirectly by availability of good quality products(WIPL) and opportunity to earn better income. through (i) improved tree cultivation practices and (ii) increased market demand for wood raw material (WSL, ITCBPL). The IPIRITI example shows that private sector commercial entrepreneurs cannot be expected to invest on R & D efforts when the benefits are shared with their competitors. Here, unlike in public sector undertakings, their own interest overrides national interest. However, there also exist non-profit oriented private sector organisations established for public interest research (BAIF, TERI).

A large number of recently established private sector forestry research organisations, which are not well represented in the sample selected for the case studies, are engaged mainly in environment related action-research and public education programmes. They are mostlv small registered societies often

centred around individuals who have enthusiasm and commitment to social cause. Although their contribution to forestry research *per se* is limited, their efforts to mould public opinion in support of forest and nature conservation often make a significant impact in society. The objective of these organisations can be broadly categorised as nature conservation; their contribution to forestry research vary widely. Some make very valuable and varied contribution to forestry-related research- for example the Centre for Herpetology (study of reptiles) established in 1976 at Madras and nurtured by Romulus Whittaker, an expert and enthusiastic herpetologist, has a large outdoor laboratory for breeding crocodiles and other reptiles. It has produced several scientific publications, documentary films, and popular articles on reptiles, amphibians and nature conservation in general. The Centre has recently set up an arboretum for conservation of forest plant species in the Andaman Islands and is engaged in collecting and propagating endangered plants. Another example is the regional centre of INTACH (Indian National Trust for Art and Cultural Heritage), Trivandrum, Kerala State manned mainly by a committed individual, Dr. Satish Chandran Nair, who is mainly involved in imparting environmental education to public. A book entitled Western Ghats of Kerala, published by this centre based on personal knowledge and field research is an authoritative account on the flora, fauna and fragmentation of the forests of Southern part of Western Ghats.

In addition to the above predominantly public-interest organisations, there exist a few private sector organisations, which combine public interest with personal interest. These organisations usually registered societies or trusts, are one-man shows established by some individuals (usually retired from public service) who undertake research or extension activities, with project grant support from Government or other agencies. Most of these have been established consequent to Government policy to encourage the involvement of non-Governmental organisations in afforestation programmes. They serve the twin objective of self-employment of professionally qualified persons and promoting forestry extension programmes.

Research areas addressed

The areas in which research has been undertaken by the case-study institutions can be summarised as follows.

a. Plantation forestry/Farm forestry

Main objectives:

i. Research for increasing the productivity of Eucalyptus, poplar, bamboo, *Anogeissus.*

ii. Rural development through integration of forestry, agriculture and animal husbandry.

Research components

- Selection of superior trees and clonal multiplication
- Standardisation of root trainer technology for nurseries
- Use of biofertilizers, including mycorrhiza
- Standardisation of mass propagation techniques using tissue culture
- Hardening procedures for tissue cultured plantlets and field testing of performance
- Assessment of mixed cropping practices.

b. Policy studies

Main objectives:

i. Development of procedures for Joint Forest Management(JFM)

ii. Conservation of forest and energy through policy interventions

Research components

- Experiments on JFM
- Analysis of energy requirements for various end uses in selected areas
- Standardising methods for reclamation of problem sites
- Developing strategies for energy and biomass conservation with women's participation

c. Wood products

Main objectives :

i. Development of innovative wood panel products

ii. Improving the quality of wood products

iii. Reducing the cost of production of wood products

Research components

- Study of the structure and properties of wood
- Standardisation methods for protection of wood from damage by insects and fungi.
- Development and testing of new processes for wood modification
- Development of new wood adhesives based on organic materials.
- Study of veneering quality and pulping quality of wood of various tree species.

In addition to the above, other private sector forestry research organisations have focused attention on the following.

Plantation forestry

- Enhancement of growth through high input management particularly irrigation and fertilisation, specially on teak and *Acacia mangium.*
- Development of hybrids between)tree species (e.g. between *Acacia mangium* and *A. auriculiformis).*
- Mixed cropping of teak with agricultural crops
- Propagation of mangrove species
- Cultivation, processing and conservation of medicinal plants
- Biodiversity conservation
- Biodiversity conservation policy studies
- Conservation of flora, fauna, and forest ecosystem
- Wildlife management studies
- Tribal-studies

However, except for the significant research contribution of some outstanding private sector institutions like M.S. Swaminathan Research Foundation, research efforts on conservation-related areas remain mostly at superficial level, with greater emphasis on environmental education aimed at the public. Some of the newly formed commercial plantation enterprises like Sterling Tree Magnum are currently making efforts on high input management of tree plantations and collaborating with public sector institutions like Kerala Forest Research Institute to study some aspects.

Analysis of the questionnaires returned from the 44 organisations indicated the number of organisations involved in the major areas of research (Table 3).

Major area of research	No. of Institutions [a]
Plantation of tree species	18
Plant propagation (excluding tissue culture)	17
Tree tissue culture	3
Farm/ Agroforestry	18
Natural forest and environment(inc1uding medicinal plants)	13
Wood products	2
Forest Policy/legislation/economics	5
Wildlife	2

a *As several institutions are engaged in search in more than one area, the total will not add up to 44. The information is based on data furnished by the respodents and not subjected to verification.*

The significance and relevance of the research areas covered by the private sector research organisations can be brought out clearly only in the contest of the national scenario. The new National Forest Policy (1988), taking into account, the increasing recognition of importance of forests for environmental health, energy and employment, has laid down the following areas of research and development, requiring special attention:

Increasing the productivity of wood and other forest produce per unit of area and per unit of time by application of modern scientific and technological inputs.

Revegetation of barren/marginal/waste/mined lands and watershed areas.

Effective conservation and management of existing forest resources (mainly natural forest ecosystem).

Social forestry for rural/tribal development.

Substitutes to replace wood and wood products.

Wildlife and management of national parks and sanctuaries.

The thrust areas of research in the Government funded institutions conform to the above policy guidelines. The ICFRE institutes in particular have devoted much of their attention to:

Determination of properties of timber obtained from plantation raised species.

Utilisation of solar energy for timber drying.

Environmentally friendly treatment of timber.

Identification of superior clones of commonly planted species.

Intra-and inter-specific breeding for increased productivity, disease resistance and improved quality.

Creation of germplasm of timber and non-timber forest species.

Technologies for restoration of degraded sites, problem areas and mine overburdens.

Pest and disease management.

Evolution of environmentally compatible and socio-economically stable forest management systems.

Technologies for restoration of problem sites.

Soil improvement

Wildlife management

In the states, the Silviculture Wing of Forest Departments have continued to concentrate on studies relating to growth and yield of important tree species, rotation, plantation trials, etc. The State sponsored Kerala Forest Research Institute has undertaken research in the following areas:

Reforestation of degraded lands.

Improvement of productivity of forest plantation, through genetic selection soil nutrient management, and pest and disease management.

Resource estimation mapping and development of GIS systems

Development of statistical methods for forestry research and forest resource estimation.

Enhancement of wood use efficiency.

Agroforestry.

Wildlife management.

Socio-economic analysis of forestry activities, including demand and supply of wood.

In the Universities, the Biosciences and Economics Departments have been conducting research in areas like tree biology, wood anatomy, physiology, pests and diseases of forest species, forest economics, etc. and produced very

useful fundamental knowledge. With several agricultural Universities embarking on forestry education since 1986, forestry research is also getting strengthened, particularly in farm forestry and agroforestry.

From the foregoing, it may be seen that the private sector forestry research organisations have focused their attention only on a few areas of importance. In general, the in-house organisations have concentrated on problem-solving and adaptive research. The research organisations sponsored by pulp and paper industries like ITC, Sirpur Paper Mills, Sesha Savi Paper Mills, Ballarpur Industries and match industry like WIMCO, are engaged in plantation forestry research either developing or adapting techniques for clonal propagation, fertilisation, irrigation, etc. Those sponsored by wood industries focus their effort to improve product quality and optimise production cost as in Western India Plywood and Indian Plywood Manufacturing Company.

Several important areas like Natural Forest Management, Wildlife management, fundamental ecosystem studies, in-depth biodiversity documentation, value addition and prospecting of non-wood forest products, integrating system studies covering the entire country, fundamental scientific studies in forestry-related disciplines like genetics, physiology, pest and disease management, statistical methods, forest mensuration, etc. have received comparatively little attention from the private sector. Even among the tree species, studied for plantation forestry, attention is focused on a handful of currentlv used species mostly fast-growing, which yield quick economic return.

Impact of private sector forestry research

The entry of private sector in forestry research in the country is recent and its role is largely self defmed. The impact is therefore not significant in quantitative terms. If quality of outputs is, however, taken into consideration, the contribution of a few are outstanding although that of many is of little significance. The former have not onlv produced results, but also transferred them to the field, farm or products and demonstrated the feasibility and value of the same. Problems addressed by them are not terminated with R & D. Equal emphasis is given to extension and application. Thus fruits of research are fully exploited. While institutions like WIPL has its factory to apply the

research findings immediately, IPIRTI has taken the research results to factories for industrial scale trials and demonstration. Others have converted R & D results to large scale field testing and application.

As compared to forestry research institutions in the public sector, where efforts are generally terminated with R & D, this is an achievement which has established the credibility of the institutes in the eyes of beneficiaries and donors.

Some institutions have made notable contributions which are nationally and even internationally recognised. Some outstanding examples are listed in Table 4.

Table 4. Some examples of successful research by private sector institutes.

Institute	Research accomplishment
BAIF	Propagation and on-farm planting of Multipurpose Tree species. Commercial production of Vascular Arbuscular Mycorrhiza (VAM) and its application.
ITC	Clonal propagation of Eucalyptus and on-farm planting
W SL	Clonal propagation of poplar and on-farm planting.
TERI	Tissue culture propagation of bamboos and *Anogeissus*

It should, however, be added that unlike institutions in the public sector, those in the private sector take up mostly such studies which have immediate application potential and are easily applied. Thus only a narrow spectrum of forestry research needs are addressed by the private sector as indicated earlier.

While field application of research results is one criterion for effectiveness of research, publication of research results in professional journals is another. Table 5 compares the publications of private sector institutions with that of others.

Table 5. Research publications in forestry by private sector institutions and others for the period 1993-1995a.

Type of Organisation	No. of Publications	%of total number of publications
Private Institutions	85	3.38
Govt. Institutions	1,300	51.65
Universities	1,031	40.36
Others	101	4.01
Total	2,517	100.00

The key areas in which the private sector institutions have conducted research is indicated by the number of publications in the relevant areas, given in Table 6. Publications of general nature (natural forest and environment) predominate.

Table 6. Distribution of research publications from private institutes in different subject areas.

Key areas	No. of Publications
Forest Plantations	15
Plant Propagation	13
Natural forest and environment	26
Non-mood forest products	13
Farm/ Agroforestry	6
Wood products	6
Forest policy/legislation/economics	6
Total	85

In spite of the imbalances, if properly motivated, the private sector has the capability and vision to address problems of forestry. Although the in-house R & D units and organisations sponsored bv industrial establishments may

have a narrow focus driven by profit motive, fortunately there are several successful public-interest private sector institutes, which can work tomards goals set by national policy.

Linkages

The majority of institutions studied (BAIF, TERI, IPIRTI, and WSL) have forged strong links with the State and Central Governments as well as international organisations. Most Private sector forestry research organisations are held in high esteem by them and they have sponsored several projects. The products of public sector research are enjoyed by private sector. For examples, clones developed bv FRI are propagated for farming by W SL. There are instances in which Governments have taken conscious decisions to entrust important studies to these institutions, partlr because of the credibility established by these organisations and partly because of high international visibility. This situation found in the institutions taken up for our case studies, however, cannot be generalised. There are several institutions in the private sector possessing expertise in key areas, languishing for want of recognition and support; there are also others who articulate capability, but do not possess it.

Incentives given by Government to private sector

The Government of India has estended fiscal incentives for R & D, particularly for in-house initiatives. These incentives were enlarged in the Budget for 1996-97. They are briefly as follows:

Tax holiday for a period of 5 years for organisations engaged in scientific and industrial research and development, as commercial venture.

Exemption from Customs Duty for equipment, spares, accessories and raw materials imported for research.

Weighted deduction of 125% on allocation to R & D for income tax.

Accelerated Depreciation Allowance on new plant and machinery installed for manufacture of goods based on R & D.

Exemption from Income Tax on donations/grants to institutions engaged in R& D.

National Awards for outstanding achievements.

The above incentives are available to R & D institutions in the private sector recognised by the Department of Scientific and Industrial Research of the Government of India. The recognition is given based on criteria like infrastructure, qualification of personnel deployed, R & D outputs etc.

Some other characteristics of private sector forestry research institutions

Some additional characteristics of the private sector institutions which were subjected to detailed case studies are described below.

i. All the institutions studied revealed a mission spirit in their research activities and are proud of what ther are doing. They desire to pursue the research and make more contributions.

ii. The private sector institutions studied did not indicate paucity of funds or lack of infrastructural facilities causing any limitations on their research plans (however, see the case of IPIRTI described below.

iii. Some of the institutions like WIPL keep the fruits of their research secret and do not publish their research methodology or findings. They mainly bring out sales promotion literature on their products and sell them claiming that some of the features of their products are derived from own R & D. Since the scientific results are not published the originality of their research cannot be ascertained.

iv. Considerable emphasis is placed by some of the organisations in creating tree plantations. However, the documentation of growth data and their publication is often inadequate.

v. The organisations studied have availed tax concessions offered to private research activities. However, they did not rate this as a strong incentive to

research. They seem to give more importance to research grants, public honours and recognitions.

vi. The in house institutions studied either do not keep separate accounts of the funds which they deploy for forestry research or they do not want to reveal the figures. They would rather give an idea of the total of their budgets on research without further details.

vii. They have expectations of being included in the national forum for deciding on forestry research priorities, policy, etc. The interest and reception to the present study on their role in forestry research indicates that they desire to be considered as active players in the field of forestry research.

Factors contributing to success of private sector forestry research institutions

As noted earlier, most institutions subjected to case studies, presented a picture of success and efficiency in their respective chosen fields, in terms of timely completion of tasks undertaken, cost efficiency, ability to focus on chosen priority issues, meeting the standards of scientific excellence, and stress on application of research results. Adequate importance was not given, however, to publication of research results in appropriate scientific media.

The factors that have contributed to the success of these institutions vary from one to another. There are, however, some common factors. These include,

Leadership

The founders or chief functionaries had a strong mission-oriented and dedicated approach. Examples are Manibhai Shah, of BAIF who had Gandhian zeal and dedication and A.K. Kaderkutty of WIPL whose knowledge, business acumen and enthusiasm are exemplary. Such leaders created a culture and climate which drive the organisations to excellence, with superordinate goals. Thus it can be said that the quality of the leadership of these organisations is a key factor in their success.

Selection of activity area

These organisations have selected research projects or activities, which have contemporary commercial or social relevance. They are vital to the organisations or their sponsors either to support manufacturing activities or to their very existence, survival and growth. For example, in the case of W SL, ITC Bhadrachalam, etc. the research activities directly feed into their production process. For TERI the main purpose of the organisation is policy research, for BXIF research on trees is an important component for the success of their mission of rural development.

Size of the institution

Al1 the organisations studied are small and staff strength is commensurate with the work on hand.

Selection of staff

There is flexibility in appointment of research personnel which is mostly done by contract. There is flexibility in fixing remuneration and terms of appointment to attract best professionals. This ensures that the most suitable persons only are inducted to implement a project, which is not always the case in public sector institutions due to lack of appropriate leadership, and/or political interference.

Management style - Absence of bureacracy

Absence of complicated rules helps in quick decision making for timely execution of projects, which is specially required in sponsored projects. Often the Chief Executives' wish is the decision. There is little hierarchy in these organisations and irrespective of rank or position, research staff get opportunities to travel, take up assignments outside, get total responsibilities and enjoy freedom of action.

Staff dynamics

In private sector organisations there is a ruthless weeding out process to maintain efficiency. This is applicable not only to scientific but also to supporting staff. This creates a drive for excellence and efficiency for job security and self sustenance.

Inadequacies of private sector forestry research

The case study showed that IPIRTI, set up originally as a joint venture between private and Government sector, had to be taken over by the Government to save it from collapsing, as the voluntary financial contribution from private industries gradually declined and ceased. As pointed out earlier, when the benefits arising out of research are to be shared as public knowledge among competing industrial units, the contributing private sector enterprises will lose their interest in sustaining the research.

The knowledge gained in this study shows that there are two prime motivations for the private sector embarking on forestry research- profit or public interest. Two basic types of organisation are involved in each of these- in-house R&D units of companies or independent R & D institutions sponsored by such companies came under the former category and public-interest societies or trusts come under the latter category. Both have a role to play, and there are several intermediate types of organisations which combine various degrees of profit, public interest and self-employment motivations.

Perhaps, the two extreme types have to be dealt with separately, but some generalisations on the inadequacies of private sector forestry research organisations are indicated below.

Limited spectrum of activity

As noted earlier, only a narrow spectrum of forestry research needs are addressed by the private sector.

Lack of long-term vision

A long term vision, very much needed in forestry research which is a long-term activity because of the long periods of time required for establishment and growth of forests is generally lacking. Each project is taken up as an end in itself. Once it is completed, another one, often totally different, is taken up, depending upon the opportunities of funding. Thus it is difficult to foresee that a particular institution will devote itself to particular areas and become centres of excellence.

As a consequence of this approach, research staff get little opportunity to specialise and continue their research in important, emerging, areas, which is essential in modern research. These observations do not apply to in-house organisations, whose goals are specific.

Lack of co-ordination among private sector institutions

Lack of initiative to interact with other institutions in the private sector working in same of similar areas. For example there are 17 organisations engaged tree plantation research. Each is largely working in isolation and no effort is made to interact.

Dependence on public sector

To a large extent, private sector research organisations build their accomplishments on the foundation laid by public sector organisations and Universities who carry out basic research (e.g. plant and animal taxonomy, developing statistical techniques, biodiversity database, etc.). Thus private sector organisations are dependent on public sector organisations, while the reverse is rarely true.

3.2. RECOMMENDATIONS

Forestry research in India, for a long time, was confined to Central Government initiative. In spite of recent developments like States setting up research facilities, Universities undertaking research and private organisations sharing the responsibility, the pivotal role is still with the Government. The only proactive interest evinced by the Central Government to promote research in these sectors is to provide grants to Universities and sponsor projects in State Government and private sector organisations. No attempt has been made to involve them in the mainstream to make use of their strength and transparentlr interact with them. In fact, even the number, location and areas of research interest in respect of private organisations were not known documented this study was undertaken.

It is in this contest that following recommendations are made:

Inclusion of private sector in perspective plan

The role, strengths and effectiveness of institutions in the private sector should be taken into consideration in drawing up perspectilve plans for forestrv research, which at present takes into account Central Government institutions only. This will help in apportioning research efforts, especially in research relating to farm forestry, restoration of degraded lands, management of common property, etc.

Networking of Institutions

Under a World Bank sponsored project, ICFRE has taken action to network their institutions through NIC and a software for INFRIS is being developed for this purpose. All organisations engaged in forestrv research (Central/State Governments and private institutions) should be included in this network and mechanisms developed for sharing of information among the participating organisations. The network should be administrated by ICFRE and periodical newsletters issued.

Directory of forestry research institutions

Similar to the directory of industrial research organisations, published by the Department of Scientific and Industrial Research, Government of India, ICFRE or the Ministry of Environment and Forests, should compile and publish. a directory of institutions engaged in forestry research. The information collected in this study can form the nucleus for the same.

Forum for interaction

A forum should be created for dialogue between organisations engaged in forestrv research in order to promote interaction and cross fertilisation of ideas. One of the means to achieve this, is periodical conferences (say once in 4 years) coinciding with, for example, regular conferences conducted by ICFRE.

ICAR funding for agroforestry research by private organisations

At present ICAR funding for agroforestry research is confined to Agricultural Universities. The institutions in the private sector should also be allowed to compete for funding by submission of projects.

Collaboration between public and private sector

A suggestion made by some of the institutions studied is that collaborative research involving Universities/Government institutions and private institutions should be encouraged to enable the latter to use the infrastructural facilities of the former and for the public sector organisations to use the espertise and grass root level esperience of private institutions to test and transfer the research results in the field.

Representation to private sector in national bodies

Selected private sector institutions should be given representations in national/regional bodies dealing with forestry research. This representation should, as far as possible be mutual, to enable government to be represented in relevant bodies of the private institutions.

Testing centres in private institutions

Institutions where testing facilities and espertise are available should be recognised by government agencies like the Bureau of Indian Standards, as testing centres for forest products to enable such institutions to earn revenue. The recognition given should be reviewed regularly and based on performance, estended.

Awards

A system of awards should be instituted by MoEF for outstanding research conducted in the private sector, smilar to awards for Vanamahotsava.

International (Asia-Pacific) interaction

FORSPA may initiate action for publication of a directory of institutions engaged in forestry research in the region, similar to the FAO directory of forest research institutes. It may also take steps to develop interaction between selected institutions in the public and private sector in the region engaged in identical areas of research (e.g. tree tissue culture).

A 'best practice' documentation and 'dissemination scheme may also be set up by FORSPA to link forestry practices in the region and take best advantage of applicable research results generated elsewhere.

Exchange of personnel between public and private sector

At present, there is no facility for researchers in the publIc sector to work with private sector or vice versa to gain insight into the working of each other and exchange of experience. FORSPA may evolve fellowship schemes for such exchange which will become trend setters to other donors.

Appendix : 1

Role of Private Sector in Forestry Research

A Study sponsored by FAO/FORSPA

Questionnaire
Part 1
General Information

Name of Organisation

2. Address
(a) Road/Street
(b) Village/Town
(c) District
(d) State
(e) Telephone No
(f) Fax No.
(g) E-Mail No.

3. Type of organisation (Please mark√

(a) Company
(b) Regd. Society
(c) Govt. Dept.
(d) University Dept.
(e) Trust
(f) Voluntary Agency
(g) Other (specifi-)

4. Name designation and telephone no. of Chief functionary

5. Name, designation and telephone no. of person authorised to respond to this questionnaire (with whom further correspondence, if necessary, can be made)

6. Date of establishment

7. Objectives of the Organisation
(if any brochure/document describing the objectives of your organisation is available please enclose a copv. If it is priced, please send by VPP).

8. What are the outputs (products/services) of your Institution?

9. Does your organisation carry out research on any of the following? (please mark (√) those applicable)

(a) Forest tree plantations (esclude rubber & horticultural crops like coffee, tea, coconut, pepper)
(b) Natural forests and forest environment
(c) Wood products
(d) Non-wood forest products including medicinal plants
(e) Agro-forestry
(f) Plant propagation
(g) Forest Policy/law/economics
(h) Others (specify)

10. Date from which forest related research was started :

11. Do vou collaborate with or engage the services of other organisations in forest related research? : Yes | No

If 'yes' please give a list of such organisations:

12. Is your research centre recognised by the Dept. of Service & Technology, Govt. of India under the provisions of Income Tax Act? If so, since when?

13. Please give us the names and addresses of private organisations, which in your knowledge are engaged in forest-related research in your State/region

14. If your organisation is not engaged in forest-related research, it is not necessary to proceed to Part *2* of this questionnaire. However, please return this part of the questionnaire to

Director,
Kerala Forest Research Institute,
Peechi 680 653, Kerala
Fax : 0487 - 782247

15. We willbe glad to send you free copies of the KFRI Newsletter, "Evergreen". If interested, please indicate : Yes | No

Role of Private Sector in Forestry Research

A Study sponsored by FAO/FORSPA

Questionnaire
Part 2
Specific Information on Forest Related Research

(Your help by way of returning the questionnaire even if you are unable to fill in all the items will be much appreciated)

1. Is your research intended to support your own other activities or as service to clicnts?:

   Own use ☐ Sen-ice to clients ☐ Both ☐

2. If applicable, please list your major clients

3. Kindly list the major functionaries/Departments of your organisation?

4. Please indicate the infrastructural facilities ı-ou have for forest-related research?

   (a) Land (area) - ..... ha

   (b) Buildings (Plinth area) - .....Sq. m.

   (c) 1,ibrary

	Scientific	Supporting	
		Tcchnical	Adminis trative
No. of Ph.Ds			
No. of post graduates			
No. of graduates			
Others			

5. Recruitment of personnel : Approximate % of people recruited through the source

(a) Experienced personnel recruited from Govt./Public Sector : ..... %
(b) Experienced personnel recruited from Private Sector : .....%
(c) Experienced personnel recruited from Universities : .....%
(d) Fresh recruits : .....%

Total : 100 %

6. Do you encourage publication of the results of research undertaken by your organisation? If so, please provide the following details and attach a list of publications.

(i) Research papers published in journals
(ii) Proceedings of Seminars/svmposia
(iii) Research reports
(iv) Consultancy reports
(v) Monographs
(vi) Pamphlets / brochures
(vii) Others (please specify)

7. Has your institution (or any of your research staff receive distinctions/awards in the area of forest related research? If 'yes', please indicate details

Yes	No

8. Do you have sub-centres/branches? If 'yes', please indicate details

Yes	No

9. Is your institution represented in national/international research policy making bodies? If 'yes', give brief details

Yes	No

10. Do you organise seminars, symposia, demonstrations, training etc If 'yes', please give the number during the year 1995-96

Yes	No

(a) Seminar/symposia .....
(b) Demonstrations .....
(c) Training programmes .....

11. If your organisation specialises in any particular area of forest-related research, please indicate the area.

12. What is your budget for research?

Year	Amount (Rs.)
Previous Year (1994-95)	.....
Current Year (1995-96)	.....
Nest Year (1996-97)	.....

13. What is the source of funding for your forest-related research? Please indicate approximate percentages.

(a) Own funds	-
(b) International agencies	-
(C) National agencies	-
(d) Clients	-
(e) others (specify)	-
Total	1

14. If you have funded research in other organisations please give details

15. Do youthink your forest related research findings have influenced policy making in your State/Country. If 'yes', indicate details

Yes	No

16. Do you think your research findings are being applied in the field? If so, please mark (√) the areas of application

(a) Plantations
(b) Ago-forestry
(c) Wood based indus tries
(d) Non-wood forest product industries
(e) Plant propagation
(f) Waste land development
(g) Others (specify)

17. Monetary and other benefits extended to the employee.

	Head of Research wing	Head of unit	Scientist	Research Technician
(a)Appx. Annual monetary benefits Rs. *'000.)*				
(b)Whether housing provided Yes / No				
(c)Average number of professional training attended per year				
(d)Average number of Seminars / Work-shops attended per year				
(e) Others (specify)				

18. What incentives do you get from the Government to support your research efforts?
Research grants :
Tax concessions :
Others (specify) :

19. What factors have contributed most to your organisation's success in forest-related research?

20. Do you collaborate with public sector Institutions/Universities for research? :If 'yes', please give brief details. Yes / No

21. Please indicate constraints, if any, you have faced in pursuing forest related research.

22. What are your suggestions for enhancing your organisations role in forest related research?

Other comments, if any :

If your organisation publishes Annual Reports of your activities, please send us a copy.

Case study on selected Institutions

23. In case me select your organisation for a detailed study, would you give an opportunity. for a research scientist authorised by the Kerala Forest Research Institute to make a study of your Institution and prepare a case study report with your help and knowledge?

Yes	No

If 'yes', please indicate your most convenient time. We prefer a date before 30 June 1776.

Checklist of enclosures :

	Enclosed herewith	Mailed separately	Not available
Organisation Brochure			
Annual Report			
List of Publications			

Please return the filled up questionnaire to **Director, Kerala Forest Research Institute, Peechi 680 653, Kerala.** FAX 0487 - 782249

Appendix 2 **List of Private Sector Organisations involved in forestry research covered in the study**

Sl. No.	Name of the Organization	Place	Year of Establishment	Year forestry Research started	Budget 1994-95 Rs['000]	Research Personnel	Key Research Areas
1	Bombay Natural History Society (BNHS)	Bombay	1883	-	770	32	Conservation of flora and fauna
2	Sirpur Paper Mills Limited	Adilabad	1942	1975	-	4	Plant propagation
3	Ballarpur Industries Limited	New Delhi	1945	1994	-	11	Pulpwood palntation
4	The Western India Plywoods Ltd.	Cannanore	1945	1972	675	12	Wood products
5	The Wildlife Preservation Society of India	Dehra Dun	1958	-	-	-	Conservation of wildlife and nature
6	Seshasayee Paper & Boards Ltd	Erode	1960	1978	-	-	Agroforestry
7	Bana Bharati	Koraput	1962	1967	-	-	Agroforestry
8	BAIF Development Research Foundation	Pune	1967	1974	2000	116	Agroforestry, plant propagation
9	Nimbkar Agricultural Research Institute	Satara	1968	1984	3500	12	Tree plantation
10	Bruksha 'O' Jeevar Bandhu Parisada	Nayagarh	1970	-	-	-	Social forestry, policy
11	The Academy of Environmental Biology	Muzaffarnagar	1970	-	-	-	Environmental education
12	The Society for Environmental Education In Kerala	Kannur	1972	-	-	-	Forest conservation, Policy & Education
13	Shri A.M.M. Murugappa Chettiar Research Centre	Chengai.	1973	1984	-	-	Agroforestry, plant propagation
14	Tata Energy Research Institute (TERI)	New Delhi	1974	1986	8000	35	Policy, Biotechnology
15	Centre for Herpetology	Mamallapuram	1975	1991	-	16	conservation of flora & fauna
16	ITC Bhadrachalam Paperboards Ltd	Secunderabad	1975	1989	700	25	Plant propagation, pulpwood plantation
17	Asian Institute for Rural Development	Bangalore	1976	-	-	-	Social forestry
18	Bhagavatula Charitable Trust	Visakhapattanam	1976	1991	-	-	Agro forestry
19	Jai Research Foundation	Valsad	1977	1994	5000	100	Plant protection, Bio-technology
20	Gokul Prakalp Pratishthan	Ratnagiri	1977	-	-	-	Tree plantation
21	AVR Educational Foundation of Ayurveda	Coimbatore	1978	1988	-	4	Medicinal plants, conservation

22	Appropriate Rural Technology Institute	Pune	1978	1988	-	20	Plant propagation, Medicinal plants
23	Centre for Tribal Conscientization	Pune	1978	1979	-	3	Forest Policy
24	Titagarh Paper Mills	Culcutta	1981	1996	-	-	Pulpwood plantation
25	Peoples Institute for Participatory Action Reserch	Dhenkanal	1981	1988	-	-	Forest Policy, Economics
26	Environmental Protection Research Foundation	Sangli	1982	-	-	-	Wasteland development
27	Gramonnati Sansthan	Mahoba	1983	1984	300	8	Watershed, Rural development
28	Wimco Seedlings Ltd	Rudrapur	1984	1984	2864	12	Plant propagation, Plantation of poplar
29	Grasim Forest Research Institute	Dharwar	1985	1985	-	19	Biotechnology, Pulpwood plantation
30	Palani Hills Conservation Council	Madurai	1985	1987	-	-	Agroforestry, Plant propagation
31	Merlin Nature Club	Banglore	1985	1985	-	-	Conservation of flora and fauna
32	Indian National Trust for Art & Cultural Heritage	Hazaribagh	1987	1989	-	-	Conservation, Ethnobotany
33	Gramalaya	Tiruchi	1987	1991	-	-	Wasteland revegetation
34	Vittal Mallya Scientific Research Foundation	Banglore	1987	1993	12500	37	Non wood forest products
35	Native Medicare Charitable Trust	Coimbatore	1988	-	150	7	Medicinal plants
36	M.S. Swaminathan Research Foundation	Madras	1989	1990	-	-	Biodiversity, Agroforestry
37	C.P.R. Environmental Educational Centre	Madras	1989	1994	-	-	Non wood forest products
38	Environmental Resources Research Centre	Trivandrum	1991	1991	-	-	Environmental impact assessment
39	The Scientific Society for Ecosphere Awareness	Visakhapattanam	1992	-	10	-	Watershed management, Environmental awareness
40	Sterling Tree Magnum Ltd.	Madras	1992	1996	-	22	Teak Plantation
41	Centre of Minor Forest Products	Dehra Dun	1992	-	-	16	Non wood forest products
42	Centre for Research on Ecology	Dehra Dun	1993	-	106	7	Forest ecology, Resource management
43	Centre for Himalayan Environment & Develomment	Chamoli	1994	-	-	55	Environment, Natural resources